Phase II
Environmental Site Assessment
Final Sampling & Analysis Plan

Virdon Property
1019 1st Avenue North

Billings, Montana

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BIG SKY ECONOMIC DEVELOPMENT

NewFields

September 2016

FINAL SAMPLING & ANALYSIS PLAN
PHASE II ENVIRONMENTAL SITE ASSESSMENT

Virdon Property
1019 1st Avenue North
Billings, Montana 59101

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Virdon Property
Billings, Montana

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TABLE OF CONTENTS

1.0 INTRODUCTION 1

1.1 BACKGROUND AND GENERAL SITE DESCRIPTION 2
1.2 GEOLOGY AND HYDROGEOLOGY 2
1.3 CURRENT AND FUTURE USE OF THE SITE AND ADJOINING PARCELS 3

2.0 PHASE II INVESTIGATION 4

2.1 PURPOSE AND OBJECTIVE OF INVESTIGATION 4
2.2 PROJECT ORGANIZATION AND STAFFING 4
2.2.1 Health & Safety Training 4
2.3 CONCEPTUAL SITE MODEL 5
2.4 CONTAMINANTS OF POTENTIAL CONCERN 6
2.5 DATA GAPS AND DATA QUALITY OBJECTIVES 6
2.6 SCOPE OF WORK 8
2.6.1 Triad Approach 8
2.6.2 Field Data Collection and Transmission 9
2.6.3 Subsurface Soil Sampling 9
2.6.4 Groundwater Sampling 10
2.6.5 Soil Vapor Sampling 12
2.6.6 Asbestos Sampling 13
2.6.7 Lead-Based Paint (LBP) Sampling 14
2.7 DECONTAMINATION PROCEDURES AND HANDLING OF INVESTIGATION-DERIVED WASTE 16
2.8 FIELD AND LABORATORY QUALITY CONTROL PROCEDURES 16
2.9 ASSESSMENT RESPONSIBILITIES 17

3.0 DATA ANALYSIS AND REPORTING 18

3.1 DATA REVIEW AND VALIDATION 18
3.2 REPORT OF FINDINGS 19
3.3 EVALUATION OF HUMAN HEALTH RISKS 19
3.3.1 Soil, Groundwater, and Soil Vapor Evaluation 19
3.3.2 Asbestos Evaluation 20
3.3.3 Lead-Based Paint Evaluation 20

4.0 PROJECT SCHEDULE 21

5.0 REFERENCES 22

LIST OF TABLES

Table 1. Contaminants of Potential Concern (COPCs) and Conceptual Exposure Pathways 6
Table 2. Subsurface Soil Sampling Laboratory Analytical Methods 10
Table 3. Groundwater Sampling Laboratory Analytical Methods 11
Table 4. Soil Vapor Sampling Laboratory Analytical Methods 13
Table 5. Asbestos Laboratory Analytical Methods 14
Table 6. Lead-Based Paint Laboratory Analytical Methods 16
Table 7. Applicable Soil Screening Levels 19
Table 8. Applicable Groundwater Screening Levels 20
Table 9. Applicable Soil Vapor Screening Levels 20

LIST OF FIGURES

Figure 1 Location Map
Figure 2 Phase I RECs Map
Figure 3 Site Plan
Figure 4 Project Organizational Chart

LIST OF APPENDICES

Appendix A Well Reports
Appendix B Site-Specific Data Quality Objectives
Appendix C Health and Safety Plan
Appendix D Standard Operating Procedures (SOPs)
Appendix E Field Investigation Planning Form
Appendix F Summary of Analytical Methods, Reporting Limits, and Regulatory Action Limits
Appendix G Montana Law Defining Asbestos Inspection Requirements
Appendix H Decision Flowcharts for Building Materials Inspection
Appendix I Inspector Certificates

DISTRIBUTION LIST

This Sampling and Analysis Plan (SAP) for the Virdon Property will be distributed to the following representatives of Big Sky Economic Development (BSED), U.S. Environmental Protection Agency (EPA), and the Montana Department of Environmental Quality (DEQ).

Distribution of the SAP within these organizations will be the responsibility of the designated representatives, below. The distribution of the SAP to the Site property owner will be the responsibility of BSED.

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1.0 INTRODUCTION

NewFields Companies, LLC (NewFields) prepared this Draft Sampling and Analysis Plan (SAP) for a Phase II Environmental Site Assessment (ESA) of the Virdon Property located in Township 1 North, Range 26 East, Section 34, Block 3: Lots 9 to 13 of in Billings, Montana (Site or Facility; **Figures 1** and **2**). The Facility is currently used as retail liquor store (Montana Liquor, Inc.). The Facility has a 7,000 square-foot building and an 11,200 square-foot parking lot located to the west and southwest of the building. The Facility was operated as a gas station and auto service and repair station from 1955 to 1970.

This SAP proposes sampling to investigate potential releases of contamination on the Facility. The SAP was prepared on behalf of the Big Sky Economic Development (BSED) using United States (U.S.) Environmental Protection Agency (EPA) Brownfields Assessment Grant funds. A Phase I ESA for the Site (NewFields, 2015a), also completed by BSED, identified six Recognized Environmental Conditions (RECs) for the Facility, as defined by ASTM 1527-13 (ASTM, 2013). These include:

- Historic use of the Site as a gas station from 1955 to 1970. Evidence of an underground storage tank (UST) basin and pump islands in the parking lot were observed during the site reconnaissance, and interviews with the site owner confirmed prior use as a gas station.
- Two floor sumps were observed within the storage warehouse. One floor sump is located in the southeast corner of the storage warehouse, and the other sump is located centrally in the northern third of the warehouse. The outflow for both sumps and their past use is unknown.
- A storm drain located near the center of the parking lot. This storm drain is considered a REC due to proximity to the former UST basin and potential to receive surface releases of fuel during operation of the site as a gas station.
- Active leaking underground storage tank (LUST) sites near the facility. The (Jack Yurko) and Historic Auto Station site (Frank's Towing & Auto Repair) located adjacent-northeast of the Site have the potential to impact the Site.
- The property located adjacent to and north of the Site (1018 2nd Avenue North). This property has a reported closed UST site (Former Gas Station at Virdon Property; currently occupied by Country Pine), and a closed hydraulic lift, which may impact the Site.
- A former dry cleaning facility located at 1015 1st Avenue North (adjacent -east of the Site) and a tractor repair facility located at 1115 1st Avenue North, approximately 250 feet hydraulically upgradient of the Site. Dry cleaning facilities often use chemical solvents (perchloroethylene or PERC, and/or Stoddard solvent). The tractor repair property is located hydraulically upgradient of the Site.

While not a REC, visual observations of the retail building made during a site reconnaissance conducted by NewFields (2015a) and its reported construction date (1950), suggest that asbestos-containing materials (ACM) and/or lead-based paint (LBP) may be present in the structure.

The purpose of the Phase II ESA is to determine whether historic use of the Site and/or adjacent properties has resulted in soil, soil vapor and/or groundwater impacts, and whether ACM or LBP is present in building materials on the Site at levels that would preclude sale or redevelopment of the property.

1.1 Background and General Site Description

The Site is located on 1st Avenue North Street in Billings, Montana and lies in Township 1 North, Range 26 East, Section 34 (**Figures 1** and **2**). Billings is the largest city in Montana and is the county seat of Yellowstone County. The city has an estimated population of approximately 110,000 people and is a regional hub serving most of eastern Montana and portions of North Dakota, South Dakota, and Wyoming. The approximate latitude and longitude of the Site are 45° 47' 33.36'' North and 108° 29' 6.00'' West, respectively. The Site is located at an elevation of 3,108 feet above mean sea level (ft amsl). Improvements on the Site include a 7,000 square-foot, one-story retail building, an 11,200 square-foot asphalt and concrete parking lot, and concrete sidewalks along the southwestern and southern border of the Site (**Figure 2**). The surrounding neighborhood is mixed use of industrial/commercial properties located in the southeastern portion of the East Billings Urban Renewal District (EBURD). According to Montana's Cadastral Mapping Program (MCMP, 2015), the legal property description and Geocode for the Site are:

- INDUSTRIAL SUBD 1st FILING, S34, T01 N, R26 E, BLOCK 3, Lot 9 – 13
- Geocode: 03-1033-34-2-07-01-0000

1.2 Geology and Hydrogeology

The Site is located within the Yellowstone River valley, which is bounded to the north by sandstone cliffs known as the "Rims" and to the south by rolling hills underlain by a thick sequence of shale. Two cliff-forming Cretaceous-aged sandstones and shales, the Eagle Sandstone and the Telegraph Creek Formation, form the Rims (DEQ, 2007). Alluvial terrace deposits from the Yellowstone River likely underlie surficial soil at the Site and consist primarily of gravel and cobbles with minor amounts of sand and silt (EDM, 2004). These terrace deposits are located approximately 10 to 20 feet above the present level of the Yellowstone River, with general groundwater flow directions in Billings ranging from east to southeast toward the Yellowstone River (EDM, 2004; DEQ, 2007).

Shallow groundwater (7 to 10 feet below ground surface [ft bgs]) has been reported in nearby wells by MBMG (2015). Well records for 122 wells in Section 34 (T01 N, R26 E) indicate the static groundwater level ranges from a depth of 4.7 to 70 feet bgs, with an average depth of 11.3 feet bgs (MBMG, 2015). According to MBMG (2015), well yields range from 2 to 500 gallons per minute (gpm), with an average of about 87 gpm. A well log summary for the surrounding area is included as **Appendix A**.

According to the U.S. Department of Agriculture (USDA, 2015) database, surficial soils underlying the Site are classified as Haverson-Hysham, which consists of loam and exhibit moderately high to high hydraulic conductivity. A typical profile of underlying soil at the Site consists of loam from 0 to 5 inches and stratified fine sandy loam to clay loam from 5 to 68 inches (USDA, 2015).

1.3 Current and Future Use of the Site and Adjoining Parcels

The Site is currently used as retail space and the 7,000 square-foot one-story building is operated as a liquor store (Montana Liquor, Inc.). An alley borders the northern perimeter of the Site with a woodworking shop (Country Pine) and automotive towing yard / automotive garage (Frank's Towing & Auto Repair) located north and northeast, respectively, of the alley (**Figures 2** and **3**). A used car sales lot (Custom Auto Sales) adjoins the Site to the east-northeast. The southern boundary of the Site is bordered by 1st Avenue North, with commercial development (Ace High Auto Sales and Scottie's Auto Sales) and industrial development (A&I Distributors) farther to the south. North 11th Street borders the western edge of the Site, with commercial development (NAPA Auto Parts, Sagebrush Trading, Burtell Fire Protection, and The Loft) located west of North 11th Street. The property adjacent and east of the facility was once used a dry cleaner.

The owner, in the short-term, intends to repave the parking lot at the Site. In the long-term, the owner wants to sell the property. The owner is concerned that underground tanks may still be on site, and is therefore unwilling to invest in paving until this is determined. The owner also wants to know if historical use of the property has resulted in contamination (building and subsurface) which may complicate the sale of the property in the future.

2.0 PHASE II INVESTIGATION

2.1 PURPOSE AND OBJECTIVE OF INVESTIGATION

The purpose of this Phase II ESA is to evaluate whether the historic use of the Site as a gas station and automotive repair facility and use of nearby properties have released contaminants to shallow groundwater, soil and/or soil vapor at the Site. In addition, investigation of potential asbestos-containing materials (ACM) and lead-based paint (LBP) associated with the on-site structure will be completed to determine if these materials are present in the on-site building.

2.2 PROJECT ORGANIZATION AND STAFFING

This section is designed to summarize the general organization and management of the BSED Brownfields Program as it relates to implementation of the Virdon Property SAP. Program organization and staffing for the BSED Brownfields Program is shown on the project organizational chart in **Figure 4**. Mr. Patrick Klugman of BSED is the primary point of contact with the EPA and DEQ for the Virdon Property Phase II ESA. Mr. Klugman will also serve as the Grantee Quality Assurance (QA) Manager to review the overall quality of project deliverables generated by the Brownfields contractor (NewFields). As Project Manager, Mr. Chris Cerquone (NewFields) will supervise contracted activities and work closely with project members to ensure the team meets scheduled milestones and the project remains on budget. He will ensure coordination of the work in cooperation with the EPA Project Officer (Greg Davis) and the Montana Department of Environmental Quality (DEQ) Petroleum Brownfields Coordinator (Brandon Kingsbury).

Directly supporting Mr. Cerquone are NewFields staff responsible for oversight and completion of field activities, data evaluation, reporting, and quality control (QC). Mr. Tyler Etzel will lead the investigation of the Site. Mr. Etzel will be responsible for reporting all assessment data to the Project Manager, BSED, EPA, and DEQ. Ms. Louise Spencer or another qualified scientist will complete the assessment, directing all sampling activities on site. Mr. Doug Rogness will serve as QA Officer to ensure analytical data quality objectives, standards for accuracy and precision, and project document quality are all met. Mr. Rogness is located in the NewFields Helena office and works independently from the NewFields Missoula office that directly generates data for the Virdon Property ESA. Ms. Heather Grotbo will lead the ACM and LBP inspection, as a licensed asbestos inspector, and provide for review and approval of all health and safety plans and compliance of field personnel with those plans.

2.2.1 Health & Safety Training

All staff associated with this project will have sufficient training to safely, effectively, and efficiently perform assigned tasks. Field staff will be trained to perform technical work tasks in accordance with the environmental contractor's Health and Safety practices. In accordance with a site-specific Health and Safety Plan developed for each project site where an assessment is conducted, field staff will complete an initial Occupational Safety and Health Administration (OSHA) 40-hour Hazardous Waste Operations and Emergency Response safety course and an 8-hour annual refresher course. The Project Manager and the Health and Safety Coordinator will ensure field staff, including subcontractors, have appropriate

training and maintain copies of training certificates. A record of the interval of staff training will be tracked in the environmental contractor's Health and Safety database.

2.3 Conceptual Site Model

A conceptual site model (CSM) was developed for the Facility based on the findings of the Phase I ESA (NewFields, 2015a). The CSM includes the following:

- The topography at the Site is generally flat;
- Near-surface lithology is predominately loams with sands and clays;
- The water table is estimated to be approximately 7 to 10 ft bgs at the Site. The presumed groundwater flow direction beneath the Site is south to southeast towards the Yellowstone River;
- There is a one-story 7,000 square foot building, constructed in 1950 on the Site with an adjoining parking lot to the west-southwest. (see **Figure 2**);
- Based on the historic operation of the Site as a gas station from 1955 to 1970 and Sanborn maps depicting the Site as an auto repair/service facility in the 1960s, hazardous substances or petroleum products may have been released to soil, soil vapor, and shallow groundwater on the Site.
- Based on the Site owner interview, six USTs were pumped dry and filled with sand in the late 1970s; however, the existence of USTs on the property has not been confirmed;
- Based on visual observations of two floor sumps within the on-site storage warehouse, hazardous substances may have been released to these sumps, and it is unknown where the fluids discharge to;
- Based on the storm drain that was historically located in the center of the Site parking lot, petroleum products released on the surface of the ground may have been released to soil or shallow groundwater at this location;
- Known groundwater contamination originating from the Jack Yurko site and potential release of chemicals or petroleum products from Frank's Towing and Auto Repair may have impacted shallow groundwater at the Site;
- Based on historic operation of the adjacent property to the north as a gas station, and the past use of a hydraulic lift on this property, hazardous substances may have impacted shallow groundwater on the Site;
- Sanborn maps show a former dry cleaning facility located on the adjacent property to the east of the Site, and a tractor repair facility located approximately 250 feet hydraulically upgradient of the Site. Chemicals or petroleum products originating from either of these properties may have impacted shallow groundwater or soil vapor on the Site; and,
- Based on the age of the building, suspect ACM and LBP may be present in the building at the Site.

2.4 Contaminants of Potential Concern

Table 1 identifies contaminants of potential concern (COPCs), potentially-impacted media, potential exposure pathways, and possible risk management options for the suspected releases.

Table 1. Contaminants of Potential Concern (COPCs) and Conceptual Exposure Pathways

COPCs	Exposure Pathways	Possible Risk Management Strategy
Petroleum Hydrocarbons [including Extractable Petroleum Hydrocarbons (EPH), Volatile Petroleum Hydrocarbons (VPH), and Air Phase Hydrocarbons (APH)] Metals (Resource Conservation and Recovery Act [RCRA] 8) Volatile Organic Compounds (VOCs) Asbestos Containing Materials (ACM) and Lead-Based Paint (LBP)	*Current or Future commercial user* Direct contact, inhalation, or ingestion of COPCs during Site uses; media of concern includes building materials, soil, groundwater, and soil vapor. Exposure pathways include consumption of groundwater from potential future onsite wells, inhalation of vapors and fugitive particles inside buildings, and direct contact or ingestion of soil. *Future construction worker* Direct contact, inhalation, or ingestion of COPCs during soil excavation or building renovation; media of concern is building materials and subsurface soil.	Eliminate direct contact and ingestion exposures (in soil and groundwater) through excavation and disposal of contaminated soil. Install vapor mitigation systems for onsite buildings to limit exposure to vapors inside buildings. Implement administrative controls preventing domestic use of shallow groundwater. Encapsulate and manage building materials in place, or remove from the building prior to renovation. If removed, building materials will be disposed in accordance with State and Federal laws.

2.5 Data Gaps and Data Quality Objectives

The EPA's Seven-Step Approach Process (EPA 2006) was used to identify Data Quality Objectives (DQOs) for this Site investigation (**Appendix B**). EPA has developed the DQOs Process (EPA 2006) as the Agency's recommended planning process when environmental data are used to select between alternatives or identify the extent of contamination. Specific goals of assessment are described in the Site-Specific DQOs found in **Appendix B**. The DQO Seven-Step Planning Approach developed for the assessment of the Site is based upon the CSM (**Section 2.3**) of potential contamination. DQOs are intended to convey the critical information needed to provide the project manager and field staff with flexible performance guidelines, and to ensure that data collected will be sufficient in both quality and quantity to support the goals of the investigation. Based on the CSM, data gaps for the Site include determining whether the USTs were closed in place or removed from the Site, and determining whether petroleum compounds, VOCs, or metals are present in soil, soil vapors, and groundwater at concentrations which pose an unacceptable human health risk. The specific objectives of this investigation to address data gaps include:

- Performing a geophysical survey of the suspected UST area using a GEM Overhauser rover magnetometer to identify any USTs in the parking lot. The Overhauser magnetometer samples twice per second and measures the magnetic density variance. The density difference will be documented with the use of a Global Positioning System (GPS) receiver unit. The diurnal field will be monitored with a proton base station so the earth's magnetic field is measured continuously during the survey and removed from the rover data. The rover sensor is carried on a pole at ground height. The earth's magnetic field is calibrated by separating responses on the surface and below the surface. Because of the geometry, sources above ground (automobiles, fences, etc.) will yield negative anomalies while sources below ground will give positive anomalies. Because of timing differences and physical offset between the rover magnetometer and GPS, a small test line will be performed over a steel nail on the ground to adjust for magnetic anomalies caused by directional variance.
- The magnetometer survey will then be processed on site and followed with ground penetrating radar (GPR) survey to map nonmagnetic material in the UST basin. The GPR data will be evaluated in real-time to obtain diffraction curves from isolated, buried objects.
- Advancing two direct push borings (B-1 and B-2), up to 16 feet in depth, in the parking lot along the northern Site boundary (**Figure 3**) to assess whether COPCs released from the 1018 2nd Avenue North (historically Former Gas Station at Virdon Property) property have impacted soil and/or groundwater.
- Advancing one direct push boring (B-3), up to 16 feet in depth, on the northwestern corner of the Site (**Figure 3**) to assess whether COPCs released from the 1002 2nd Avenue North (Jack Yurko LUST site) and 213 North 10th Street (Frank's Towing and Repair) properties have impacted soil and/or groundwater at the Site.
- Advancing five direct push boring (B-4, B-5, B-6, B-7, and B-8), up to 16 feet in depth, in the concrete parking lot (**Figure 3**) to assess whether COPCs released from the former storm drain, potential UST locations, former dispenser islands, or indoor sumps have impacted soil and/or groundwater on the Site.
- Advancing two direct push borings (B-9 and B-10), up to 16 feet in depth, along the western Site boundary (**Figure 3**) to assess whether COPCs released from the former onsite USTs and the 1115 1st Avenue North (former tractor repair facility) property have impacted soil and/or groundwater on the Site.
- Advancing one direct push boring (B-11), up to 16 feet in depth, at the southeast Site boundary (**Figure 3**) to assess whether COPCs released from 1015 1st Avenue North (former dry cleaning facility) have impacted soil and/or groundwater on the Site
- Installing two vapor probes to evaluate potential air-phase petroleum and volatile organic compound impacts to soil vapor beneath the building. The two probes would be sub-slab soil vapor probes (SV-1 and SV-2) in the cement floor of the building beneath the concrete floor slab (**Figure 3**).
- Performing a Building Materials Inspection (BMI) of the onsite building to determine whether ACBM and/or LBP are present.

2.6 Scope of Work

The following subsections present the scope of work for this Phase II ESA. All fieldwork will be completed in accordance with the site-specific Health and Safety Plan, included as **Appendix C**, and the Final Quality Assurance Project Plan (QAPP) approved by the EPA for BSED (NewFields, 2015b). Prior to conducting the investigation, NewFields will obtain a site access agreement from the property owner and contact the One-Call Utility Notification Center at least 72 hours prior to conducting subsurface soil investigation activities to verify there are no underground utilities in proximity to proposed boring locations. Brandon Kingsbury will also be notified of the investigation start date to give him the opportunity to be on site during the investigation.

2.6.1 Triad Approach

NewFields will follow the EPA Triad Approach for the environmental investigation at the Site. The primary goal of the Triad Approach is to increase confidence in project decisions concerning contaminant presence, location, fate, exposure, and risk (EPA, 2004). The approach comprises three primary components: 1) Systematic Project Planning, 2) Dynamic Work Strategies, and 3) Real-Time Measurement Technologies. The Systematic Project Planning element identifies key decisions to be made with the data and establishes the end goals of the project prior to initiating the investigation.

Dynamic Work Strategies identify a decision logic that allows for changes to the assessment based on information obtained in the field. Real-Time Measurement Technologies provide data during completion of the fieldwork. Elements of the Triad Approach that were or will be used for the Phase II ESA of the Site are described below:

- NewFields used the findings of the Phase I ESA to develop a site-specific CSM (**Section 2.3**) and the scope of work.
- This SAP was developed with the potential end use of the property in mind (i.e., continued commercial use).
- Laboratory reporting limits were compared to regulatory screening levels prior to conducting the field assessment to ensure that the data collected allows stakeholders to make informed decisions with respect to contamination and health risk. This approach reduces the potential for collecting unusable data.
- The field team leader will be responsible for communicating with the project manager and will have the authority to make decisions to adapt the SAP based on observed field conditions.
- Visual identification of suspect ACM or LBP in the building prior to sampling of building materials.
- The SAP provides for the collection of additional soil and/or groundwater samples beyond those proposed based on field observations. This approach has the following advantages: 1) allows for decisions concerning contamination extent in the field; 2) reduces costs associated with multiple remobilizations; 3) increases the amount of data and information that can be collected during one mobilization; and 4) reduces the time and costs required for preparation of supplemental planning documents.

- NewFields will use a photoionization detector (PID) capable of providing real-time measurements of volatile concentrations in soil to aid in evaluating sampling frequency, identifying the presence and relative magnitude of contamination, and determining the need for supplemental sampling.
- All sample locations will be recorded in the field using a mapping-grade global positioning system (GPS) receiver, which reduces investigation costs by allowing rapid import of accurate investigation locations into a Geographic Information System.
- All laboratory analytical data will be provided in an electronic format, which will allow NewFields to evaluate and manage the data more efficiently.

2.6.2 Field Data Collection and Transmission

Prior to initiating field work, all field staff will review this SAP including the Standard Operating Procedures (SOPs) (**Appendix D**) to understand the investigative approach and data quality requirements for the investigation. Appropriate sample delivery and shipping arrangements will be made in advance of sampling to ensure samples are received by the lab within the required analytical method extraction and hold timelines. A proposed Field Investigation Planning Form showing the analytical methods, container and preservation requirements, and holding times by method is included in **Appendix E**. This form will be finalized following EPA approval of this SAP by field personnel and used by the field personnel to plan for the investigation.

Field staff will record all relevant data on field logs daily in accordance with SOP-1 (**Appendix D**). Field sampling forms will be discussed with the project manager while on site to ensure the correct number and type of samples were collected to sample shipment to the lab. Should there be any issues concerning sampling approach, the project manager will instruct field staff immediately to remedy the situation. Field log books and forms will be saved electronically in the hard file in the NewFields Missoula office.

All samples will be placed in coolers with ice immediately upon sample collection to ensure sample integrity and preservation. Samples will be shipped to the analytical laboratory under chain-of-custody in accordance with SOP-3 and SOP-4 (**Appendix D**). An example chain-of-custody form is included in **Appendix E**. All samples submitted to the laboratory will be analyzed on standard turnaround times of 10 working days. Each field sampling location point will be determined in the field using a mapping grade GPS with sub meter accuracy.

2.6.3 Subsurface Soil Sampling

NewFields will complete eleven (11) soil borings using direct-push drilling techniques. Boring locations, shown on **Figure 3**, were chosen based on potential sources of contamination. Each soil boring will be advanced approximately 4 feet below the water table (anticipated at 7 to 10 ft bgs), up to a maximum total depth of 16 ft bgs.

Soil samples from each boring will be collected using a direct-push continuous core sampler at 4-foot intervals in accordance with SOP-14 (**Appendix D**). Field screening of soil samples will be completed and

consist of olfactory and visual observations, and heated headspace screening using a PID in accordance with SOP-17 (**Appendix D**). In each boring, a soil sample exhibiting the highest PID reading and one from immediately above the soil-groundwater interface will be submitted for laboratory analysis. In the event that no subsurface soil shows elevated headspace readings, a soil-groundwater interface sample and a sample from approximately midway between ground surface and the soil-groundwater interface will be collected and submitted for analysis. If groundwater is encountered, groundwater samples will be collected as described below in **Section 2.6.4**. NewFields will describe the subsurface conditions in each of the boreholes on individual boring logs in accordance with the Unified Soil Classification System as described SOP-13 (**Appendix D**). All field observations will be recorded in a project-dedicated field log book.

All subsurface soil samples will be submitted to Pace Analytical Services, Inc. (Pace) in Billings, Montana for analysis of extractable petroleum hydrocarbons (EPH) and volatile petroleum hydrocarbons (VPH), Analysis of the samples will be performed by the methods identified in **Table 2**. A comparison of laboratory reporting limits to applicable screening levels and standards for COPCs is included in **Appendix F**. All soil samples will be placed in ice-filled and sealed coolers for shipment to the laboratory under chain of custody in accordance with SOP-3 (**Appendix D**). Shipping documents will specify the laboratory analyses for each sample. Each cooler will be secured with tape and clearly display a shipping label with appropriate laboratory information in accordance with SOP-4 (**Appendix D**).

Table 2. Subsurface Soil Sampling Laboratory Analytical Methods

COPCs	Boring Locations	Analytical Method
C9-C18 Aliphatics C19-C36 Aliphatics C11-C22 Aromatics	B-1 through B-11	Massachusetts Department of Environmental Protection (MDEP) EPH[1]
MTBE Benzene Toluene Ethylbenzene Xylenes Naphthalene C5-C8 Aliphatics C9-C12 Aliphatics C9-C10 Aromatics	B-1 through B-11	MDEP VPH

[1] EPH Fractions will be analyzed if the EPH Screen result is above 200 milligrams per kilogram (mg/kg).

2.6.4 Groundwater Sampling

If groundwater is encountered in any boring, a groundwater sample will be collected by advancing decontaminated probe rod equipped with a stainless steel screen enclosed within a steel sheath. When the decontaminated probe rods reaches a depth of 3 to 4 feet below the soil-groundwater interface, the screen will be exposed to allow groundwater to flow into the rod. Polyethylene tubing connected to a

purge and trap bailer tip (inertial pump) will be lowered through the chamber to collect groundwater samples for laboratory analysis. Prior to purging water from the rod, the water level will be measured using a decontaminated, electronic well probe and recorded on individual sampling logs in accordance with SOP-5 (**Appendix D**). Prior to collecting a groundwater sample, groundwater will be purged from each soil boring to remove excessive turbidity. Due to expected low purge volumes, field parameters will not be measured during purging. Each groundwater sample will be appropriately containerized, preserved, and placed in ice-filled and sealed coolers for shipment to Pace under chain-of-custody in accordance with SOP-3 (**Appendix D**). Each cooler will be secured and labeled in accordance with SOP-4 (**Appendix D**).

Groundwater samples will be analyzed for EPH Screen, VPH, VOCs, and Dissolved RCRA metals, as shown in **Table 3**. In the event the total EPH Screen concentration is above the DEQ threshold value of 1,000 micrograms per liter (µg/L) in any sample, the sample will also be analyzed for EPH fractions. A comparison of laboratory reporting limits to applicable screening levels and standards for COPCs is included in **Appendix F**.

Table 3. Groundwater Sampling Laboratory Analytical Methods

COPCs	Location	Analytical Method
C9-C18 Aliphatics C19-C36 Aliphatics C11-C22 Aromatics	B-1 through B-11 (if groundwater encountered)	MDEP EPH[1]
MTBE Benzene Toluene Ethylbenzene Xylenes Naphthalene C5-C8 Aliphatics C9-C12 Aliphatics C9-C10 Aromatics		MDEP VPH
Volatile Organic Compounds (VOCs)[2]		EPA Method 8260B
Dissolved Arsenic Dissolved Barium Dissolved Cadmium Dissolved Chromium Dissolved Lead Dissolved Mercury Dissolved Selenium Dissolved Silver		EPA Method 6010B /7471

[1] EPH Fractions will be analyzed if the EPH Screen result is above 1,000 micrograms per liter (µg/L).
[2] Complete VOCs list is provided in Appendix F.

2.6.5 Soil Vapor Sampling

NewFields will install two sub-slab soil vapor probes (SV-1 and SV-2) in the cement floor of the building as shown on **Figure 3**. The actual soil probe locations will be determined after discussion and permission from the site owner. The vapor sampling is intended to assess whether there is potential for vapor intrusion to the on-site building**.** The soil vapor probe installation will be performed using methods described below that are compatible with the DEQ April 2011 Vapor Intrusion Guide (DEQ, 2011).

The indoor sub-slab soil vapor probes will be constructed by drilling a small (3/4- or 1-inch) hole through the concrete floor, then drilling beneath the concrete floor slab to a depth of 12 inches below the upper walking surface of the floor. A ¼-inch outer diameter Teflon tube will be placed to ½ inch above the bottom of the hole, and silica sand will be emplaced around the tube. Granular bentonite will then be added around the tube to within 1 inch of the top of the floor and hydrated with distilled water. After the sample is collected, the tube will be removed, a small amount of silica sand will be added above the bentonite, the materials in the hole will be compacted with a hammer, and the concrete surface will be repaired with cement. The abandoned probe locations will be photographed and floor covering such as carpet will be replaced to the satisfaction of the building owner.

To collect the soil vapor samples, NewFields personnel will purge three tubing volumes of air from each probe prior to sample collection using a pump or syringe in accordance with SOP-22 (**Appendix D**). Purging will occur at a rate less than 200 milliliters per minute (mL/min), and the purge volume and total purge time will be documented during sampling. After purging, the sample will be collected into an individually certified Summa canister using a 1-hour flow controller. Summa canister vacuum pressure will be recorded at the start, end, and periodically during the period of sampling. To demonstrate the integrity of the soil vapor sample, helium will be used as a leak tracer. At the end of sampling, the sample point will be monitored with a PID for organic vapor concentration, and the PID reading will be recorded on the purge record for the sample point. Each soil vapor sample will be labeled with the location number, sampling interval (date and time), and the start and end vacuum on laboratory-provided tags.

The soil vapor samples will be submitted to ALS Environmental of Simi Valley, California for analysis of Massachusetts Department of Environmental Protection (MDEP) Air-Phase Petroleum Hydrocarbons (APH), which includes target compounds C5-C8 Aliphatics, C9-C12 Aliphatics, and C9-C10 Aromatics; EPA TO-15, which includes 1,3 Butadiene, Methyl Tertiary Butyl Ether (MTBE), Benzene, Toluene, Ethylbenzene, Xylenes; and, EPA TO-15 SIM, which includes 1,2-Dichloroethane, 1,2-Dibromoethane, and Naphthalene (see **Table 4**). In addition, the soil vapor samples will be analyzed for helium by Modified EPA Method 3C to evaluate sample integrity.

Table 4. Soil Vapor Sampling Laboratory Analytical Methods

COPCs	Location	Analytical Method
C5-C8 Aliphatics C9-C12 Aliphatics C9-C10 Aromatics	SV-1 and SV-2	MDEP - APH
1,3 Butadiene MTBE Benzene Toluene Ethylbenzene Xylenes		EPA TO-15
Volatile Organic Compounds (VOCs)[1]		EPA TO-15 SIM
Helium		EPA 3C Modified

[1] Complete VOCs list is provided in Appendix F.

2.6.6 Asbestos Sampling

Prior to commencing the building inspection of ACM in the building, as-built drawings will be reviewed, if available, to become familiar with the facility, mechanical/heating system layout, and the general materials used in construction.

Inspection and sampling for asbestos will be performed by an asbestos inspector accredited in Montana per requirements of the Montana Asbestos Control Program, using sampling frequencies stipulated in Administrative Rules of Montana (ARM) 17.74.354 (**Appendix G**). A flowchart summarizing asbestos inspection activities and resulting building materials management actions is provided in **Appendix H**. Current accreditations for NewFields personnel are provided in **Appendix I**. The accredited asbestos inspector will perform a walkthrough of the entire building. The inspector will identify all suspected ACM based on professional judgement and information obtained through required accreditation trainings. The asbestos inspection will include the following specific activities:

- Informational meetings with the site owner to learn more about the history of the building and to inform the owner how the inspection will be performed.
- An initial walkthrough of the building accompanied by the site owner, if possible, to identify building construction phases, mechanical areas, pipe chases, pipe tunnels, crawl spaces, attics, and roof(s).

- Visual survey of all building materials to identify suspect homogeneous areas of ACBM.
- Subsequent collection of samples from homogeneous areas of suspect ACM in accordance with SOP-27 (**Appendix D**). Building material samples of suspect ACM will be submitted to CEI Labs, Inc. (CEI) of Cary, North Carolina for analysis of asbestos by polarized light microscopy (PLM), as shown in **Table 5**. The laboratory will analyze the samples using the following positive-stop approach: if one sample within a group of homogeneous samples tested positive for asbestos, the remaining samples within that group were not analyzed, and were assumed to be positive for asbestos. ACM, including non-friable ACM, is defined in 40 CFR, Part 763-Asbestos Model Accreditation Plan and Section 202, Toxic Substance Control Act, as a material containing greater than 1% asbestos (>1%) by weight. Current guidelines from EPA and the Montana Department of Environmental Quality – Asbestos Control Program (MDEQ-ACP) indicate that wood, glass, and metal are not considered suspect for asbestos content, and therefore, these materials will not be sampled during the ACM inspection.

Table 5. Asbestos Laboratory Analytical Methods

Contaminants of Potential Concern (COPCs)	Analytical Method
Asbestos (building materials)	EPA 600/R-93/116 (Polarized Light Microscopy)

In accordance with Montana rules and regulations (**Appendix G**), the number of samples collected per homogeneous area will be dictated by the type of potential ACM:

- A minimum of three bulk samples will be collected from non-friable suspect ACM to determine whether the material is asbestos-containing.
- The minimum number of samples collected from friable surfacing material will be three samples (1,000 square feet or less), five samples (1,000 to 5,000 square feet), or seven samples (over 5,000 square feet) depending on area of the material.
- Thermal system insulation will be sampled in a randomly distributed manner, with at least three bulk samples collected from each homogeneous material.
- Bulk samples will be collected from each insulated mechanical system where cement or plaster was used on fittings, such as tees, elbows, or valves.
- Bulk samples will not be collected from any homogeneous material where the inspector determines through professional judgment that the thermal system insulation is fiberglass, foam glass, rubber, or other non-ACM.

2.6.7 Lead-Based Paint (LBP) Sampling

Interior and exterior painted surfaces will be surveyed for LBP using an X-Ray Fluorescence (XRF) spectrometer or by laboratory analysis of total lead if XRF results are inconclusive. XRF procedures will follow the recognized standard protocol developed by HUD, as described in SOP-28 (**Appendix D**). Paint

chip sampling is also described in SOP-28 (**Appendix D**). A flowchart summarizing LBP inspection activities, evaluation of results, and resulting building materials management actions is provided in **Appendix H** for demolition, renovation, and fire conditions.

Prior to taking XRF measurements, the inspection staff will walk through the building to familiarize themselves with the building layout. During the walkthrough, a complete inventory of the painted surfaces in interior rooms, on exterior walls, and on surfaces in other exterior areas, such as fences, and garages, will be conducted. Paint combinations, equivalents, and combinations within rooms and on the exterior of the building will be identified. For the purpose of BMI, a paint equivalent is characterized by an identifiable part of a building, such as a room, hallway, stairways, or exterior area. Each paint equivalent is further divided up into components, which are then tested using the XRF. For example, components in a room may include the ceiling, floor, walls, door and its casing, window sash, and window casings.

At least one XRF reading of all components coated with paint, varnish, shellac, stain, or other coating will be collected. Readings will be repeated three times to ensure accuracy. XRF readings will also be recorded on the first bare substrate area. Readings will be classified as negative, positive, or inconclusive. XRF measurements classify paint as lead-based when the result is equal to or greater than 1.0 milligram per square centimeter (mg/cm^2). For XRF results that fall into the inconclusive range, paint chip samples will be collected and sent under chain-of-custody to a laboratory for analysis of total lead in accordance with SOP-28 (**Appendix D**). Paint chip sampling will include collection of all paint layers, while minimizing collection of substrate. The locations, area (square feet), component, substrate, and color of paint found to be positive for lead or assumed to be positive for lead will be recorded in a field log book or on a sampling form.

As indicated in the flowchart for LBP inspection (**Appendix H**), should XRF or analytical testing identify LBP on exterior surfaces of building(s), and there is evidence that the exterior paint is damaged or peeling, surface soil samples will be collected in proximity to the LBP to determine whether soil is contaminated with total lead. Surface soil samples will be collected at a frequency of one 5-point, composite sample from 0-6 inches for every 40 linear feet of exterior LBP in accordance with SOP-28 (**Appendix D**). The composite samples will be roughly equally spaced along the 40 linear feet and collected approximately 18 inches from the building wall and submitted to the laboratory for analysis of total lead.

All samples submitted for laboratory analysis will be analyzed using standard turnaround times. All analysis will be performed by methods identified in **Table 3**. A comparison of laboratory reporting limits to applicable screening levels and standards for constituents of concern is included in **Appendix F**.

Table 6. Lead-Based Paint Laboratory Analytical Methods

Contaminants of Potential Concern (COPCs)	Analytical Method
Lead-Based Paint (LBP) on Building Materials	HUD-approved X-Ray Fluorescence (XRF) spectrometer procedures for building demolition; or EPA Method 7420 – Flame Atomic Absorption (Flame AA), if laboratory testing of paint chip sample is completed
Total Lead in Soil	Extraction by EPA Method 3050; Analysis by EPA Method 6010

2.7 Decontamination Procedures and Handling of Investigation-Derived Waste

To avoid cross-contamination between borings and sampling intervals, all downhole sampling equipment will be decontaminated on-site using a high-pressure wash, or wash with tap water and an environmentally benign detergent (e.g., Alconox) and appropriate rinses in accordance with SOP-2 (**Appendix D**). Decontamination procedures will be conducted at a designated decontamination area on the Site, and wash fluids that do not have a petroleum sheen will be allowed to infiltrate or evaporate.

Investigation-derived waste (soil cuttings, wash water, and potential purge water) will be handled in accordance with SOP-25 (**Appendix D**). Soil cuttings will be containerized and stored on-site pending laboratory characterization for appropriate disposal. Upon completion of soil sampling, boreholes will be backfilled with bentonite chips to the ground surface.

2.8 Field and Laboratory Quality Control Procedures

The EPA-approved QAPP (NewFields, 2015b), which establishes specific QA/QC policies and activities, will be followed during the site investigation. Applicable SOPs (**Appendix D**) will be followed during the Phase II ESA. A Field Investigation Planning Form, provided in **Appendix E**, which will be used by NewFields field staff to ensure that the field data collection is performed in accordance with this SAP. The EPA-approved QAPP (NewFields, 2015b) references standard EPA laboratory methods, which specify equipment requirements. New commercially available supplies and consumables from standard sources (i.e. hardware store) are acceptable for implementation of this SAP. The following field QC samples will be collected:

- One equipment rinseate blank (ERB) sample will be collected and analyzed for subsurface soil analytes by running distilled water over the decontaminated continuous core soil sampler used during the assessment.
- One field duplicate (DUP) groundwater sample will be collected and analyzed for COPCs during the assessment.

- One ERB will be collected and analyzed for COPCs if non-disposable sampling equipment is used for groundwater sample collection.
- A laboratory-provided trip blank (TB) sample will accompany each soil or groundwater sample cooler containing samples for VPH or VOC analysis.

The ERB and DUP will be analyzed for COPCs shown on **Tables 4** and **5**. The TB will be analyzed for VPH and VOCs, as appropriate.

2.9 Assessment Responsibilities

The Project Manager will be responsible for oversight of assessment activities and will review elements of this work plan and the Programmatic QAPP to ensure the objectives of the project are fulfilled. The Project Manager will also be responsible for making corrective action decisions should issues arise. Corrective actions will be taken immediately upon identification of potential problems with data acquisition or measurement. Field equipment malfunctions will be corrected by the field team leaders, and reported to the Project Manager. Corrective actions will be documented in the field notes.

3.0 DATA ANALYSIS AND REPORTING

3.1 DATA REVIEW AND VALIDATION

A data usability review and validation will be conducted on all data collected for this investigation. Data validation undertakings will be completed in conformance with the EPA-approved QAPP (NewFields, 2015b). All laboratory analytical data will be provided by the analytical labs electronically, both in portable document format (pdf) and as tabulated electronic data deliverables (EDD). To facilitate data review, the pdf report will be searchable (embedded text) and bookmarked. Laboratory data packages will contain:

- A narrative specific to the sample data group identifying any difficulties encountered during sample analysis and exceedance in the labs quality control sample results;
- Analytical and preparatory method references;
- A table cross-referencing field and lab identification numbers;
- A list and definition of any data qualifiers used;
- A chain-of-custody form signed and dated by the lab indicating data receipt; cooler temperature at time of lab receipt will be noted in the chain of custody;
- Results for each field sample, blank and QC samples; reporting limits will be provided and any analyte which is not detected will be reported as less than the reporting limit;
- Dilution factor for each sample or analyte;
- Internal standard data, and surrogate data; and
- Laboratory QC data including method blank data, lab duplicate data reported as a relative percent difference (RPD), lab control spike data reported as a RPD, matrix spike and matrix spike duplicate (MS/MSD) data reported as percent recovery with RPD calculated.

Data qualifiers will be applied to the data consistent with EPA guidelines. Upon receipt of data from the laboratory, the data and EDDs will be checked for completeness. During the data evaluation process several checks of the data will be completed, including:

- Verification of whether field staff conformed to SOPs and field methodologies proposed in the SAP and QAPP;
- Determination of whether the laboratory reported all requested analyses;
- Review to ensure that units of measurements are consistent, and reviews of sample definitions for consistency; and
- Inspection for the presence of elevated detection limits due to matrix interference or other data quality concerns indicated by laboratory QC testing.

The impact of nonconformance will be discussed in the Report of Findings (**Section 3.2**). Deviations from approved field and laboratory procedures and sampling approach will be identified in the Report, including whether the deviation adversely impacted the quality of the data obtained.

3.2 Report of Findings

NewFields will prepare a Report of Findings summarizing the results of the Phase II site investigation. The Report of Findings will be provided to BSED, the Site owner, DEQ, and the EPA. Methods of investigation, results of field and laboratory testing, and any deviations from the scope of work will be presented in the report. The report will also provide conclusions and recommendations based on the data. In addition, the report will include the following supporting information:

- Figures depicting sampling locations;
- Laboratory analytical reports and tabulated summaries of the laboratory data along with a comparison of the data to applicable screening levels as discussed in **Section 3.3**;
- Summary of QC findings and data usability and validation completed as described in **Section 2.8**; and,
- Field notes, including boring logs, sampling forms, and investigation photographs.

3.3 Evaluation of Human Health Risks

3.3.1 Soil, Groundwater, and Soil Vapor Evaluation

A comparison of site data to relevant screening levels will be used to determine whether soils, groundwater, or soil vapor will require additional investigation or response actions consistent with planned redevelopment and reuse of the property.

Detected concentrations will be compared to the following regulatory action levels: Montana Tier 1 Risk Based Screening Levels (RBSLs) (DEQ, 2009), Montana Risk-Based Corrective Action (RBCA) Screening Levels, EPA Regional Screening Levels (RSLs), (EPA, 2009), DEQ APH Screening Levels, (DEQ, 2011), Circular DEQ-7 Montana Numeric Water Quality Standards (DEQ, 2012), and EPA Industrial RSLs (EPA, 2015a & 2015b) as outlined in **Table 7**, **Table 8,** and **Table 9** for soil, groundwater, and soil vapor, respectively.

Table 7. Applicable Soil Screening Levels

COPCs	Montana Tier 1 RBSLs Subsurface Soil (< 10 ft to groundwater)	EPA Industrial RSLs
EPH	x	
VPH	x	

Table 8. Applicable Groundwater Screening Levels

COPCs	Montana Tier 1 RBSLs Groundwater	Circular DEQ-7 Numeric Water Quality Standards
EPH	x	
VPH	x	
VOCs	x	x
Dissolved Metals (RCRA 8)		x

Table 9. Applicable Soil Vapor Screening Levels

COPCs	DEQ APH SLs	EPA/DEQ Industrial RSLs [1]
APH	x	
TO-15		x
TO-15 SIM		x

[1] Soil vapor data will be compared to adjusted Montana Indoor Air Standards, assuming a soil vapor-to-indoor air attenuation factor of 0.03 (EPA 2015b).

3.3.2 Asbestos Evaluation

In accordance with current EPA and DEQ Asbestos Control Program (ACP) regulations, building materials which contain greater than one percent (>1%) asbestos will be placed into one of the three following NESHAP categories:

- **Category I non-friable ACM**, which includes any ACM packing, gasket, resilient floor covering, or asphalt roofing product which contains more than one percent (>1%) asbestos;
- **Category II non-friable ACM**, which includes any material, excluding Category I non-friable ACM, containing more than one percent (>1%) asbestos, that when dry cannot be crumbled, pulverized, or reduced to powder by hand pressure such as cement asbestos board, asbestos cement pipe, and window glazing materials; or,
- **Regulated Asbestos-Containing Materials (RACM)**, which includes friable materials, Category I non-friable ACM that will or may be subjected to sanding, grinding, cutting, or abrading and Category II non-friable ACM which has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by forces acting on it or expected to act upon it during the course of renovations and/or demolition activities.

3.3.3 Lead-Based Paint Evaluation

EPA defines LBP as paint containing greater than 0.5% lead by weight (i.e., 5,000 milligrams of lead per kilogram of paint chips). Disposal of lead-containing wastes is regulated under RCRA. Under RCRA, demolition debris is required to be tested using the Toxic Characteristic Leaching Procedure (TCLP)

method of analysis to determine whether the material exhibits the characteristics of hazardous waste. If so, the paint must be managed as a hazardous waste.

4.0 PROJECT SCHEDULE

Field activities will be initiated upon review and approval of this plan by BSED, EPA, and DEQ. It is anticipated the investigation will be completed in September/October 2016 (dependent upon regulatory review times). The Phase II ESA Report of Findings will be prepared within 4 weeks following receipt of all laboratory analytical results.

5.0 REFERENCES

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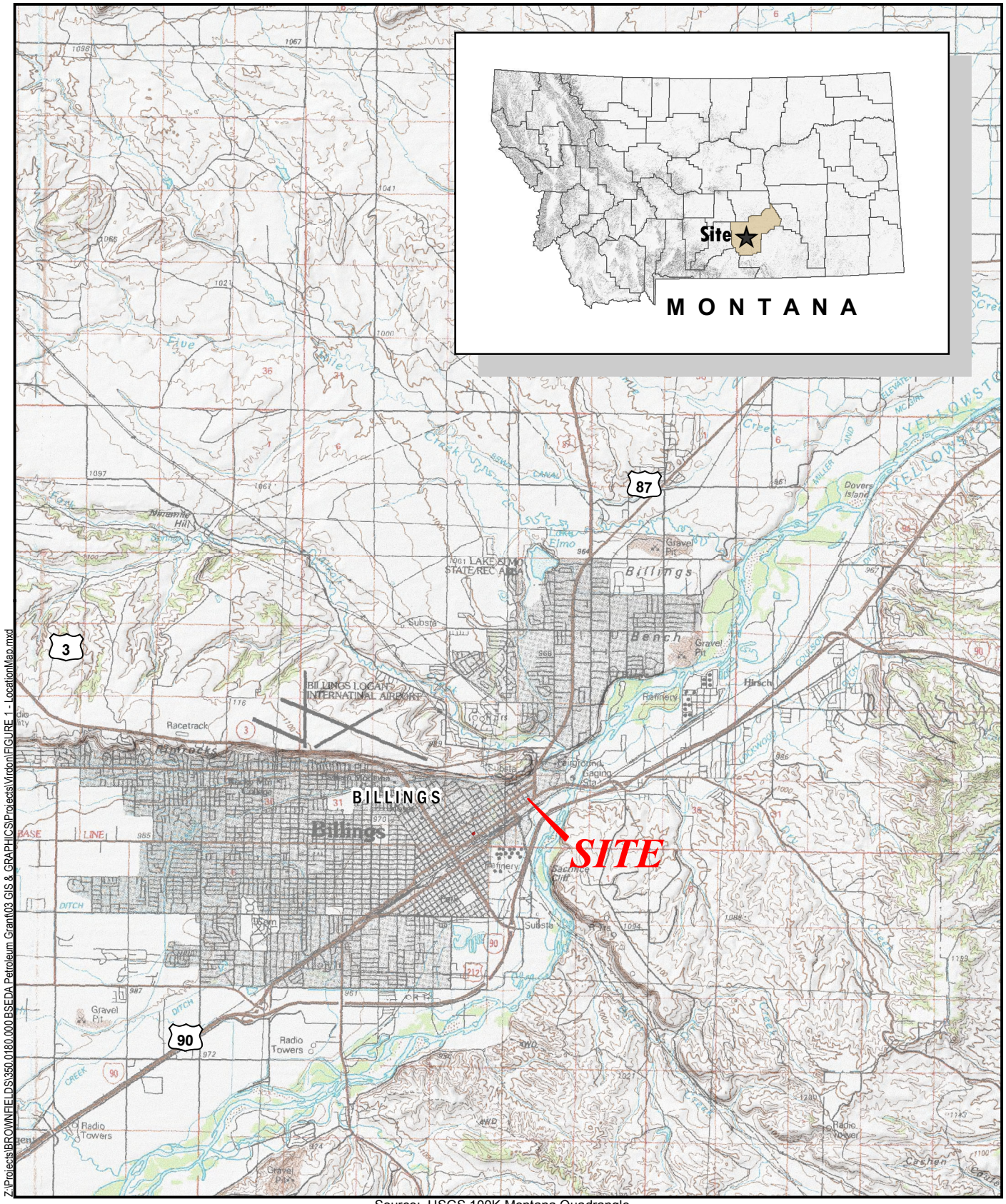
1019 1st Avenue North

Billings, Montana

FIGURES



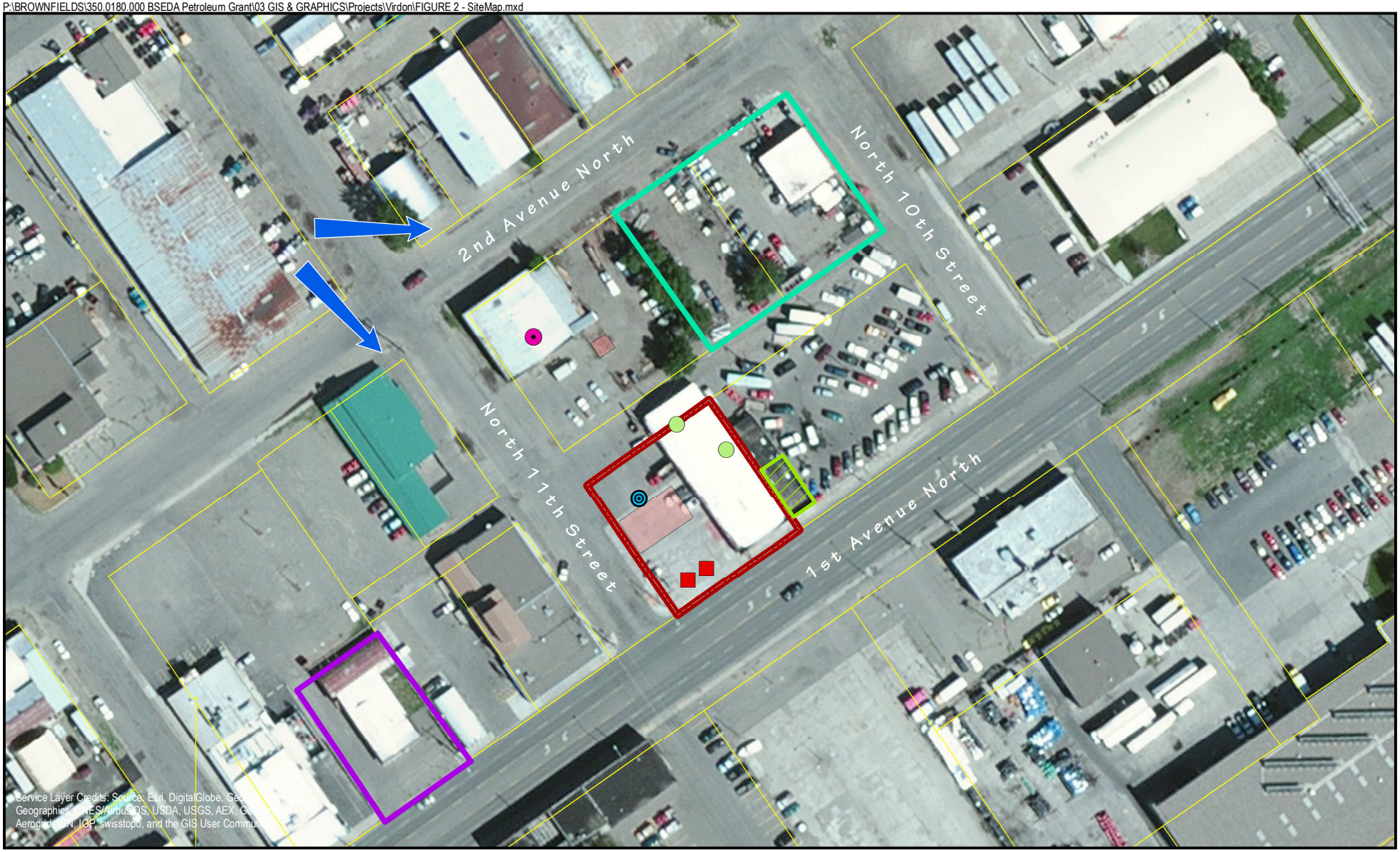
Source: USGS 100K Montana Quadrangle

0 Miles 2

NewFields

Location Map
Virdon Property
1019 1st Ave North
Billings, Montana
FIGURE 1

P:\BROWNFIELDS\350.0180.000 BSEDA Petroleum Grant\03 GIS & GRAPHICS\Projects\Virdon\FIGURE 2 - SiteMap.mxd



Recognized Environmental Conditions (RECs)

- Former Pump Islands
- Floor Sump
- Storm Drain
- Former Hydraulic Lift
- Historic Dry Cleaning Facility
- UST Areas
- Active LUST Site & Historical Auto Station Site
- Historic Tractor Repair Facility
- Approximate Target Property Boundary
- Approximate Parcel Boundary
- Assumed Groundwater Flow Direction(s)

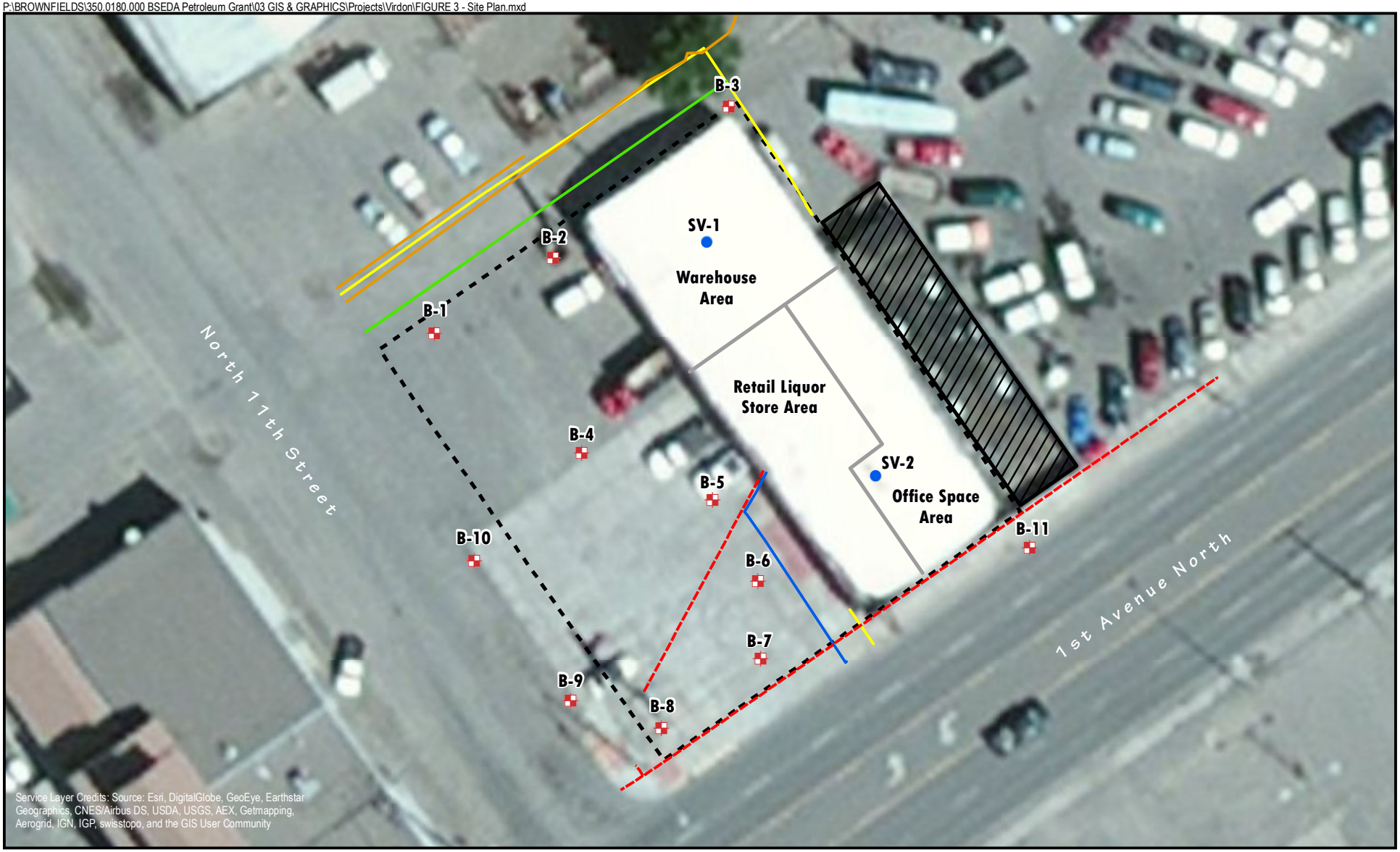
N

0 Feet 100

NewFields

Phase I Recognized Environmental Conditions (RECs) Map
Virdon Property
1019 1st Avenue North
Billings, MT
FIGURE 2

P:\BROWNFIELDS\350.0180.000 BSEDA Petroleum Grant\03 GIS & GRAPHICS\Projects\Virdon\FIGURE 3 - Site Plan.mxd



N

0 Feet 40

NewFields

Marked Utilities

- Approximate Target Property Boundary
- Historic Dry Cleaner
- Proposed Soil Boring
- Proposed Sub-slab Vapor Sample
- Communications
- Electric
- Gas
- Sewer
- Water

Site Plan
Virdon Property
1019 1st Avenue North
Billings, MT
FIGURE 3

EPA Brownfields Coordinator
Greg Davis, E. Montana

Big Sky Economic Development
Patrick Klugman, Brownfield Coordinator

DEQ Petro Brownfields Coordinator
Brandon Kingsbury

Project Manager
Chris Cerquone, NewFields, Missoula

Quality Control Officer
Doug Rogness, NewFields, Helena

Redevelopment Planning
Randy Hafer, Lead, High Plains, Billings
Steve Zeier, Zeier, Billings
Jon Pederson, P.E., Missoula

Public Outreach
Chris Cerquone, Lead, Missoula
Karen Lyncoln, Billings
Sally Staley (graphics), Helena

Phase I/II Site Assessments
Tyler Etzel, Technical Lead, Missoula
Willy Welzenbach, USTs/Petrofund, Missoula
Kevin Oliver, Asbestos/LBP, Northern, Billings
Kerri Sitler, RB Assessment, Denver
David Tooke, Ph. D., Geochemist, Missoula
Cam Stringer, P.G., Hydrogeologist, Missoula
Louise Spencer, Phase I/II, Missoula
Heather Grotbo, Phase I/II, Missoula
Levi McKay, Phase I/II, Missoula

Data Management/GIS
Shane Fox, Lead, Missoula
Sally Staley, Helena

Cleanup Planning
Matt Wright, P.E., Lead, Missoula
Jon Pederson, P.E., Missoula
Randy Hafer, High Plains, Billings

Note: Subcontractors shown in black.

Project Organizational Chart
Big Sky Economic Development Brownfields Program
Billings, Montana
FIGURE 4

WELL REPORTS

1019 1st Avenue North

Billings, Montana

APPENDIX A

Ground Water Information Center | MBMG Data Center
Montana Bureau of Mines and Geology
Montana Tech of The University of Montana
1300 West Park Street - Natural Resources Building Room 329
Butte Montana 59701-8997
Ph: (406) 496-4336 Fx: (406) 496-4343

GWIC Data > Well Construction Data > Township: 01N Range: 26E Sec: 34

The following data were returned from the GWIC databases for the area you requested. For a more detailed description of the data view the GWIC Metadata report. If you notice data entry errors or have questions please let us know by sending us an Email at **GWIC@mtech.edu.** If you wish to view a one page report for a particular site, click the hyperlinked **Gwic Id** for that well. Scroll to the right of your screen to view all the data. All data displayed on the screen may not show up when printed.

Retrieval Statistics*

Field	Max	Min	Avg
Total Depth (ft)	130.00	6.00	21.08
Static Water Level (ft)	70.00	4.70	11.31
Yield (gpm)	500.00	2.00	86.57

* These statistics do not take any geographic, topographic, or geologic factors into consideration. Negative swl values are reported for water levels that are above land surface.

Did you know about...

Other GWIC data

GWIC has 1 field visit(s) for this request area.

Thanks, Just take me back to the menu.

Other MBMG data

MBMG has 532 publications available for BIG HORN county.
MBMG has 429 publications available for YELLOWSTONE county.
MBMG has 2 abandoned mine record(s) for this request area.

Gwic Id	PDF	DNRC WR	Site Name	Twn	Rng	Sec	Q Sec	Ver?	Type	Td	Swl	Pwl	Rwl	Yield	Test	Date	Use
11512			AGRI SYSTEMS	01N	26E	34		No	WELL	26.00	11.00	24.00		20.00	PUMP	11/26/1980	INDUSTRIAL
134808			BILLINGS REFINERY * RW-112	01N	26E	34		No	WELL	18.80					OTHER	1/25/1993	MONITORING
134810			BILLINGS REFINERY * RW-113	01N	26E	34		No	WELL	23.00					OTHER	1/15/1993	MONITORING
134846			BILLINGS REFINERY * RW-114	01N	26E	34		No	WELL	24.10					OTHER	1/18/1993	MONITORING
11513			MIDLAND FOODS INC.	01N	26E	34		No	WELL	27.00	11.00	19.00		23.00	PUMP	10/2/1980	PUBLIC WATER SUPPLY
905677			MONARCH	01N	26E	34		No	PETWELL								
147380			STATE OF MONTANA, DOT, HIGHWAYS DIVISION	01N	26E	34		No	WELL	35.00	16.80	31.50		7.00	AIR	7/14/1994	TEST WELL
11517			LOCKWOOD WATER USERS ASSOCIATION * #1	01N	26E	34	A	No	WELL	27.00	15.00			350.00	OTHER	12/1/1956	PUBLIC WATER SUPPLY
11514			LOCKWOOD WATER USERS ASSOCIATION * #2	01N	26E	34	A	No	WELL	27.00	15.00			350.00	OTHER	12/1/1956	PUBLIC WATER SUPPLY
11515			LOCKWOOD WATER USERS ASSOCIATION * #3	01N	26E	34	A	No	WELL	27.00	15.00			500.00	OTHER	12/1/1956	PUBLIC WATER SUPPLY
282310			MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY * DH-5	01N	26E	34	AA	No	WELL	10.00	8.40					4/1/2015	MONITORING
282318			MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY * LMW-2	01N	26E	34	AA	No	WELL	14.00	9.94					4/1/2015	MONITORING
282316			MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY * LMW-3	01N	26E	34	AA	No	WELL	15.00	10.50					4/2/2015	MONITORING
282315			MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY * MSE-1	01N	26E	34	AA	No	WELL	11.00	9.07					4/1/2015	MONITORING
282314			MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY * PIEZD-NEST 2	01N	26E	34	AA	No	WELL	10.00	9.11					4/1/2015	MONITORING

282317			MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY * PIEZO-3	01N	26E	34	AA	No	WELL	16.90	10.07					4/1/2015	MONITORING
198254			MONTANA DEQ	01N	26E	34	AA	No	WELL	28.00	9.00				OTHER	7/18/2002	MONITORING
165440		102251	LOCKWOOD IRRIGATION DISTRICT	01N	26E	34	AAA	No	WELL	40.00	8.00		8.00	25.00	AIR	10/20/1997	OTHER
265199			LOCKWOOD WATER AND SEWER DISTRICT * LMW-4	01N	26E	34	AAA	No	WELL	15.00	7.00					10/7/1992	MONITORING
11519			ORCHOWSKI, FRANK	01N	26E	34	AAA	No	WELL	22.00	18.00			45.00	OTHER	1/1/1946	DOMESTIC
11520			LOCKWOOD WATER USERS WELL * #4	01N	26E	34	AAAC	No	WELL	32.00	17.00	23.00		210.00	PUMP	10/4/1965	PUBLIC WATER SUPPLY
213271			L & J MACHINE	01N	26E	34	ABAA	Yes	WELL								INDUSTRIAL
29647			CENEX BILLINGS TANK FARM * MW-1	01N	26E	34	ABD	No	WELL	17.20	4.70				OTHER	9/3/1991	MONITORING
29668			CENEX BILLINGS TANK FARM * MW-2	01N	26E	34	ABD	No	WELL	17.40					OTHER	9/3/1991	MONITORING
29665			CENEX BILLINGS TANK FARM * MW-4	01N	26E	34	ABD	No	WELL	19.50					OTHER	9/4/1991	MONITORING
29676			CENEX BILLINGS TANK FARM * MW-6	01N	26E	34	ABD	No	WELL	22.30					OTHER	9/5/1991	MONITORING
29688			CENEX BILLINGS TANK FARM * MW-5	01N	26E	34	ABDC	No	WELL	17.40					OTHER	9/4/1991	MONITORING
195369			CONOCO INC	01N	26E	34	AC	No	WELL	20.50	10.00				OTHER	4/26/2002	MONITORING
29689			CENEX BILLINGS TANK FARM * MW-3	01N	26E	34	ACA	No	WELL	17.90	10.50				OTHER	9/4/1991	MONITORING
182034			METRA PARK	01N	26E	34	AD	No	WELL	28.00	9.00	23.00		70.00	PUMP	5/12/2000	IRRIGATION
222101			METRA PARK	01N	26E	34	BA	No	WELL	32.00	11.00				OTHER	7/13/2005	UNKNOWN
11522		4552	CHARBONNEAU, R. W.	01N	26E	34	BB	No	WELL	130.00	70.00	80.00		20.00	PUMP	11/20/1974	DOMESTIC
284032			KEENAN & JOHNSON * KJ-3	01N	26E	34	BB	No	WELL	27.00	21.00					8/14/2015	MONITORING
284030			KEENAN AND JOHNSON * KJ-1	01N	26E	34	BB	No	WELL	25.00	22.00					8/13/2015	MONITORING
284031			KEENAN AND JOHNSON * KJ-2	01N	26E	34	BB	No	WELL	30.00	19.20					8/13/2015	MONITORING
146657			PACIFIC HIDE AND FUR RECYCLING * MW-1	01N	26E	34	BBA	No	WELL	30.00	25.26			5.00	BAILER	10/15/1993	MONITORING
248882			CON-WAY FREIGHT * MW-19	01N	26E	34	BBC	No	WELL	24.00	16.50					12/4/2008	MONITORING
248884			CON-WAY FREIGHT * MW-20	01N	26E	34	BBC	No	WELL	26.00	16.60					12/5/2008	MONITORING
218959			CON-WAY TRANSPORTATION CO * MW-10	01N	26E	34	BBC	No	WELL	25.00	18.00				OTHER	5/11/2005	MONITORING
218962			CON-WAY TRANSPORTATION CO * MW-11	01N	26E	34	BBC	No	WELL	25.00	18.00				OTHER	5/11/2005	MONITORING
218954			CON-WAY TRANSPORTATION CO * MW-7	01N	26E	34	BBC	No	WELL	25.00	18.00				OTHER	5/10/2005	MONITORING
218955			CON-WAY TRANSPORTATION CO * MW-8	01N	26E	34	BBC	No	WELL	25.00	18.00				OTHER	5/10/2005	MONITORING
218957			CON-WAY TRANSPORTATION CO * MW-9	01N	26E	34	BBC	No	WELL	25.00	18.00				OTHER	5/11/2005	MONITORING
219658			CON-WAY TRANSPORTATION CO. * MW-12	01N	26E	34	BBC	No	WELL	25.00	18.00				OTHER	6/15/2005	MONITORING

219659	CON-WAY TRANSPORTATION CO. * MW-13	01N	26E	34	BBC	No	WELL	25.00	18.00			OTHER	6/15/2005	MONITORING
256938	CONWAY FREIGHT * MW-21	01N	26E	34	BBC	No	WELL	24.00	15.60		40.00	PUMP	6/30/2010	MONITORING
248877	XPO LOGISTICS FREIGHT, INC. * MW-14	01N	26E	34	BBC	No	WELL	24.00	14.00				12/2/2008	MONITORING
248878	XPO LOGISTICS FREIGHT, INC. * MW-15	01N	26E	34	BBC	No	WELL	22.00	13.60				12/3/2008	MONITORING
248879	XPO LOGISTICS FREIGHT, INC. * MW-16	01N	26E	34	BBC	No	WELL	21.00	11.60				12/3/2008	MONITORING
248880	XPO LOGISTICS FREIGHT, INC. * MW-17	01N	26E	34	BBC	No	WELL	21.00	10.00				12/4/2008	MONITORING
248881	XPO LOGISTICS FREIGHT, INC. * MW-18	01N	26E	34	BBC	No	WELL	26.00	16.00				12/5/2008	MONITORING
180221	CONSOLIDATED FREIGHT WAY * CFN-#1	01N	26E	34	BC	No	WELL	16.50	7.50			OTHER	2/3/2000	MONITORING
180220	CONSOLIDATED FREIGHT WAY * CFN-#2	01N	26E	34	BC	No	WELL	16.00	6.50			OTHER	2/3/2000	MONITORING
180219	CONSOLIDATED FREIGHT WAY * CFN-#3	01N	26E	34	BC	No	WELL	16.50	7.00			OTHER	2/4/2000	MONITORING
180218	CONSOLIDATED FREIGHT WAY * CFN-#4	01N	26E	34	BC	No	WELL	16.50	7.00			OTHER	2/4/2000	MONITORING
180217	CONSOLIDATED FREIGHT WAY * CFN-#5	01N	26E	34	BC	No	WELL	16.50	7.00			OTHER	2/4/2000	MONITORING
265299	GM PETROLEUM * CF-10-12	01N	26E	34	BC	No	WELL	15.00	7.50				4/4/2012	MONITORING
265295	GM PETROLEUM * CF-6-12	01N	26E	34	BC	No	WELL	15.00	7.50				4/3/2012	MONITORING
265296	GM PETROLEUM * CF-7-12	01N	26E	34	BC	No	WELL	15.00	7.50				4/3/2012	MONITORING
265297	GM PETROLEUM * CF-8-12	01N	26E	34	BC	No	WELL	15.00	7.50				4/3/2012	MONITORING
265298	GM PETROLEUM * CF-9-12	01N	26E	34	BC	No	WELL	15.00	7.50				4/4/2012	MONITORING
905591	MONARCH NO. 1	01N	26E	34	BC	No	PETWELL							
94216	NAVISTAR * MW-1	01N	26E	34	BCACD	No	WELL	20.00	9.00			OTHER	7/6/1989	MONITORING
94217	NAVISTAR * MW-2	01N	26E	34	BCACD	No	WELL	20.00	8.00			OTHER	7/6/1989	MONITORING
190071	YURKO PROPERTIES * MW-01	01N	26E	34	BCB	No	WELL	16.00	6.32		2.00	BAILER	6/15/2000	MONITORING
190065	YURKO PROPERTIES * MW-02	01N	26E	34	BCB	No	WELL	16.00	7.93		2.00	BAILER	6/15/2000	MONITORING
190069	YURKO PROPERTIES * MW-03	01N	26E	34	BCB	No	WELL	16.00	8.36		2.00	BAILER	6/15/2000	MONITORING
190070	YURKO PROPERTIES * MW-04	01N	26E	34	BCB	No	WELL	15.00	7.89		2.00	BAILER	6/16/2000	MONITORING
219663	YURKO PROPERTIES * MW-05	01N	26E	34	BCB	No	WELL	15.00	8.00			OTHER	6/16/2005	MONITORING
219660	YURKO PROPERTIES * MW-06	01N	26E	34	BCB	No	WELL	15.00	8.00			OTHER	6/16/2005	MONITORING
123504	CONSOLIDATED FREIGHT WAYS * CF-1	01N	26E	34	BCC	No	WELL	19.80	6.16			OTHER	4/10/1990	MONITORING
123513	CONSOLIDATED FREIGHT WAYS *	01N	26E	34	BCC	No	WELL	19.00	6.30			OTHER	2/6/1991	MONITORING

		CF-10												
123505		CONSOLIDATED FREIGHT WAYS * CF-2	01N	26E	34	BCC	No	WELL	18.80	6.31		OTHER	4/19/1990	MONITORING
123506		CONSOLIDATED FREIGHT WAYS * CF-3	01N	26E	34	BCC	No	WELL	18.80	6.67		OTHER	4/10/1990	MONITORING
123507		CONSOLIDATED FREIGHT WAYS * CF-4	01N	26E	34	BCC	No	WELL	20.50			OTHER	4/17/1990	MONITORING
123508		CONSOLIDATED FREIGHT WAYS * CF-5	01N	26E	34	BCC	No	WELL	21.30	5.40		OTHER	2/5/1991	MONITORING
123509		CONSOLIDATED FREIGHT WAYS * CF-6	01N	26E	34	BCC	No	WELL	19.30	6.50		OTHER	2/5/1991	MONITORING
123510		CONSOLIDATED FREIGHT WAYS * CF-7	01N	26E	34	BCC	No	WELL	20.00	6.50		OTHER	2/5/1991	MONITORING
123511		CONSOLIDATED FREIGHT WAYS * CF-8	01N	26E	34	BCC	No	WELL	19.50	5.60		OTHER	2/5/1991	MONITORING
123512		CONSOLIDATED FREIGHT WAYS * CF-9	01N	26E	34	BCC	No	WELL	21.70	5.50		OTHER	2/4/1991	MONITORING
285684		LARSON PROPERTIES LLC	01N	26E	34	BCC	No	WELL	19.00	9.00			12/4/2015	MONITORING
285683		LARSON PROPERTIES LLC * PBMW-1	01N	26E	34	BCC	No	WELL	20.00	9.00			12/3/2015	MONITORING
285685		LARSON PROPERTIES LLC * PBMW-3	01N	26E	34	BCC	No	WELL	20.00	7.00			12/4/2015	MONITORING
285686		LARSON PROPERTIES LLC * PBMW-4	01N	26E	34	BCC	No	WELL	19.00	9.00			12/3/2015	MONITORING
285688		LARSON PROPERTIES LLC * PBMW-5	01N	26E	34	BCC	No	WELL	20.00	8.00			12/4/2015	MONITORING
285689		LARSON PROPERTIES LLC * PBMW-6	01N	26E	34	BCC	No	WELL	19.00	7.00			12/3/2015	MONITORING
273492		YALE OIL COMP ERA HYDROMETRICS	01N	26E	34	BD	No	WELL	15.00	8.90			5/20/2013	MONITORING
273544		YALE OIL COMPANY ERA HYDROMETRICS	01N	26E	34	BD	No	WELL	15.00	9.90			4/25/2013	MONITORING
273546		YALE OIL COMPANY ERA HYDROMETRICS	01N	26E	34	BD	No	WELL	15.00	9.00			4/26/2013	MONITORING
273554		YALE OIL COMPANY ERA HYDROMETRICS	01N	26E	34	BD	No	WELL	15.00	11.20			5/2/2013	MONITORING
273557		YALE OIL COMPANY ERA HYDROMETRICS	01N	26E	34	BD	No	WELL	15.00	10.50			4/30/2013	MONITORING
273558		YALE OIL COMPANY ERA HYDROMETRICS	01N	26E	34	BD	No	WELL	15.00	9.50			4/24/2013	MONITORING
273493		YALE OIL COMPANY ERA HYDROMETRICS	01N	26E	34	BD	No	WELL	15.00	8.80			4/25/2013	MONITORING
273494		YALE OIL COMPANY ERA HYDROMETRICS	01N	26E	34	BD	No	WELL	15.00	7.90			4/29/2013	MONITORING
273553		YALE OIL COMPANY ERA HYDROMETRICS	01N	26E	34	BD	No	WELL	15.00	7.50			4/30/2013	MONITORING
273555		YALE OIL COMPANY ERA HYDROMETRICS	01N	26E	34	BD	No	WELL	15.00	7.80			4/29/2013	MONITORING
273556		YALE OIL COMPANY ERA HYDROMETRICS	01N	26E	34	BD	No	WELL	15.00	11.40			4/26/2013	MONITORING

273552		YALE OIL COMPANY ERA HYDROMETRICS	01N	26E	34	BD	No	WELL	15.00	7.80					4/30/2013	MONITORING
273559		YALE OIL COMPANY ERA HYDROMETRICS	01N	26E	34	BD	No	WELL	15.00	10.30					4/23/2013	MONITORING
126401		AGRI SYSTEMS	01N	26E	34	C	No	WELL	24.00	6.00	18.00	6.00	30.00	PUMP	10/5/1991	INDUSTRIAL
179478		CONOCO INC. * CCPMW#1	01N	26E	34	CA	No	WELL	18.00	11.00				OTHER	3/28/2000	MONITORING
179477		CONOCO INC. * CCPMW#2	01N	26E	34	CA	No	WELL	18.00	11.00				OTHER	3/29/2000	MONITORING
179479		CONOCO INC. * CCPMW#3	01N	26E	34	CA	No	WELL	18.00	11.50				OTHER	3/29/2000	MONITORING
179480		CONOCO INC. * CCPMW#4	01N	26E	34	CA	No	WELL	15.00	11.00				OTHER	3/30/2000	MONITORING
171707		CITY OF BILLINGS	01N	26E	34	CAD	No	WELL	15.00					OTHER	2/23/1999	MONITORING
11524		RICHARDS, LAURA	01N	26E	34	CB	No	WELL						OTHER	1/1/1950	DOMESTIC
130062		MT DEPT OF HIWYS * 13TH ST UNDERPASS	01N	26E	34	CBB	No	WELL	30.00	15.40				OTHER	9/2/1992	MONITORING
130058		MT DEPT OF HIWYS * 13TH ST UNDERPASS	01N	26E	34	CBB	No	WELL	30.00	16.80				OTHER	8/31/1992	MONITORING
130059		MT DEPT OF HIWYS * 13TH ST UNDERPASS	01N	26E	34	CBB	No	WELL	25.70	14.90				OTHER	9/1/1992	MONITORING
286802		CONOCO	01N	26E	34	CBC	No	WELL	6.00							MONITORING
287312		CONOCO	01N	26E	34	CBC	No	WELL	6.00							MONITORING
129570		BILLINGS REFINERY * PZ-1	01N	26E	34	CCD	No	WELL	19.80	10.00				OTHER	2/26/1991	MONITORING
129573		BILLINGS REFINERY * PZ-2	01N	26E	34	CCD	No	WELL	20.80					OTHER	2/26/1991	MONITORING
129576		BILLINGS REFINERY * PZ-3	01N	26E	34	CCD	No	WELL	21.60					OTHER	2/25/1991	MONITORING
129579		BILLINGS REFINERY * PZ-4	01N	26E	34	CCD	No	WELL	19.10					OTHER	2/25/1991	MONITORING
185615		CONOCO INC. * P2-23	01N	26E	34	CCD	No	WELL	25.00	9.50				OTHER	11/20/2000	MONITORING
185614		CONOCO INC. * P2-24	01N	26E	34	CDC	No	WELL	23.50	9.50				OTHER	11/20/2000	MONITORING
140977		INTERNATIONAL LEATHER MAN.	01N	26E	34	DB	No	WELL	21.00	7.70		7.70	75.00	PUMP	11/2/1990	INDUSTRIAL
208046		SCHAFNITZ JOHN	01N	26E	34	DBCD	No	WELL	29.00	12.20		12.20	28.00	AIR	12/11/2003	DOMESTIC
185616		CONOCO INC. * P2-25	01N	26E	34	DC	No	WELL	20.00	9.00				OTHER	11/21/2000	MONITORING
185617		CONOCO INC. * P2-26	01N	26E	34	DC	No	WELL	15.00	9.00				OTHER	11/24/2000	MONITORING
11527		JOHNSON, J. DONOVAN	01N	26E	34	DC	No	WELL	20.00	9.00	20.00		12.00	PUMP	8/7/1973	DOMESTIC

End of Report.
122 record(s) listed.

Items of Note:

[1]This report is restricted to site types of **WELL, BOREHOLE, SPRING, COAL BED METHANE WELL, PETWELL, PIEZOMETER**.

[2]A single well record (a distinct GWIC Id) may be represented by more than one line in this report if more than one performance test was conducted on the well at the time of drilling.

Explanation of Columns:
GWIC Id = Key field for the GWIC database. Links to one page reports.
PDF = Are scanned documents available through the Document Manager?

- = Yes, click on the icon to download the PDF file.
- = No, well was submitted electronically. No paper record exists.
- = No, record does have a known well log but it is not scanned yet.
- = No, record may or may not have a document to scan. Metadata is unclear.
- = No, record was created from a source other than a well log. No paper record exists.

DNRC WR = Water right number assigned to this site by Department of Natural Resources and Conservation.
Site Name = Current owner name assigned to GWIC record.
Location = Location of site in Montana township, range, section, and quarter-section coordinates.

Ver? = Has this location been verified by field staff?
Type = Type of site assigned to GWIC record.
Td = **T**otal **d**epth of well in feet below ground.
Swl = **S**tatic **w**ater **l**evel in feet above/below ground - Negative values are reported for water levels that are above land surface.
Pwl = **P**umping **w**ater **l**evel in feet below ground.
Rwl = **R**ecovery **w**ater **l**evel in feet below ground.
Yield = Yield in gallons per minute.
Test = Type of performance test reported.
Date = Completion date of well/borehole.
Use = Reported use of water.

Disclaimer:
The preceding materials represent the contents of the GWIC databases at the Montana Bureau of Mines and Geology at the time and date of the retrieval. The information is considered unpublished and is subject to correction and review on a daily basis. The Bureau warrants the accurate transmission of the data to the original end user at the time and date of the retrieval [6/14/2016 3:00:11 PM]. Retransmission of the data to other users is discouraged and the Bureau claims no responsibility if the material is retransmitted. There may be wells in the request area that are not recorded at the Information Center.

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SITE-SPECIFIC DATA QUALITY OBJECTIVES

1019 1st Avenue North

Billings, Montana

APPENDIX B

Appendix B-1

Site-Specific Data Quality Objectives for Soil, Groundwater, and Soil Vapor

Virdon Properties

Billings, Montana

Step 1: Problem Statement	Step 2: Identifying the Decisions	Step 3: Decision Inputs	Step 4: Study Boundaries	Step 5: Decision Rules	Step 6: Tolerance Limits on Errors	Step 7: Optimization of Sample Design
Future sale and/or redevelopment of the property is affected by concerns about contamination from onsite petroleum product dispensing and historic use as an auto repair facility and adjacent releases of petroleum to groundwater	Are COPCs (petroleum hydrocarbons, VOCs, metals) in subsurface soil, groundwater, and soil vapor at levels that preclude redevelopment for commercial use?	1) Subsurface soil samples will be collected and analyzed for COPCs at and above the groundwater interface. 2) Groundwater, if encountered, will be sampled and analyzed for COPCs. 3) Soil vapor samples will be collected and analyzed for COPCs. 4) Concentration of COPCs will be compared to MDEQ Tier 1 RBSLs and EPA and MDEQ screening levels based on commercial and industrial use of the facility.	The Study Area consists of one parcel in the Eastern Billings Urban Renewal District (EBURD) located at 1019 1st Avenue North. The parcel consists of a one-story retail building and a parking lot that adjoins the building to the west and southwest. An alley borders the northern perimeter of the target property.A used car sales lot (Custom Auto Sales) adjoins the property to the east-northeast. The southern boundary of the property is bordered by 1st Avenue North, with commercial development (Ace High Auto Sales and Scottie's Auto Sales) and industrial development (A&I Distributors) farther to the south. North 11th Street borders the western edge of the target property, with commercial development (NAPA Auto Parts, Sagebrush Trading, Burtell Fire Protection, and The Loft) located west of North 11th Street.	- If soil COPC concentrations exceed MDEQ/EPA screening levels, results indicate the Site is impacted at concentrations requiring additional assessment and/or cleanup. - If groundwater COPC concentrations exceed MDEQ screening levels and standards, results indicate the Site is impacted at concentrations requiring additional assessment and/or cleanup. - If soil vapor COPC concentrations exceed MDEQ screening levels and standards, results indicate the Site is impacted at concentrations requiring additional assessment and/or cleanup.	Soil boring sampling locations will be biased toward areas of suspected contamination therefore calculating numeric tolerance limits on errors is not appropriate. No previous Site data is available for estimating the distribution of surface soil results, therefore quantitative estimate of error was not performed. Quality assurance procedures, quality control procedures, and data validation will be completed in accordance with the EPA-approved QAPP.	The findings of the Phase I ESA were used to develop a site-specific CSM and the proposed assessment strategy. The soil, groundwater, and soil vapor sampling strategy was designed to evaluate the area of the site with the highest potential for containing COPCs. The site assessment strategy is based upon the Triad Approach which allows real-time field data to be used in an effort to determine extent of contamination, if observed.

Notes:

COPCs - Contaminants of Potential Concern

MDEQ - Montana Department of Environmental Quality

EPA - U.S. Department of Environmental Protection

QAPP - Quality Assurance Project Plan

CSM - Conceptual Site Model

RBSL - Risk Based Screening Level

RSLs - EPA Regional Screening Levels

SVOCs - Semi-volatile Organic Compounds

VOCs - Volatile Organic Compounds

Appendix B-2

Site-Specific Data Quality Objectives for Asbestos and Lead-Based Paint

Virdon Property

Billings, Montana

Step 1: Problem Statement	Step 2: Identifying the Decisions	Step 3: Decision Inputs	Step 4: Study Boundaries	Step 5: Decision Rules	Step 6: Tolerance Limits on Errors	Step 7: Optimization of Sample Design
Inadequate information is available to determine whether special waste handling and/or exposure controls are necessary to protect human health and the environment from hazardous building materials during renovation or demolition building material at the site. To this end, the existing building will require assessment to determine whether the following are present*:* 1) asbestos containing building materials (ACBM), 2) lead-based paint (LBP), or 3) surface soil containing elevated lead concentrations.	1) Does the existing building contain asbestos above regulatory limits? 2) Is LBP present on interior and exterior surfaces of the building? and 3) If exterior surfaces are LBP which is damaged or peeling, is surface soil near the building contaminated with elevated lead? 4) What are the estimated costs to abate ACBM and LBP in the building?	1) A visual survey and material sampling will be conducted for all suspect ACBM. 2) Painted surfaces will be measured for LBP using an XRF spectrometer, or paint chip samples will be analyzed for total lead, if XRF measurement is inconclusive. If LBP is present on the building, TCLP analysis will be performed on a sample representative of the waste stream to be generated during demolition. 3) If exterior surfaces contain LBP, surface soil near building will be analyzed for total lead.	The parcel located at 1019 1st Avenue North has one single-level retail building. Suspect asbestos-containing floor tile was observed in this building during the Phase I ESA.	1) Building materials will be considered ACBM if they contain greater than one percent asbestos based on the sampling results (40 Code of Federal Regulations CFR] 61, Subpart M). 2) Painted surfaces will be considered LBP if XRF results are greater than 1.0 mg/cm^2, or if analytical results of paint chip samples are above 0.5% lead or 5,000 mg/kg lead. Waste streams having a TCLP lead result greater than 5.0 mg/L lead will be considered hazardous waste. Surface soil will be considered contaminated if the concentration of total lead is above 800 mg/kg.	Sampling frequency, as specified by Montana Law, will be used to obtain representative results, as described in SOP 27 and SOP-28. Quality assurance and quality control procedures will be conducted and data validation will be performed in accordance with the programmatic QAPP (NewFields 2015).	Building materials suspected of containing asbestos will be sampled in accordance with 40 CFR 763 and the Administrative Rules of Montana (ARM) 17.74.354. XRF spectrometer analysis will be performed in the field to identify LBP. Composite soil samples along exterior areas of LBP will be collected at a frequency of one sample per every 40 linear feet of painted surface.

Notes:

mg/cm^2 = milligrams per square centimeter

mg/kg = milligrams per kilogram

mg/L = milligrams per liter

HEALTH AND SAFETY PLAN

1019 1st Avenue North

Billings, Montana

APPENDIX C

NewFields

HEALTH AND SAFETY PLAN

Virdon Property, Billings, Montana

Project No.: 350.0181.000

1. HASP Preparation and Approval

Project Name: Virdon Property, Billings, Montana
Task: Phase II Environmental Site Assessment
Proposed Start Date: September or October 2016

Prepared by/Reviewed by:

Printed Name: Heather Grotbo

Signature _____ Date_____

Title: Health & Safety Officer

Approved by:

Printed Name: Chris Cerquone

Signature _____ Date_____

Title: Project Manager

Note to Project Managers:

A signed and completed copy of the Health and Safety Plan and a signed and completed copy of the safety briefing (last page) must be included in the project file.

2. Project Description:

A subsurface investigation will be completed at the Virdon Property site in Billings, Montana. The purpose of the Phase II ESA is to determine whether the historic use of the Site properties and adjacent properties has resulted in soil, soil vapor, and/or groundwater impacts. The investigation may include:

- Direct push drilling; and
- Soil, groundwater, and soil vapor sampling.

3. Location:

The Site is located along 1st Avenue North in Billings, Montana and lies in Township 1 North, Range 26 East, Section 34. Billings is the largest city in Montana and is the county seat of Yellowstone County.

4. Facility/Work Site Description:

The Site is currently used as retail space. The 7,000 square-foot one-story building is operated as a liquor store (Montana Liquor, Inc.), along with an 11,200 square-foot parking lot that adjoins the building to the west and southwest. The Site is currently owned by the Mr. Randy Stone and is located in a commercial/industrial neighborhood known as the East Billings Urban Renewal District (EBURD). The specific objectives of this work are as follows:

- Install boreholes at locations shown on the attached Site Map, and collect soil samples from boreholes B-1 through B-11.
- Collect grab groundwater samples; and
- Collect two sub-slab soil vapor samples in the warehouse portion of the structure.

5. Proposed Personnel and Tasks:

Field Team Leader: Louise Spencer (perform Project Coordination, Health & Safety Oversight, Project Reporting; Field Investigation, Data Collection & Documentation)

6. Confined Space Entry

A confined space is defined as any space not currently used or intended for human occupancy, having a limited means of egress, which is subject to the accumulation of toxic contaminants, a flammable or oxygen deficient atmosphere, or other hazards, such as engulfment, or electrical or mechanical hazards should equipment be inadvertently activated while an employee is in the space. Confined spaces include but are not limited to storage tanks, process vessels, bins, boilers, ventilation or exhaust ducts, air pollution control devices, smoke stacks, underground utility vaults, sewers, septic tanks, and open top spaces more than four feet in depth such as test pits, waste disposal trenches, sumps and vats.

Will this task require entry into any confined or partially confined space?

☐ YES - Describe below

☒ No

7. Cutting and Welding

Will this task involve use of a cutting torch or welding?

☐ YES - Describe below

☒ No

8. Other Potential Hazards

- ☒ Chemical
- ☐ Radiological
- ☒ Fire/Explosion
- ☐ Heat Stress
- ☒ Electrical
- ☒ Machinery/Mechanical Equipment
- ☒ Trips, Slips, Falls
- ☐ Trenching/Shoring
- ☒ Heavy Equipment/Vehicular Traffic
- ☐ Overhead Hazards
- ☒ Unstable/Uneven Terrain
- ☐ Other - Describe below

9. Chemical/Radiological Hazard Evaluation

Waste Media	**Hazardous Characteristics**
☒ Airborne Contamination	☒ Ignitable
☒ Surface Contamination	☐ Corrosive
☒ Contaminated Soil	☐ Reactive
☒ Contaminated Groundwater	☒ Explosive
☐ Contaminated Surface Water	☒ Toxic (non-radiological)
☐ Solid Waste	☐ Radioactive
☐ Liquid Waste	
☐ Sludge	

This task involves a reasonable possibility of exposure to the substances listed below at concentrations or in quantities which may be hazardous to the health of the site personnel.

- Petroleum Hydrocarbons (gasoline, diesel)

11. Ambient Air/Site Monitoring Procedures

The following instruments shall be used to monitor the work environment and workers' breathing zones prior to site entry and at the specified intervals.

Instrument	**Monitoring Frequency**				
☒ PID (HNU, OVM) w/ 10.6 eV lamp	Cont.	15min.	30min.	hourly	other as needed*
☐ Multi Gas Meter	Cont.	15min.	30min.	hourly	other _____
☐ Combustible Gas Indicator	Cont.	15min.	30min.	hourly	other _____
☐ H2S Detector	Cont.	15min.	30min.	hourly	other _____
☐ Colorimetric Detector Tubes	Cont.	15min.	30min.	hourly	other _____
☐ Other (describe below)	Cont.	15min.	30min.	hourly	other _____

* Monitoring performed during soil sampling.

12. Action Levels

Task personnel shall observe the following Action Levels:

Instrument	Action Level	Specific Action
PID	Any detection for a continuous period of time (> 5 minutes) in the breathing space of site workers.	Contact H&S Officer to determine if respirators should be worn or if other exposure prevention methods are needed.

13. Personal Monitoring

☐ Passive Dosimeter ☐ Personal Air Sampling ☒ Other: visual and olfactory observation

14. Onsite Control

Work zones will be delineated with cones. Field Team Leader will instruct site visitors to stay at least one drilling mast height away from the drill rig in all directions.

15. Personal Protective Equipment

List the specific protective equipment, where applicable, for each Level of Protection identified below:

Level D PPE ☒

☐ Flame resistant clothing

☒ Hard hat, steel toed boots, safety glasses

☒ Ear protection during equip. operation

☒ Protective Eyewear

☒ Inert latex or nitrile gloves

16. Special Instructions

None

17. Sanitation Requirements

Potable water supply available on work site? ☒ Yes ☐ No

Portable toilets required on work site? ☐ Yes, how many? _____ ☒ No

Temporary washing/shower facilities required at work site? ☐ Yes, describe below. ☒ No

18. Emergency Procedures (This page is to be posted at prominent location on site)

Yes No

☐ ☒ On-site Communications Required? Emergency Channel: _____

Nearest Telephone: Cell phone

Fire and Explosion

In the event of a fire or explosion:

1. Evacuate the area – Safe Refuge Area (Fedex Ship Center located to the southeast of the Site, across 1st Avenue North)
2. Notify emergency personnel (Emergency Services: 911).
3. Notify NewFields project manager (Chris Cerquone: 406-830-6102)

On Site Injury or Illness

In the event of an injury requiring more than minor first aid, or any employee reporting any sign or symptom of exposure to hazardous substances, immediately call for emergency medical assistance by calling:
Emergency Services: 911.

Local Emergency Room *(SEE ATTACHED MAP)*

Name: **Billings Clinic Hospital, 2800 10th Avenue North, Billings, MT 59101**
Location: **2800 10th Avenue North, Billings, MT 59101**(see attached map)
Phone: **(406) 238-2500**

Contacts in Case of Injury, Illness, or Near Miss:

Project Manager: Chris Cerquone Phone (cell): 406-830-6102

Health and Safety Officer: Heather Grotbo Phone (cell): 406-465-7661

25. Safety Briefing

The following personnel were present at pre-job safety briefing conducted at _____ (time) on _____ (date) at _____ (location), and have read the above plan and are familiar with its provisions:

Printed Name	Signature

Fully charged ABC Class fire extinguisher available on site? ☐ YES

Fully stocked First Aid Kit available on site? ☐ YES

All project personnel advised of location of nearest phone? ☐ YES

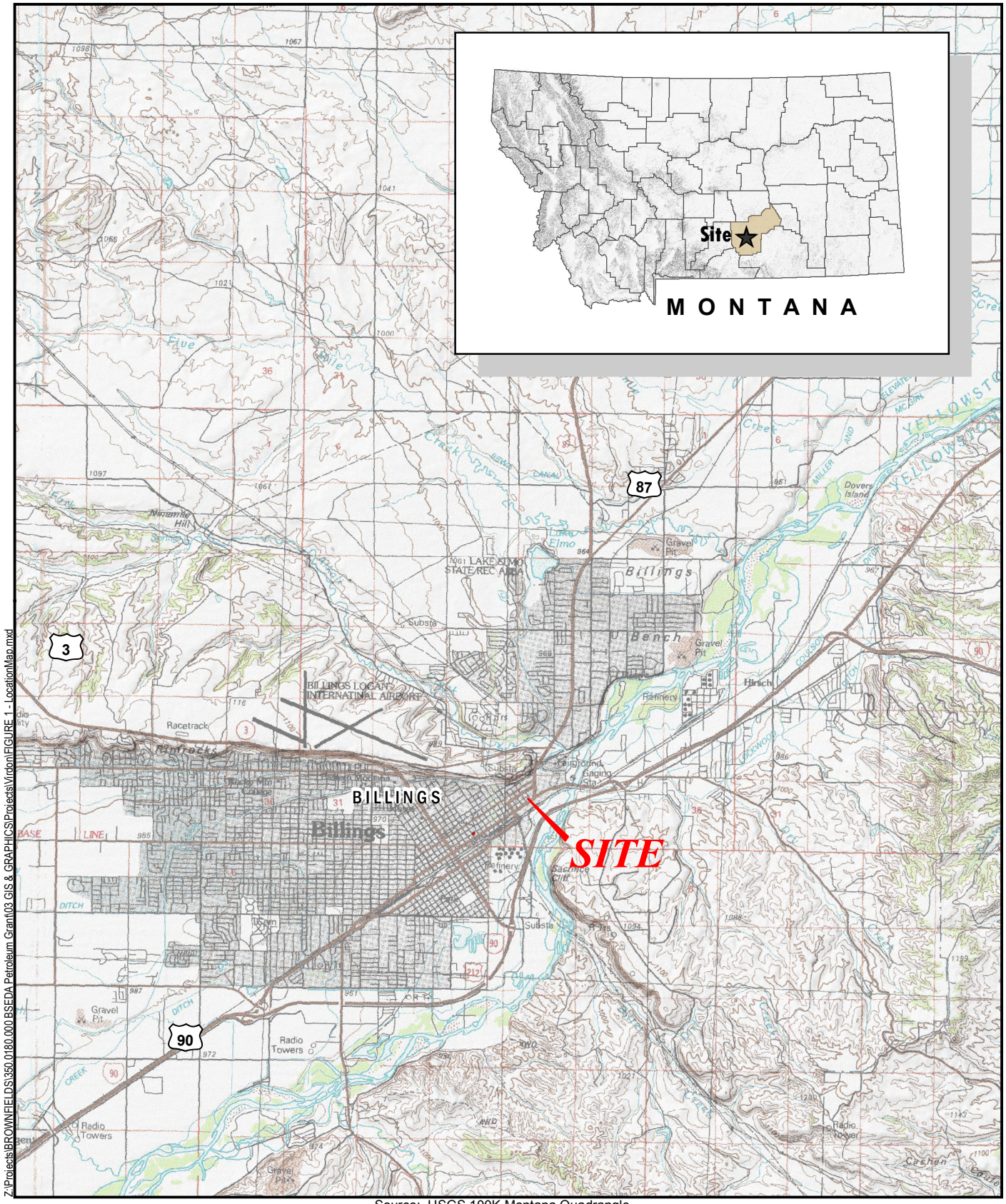
All project personnel advised of location of designated medical facility or facilities? ☐ YES

Printed Name of Field Team Leader or Site Safety Officer:

_____ _____

Signature Date

SITE MAP



Source: USGS 100K Montana Quadrangle

0 Miles 2

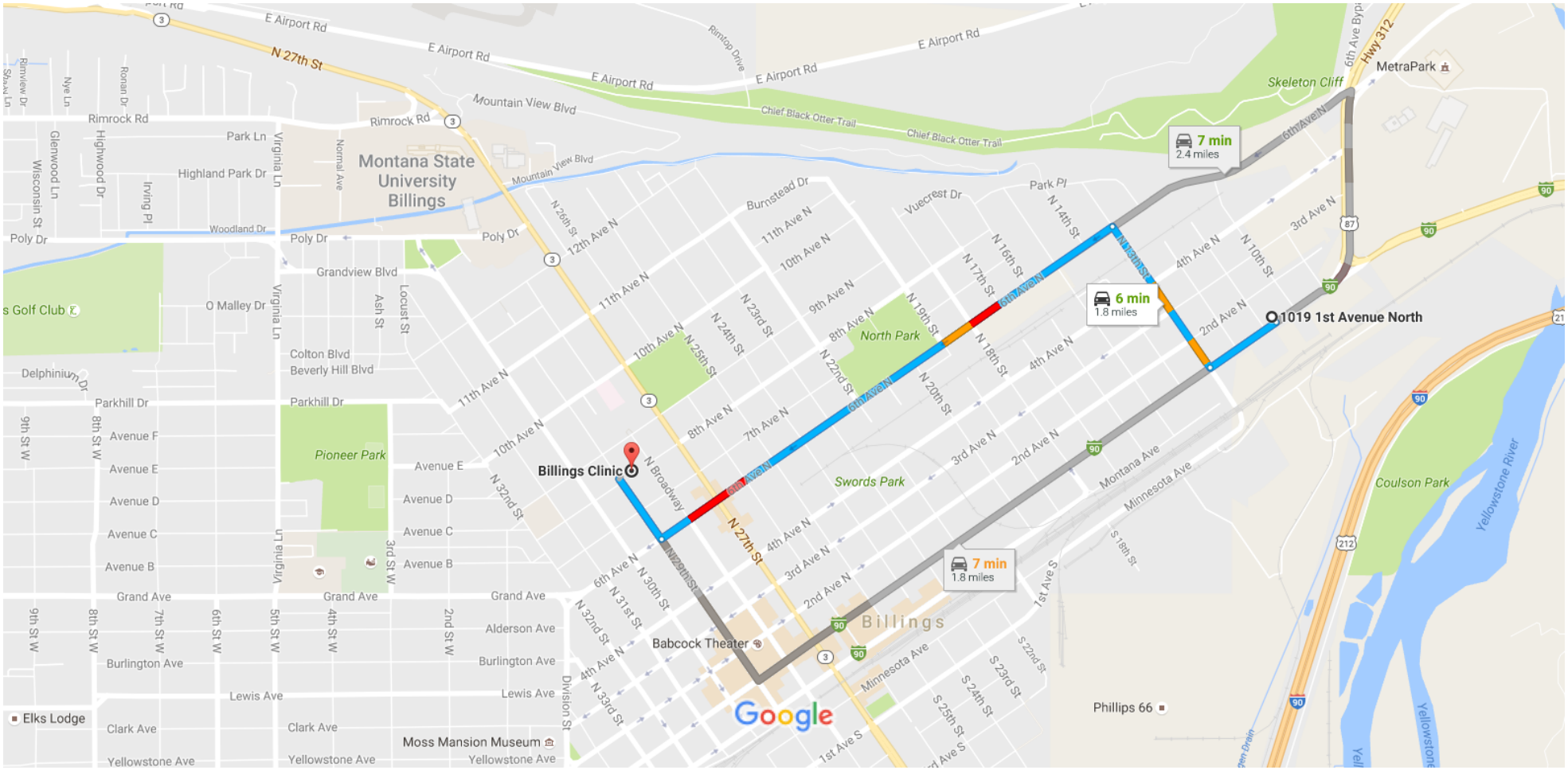
NewFields

Location Map
Virdon Property
1019 1st Ave North
Billings, Montana
FIGURE 1

MAP TO HOSPITAL

Google Maps 1019 1st Ave N, Billings, MT 59101 to Billings Clinic

Drive 1.8 miles, 6 min



Map data ©2016 Google 1000 ft

via 6th Ave N — 6 min

5 min without traffic — 1.8 miles

via 1st Ave N and N 29th St — 7 min

6 min without traffic — 1.8 miles

via US-87 N and 6th Ave N

6 min without traffic

7 min

2.4 miles

STANDARD OPERATING PROCEDURES (SOPs)

1019 1st Avenue North

Billings, Montana

APPENDIX D

STANDARD OPERATING PROCEDURES
TABLE OF CONTENTS

SOP	TITLE
1	Field Log Book and Field Sampling Forms
2	Equipment Decontamination
3	Sample Nomenclature, Documentation, and Chain-of-Custody Procedures
4	Sample Packaging and Shipping
5	Field Measurement of Groundwater Level
6	Field Measurement of LNAPL (Free Product)
7	Field Measurement of Electric or Specific Conductance
8	Field Measurement of pH
9	Field Measurement of Dissolved Oxygen
10	Field Measurement of Oxidation Reduction Potential (ORP)
11	Field Sample Filtration
12	Groundwater Sampling
13	Surface Soil Sampling
14	Subsurface Soil Sampling
15	Monitoring Well Construction
16	Monitoring Well Installation with Direct Push Equipment
17	Field Screening of Volatile Organic Compounds in Soil
18	Monitoring Well Development
19	Surface Water Sampling
20	Sediment Sample Collection
21	Soil Vapor Sampling (Summa canister with isopropyl alcohol tracer)
22	Soil Vapor Sampling (Summa Canister with Helium Leak Detection)
23	Ambient Air Sampling
24	Quality Control Sampling
25	Management of Investigative-Derived Waste
26	Using a PetroFlag® Hydrocarbon Analyzer
27	Asbestos Sample Collection
28	Lead-Based Paint Sample Collection
29	Air Sampling for Asbestos & Lead
30	Methamphetamine Sampling
31	Precursory Methcheck Sampling
32	Asbestos Fiber Air Sample Collection
33	Air Sampling with Sorbent Tube
34	Sampling Groundwater with a HydraSleeve™

SOP-1

FIELD LOG BOOK AND FIELD SAMPLING FORMS

Pertinent field investigation and sampling information should be recorded on a daily field log book and appropriate sampling forms to provide a continual record of actions taken each day on the site. Each employee is responsible for completing a record of the day's activities in a log book and field forms of sufficient detail such that someone can reconstruct the field activities without relying on the memory of the field crew. At a minimum, entries on the field log book shall include:

- Project and client name
- Purpose of the field effort
- Names of field crew leader and team members present on the site, and other site visitors
- Description of site conditions and any unusual circumstances, including weather conditions
- Details of actual work effort, particularly any deviations from the field work plan or standard operating procedures
- Location of sample site, including map reference, if relevant
- Field observations
- Field measurements made (e.g., PID readings, pH, temperature) on appropriate forms.
- Date and time of initiation and cessation of work.

Purpose

To provide guidance on how to document activities completed in the field by NewFields employees

Goal and Objective

To provide a record of our project work and the decisions made in the field

Equipment Needs

Field Note Book
Field Sampling Forms

Specific details for each sample collected should be recorded using NewField's standardized field forms. These field forms contain blank queries to be filled in by field personnel. Items typically recorded on field sampling forms consist of the following:

- Sample name
- Time and date samples were collected
- Number and type (media; natural, duplicate, QA/QC) of samples collected
- Analysis requested
- Sample preservative (if applicable)
- Sampling method, particularly any deviations from standard operating procedures
- Signature of sampler

Upon completion of the field effort, the original field forms shall be filed in the project file. Photocopies of the original field forms can be made and used as working documents.

SOP-2

EQUIPMENT DECONTAMINATION

Decontamination of field equipment is necessary to prevent cross contamination between sites and sampling locations. Decontamination should be performed on all non-dedicated and non-disposable sampling equipment that may contact potentially contaminated media. Field personnel must wear disposable gloves while decontaminating equipment to prevent cross contamination.

The following should be done to decontaminate field equipment:

- Set up a decontamination area, preferably upwind from your sampling area to reduce the potential for windborne contamination.
- Prior to initiating decontamination, visually inspect sampling equipment for evidence of contamination; use stiff brush to remove visible material.
- Once rough brushing is complete, decontaminate each piece of equipment following a sequential process of washing with Liquinox or an equivalent degreasing detergent; rinsing with distilled water; rinsing with 10% dilute nitric acid; and finally rinsing with distilled water three times. Best procedure is to set up wash tubs for each of the above processes.
- Rinse equipment with methanol instead of nitric acid if sampling for organic contamination.
- Decontaminated equipment that is used for sampling organics should be wrapped in aluminum foil or another inert material if not used immediately.

Field equipment can be decontaminated by steam cleaning as an alternative. If equipment is steam cleaned, it should still be rinsed with 10% dilute nitric acid and distilled water.

All disposable items (e.g., paper towels, latex gloves) should be deposited into a garbage bag and disposed of in a proper manner. Handling and disposal procedures for the rinse and wash water will depend on the likely presence and type of contaminant in the wash water. The project Sampling & Analysis Plan should be reviewed to determine the process for handling wash water.

Purpose

The purpose of this SOP is to describe general decontamination procedures for field equipment

Goal and Objective

To sufficiently clean field equipment to prevent cross contamination between sites and sample locations

Equipment Needs

5-gallon plastic tubs

Distilled water

1-gallon cube of 10% Nitric Acid

Spray Bottle of 10% Methanol

Liquinox Soap

Hard Bristle Brush

Garbage Bags

Disposable Gloves

Paper Towels

55-gallon drums (optional depending on need to containerize wash water)

A list of equipment for decontamination is provided below. The amount of dissolved water needed on site will depend on the number of samples to be collected and the sampling methods. For this reason, the you should evaluate the need prior to going in the field.

SOP-3

SAMPLE NOMENCLATURE, DOCUMENTATION, AND CHAIN-OF CUSTODY PROCEDURES

When completing sampling it is critical that the process used to label and transport samples to the laboratory for analysis is sufficient to demonstrate with confidence that the samples were collected from the location indicated, and that during transport to the lab no actions were taken to potentially alter the integrity of the samples. Without following strict sample labeling and chain-of-custody procedures, analytical data collected at a site has little to no value.

SAMPLE NOMENCLATURE

Samples should be labeled in such a way to allow a person unfamiliar with the site to understand where the samples were collected. Samples should be labeled sequentially as follows:

> Project site initials- sample type- sampling method- sample number-sample depth.

For example, the sample KR-SBSS-TP1-12', indicates the sample was collected at Knife River (KR), the sample was a sub-surface soil sample (SBSS), was from test pit 1 (TP-1), and was collected at 12 feet below ground. Samples numbers should be numerically sequential (TP1, TP2, etc.). Prior to initiating sampling, field personnel should familiarize themselves with the Sampling & Analysis Plan and the nomenclature to be used for the site. The character prefixes in the table below are recommended for sample types.

Purpose

To identify the specific requirements for labeling and documenting sample collection

Goal and Objective

To increase the confidence in sample locations and to submit samples to the laboratory without risk of integrity loss

Equipment Needs

Indelible ink pen

Chain-of-custody forms

Field Log Book

Field Sampling Form

SAMPLE DOCUMENTATION

In addition to the chain-of-custody forms discussed below, field person must keep a list of samples collected at the field in the field log book and on appropriate field sampling forms. This allows you to go back and verify sample locations and numbers should there be any confusion at a later time. Upon returning to the office, the field log book and forms should be kept in the project file and subsequent copies sent to the laboratory, or other designated parties, as needed.

Each person in the field is responsible for putting entries into the field log and sampling forms. Designating an individual from the sampling team for record keeping is fine, provided all field personnel come to an agreement as to who this will be, and the field crew leader is certain field personnel are familiar with the record keeping requirements. All entries on the log book and field sampling forms must be made in indelible ink.

Sampling Acronym	Label
EB	Equipment Blank
TB	Trip Blank
FB	Field Blank
MW	Monitoring Well
DW	Domestic Well
IW	Injection Well
OB	Observation Well
UST	Underground Storage Tank
VE	Vapor Extraction
AA	Ambient Air
SUMP	Sump (Water sample)
POND	Ponds
SPR	Spring
LAKE	Lake
SW	Surface Water, Stream or River
SR	Surface Runoff
TP	Excavated Test Pit
SS	Surface Soil Sample
SBSS	Subsurface Soil Sample
GW	Groundwater Sample

CHAIN OF CUSTODY PROCEDURES

A chain-of-custody form must be generated for all samples collected in the field for laboratory analysis. Samples from more than one project should not be included on the same chain of custody; however, multiple samples from a specific project can be included on the same custody form.

Copies of the chain-of-custody form should be maintained in the project file. The sampler may use a NewFields' chain-of-custody form or a chain- of-custody form provided by the laboratory. Sample custody records must be maintained from the time of sample collection until the time of sample delivery to the analytical laboratory and should accompany the sample through analysis and final disposition. The information to be included on the chain-of-custody form will include, but is not limited to:

- Project number/site name
- Sampler's name and signature
- Date and time of sample collection
- Unique sample identification number or name
- Number of containers
- Sample media (e.g., soil, water, vapor, etc.)
- Sample preservative (if applicable)
- Requested analysis
- Comments or special instructions to the laboratory

Each sample must be assigned a unique sample identification number as described above. The information on the chain-of-custody form, including the sample identification number, must correspond to the information recorded by the sampler on the field forms and field log book and the label on the sample container.

A sample is considered under a person's control when it is in their possession. When custody of a sample is relinquished by the sampler, the sampler will sign and date the chain-of-custody form and note the time that custody was relinquished. The person receiving custody of the sample will also sign and date the form and note the time that the sample was accepted into custody. The goal is to provide a complete record of control of the samples. Should the chain be broken (signed by the relinquisher but not receiver or vice versa), the integrity of the sample is lost and the resulting analytical data suspect. Samples must be shipped to the analytical laboratory following the procedures described in in SOP-4. If an overnight shipping service is used to transport the samples to the laboratory, custody of the samples must be relinquished to the shipping service. If possible, have the shipping service sign the chain-of-custody form prior to placing the chain of custody in the sample cooler. If this is not possible (i.e. form placed in the sealed cooler), a note should be included on the chain of custody that the shipping company has received the samples with the chain of custody inside the cooler.

SOP-4

SAMPLE PACKAGING AND SHIPPING

SAMPLE PACKAGING

Samples must be packaged to preclude breakage or damage to sample containers, and shipped to comply with shipper, U.S. EPA, and U.S. DOT regulations. When packaging samples:

- Use sample labels from the laboratory whenever possible. Place the sample label on the side of the sample container and use indelible ink when completing the label.
- Place labeled sample bottles in a high quality cooler. Place the samples in an upright position inside the cooler and wrap the samples with cushioning material for protection during transport. The cooler should be able to withstand tough handling during shipment without sample breakage.
- Make sure the cooler has an adequate amount of ice (inside sealed Ziploc bags) and/or frozen blue ice (appropriate for the season) to maintain a temperature of 4°C or less inside the cooler from the time the samples are placed in the cooler until they are received by the laboratory. When in doubt put in more ice. Ensure the cooler drain plug is taped shut.
- Fill out the appropriate chain-of-custody forms and place them in a Ziploc bag and tape it to the inside lid of the shipping container. If more than one cooler is used per chain of custody, put a photocopy in the other coolers and mark them as a copy.
- Close and seal the cooler using strapping tape.
- Place completed sample custody seals on the outside of the cooler such that the seals will be broken when the cooler is opened. Secure the custody seals on the cooler with clear strapping tape.
- Secure a shipping label with address, phone number, and return address on the outside of the cooler where it is clearly visible.

Purpose

To ensure samples are properly packaged for shipment to the analytical laboratory

Goal and Objective

To have samples received by the analytical laboratory in good condition and within EPA temperature thresholds

Equipment Needs

Indelible ink pen

Chain-of-custody forms

Custody Seals

Sample Labels from Lab

Coolers and Ice

Field Sampling Form

SHIPPING HAZARDOUS MATERIALS/WASTE

Transportation regulations for shipping of hazardous substances and dangerous goods are defined by the U.S. DOT in 49 CFR, Subchapter C, Part 171 (October 1, 1988); IATA and ICAO. These regulations are accepted by Federal Express and other ground and air carriers.

According to DOT regulations, environmental samples are classified as Other Regulated Substances (ORS). ORS are articles, samples, or materials that are suspected or known to contain contaminants and/or are capable of posing a risk to health, safety, or property when transported by ground or air. Samples, substances, or materials from sources other than material drums, leachate streams, and sludges should be considered as ORS or environmental samples. Materials shipped under the classification of ORS must not meet any of the following definitions:

Class 1: Explosives; Class 2: Gases- compressed, liquefied, dissolved under pressure, or deeply refrigerated; Class 3 Flammable Liquids; Class 4: Substances susceptible to spontaneous combustion; Class 5: Oxidizing substances; Class 6: Poisonous (toxic and infectious); Class 7: Radioactive materials; Class 8: Corrosives.

If your samples might meet any of the above definitions, contact the project manager to obtain instructions on sample shipment.

SOP-5

FIELD MEASUREMENT OF GROUNDWATER LEVEL

FIELD PROCEDURE

- Verify the water level indicator is operating correctly prior to leaving for the field by placing probe in water to test the buzzer and light. Repair as necessary. Make certain the meter and extra batteries are in the carrying case.
- Prior to collecting a measurement, decontaminate the water level indicator, as appropriate, and calibrate the probe to a steel tape. Note any corrections to water level meter measurements on field forms.
- Measure all wells (monitoring and domestic) from the top of the well casing in the north quadrant or from a designated measuring point, as appropriate. Measure and record the distance from the measuring point to ground level. Make sure the measuring point is labeled on the well, so future measurements can be made from the same location.
- Measure the depth to water from the measuring point to the nearest hundredth of a foot.
- Record measurements on the appropriate field forms. Also record the presence/absence of free product on the field forms.
- Decontaminate the water level meter between each measurement following the procedures in SOP-2.
- If free product is known or suspected to be present in a well, an oil-water level indicator or other method should be used to measure the depth to water and the thickness of free product in the well, as described in SOP-6.

Purpose

To ensure groundwater levels are accurately measured in the field

Goal and Objective

To have samples received by the analytical laboratory in good condition and within EPA temperature thresholds

Equipment Needs

Water Level Indicator

Extra set of batteries

Indelible Ink Pen

Field Sampling Form

SOP-6

FIELD MEASUREMENT OF GROUNDWATER LEVEL

Three different procedures are described in this SOP for measuring product thickness in a monitoring well. These include using a specialized probe, using a bailer, and using product and water finding paste.

Purpose

Provide guidelines for various techniques for measuring the thickness of free-phase LNAPL in monitoring wells

Goal and Objective

To employ a consistent measuring method for LNAPL in monitoring wells

Equipment Needs

Solinst LNAPL Probe or equivalent

Extra set of batteries

Indelible Ink Pen

Field Sampling Form

Using a Solinst LNAPL Probe:

- Turn the probe on and rotate the disc at the top of the probe head. To test the batteries, insert the probe into the holder, this should cause a steady beep to be heard.
- Remove the probe from the holder and slowly lower the probe into the well. When the top of the product is reached, the probe should emit a steady beep. Note the depth on a field form and label "Depth to Product".
- Continue to lower the probe in the well. When the water column is reached the sound should change from a steady to an intermittent beep. Note the depth on the form under "Depth to Water".
- Remove the probe and rotate the disc back to the off position and turn the meter off.
- Product thickness can be calculated by subtracting the depth to product from the depth to water.

Using a Bailer:

- This method is less precise, but can provide a general idea of product thickness. The resulting thickness will likely be less than what is actually in the well.
- Lower a bottom loading bailer slowly into the well. You should be able to hear when it reaches the top of the fluid column. Continue to SLOWLY lower the bailer into the well no deeper than the total length of the bailer (i.e. the top of the bailer should remain above the top of the fluid in the well.
- Remove the bailer and measure the thickness with a tape measure.

Using Paste:

- • Using a steel tape, smear water finding paste over a 3-4 foot interval of one side of the tape. Smear product finding paste (or chalk) over the other side.
- • Lower the tape into the well until the bottom of the tape is roughly 2-3 feet below the top of the fluid in the well. Note the depth of the tape on the form.
- Remove the tape and note the reading indicated by the water finding paste or chalk, and the reading indicated by the product finding paste (both of these should be evident as a change in color, or a wet line in the case of chalk).

- The depth to water is calculated by subtracting the water reading from the total tape depth. The depth to product is calculated by subtracting the product reading from the total tape depth. Product thickness is calculated by subtracting depth to product from the depth to water.
- This may need to be repeated several times, especially if the depth to water is not known, or if the product thickness is greater than the depth the tape is lowered into the fluid. Previous depth to water and product thickness readings can be used as a guide.

SOP-7

FIELD MEASUREMENT OF ELECTRIC OR SPECIFIC CONDUCTANCE

INSTRUMENT CALIBRATION

The conductivity meter should be calibrated prior to each sampling event following the manufacturer's recommendations. If the instrument is a multi-parameter meter, follow the instructions for measurement of electric or specific conductance from the manual.

Prior to conducting field measurements, verify the meter automatically corrects for temperature variations. If the meter does not, apply the appropriate temperature correction to the field measurements.

FIELD MEASUREMENT PROCEDURE

Rinse a decontaminated glass container or plastic flow-through cell with sample water.

Fill the container or flow-through cell with sample water, with enough available space to insert the probe without undesired overflow.

Rinse the conductivity or multi-parameter probe with deionized water and place it in the beaker of sample water. Immerse the probe in sample and move it around to displace any air bubbles. Keep the probe tip off of the sides of the beaker. Record the conductivity reading. Be sure to recognize the units of the reading (i.e. microseimens/centimeter (µs/cm), micromhos/centimeter (µmhos/cm), or milliseimens/centimeter (ms/cm). Record the reading on the field sampling form and filed log book. If the reading is being taken in-situ or using a flow-through cell, wait until the reading stabilizes and record it on the sample field form.

Remove the probe from sample and decontaminate probe. Store the probe following the manufacturer's recommendations.

Purpose

To ensure measurement of specific conductance is done consistently and correctly in the field

Goal and Objective

To obtain accurate specific conductivity measurements in the field

Equipment Needs

Specific Conductivity Meter

Calibration standard

Measurement container

Extra set of batteries

Indelible Ink Pen

Field Sampling Form

SOP-8

FIELD MEASUREMENT OF PH

Purpose

Provide guidelines for pH measurements in water samples

Goal and Objective

To obtain accurate pH measurements in the field

Equipment Needs

pH Meter

Calibration standards

Glass container or flow-through cell

Extra set of batteries

Indelible Ink Pen

Field Sampling Form

INSTRUMENT CALIBRATION

The pH meter must be calibrated prior to each field event and after every 10 samples during a sampling event, or more frequently if required by the project/client. Follow the manufacturer's recommendations to calibrate. This typically involves sequence of steps, as follows:

1. Verify sensor is clean and filled with solution, then turn on meter.
2. Place in pH 7 solution, press "cal". Wait until calibration complete.
3. Rinse sensor in distilled water.
4. Place in pH 10 (or pH 4) buffer solution. Press "cal" a second time. Wait until endpoint reached.
5. Rinse in distilled water.

Three point calibration is standard procedure. If instrument is a multi-parameter meter, follow the instructions for measurement of pH from the manual.

Periodically throughout the field day, place the probe in 7.0 pH buffer solution. If the measured value differs from the expected value by more than 0.1 pH units, recalibrate the meter according to the manufacturer's instructions.

FIELD MEASUREMENT PROCEDURE

- Rinse a decontaminated glass beaker or plastic flow-through cell sample water three times.
- Rinse the pH probe with deionized water.
- Fill the container with sample water.
- Immerse the probe in the sample and agitate it to provide thorough mixing. Continue to agitate until the reading has stabilized. Read the pH to the nearest 0.1 s.u. and record on the field sampling form. If the reading is being taken in-situ or using a flow-through cell, wait until the reading stabilizes and record it.
- Note any problems such as erratic readings. If previous readings are available, compare the current measurement to previous reading to check that the current reading is within reasonable limits.
- Rinse probe with deionized water and store according to the manufacturer's instructions.

SOP-9

FIELD MEASUREMENT OF DISSOLVED OXYGEN

FIELD MEASUREMENT PROCEDURE

Before each use, clean and rinse the electrode tip with distilled water. Verify that the membrane cap has been filled with DO electrolyte in accordance with manufacturers required maintenance schedule.

Calibrate the probe and meter using the fresh water-air calibration method described in the manufacturer's manual. Correct the calibration value for temperature and altitude and adjust the meter accordingly. Sensor can maintain polarization when disconnected from the meter for up to three hours.

Place probe the directly into the stream or well to be measured. If not possible, place the probe into a flow-through cell receiving a continuous stream of water from the source being measured. Allow sufficient time for the probe to stabilize to sample temperature and dissolved oxygen concentration. Record the dissolved oxygen value on the appropriate field forms. Decontaminate probe when measurement is complete.

If sensor will not calibrate, becomes sluggish or erratic:

- Clean tip and refill cap with DO electrolyte in accordance with manufacturer's instructions (typically care must be taken to eliminate air bubbles from inside probe, and probe tip must be scarified using manufacturer-provided sandpaper).
- Check membrane for damage, replace if necessary.
- Check meter with test plug.
- Replace battery.

Purpose

Provide guidelines for Dissolved Oxygen measurements in water samples

Goal and Objective

To obtain accurate dissolved oxygen measurements in the field

Equipment Needs

Dissolved Oxygen Meter

Distilled water

Calibration cup

Extra set of batteries

Indelible Ink Pen

Field Sampling Form

SOP-10

FIELD MEASUREMENT OF OXIDATION REDUCTION POTENTIAL (ORP)

FIELD MEASUREMENT PROCEDURE

- Calibrate the meter in accordance with the manufacturer's instructions prior to each sampling event.
- Decontaminate a plastic or glass container in accordance with SOP-2.
- Rinse the ORP electrode with distilled water and then with sample water prior to inserting it into the sample beaker.
- If possible, obtain an in situ measurement of ORP. If not possible, preferably use a flow-through cell receiving a constant stream of water from the well, or (least preferred) collect a sample of water. If obtaining a sample for ORP measurement, minimize agitation of the sample in an effort to limit exposure to oxygen.
- Immerse the ORP electrode in the sample and allow at least one minute for the probe to equilibrate with the water.
- Obtain a reading to the nearest ten millivolts.
- Record the reading on standardized field forms and the field book. Note any problems such as erratic or drifting readings.
- Decontaminate the probe following the SOP-2.

Purpose

Provide guidelines for Redox Potential measurements in water samples

Goal and Objective

To obtain accurate Redox Potential measurements in the field

Equipment Needs

Redox Potential Meter

Distilled water

Calibration solution with table of temperature adjustment information

Extra set of batteries

Indelible Ink Pen

Field Sampling Form

SOP-11

FIELD SAMPLE FILTRATION

FIELD PROCEDURE

- Set up a system whereby water samples can be filtered, including a filter apparatus and hand-vacuum pump.
- To avoid the need for decontamination, use disposable tubing and equipment and a hand-vacuum pump.
- Place groundwater or surface water into a vessel that can be pressurized using the hand-vacuum pump. The filtered effluent from the pump can be placed directly into sample containers post filtering with a 0.45 micron filter.
- As appropriate, fill pre-preserved, laboratory supplied sample containers with filtered sample and cap.
- Invert sample container several times to insure complete sample-preservative mixing.
- Place sample into cooler; package and ship accordance with the SOP concerning shipping.
- If extremely turbid sample water is obtained, you may need to pre-filter the sample using 3.0 or 5.0 micron filter paper followed by 0.45 micron filtration.
- Decontaminate, if necessary, all equipment in accordance with the SOP concerning decontamination.

Purpose

Provide guidelines for filtering water samples in the field

Goal and Objective

To employ a method of filtering samples in the field, thus removing sediment from the sample and allowing for analysis of dissolved components in the sample

Equipment Needs

0.4, 3.0, and 5.0 micron filters

Filter apparatus and Hand-vacuum pump

Preservatives, as required

Indelible Ink Pen

Field Sampling Form

SOP-12

GROUNDWATER SAMPLING

Prior to initiating groundwater sampling, all equipment should be inspected for damage and repaired. Check with the project manager to be sure you understand what type of pump will be used to purge and sample groundwater. Equipment to be placed down hole must be decontaminated. Begin with the well containing the lowest level of contamination, and sample wells in succession based on anticipated increasing concentrations. If the relative degree of concentrations cannot be determined, wells should be sampled in order of increasing proximity to the suspected source of contamination, preferably from the perimeter towards the center of the site.

Field sampling forms must be completed for each well to document purging and sampling.

SAMPLING FROM TEMPORARY BOREHOLES

If samples are to be collected from temporary boreholes, a temporary well screen (PVC or stainless steel) should be placed in the borehole when feasible, and the water level should be measured prior to sampling and at least 15 minutes after completion of the borehole to the sampled depth. If it is not feasible to set temporary well screen, collect the sample initially into unpreserved, laboratory-provided ultraclean containers, then filter the sample prior to placement in the final sampling containers.

When sampling from a temporary well screen, use either new tubing (LDPE or Teflon) with a stainless steel foot valve, or use a new/decontaminated bailer. Note the physical appearance of the sample (color and qualitative turbidity) on the field sampling form. Where feasible, avoid sampling from the bottom 1-foot of the borehole or well screen to minimize entrainment of sediment into the sample.

WELL PURGING

Purging must be performed on all wells prior to sample collection.

Before purging each well, record the depth to water from the top of the well casing to the nearest 0.01 foot using a water level meter. If sampling at a site where there may be free product, wells shall be checked for the presence of free product prior to purging and sampling using an oil-interface probe.

Purpose

Provide guidelines for sampling groundwater

Goal and Objective

To employ a method of collecting groundwater samples representative of the chemistry of the underlying aquifer

Equipment Needs

Five gallon bucket graduated in gallons

Purge/sampling pump(s)

Oil-Interface Probe, as necessary

Water Level Meter

pH, temperature, and conductivity meter

Filtering apparatus and hand pump (if filtering samples)

Sample Containers

Preservatives, as required

Field Sampling Forms

Decontamination equipment and fluids

Tubing, as needed

Generator or power supply

Coolers and Ice

Stop Watch

Rope and Bailer, for backup

Determine the saturated thickness by subtracting the total well depth from the depth to water.

Monitoring wells shall be purged until a minimum of three casing volumes have been removed and water quality characteristics (pH, temperature, conductivity) have stabilized. Field parameters should be measured during well purging at least three times per casing volume purged. Stabilization is achieved when pH readings stabilize to within 0.1 and temperature and conductivity stabilize to within 5% over a casing volume. The following equation is used to calculate well volume in gallons:

1) V=3.14*(r2)*d*7.48 where V= volume (gallons)
r= well radius, feet
d= depth of water in well (feet)

The radius of the well pack will be used for the well radius for calculating bore volumes where appropriate. For example, a 2" PVC monitoring well installed in a 6" hole with sand filter pack would use a well radius of 3" or 0.25 feet.

Several general methods can be used for well purging. Well purging may be achieved using bailers, bladder pumps and submersible pumps. The specific pumping method shall be chosen based on depth to groundwater, diameter of well, existing well configuration and contaminant(s) of concern.

If the recovery of a low-yield well exceeds two hours after purging, a sample shall be extracted as soon as sufficient volume is available in the well. At no time should a monitoring well be pumped dry if the recharge rate causes formation water to cascade down the well casing causing an accelerated loss of volatiles and change in pH.

Purge water must be handled in accordance with the SOP for investigative-derived wastes. is discharged directly to the ground, attention must be given to avoid direct recharge of shallow wells with the purge water. Purge water must be discharged down gradient and at an adequate distance from the well to avoid mounding and interference.

COLLECTING WATER QUALITY SAMPLES

Label each sample container with project number, sample location, well owner, date, military time, sampler's initials, preservative, and analysis required.

Don clean latex or nitrile gloves immediately prior to obtaining the sample.

Obtain the sample from the well using a disposable polyethylene bailer, a decontaminated stainless steel or Teflon bailer, or pump and tubing (submersible, bladder, peristaltic, etc.), as appropriate. The pump to be used should be determined by the contaminants of concern, so check with the project manager. The pump or bailer intake should generally be placed at the midpoint of the saturated thickness in the casing for sampling. If the well is pumped dry during the purge, the pumping rate shall be reduced to match well yield if possible and a note made on the sampling form. When using a bailer, take care to minimize degassing or contamination of the sample by submerging and withdrawing the bailer slowly to avoid splashing. Do not place the bailer on the ground.

When sampling a domestic well connect a hose to the outside fixture to direct water away from the home to an area where the water can soak into the ground. Turn on the faucet and let it run for 60 minutes. Turn flow rate down and collect a water sample in appropriate containers. Make sure to add preservatives to the sample containers prior to filling them, in accordance with the table below.

When sampling a monitoring well, add preservatives to the sample container prior to sample collection (this is often done by the analytical laboratory). Remove water from the well and transfer sample water directly into sample bottles or filter apparatus (should filtering be necessary), maintaining a slow linear flow with as little agitation as possible. For volatile analyses fill vials at the rate of 100 milliliters per minute (24 seconds for 40 milliliter vial) or less. Fill each sample vial completely so the water forms a convex meniscus at the top to ensure no air space exists in the vial after it has been capped. After filling, immediately cap, invert, and gently tap the vial to check for trapped air. If air bubbles are present, un-cap vial, add more sample water and repeat procedure. If air bubbles are still present, discard the vial.

Samples should be preserved as described in the table below.

Parameter	Number	Container	Preservation	Maximum Holding Time Extraction/ Analysis
VOCs	2	40 ml glass	4°C & HCL	14 days to analysis
SVOCs	1	1 liter glass	4°C	7 days/40days from extraction to analysis
Metals	1	500 ml HDPE	4°C & HNO_3	6 months to analysis,, Hg 28 days to analysis
Nutrients	1	500 ml HDPE	4°C & H_2SO_4	Varies – contact laboratory for additional information
Common Ions	1	1 liter HDPE	4°C	7 days/40 days from extraction to analysis

Be sure to properly cap and lock the well when sampling is complete.

Be sure to complete the necessary shipping and handling paperwork, and record all pertinent information on Field Sampling Forms.

SOP-13

SURFACE SOIL SAMPLING

This SOP describes the field equipment and sampling methods for surface sampling of soil. Be sure to review the project specific Sampling and Analysis Plan (SAP) for additions or deletions to the methods noted below. These procedures may be modified in the field based on field and site conditions after appropriate annotations have been made in the field logbook and the project manager is consulted to discuss.

All sampling equipment shall be decontaminated before arriving on site.

Purpose

Provide guidelines for sampling of surface soil.

Goal and Objective

To employ a method of collecting surface soil samples representative of field conditions.

Equipment Needs

Stainless steel mixing bowl and sampling trowel

Hand lens (10) power

pH and electrical conductivity meters (if required)

Munsel color book (if required)

Latex or Nitrile gloves

Locating Flags

Coolers and Ice

GPS Unit

Field forms and field book

SURFACE SOIL SAMPLING

Commonly, there are two different methods of surface soil sampling completed on a site: Discreet or Grab Samples, and Composite Samples. The methods for each of these are described below.

For both methods, surface soil samples should be collected from the surface to a depth of six inches unless otherwise specified in the project specific SAP.

Soils should be described according to the procedures outlined in the United Soil Classification System (USCS; method ASTM D2487) or the Soil Conservation Service (SCS) classification system. Soil texture should be classified by either the USCS or the U.S. Department of Agriculture (USDA) classification. Descriptions shall be recorded in the field books or on standard morphological description logs as provided in the SAP.

Discrete or Grab Soil Samples

- Locate the site as directed in the appropriate sampling and analysis plan.
- Wearing disposable latex or nitrile gloves collect a sample by scraping the 0-6 inch interval of soil with a stainless steel spoon.
- Place the soil in a stainless steel bowl.
- Remove all coarse fragments greater than 0.5 inches from the bowl. If volatile organics analysis is not required, mix the remaining sample in the bowl with the stainless steel spoon.
- Transfer the soil sample directly into a glass sample jar with Teflon cap (4 or 8 ounce, depending on number of analyses required) and store in a cooler at 4 degrees Celsius or less. Retain approximately 30 grams of the sample in a plastic bag for field measurement of pH or PID screening, if required.

- Push flag into the ground at the sample location, which will allow for obtaining the coordinates of the sample location later with a GPS Unit, or take a coordinate reading of the location prior to moving to another sample location.
- Record information about the sample collection on the appropriate forms.

Composite Samples

Review the work plan or SAP to determine the location and spacing of sampling area grids for the collection of composite samples. When reviewing, determine the grids to be cordoned off in the field and the number of composite samples to be collected within the each grid. Follow the process below to collect the composite samples. **Composite soil samples should not be collected for analysis of volatile organic compounds.**

- Prior to collecting the composite samples, mark off the sampling grid as described in the SAP.
- Collect five to eight (as indicated in the SAP) surface soil samples of equal volume using a sampling trowel from discrete locations within a sampling area and place them in the mixing bowl. If a sod or duff layer is present, this layer should be peeled back to the top of the mineral soil.
- Remove all coarse fragments greater than 0.5 inches from the bowl.
- Mix the samples in the mixing bowl well and then a fill a laboratory supplied sample container with the mixed soil.
- Complete appropriate field sampling forms and the chain of custody. Store all samples in a cooler with ice.

SOP-14

SUBSURFACE SOIL SAMPLING

SUBSURFACE SOIL SAMPLING

Typically, subsurface sampling is completed using a hand auger, split spoon sampler, direct push drilling equipment, or backhoe or excavator. Sampling procedures for each type of equipment is described below.

Hand Auger

- Arrive on-site equipped with stainless steel auger rod and hand auger. If you intend to collect samples from different intervals below grade, bring several sizes of stainless steel augers (e.g. 2-inch, 4-inch, 6-inch, etc.).
- Hand auger holes can be drilled as one size or in a telescoping manner if you wish to collect discreet samples at intervals below grade and prevent risk of cross contamination between intervals. If a single depth sample is required, advance the auger bucket to the desired sampling interval depth and empty the contents of the auger in a stainless steel mixing bowl. Mix and place soil into appropriate sample containers.
- For the telescoping method, advance the largest auger first to the desired depth, collecting a specified depth increment sample as the auger bucket is advanced. Install temporary decontaminated PVC casing with a diameter slightly smaller than the borehole to keep the hole open and reduce possible cross-contamination between depth intervals. Using the next size smaller auger bucket, repeat the process.
- Fill out appropriate sample labels, field forms and chain-of-custody paperwork and place samples for lab analysis in a cooler with ice.
- Decontaminate all equipment between sample locations.

Purpose

Provide guidelines for sampling of subsurface soil.

Goal and Objective

To employ a method of collecting subsurface soil samples representative of field conditions.

Equipment Needs

Will depend on sampling method

Stainless steel mixing bowl and sampling trowel

Hand lens (10) power

Munsel color book (if required)

Latex or Nitrile gloves

Locating Flags

GPS Unit

Coolers and Ice

Field forms and field book

Split Spoon Sampler

- Arrive on-site equipped with at least two standard 1.4 inch inside diameter split spoon samplers. If geotechnical information is desired, a 140 pound drive hammer is required.
- Install split-spoon sampler into borehole and advance to the desired depth with the 140 pound drop hammer. Record number of blow counts to complete sampling over each 18-inch interval, as necessary.
- Retrieve sampler and place on work table. Using the other sampler, repeat this sequence.

- Record lithology and percent recovery from cores retrieved from split spoon sampler.
- If required by the project work plan or sampling and analysis plan, composite like core intervals by mixing in stainless steel bowl in a similar manner as described for surface sampling. When sampling for volatile organic compounds, the sample should not be mixed.
- Decontaminate sampling equipment between each interval sampled if required by the SAP.
- Decontaminate sampling equipment between sampling sites.

Direct Push Drilling Equipment

- Locate the site to be sampled and ensure that drilling equipment can safely access the site.
- Minimize off road travel to prevent off site damage to surrounding vegetation.
- Advance sampling rods lined with acetate sleeves to the prescribed depth. Retrieve the rods, remove the sample sleeves, and secure on the work table.
- Record lithology and percent recovery from the retrieved sample sleeve.
- If required by the project work plan or sampling and analysis plan, composite like core intervals by mixing in stainless steel bowl in a similar manner as described for surface sampling. When sampling for volatile organic compounds, the sample should not be mixed.
- Decontaminate sampling equipment between each interval sampled if required by the SAP.
- Decontaminate sampling equipment between sampling sites.

Backhoe or Hand Dug Excavations

- Locate the site to be sampled and ensure that equipment can safely access the site.
- Minimize off road travel to prevent off site damage to surrounding vegetation.
- Orient excavation to maximize use of the angle of the sun to illuminate the pit for photographs.
- Excavate to the prescribed depth. Place excavated material a sufficient distance from the excavation. If the pit exceeds five feet in depth, OSHA construction standards for shoring or sloping must be observed to prevent accidental burials. Sampling personnel should avoid entering any pit to collect samples, and if required to do so, strict adherence to all OSHA standards must be implemented.
- Soil profile descriptions shall be made from a hand cleaned surface along the pit wall.
- Complete profile descriptions and take photographs before pit is sampled.
- Soil samples shall be collected from depth intervals specified in the SAP. When a depth interval is sampled, an equal volume of soil should be collected from the entire interval exposed on the pit wall by the excavating bucket. When the bucket is brought to the surface, soil samples should be collected from the bucket with the stainless steel trowel and mixing bowl according to methods described for surface soil sampling. When sampling for volatile organic compounds, the sample should not be mixed.
- After sampling is completed, the pit should be backfilled with excavated material in the reverse order that it was excavated so that topsoil material is returned to the top of the pit. When backfilling is complete the area should be cleaned up to its original condition. If a test pit is left open overnight, temporary fencing and appropriate signs and flagging tape should be used to prevent access to the excavation.

- Decontaminate the excavator bucket and all sampling equipment between sampling sites. Excavation equipment should be cleaned between sites with water (where possible) or with a shovel to remove accumulated dirt and mud.

SAMPLE CONTAINERS AND PRESERVATION

Soil samples should be preserved as described in the table below.

Parameter	Number	Container	Preservation	Maximum Holding Time Extraction/ Analysis
VOCs	1	4 oz glass	4°C	14 days to analysis
VPH	1	4 oz glass	4°C	Preserve in methanol within 7 days/40 days from preservation to analysis
EPH	1	4 oz glass	4°C	14 days/40 days from extraction to analysis
SVOCs	1	4 oz glass	4°C	7 days/40days from extraction to analysis
Metals	1	4 oz glass or plastic	4°C	6 months to analysis,, Hg 28 days to analysis

SOP-15

MONITORING WELL CONSTRUCTION

- Arrive on site with the appropriate drilling equipment and materials for site conditions. Be sure to review the SAP to determine anticipated lithology. Filter pack and well-screen slotting should be based on the lithology. Ensure that the driller has properly decontaminate all drilling equipment and materials prior to arrival on- site.
- Many states now require certification and licensing for monitoring well drillers. Verify the driller is licensed in the State (if required) prior to beginning fieldwork.
- Safety equipment required on-site of the drill rig is mandatory. Personal protective equipment includes (at a minimum): hardhat, safety glasses, steel toed boots, gloves, first aid kit, and site safety plan-with routes to hospitals known by all personnel on-site.
- Acceptable drilling techniques for the installation of monitoring wells include air- rotary, cable tool, and hollow-stem auger. If unconsolidated material is encountered, it may be necessary to drive steel casing during drilling to maintain borehole integrity.
- Appropriate decontamination of the auger flights between boreholes is required.
- Drilling mud or drilling solutions of any kind are not to be used during drilling activities in conjunction with monitoring well construction. Hydraulic jacks or the drill rig can be used to pull back the steel casing following emplacement of plastic casing.
- Subsurface samples must be collected by the driller at intervals specified in the SAP. Down-hole soil samples should be collected using a standard 1.4-inch inside diameter split spoon sampler and a 140-pound drive hammer. The number of blows necessary to obtain an 18-inch length of sampler by the driller should be recorded on the boring log.
- A detailed lithologic boring log must be completed during drilling activities. Soils should be described on the log according to the procedures outlined in the United Soil Classification System (USCS; method ASTM D2487) or the Soil Conservation Service (SCS) classification system. Soil texture should be classified by either the USCS or the U.S. Department of Agriculture (USDA) classification. Water bearing characteristics of the formations should also be denoted on the log. In addition, details of monitoring well construction should be described on the well log including total depth, perforated interval, sizes

Purpose

Provide guidelines for installing monitoring wells in the field

Goal and Objective

To employ a standard method of installation monitoring wells, which will allow for collected of representative groundwater samples

Equipment Needs

Drilling system

Well completion material (screen, filter pack, borehole seal, and surface seal) consistent with anticipated lithology

Hand lens (10) power

USGS Soil Classification Chart and Munsel color book

Latex or Nitrile gloves

Boring Log and field book

and types of construction materials, etc.

- When completing the well, install factory slotted well screen (size dependent on lithology) and blank PVC (or stainless steel or PTFE for organics) well casing into the borehole. Emplace chemically inert silica sand at least 2 feet above and below any perforated sections and install a bentonite plug above the sand. Backfill remaining well annulus with bentonite slurry or grout to the ground surface. Develop the well prior to sample in accordance with the appropriate SOP.
- Place locking protective well cover over well casing(s) after outer steel casing has been removed from the borehole (if necessary). Place bentonite plug below bottom of well cover; grout cover in place and lock with high quality lock.

SOP-16

MONITORING WELL INSTALLATION WITH DIRECT PUSH EQUIPMENT

FIELD PROCEDURE

- Arrive on-site with the appropriate drilling equipment and materials for site conditions. Ensure drill has properly decontaminate all drilling equipment and materials prior to arrival on- site.
- Safety equipment required on-site is mandatory. Personal protective equipment includes (at a minimum): hard hat, safety glasses, steel toed boots, gloves, first aid kit, and site safety plan-with routes to hospitals known by all personnel on-site.
- Check SAP to determine if soil samples should be collected during advancement of direct push equipment. If so, follow methods described in SOP for subsurface soil sampling.
- Advance the direct push drill rods to the desired depth for monitoring well installation.
- Describe lithology encountered following method described in SOP for subsurface soil sampling. A detailed lithologic log should be completed. Water bearing characteristics of the formations should be denoted on the log. In addition, details of monitoring well construction should also be described on the well log including total depth, perforated interval, sizes and types of construction materials, etc.
- Construct the monitoring well of Schedule 40 or 80 PVC casing and factory- slotted well screen up to 1-inch in diameter. Once the drill rods are at the desired depth, lower the well screen and casing through the drill rods. Retract the drill rods out of the borehole while placing a chemically-inert silica sand around the screen interval to one foot above the well screen. Install a bentonite plug above the sand at least 2 feet in thickness. Above the bentonite, backfill the remaining well annulus with a bentonite slurry or grout to ground surface.
- Place locking protective well cover over the well casing after the drill rods have been removed from the borehole. Place bentonite plug below bottom of well cover; grout the cover in place and lock with high quality lock.

Purpose

Provide guidelines for installing monitoring wells using direct push techniques

Goal and Objective

To employ a standard method of well installation using direct push techniques

Equipment Needs

Ink Pen

Well Completion materials, as necessary

Latex or Nitrile gloves

Field Log Book and Boring Well Log

SOP-17

FIELD SCREENING OF VOLATILE ORGANIC COMPOUNDS IN SOIL

- Field screening can be done using a flame ionization detector (FID), photoionization detector (PID), or combustible gas indicator (GCI). Which instrument is used will depend on the contaminants at the site and site conditions. The project SAP should be reviewed to identified the field screening instrument to be used at the site.
- If using a PID, ensure the instrument is equipped with the appropriate lamp for the compound(s) of interest (refer to table below). Use a filter to prevent moisture and dust from contacting the PID lamp.
- Calibrate the instrument prior to each field day following the manufacturer's instructions. Document the calibration on the appropriate field form or in the project field book.
- Obtain a soil sample from the interval of interest, place it in a new ziploc bag, and seal the bag. Shake the bag to thoroughly mix the sample with the air in the headspace.
- Allow the sample to come to room temperature (approximately 70 - 80° F) by placing it in a warm location (not in direct sunlight). In the winter, it may be necessary to place the sample bag under a vehicle heater vent.
- Insert the probe in the ziploc bag and record the maximum reading on the appropriate field forms.

Purpose

Provide guidelines for field screening of volatile organic compounds in soil

Goal and Objective

To employ a standard method of measuring the concentration of volatile organics in soil

Equipment Needs

FID, PID, or GCI, as required by SAP

Ink Pen

Zip Lock Bags

Latex or Nitrile gloves

Field Log Book and Sampling Forms

PID Lamp Selection

Lamp	Description	Typical Compounds Detected
9.8 eV	Most selective lamp	Benzene, aromatic compounds, amines
10.6 eV	Standard PID lamp	All compounds detected by 9.8 eV lamp and chlorinated compounds, including vinyl chloride, DCE, TCE, PCE, and chlorobenzene
11.7 eV	Detects broadest range of analytes	All compounds detected by 10.6 eV lamp, used to detect methylene chloride, carbon tetrachloride, chloroform, 1,1,1-trichloroethane

SOP-18

MONITORING WELL DEVELOPMENT

FIELD PROCEDURE

Prior to sampling of a monitoring well, the well must be developed to remove excess fines and set the filter pack installed during well construction.

Purpose

Provide guidelines for developing monitoring wells

Goal and Objective

To ensure wells are developed prior to sampling

Equipment Needs

Decontamination equipment and fluids

Latex or Nitrile gloves

Well Development Form

- Visually inspect all well development equipment for damage and repair as necessary.
- Decontaminate all stingers, air hoses, surge blocks following the SOP developed for decontamination of field equipment.
- If using compressed air method for well development, verify the compressor utilized does not produce air laden with hydraulic fluid for lubricating purposes. This may affect the integrity of the monitoring well for producing viable water quality data.
- Develop well by using surging techniques (surge block or bailer) followed by evacuation of water and sediment. Place the surge block or bailer in the well and lower to bottom. Move the surge block or bailer up and down over the entire length of the well screen several times. Remove and evacuate water from the well. Repeat this procedure until evacuated water is visibly clean and essentially sand-free. Record clarity of water after development on the well development form.
- Evacuated water should be disposed of following to the process defined in the SAP or project work plan.
- Report field observations and volume of water removed on well development form.

SOP-19

SURFACE WATER SAMPLING

Purpose

To provide field sampling methodologies for surface water

Goal and Objective

.To ensure surface water samples are collected consistently in the field

Equipment Needs

Decontamination equipment and fluids

Latex or Nitrile gloves

pH, conductivity, temperature meter

Coolers and ice

Sample bottles Preservatives

Indelible marker

Field sampling Form

Chain-of-custody

GRAB SAMPLING

- When collecting a grab sample of surface water attempt to collect the sample at the interval in the stream which exhibits the largest volume of flow and/or highest velocity. More than one interval may be sampled.
- Field parameters should be measured in accordance with applicable SOP prior to collect a sample for analytical testing. Take care to collect measurements from the sample locations in the stream as the grab sample.
- To collect a sample, submerge a pre-labeled sample bottle such that mouth of bottle is submerged below the water surface 2 to 3 inches, if possible. If sampling inorganics, allow bottle to fill partially; rinse bottle by shaking and discharge this water away from sample site. Repeat this procedure three times. Do not rinse sample bottles for organics analysis.
- Once the sample container is filled, add preservative (if necessary), and cap. If water is too shallow to fill directly to sample bottles use a decontaminated container to collect sample water. Transfer water from compositing container into pre-labeled sampling bottles.
- Fill out appropriate field form(s) documenting sample location, time, and other pertinent information prior to leaving sampling site.

SAMPLING FREE PRODUCT ON SURFACE WATER

This sampling procedure to be used when sampling for free phase organic constituents floating on top of water is described below.

- Decontaminate sample container in accordance with appropriate SOP.
- Using a wide mouth jar, submerge the sample container in such a manner that leaves the mouth of the container half-way out of the water. Wait for the container to fill.
- Transfer directly into sampling bottles.
- Fill out appropriate field form(s) documenting sampling location, time, and other pertinent information prior to leaving the sampling site.

SOP-20

SEDIMENT SAMPLE COLLECTION

This SOP describes the field equipment and sampling methods for collection of fresh-water sediment samples in shallow water (less than eight feet deep). Methods explained in this SOP may be different from those identified in the project specific Sampling and Analysis Plan (SAP) and the project specific SAP should be referenced for additions or deletions to the methods noted below.

Purpose

To describe field sampling methodology for sediment water

Goal and Objective

To ensure sediment samples are collected consistently in the field

Equipment Needs

Decontamination equipment and fluids

Latex or Nitrile gloves

Stainless steel scope, spoon, or trowel

Stainless steel mixing bowl

Sample jars with Teflon-lined lids

Sample jar labels

Cooler and ice

Field forms and field book

Chain-of-custody

SAMPLE COLLECTION

- Prior to sample collection and between samples, be sure to decontaminant all non-disposable sampling equipment in accordance with standard operating procedures.
- Label your sample containers in accordance with standard operating procedures.
- If you can wade into the surface water body, collect the sediment sample using a stainless steel scoop or spoon. Collect the sediment sample with the scoop or spoon while facing upstream. Excess water may be removed from the scoop or spoon; however, care should be exercised to avoid the loss of fines when decanting excess water.
- In surface water bodies that are too deep to wade, but less than eight feet deep, a stainless steel spoon or scope attached to a piece of pipe may be used from the banks if the surface water body is narrow or from a boat.
- Following collection, place the sample in a stainless steel mixing bowl, mix it thoroughly, and then place a portion of the sample in the sample container. When sampling soil for organics, do not mix the samples as this may release organics from the sediments. Place sample containers in a cooler with ice.
- Complete all out appropriate field sampling forms and chain-of-custody forms.

SOP-21

SOIL VAPOR SAMPLING

(SUMMA CANISTER WITH ISOPROPLY ALCOHOL TRACER)

GENERAL PROCEDURE – PURGING

Prior to sample collection, purging of soil vapor from the sampling probe must be performed. If previous purge testing has not been performed, a purge optimization test should be conducted to select an appropriate purge volume for the site. During purge optimization, remove 1, 3, and 7 volumes of dead space (tubing, probe, air within filter pack surrounding the probe). The number of purge volumes that yields the highest concentrations of target analytes as measured using a PID should be selected.

After selecting a purge volume, purging should be conducted using a pump (such as personal air sampling pump) or vacuum canister (either one-time use, such as a Summa canister, or electric canister maintaining a consistent vacuum). Constant flow rates during purge should be maintained by air flow meters with adjustable purge pumps or the use of flow controllers with vacuum canisters. The rate of purging (usually in mL/min), and the start and stop time of purging (recorded as hour:minute:second) should be recorded at each sampling location.

Following purging, and prior to soil vapor sampling, the sampling train should be sealed to influence from outside ambient air using valves or other closure mechanisms.

COLLECTING SOIL VAPOR SAMPLES

Generally, sampling locations shall be sampled from the least contaminated to the most contaminated, if known.

- Prior to initiating sampling, confirm that all connections from the vapor sampling point to the vacuum canister are tightly sealed, the flow controller is in-place in the sampling train, and that a pressure gauge is properly installed between the sampling canister and the flow controller (or that the flow controller has a built-in sampling gauge installed in the proper orientation).
- Place a weighted absorbent towel on the ground at the point where the sampling train enters the subsurface and beneath any connections in the sampling train, then soak the towel with liquid isopropyl alcohol.

Purpose

To describe field sampling methodology for soil vapor

Goal and Objective

To ensure soil vapor samples are collected correctly and consistently in the field

Equipment Needs

Summa canister

Flow controller Pressure gauge

Flow controller-to-tubing and purge pump-to-tubing connections

Tubing

Other fittings for top of soil vapor probe (if necessary)

Tracer gas and absorbent towels

Purge pump

Stop watch

PID, or volatile organic meter that can detect both the target environmental analyte and the tracer gas

Field forms and field book

Chain-of-custody

- Open the valve on the summa canister, and record time, canister pressure (in negative inches of mercury), and the serial number of the canister in the field log book and field sampling form. If using a 6-liter Summa canister, the initial vacuum should be between -30 and -25 inches of mercury. If this is not the case, contact the laboratory and start the purging and sampling process over including use of a different Summa canister.
- Using a field instrument, also record organic vapor concentrations (dominated by isopropyl alcohol tracer compound) in the ambient air near the base of the sampling probe.
- At about ½ the time necessary to complete sampling, record time and canister pressure, and ambient organic vapor concentrations. The pressure on a 6-liter Summa canister should be between -20 and -12 inches of mercury at ½ of the sampling time. Determine whether the sampling time will have to be extended to obtain sufficient sample volume, and adjust accordingly.
- At the end of the designated time necessary to complete sampling with the flow controller used, record time and canister pressure, and ambient organic vapor concentrations.
- Continue to draw air from the soil vapor probe until the 6-liter Summa canister vacuum is reduced to between -10 and -5 inches of mercury. Record the time and canister pressure, then close the canister valve to end sampling.
- Remove the canister to a location distant from the soil vapor probe and tracer gas application, and prepare the canister for shipment to the laboratory
- Label each Summa canister with project name, project number, sampling location, date, military time (at the end of the sampling interval), sampler's initials, and analysis required.
- Ship the samples to the laboratory under chain-of-custody, include one copy of the chain of custody form with each package.

SOP-22

SOIL VAPOR SAMPLING

(SUMMA CANISTER WITH HELIUM LEAK DETECTION)

FIELD PROCEDURE

- Attach flow controller and pressure gauge to Summa canister.
- Seal the upstream end of controller/canister with a brass cap, then open the canister valve for approximately 5 seconds. Observe pressure gauge. Pressure should stay constant at an initial point between 30 and 23 inches of mercury. If the initial pressure is above or below this range, contact the laboratory and use a different Summa canister. If the pressure changes, re-tighten connections and repeat.
- Confirm that sample tubing (3 to 4 feet) is attached to the soil vapor probe, and also place a short section of tubing for helium monitoring adjacent to the soil vapor probe.
- Seal the distant ends of the helium monitoring tubing and sample tubing using a valve or clamped section of silicon tubing.
- Provide helium supply line to near the soil vapor probe entrance to the ground, and cover the probe and adjacent sections of helium supply line, helium monitoring line, and sample tubing with a shroud (plastic bag weighed down to the surrounding surface using a sand-filled hose).
- Open the helium monitoring line, turn on the helium meter, and connect the meter to the monitoring line.
- Add helium and until the concentration monitored under the shroud is 20%.
- Purge 3 dead-space volumes from the sample tubing and probe using a syringe, personal air sampling pump, or vacuum canister (either one-time use, such as a Summa canister, or electric canister maintaining a consistent pressure). Maintain constant flow rate during purging using an air flow meter with adjustable purge pump or flow controller with vacuum canister. The rate of purging (usually in mL/min), and the start and stop time of purging (recorded as hour:minute.second) should be recorded at each sampling location. If pump or canister is not used, a syringe can be used for purge, in which case simply record

Purpose

To describe field sampling methodology for soil vapor

Goal and Objective

To ensure soil vapor samples are collected correctly and consistently in the field

Equipment Needs

Summa canister

Flow controller Pressure gauge

Flow controller-to-tubing and purge pump-to-tubing connections

Tubing (silicon and Teflon)

Other fittings for top of soil vapor probe (if necessary)

Syringe or pump for purge

Stop watch

PID

Shroud (clear plastic bag, hose filled with sand for weighing down bag)

Helium

Helium Meter

Field forms and field book

Chain-of-custody

total volume purged and time interval of purge.

- Detach the helium monitor from the monitoring line, close the helium monitoring line, and allow the helium monitor to return to a reading of zero. Attach the helium monitor to the sample tubing (note that some helium meters only function if placed in a open air stream, such as being loosely placed into a much larger rigid tube – rather than a tight connection).
- Record the stabilized helium concentration in the sample tubing, and the estimated purge volume, if any, removed by action of the helium monitoring device. The ratio of helium concentration in the sample tubing to the concentration previously monitored under the shroud should be no more than 0.1 (i.e. approximately 2%). If this condition is met, proceed. If the ratio is more than 0.1, remove the shroud, repair sampling train connections and seal of the probe to the ground, and repeat helium supply and purge.
- Connect PID to the sample port. Record the stabilized reading, and the estimated purge volume removed by action of the vapor detector, then close the sample tubing.
- Remove the shroud.
- Attach the sample tubing to the regulator/Summa canister train.
- Replace the shroud over the entire sampling train (including Summa canister) and over the helium supply and monitoring lines.
- Add helium and until the concentration monitored under the shroud is 20%.
- Open the valve on the Summa canister, and record time, canister pressure (in negative inches of mercury), and the serial number of the canister.
- Record the helium concentration during sampling at 2-minute intervals for the entire sampling period, if 15 minutes or less; or for the first 15 minutes if sampling for a longer period. Add helium as needed to maintain 20% inside the shroud.
- At approximately ½ the time necessary to complete sampling with the flow controller used, again record time, canister pressure, and helium concentration under the shroud. Make a preliminary evaluation of whether the sampling time will have to be extended or shortened to obtain appropriate sample volume (the pressure on a 6-liter Summa canister should be between -20 and -12 inches of mercury at ½ of the sampling time). Add helium as necessary.
- At the end of the designated time necessary to complete sampling with the flow controller used, record time, canister pressure, and helium concentration under the shroud. If using a 6-liter Summa canister, extend the sampling interval until the canister vacuum is between -10 and -5 inches of mercury; record time, canister pressure, and helium concentration, then close the canister valve to end sampling.
- Prepare the canister for shipment to the laboratory: replace the brass cap, label the Summa canister with project name, project number, sampling location, date, military time (at the end of the sampling interval), sampler's initials, and analysis required. Analysis must include helium.
- Make sure to record all data on appropriate field sampling form. Ship the samples to the laboratory, including one copy of the Chain of Custody form with each package.

SOP-23

AMBIENT AIR SAMPLING

PRIOR TO SAMPLING

During the 48-hours prior to sampling and throughout the duration of the sampling event, the facility should be controlled in the following manner:

- If an HVAC system is present, ensure that the HVAC system is operated in a typical manner for the sampled space.
- Control cleaning and maintenance activities, as well as dry-cleaned clothing, to minimize potential sources of VOCs within the facility.

SAMPLING PROCEDURES

Use 6-liter stainless-steel Summa canisters and flow controllers provided by the laboratory. Place indoor air sampling canisters such that the intake into the sampling train is at a height of approximately 4 to 5 feet above floor level (i.e., in the breathing zone of a standing worker).

At least three outdoor ambient air sampling locations should be used to provide background data at the time of the indoor air sampling. The outdoor locations should be upwind of the subject building(s), and one of the outdoor ambient air sampling locations should be on the roof near the intake of one of HVAC units, if present. Begin sampling of outdoor ambient air at least one hour before sampling indoor air, and continue collecting outdoor air until at least 30 minutes prior to the end of the indoor air sampling period.

Purpose

To describe a field sampling methodology for sediment water

Goal and Objective

To ensure sediment samples are collected consistently in the field

Equipment Needs

Summa canister

Flow controller

Tubing (and associated connections) Apparatus for setting height of air intake

Wind speed meter

Vapor detector (such as PID, if applicable)

Field forms and field book

Chain-of-custody

Collect one field duplicate quality control (QC) sample per sampling event, unless specifically exempted by the project manager. Record meteorological conditions, including temperature, barometric pressure, wind direction, and wind speed during the sampling period. Meteorological conditions may be estimated, and reported along with weather information from outside sources, if approved by the project manager. Take a photograph of each sample location.

Using pre-calibrated 8-hour flow controllers to fill each 6-liter Summa canister to within the pressure range recommended by the laboratory. For each sample, record times of the start and end of sampling. Record initial and final canister pressures. Label each canister with a unique sample number. Complete field sampling sheets (including canister serial number, pressure and time at the start and end of sampling) and chain-of-custody documents for all samples prior to shipment to the laboratory for analysis.

SOP-24

QUALITY CONTROL SAMPLING

Quality Control (QC) samples are submitted along with natural samples to provide supporting laboratory data to validate laboratory results. QC field samples are submitted blind to the lab with the exception of trip blanks. In general, field equipment and duplicate samples should be collected during every sampling event. Duplicate samples should be collected at a frequency of one sample for every 20 natural samples. Always check the SAP before going to the field to understand what QC samples are required for the sampling event, and at what frequency samples should be collected.

With the exception of trip blank, QC samples will be prepared in the field. Trip blanks are supplied by the laboratory and will accompany each sample cooler containing samples for analysis of volatile organic compounds. Trip blanks provide data to evaluate whether the samples were affected by organic compounds during transport to the lab. Matrix spike and matrix spike duplicates are generated by submitting three duplicate samples from the same sample to the laboratory. The laboratory spikes two of the three samples with known concentrations of select target compounds, and all three are analyzed to evaluate the accuracy of the analysis.

The most common QC samples are shown in the table below.

Purpose

To outline the quality control samples to be collected in the field

Goal and Objective

To ensure quality control samples are collected along with natural samples to validate laboratory results

Equipment Needs

Field Forms and field book

Chain-of-custody

Most Common QC Samples		
SP	Split Sample	A portion of a natural sample collected for independent analysis; used in calculating laboratory precision
D	Duplicate Sample	Two samples taken from the same media under similar conditions; also used to calculate precision
FB	Field Blank	Deionized water collected in sample bottle; used to detect contamination introduced during the sampling process.
RB	Rinsate Blank	Deionized water run through or over decontaminated equipment; used to verify the effectiveness of equipment decontamination procedures
MS/MSD	Matrix Spike/ Matrix Spike Duplicate	Certified materials of known concentration; used to assess laboratory precision and accuracy
TB	Trip Blank	Inert material (deionized water or diatomaceous earth) included in sample cooler; sent by the lab, the sample is used to detect any contamination or cross-contamination during handling and transportation.

QC sample collection frequencies are presented in the table below. Each field crew leader will be responsible for all QC samples prepared by that crew.

QC Sample	Purpose	Collection Frequency
Field Duplicate	Measure analytical precision.	1 per every 20 samples
Matrix Spike/Matrix Spike Duplicate	Measure analytical accuracy.	1 per every 20 samples
Equipment rinse blanks	Evaluate effectiveness of equipment decontamination and sample handling procedures.	1 per sampling event per media
Field Blank	Assess possible cross-contamination of samples due to ambient conditions during sample collection.	1 per sampling event
Trip Blanks	Evaluate sample preservation, packing, shipping, and storage.	1 per sampling event with volatile constituents

SOP-25

MANAGEMENT OF INVESTIGATIVE-DERIVED WASTE

Prior to the field sampling event, review the Sampling and Analysis Plan to understand how wastes generated during the investigation should be handled. This standard operating procedure is applicable to non-hazardous wastes. If hazardous wastes may be generated, please consult with the project manager.

Purpose

To outline the procedure for handling wastes generated during site investigation

Goal and Objective

To employ a method for appropriate handling investigative-derived wastes that limits contamination of the environment

Equipment Needs

PID

Field Forms and field book

DOT approved 55-gallon drums

Drum wrench

SOIL

Whenever possible, soils excavated from test pits should be placed back in the test pit in the reverse order that it was excavated.

To determine appropriate method for handing of drill cuttings from soil borings or monitoring well installation, soils exhumed from the borehole should be monitored for staining and field screened for VOCs using a PID in accordance with standard operating procedures. Based on the PID screening, cuttings with organic vapor concentrations greater than 100 ppm should be containerized in labeled 55-gallon drums (or roll-off containers if large volumes of cuttings are anticipated) pending further characterization. Alternatively, project personnel may elect to containerize all drill cuttings based on the presence of known contamination and contaminant concentrations. Containerized soil must be disposed of in accordance with state and federal regulations based on of soil analytical results.

Soil that does not appear to be contaminated based on observations by field personnel and PID screening may be spread on the ground near the point of origin.

GROUNDWATER

Groundwater purged from a well during development or sampling that has a sheen or contains free product must be containerized in an appropriately labeled 55-gallon drums or tank pending receipt of analytical results. A drum should be dedicated to each well sampled so that the analytical results of the groundwater sample can be used to characterize the water in the drum. If groundwater from several wells is placed in a drum, the water in the drum should be sampled for adequate characterization. The containerized water must be disposed of in accordance with state and federal regulations based on the analytical results. Groundwater that does not have a sheen or contain free product may be discharged to the ground surface.

SOP-26

USING A PETROFLAG® HYDROCARBON ANALYZER

Purpose

Provide guidelines for operating the PetroFlag® test kit

Goal and Objective

To ensure field staff use the PetroFlag Test Kit correctly and consistently in the field.

Equipment Needs

PetroFlag Kit and manual

Field Forms and Field book

Calibration:

- The PetroFlag meter should be calibrated with each batch of 10 samples or, at least daily.
- The extraction solvent (vial with blue polypropylene top) is used as the blank solution and the calibration standard supplied with each 10 pack (vial with white polypropylene top) is used as the standard solution.
- A reagent calibration (rC) can be used or, if uncontaminated soil is available, a soil calibration (SC) can be used to prepare a site specific calibration.
- Either of the two calibrations, "rC" and "SC", can be selected from the main menu of the PetroFlag analyzer, then choose an appropriate response factor.

Preparing/Reading Blanks and Standards:

- Label two soil tubes (yellow caps) as "blank" and "standard", then pour contents of the extraction solvent into the 'blank' tube and the contents of the calibration standard into the 'standard' tube.
- Process the blank and standard tubes exactly as the unknown soil samples are pre- pared (described below). Once the blank and calibration standard have been read, discard them. They fade with time and cannot be reused.
- A soil calibration is prepared in the same way, with the additional step of adding 10 grams of uncontaminated native soil to each of the labeled calibration tubes.
- The blank is ready to be read after the response factor is chosen and the 'next' is pressed, causing the screen to prompt with "bL". Insert the blank vial and press "read".
- After 5 seconds the display should read "0" for 2 seconds, then a prompt of "Csd" for the calibration standard is given. Insert the calibration standard and press read. When 5 seconds have passed the meter should then verify a valid calibration and display "1000".
- If an error message is displayed, a recalibration must be completed.

Soil Testing Procedure:

- Label the soil tubes and developer vials (black caps, half filled with liquid) with the appropriate sample ID. Label either the top or bottom of the developer vial.
- Weigh 10 grams (±0.1 gram) of all unknown soils into labeled soil tubes.
- Set timer for 5 minutes. Add extraction solvent to first tube, start timer and shake tube for 15

seconds making sure all soil is saturated.

- Add extraction solvent to each of the remaining samples, allowing sufficient time intervals between samples to operate efficiently.
- Shake all tubes intermittently for a total of 4 minutes, then let stand for the re-maining 1 minute.
- Pour free liquid from the soil tube into the barrel of a filter-syringe assembly (make sure the filter disk is firmly attached). Discard the first few drops from the filter to a waste container, then filter into the properly labeled developer vial.
- Add extraction solvent drop-wise to developer solution until meniscus just enters the neck, shake for 10 seconds, start 10 minute timer and proceed to next sample.
- Begin reading the developer vials with the PetroFlag analyzer when 10 minutes have elapsed. Attempt to make each 'reading' at approximately the same elapsed time, as varying time intervals will result in a higher % of error.
- Turn meter on by pressing "read/on". Place sample vial into reader (make sure outside of vial is clean) and press "read/on", then record result.

Standard Analyzer Operation:

- When daily calibrations are run and the ambient temperature deviates from the calibration temperature by more than 10°C, an error condition will result. The analyzer will display "err4" which can be cleared by pressing "next" and recalibrating the meter.
- To take a standard reading, the last operation mode must have been in "read", the calibration data must be current, and the response factor last used must be valid.
- Turn meter on by pressing "read/on". The last reading is displayed for 2 seconds, followed by the calibration curve and response factor. The meter is now ready to read your sample. Insert vial and replace cap, then press "read/on". The display will show "calc" for seconds, the calibration curve, response factor, and finally the result.

SOP-27

ASBESTOS SAMPLE COLLECTION

PLANNING PHASE

Prior to commencing building inspection activities the following tasks should be performed:

- Contact management of the facility to inform them as to what will take place during the inspection.
- Develop a project schedule agreeable to the building owner including arrival time at the site and time of initial meeting with building personnel.
- Review existing as-built drawings, if available, to become familiar with the facility as to the mechanical system layout, and materials used in construction. Develop scaled drawings from as-built drawings, if provided by the building owner, for use in the inspection.
- Review any previous asbestos inspections that may have been conducted in the past.

INSPECTION PHASE

Inspections should be performed using the currently recognized standard protocol developed for schools under AHERA. General guidelines for conducting the inspection are as follows:

- Conduct on-site informational meetings with facility personnel to inform them of what will transpire during the inspection. Discuss bulk sampling protocol with maintenance personnel and determine sampling locations that will be acceptable to the owner.
- Perform an initial walk through of the building accompanied by a maintenance person if possible.
- Observe the building layout and whether the building was built in phases or all at once.
- Observe where the divisions are between construction phases.
- Locate all mechanical areas.
- Document location of and access to all pipe chases, pipe tunnels, crawl spaces, attics, and roof(s).

Purpose

To identify the specific requirements for asbestos sample collection in the field

Goal and Objective

To employ a method of asbestos sample collection to ensure staff safety and to prevent cross contamination between sites and sample locations

Equipment Needs

Ladder to access areas

Flashlight to aid in visibility

Air tight sampling containers (film canisters, centrifuge tubes, zip lock baggies)

Spray mister bottle with water to spray the area to be sampled

Plastic drop cloth to spread beneath the area to be sampled

Knife, linoleum cutter, cork borer, or other tool appropriate for extracting samples

Caulking gun and compound for filling holes once a sample has been extracted

Spray acrylic or adhesive to encapsulate sample extractions.

- Walk completely around the outside of the building.
- Fill out asbestos inspection checklist sheet.
- Fill out building information sheet.
- Fill out homogeneous area summary sheet.
- Fill out room by room sheets.
- Prepare a building diagram.

NUMBER OF SAMPLES

Nine samples per homogeneous sampling area are generally recommended. Cost or other constraints, may limit the number of samples that can be collected. If nine samples cannot be collected, use the following table to determine the minimum number as required by AHERA Rules.

Friable Surfacing Material

The number of samples collected from friable surfacing material was determined based on the following protocol developed under AHERA.

- 1,000 square feet or less: Three bulk samples
- 1,000 to 5,000 square feet: Five bulk samples
- Over 5,000 square feet: Seven bulk samples

Thermal System Insulation

Thermal system insulation should be sampled in a randomly distributed manner, with at least three bulk samples collected from each homogeneous material. At least one bulk sample should be collected from each homogeneous material of patched thermal system insulation that is not assumed to be ACBM.

Bulk samples should also be collected from each insulated mechanical system where cement or plaster was used on fittings, such as tees, elbows, or valves. The number of samples should be sufficient to determine whether the material is asbestos containing. Generally, a minimum of three samples should be collected from each homogenous area.

Bulk samples should not be collected from any homogeneous material where the inspector determined that the thermal system insulation is fiberglass, foam glass, rubber, or other non- asbestos containing building material.

Miscellaneous Material

Bulk samples should also be collected from each miscellaneous material. The number of samples should be sufficient to determine whether the material is asbestos containing. Generally, a minimum of three samples were collected from each homogenous area.

Equipment Needs
(Continued)

Duct tape for repairing thermal system insulation jackets

Cloth (pre-moistened) for cleaning up debris and tools

Vacuum cleaner equipped with high efficiency particulate air (HEPA) filters

Indelible ink pen for labeling sample containers

Camera for photographic documentation

Disposable protective clothing, gloves and bootees

Personal respirator, either a negative pressure full or half mask with HEPA cartridge.

Safety glasses for eye protection

Non-friable suspected ACBM.

The number of samples collected from non-friable suspect ACBM should be sufficient to determine whether the material is asbestos containing. Generally, a minimum of three samples should be collected from each homogenous area.

SELECTION OF SAMPLES

Sample locations should be selected so that they are representative of the sample area. Sample locations should be distributed evenly throughout the sampling area. If fewer than nine samples are collected, a random sampling scheme should be used to determine their location. Choosing sample locations according to personal judgment produces samples which may not be representative and can lead to a wrong decision about the presence or absence of asbestos. The sampling scheme described below should be used to avoid this problem.

> *Divide the sampling area into nine equally sized sub areas and label them 1 through 9. This can be done carefully by eye. Exact measurements are not needed. If three samples are going to be collected, randomly select three numbers from 1 to 9 and collect a sample from the corresponding subarea shown on map.*

For each sampling area, use a new diagram. If you have more than 18 sampling areas, start again at the top of the random number diagram (sample area #1) to determine sampling locations for sampling area 19.

IDENTIFICATION OF SAMPLES

Assign a unique sample ID number to each sample location. This ID number should be placed on the sampling container when shipped to the certified laboratory for analysis. Record the ID number and the sample location on the sample area diagrams and also on room by room summary sheets.

This must be done carefully so that there is no uncertainty about the location and identity of each sample collected. Make sure that no two samples have the same ID number. Non- sequential numbers are used to prevent the laboratories from knowing which samples come from the same sample areas or the same buildings. On the other hand, non-sequential ID numbers make organizing the analytical results by homogeneous area much more difficult.

SAMPLE COLLECTION

- Since inhalation of asbestos fibers during asbestos inspections and sampling projects may pose a health hazard, the use of personal protective equipment by building inspectors is required during the sampling process. As a minimum level of protection, inspectors should wear a respirator, either a negative pressure full or half mask with HEPA cartridges. Disposable clothing should be worn during sampling if the sampling operation is likely to dislodge pieces of suspect material or if the environment is extremely dusty. Inspectors should have plastic bags, twisters, and labels with them to handle the disposal of cartridges, protective clothing, wet cloths, and debris. These waste materials should be stored pending survey results. If laboratory results establish the presence of asbestos containing materials, these waste materials should be disposed of as asbestos containing waste.

- If possible, collect samples after hours or when the building is not in use.
- Spread the plastic drop cloth and set up other equipment.
- Put on protective equipment.
- Label containers with its ID, sample location, and type of material to be sampled on a sample data form. Always place the label on the container itself. If using ridged containers always place the ID on the container, not on the lid, as lids can be inadvertently switched by a laboratory when handling numerous sample containers.
- Mark the location of the sample on the sampling diagram and record the sample identification number on the plan diagram as well.
- Moisten the area to be sampled (spray the immediate area with water).
- Extract sample using a clean knife to cut or scrape off a small piece of the material. Be sure to penetrate all layers of material. Be careful not to disturb adjacent material.
- Place sample in a container and tightly seal it.
- Wipe the exterior of the container with a wet wipe to remove any material which may have adhered to it during sampling.
- Clean your tools with wet wipes and wet mop or vacuum sampling area with a HEPA vacuum to clean all debris.
- Fill hole with calking compound on highly friable material and/or spray with an encapsulant (to minimize subsequent fiber release).
- Repeat the above steps at each sample location. Place sample containers in plastic bags.
- Discard protective clothing, wet wipes and rags, filter cartridges, and drop cloth in a labeled plastic bag.

SAMPLE HANDLING

- After placing a sample in a container according to the procedures outlined earlier, enter the ID number on the Chain-of-Custody Sheet.
- Upon receipt of samples from the inspector, the laboratory should check and sign the Chain-of-Custody Sheet(s), copy same and return original(s) to the inspector. It is important that this, or a similar arrangement for sample accountability be agreed upon by the laboratory prior to sending samples for analysis.
- Each individual or laboratory engaged in asbestos identification shall participate in the American Industrial Hygiene Association (AIHA) Proficiency Analytical Testing (PAT) Program of quarterly external audits, the Asbestos Analyst Registry, or equivalent.
- Polarized light microscopy (PLM) according to EPA Method 600/R4-93-116 is the approved method for analyzing bulk materials for asbestos. PLM utilizes a light microscope equipped with polarizing filters. The identification of asbestos fiber bundles is determined by the visual properties displayed when the sample is treated with various dispersion staining liquids. Identification is substantiated by the actual structure of the fiber and the effect of polarized light on the filter, all of which is viewed by the trained technician. The limit of detection of asbestos by PLM is about 1% by area. Samples containing lower levels of asbestos are not reliable detected by this technique.

QUALITY ASSURANCE

After inspection is completed perform a field quality assurance program including the following tasks.

- Review all inspection forms for completeness. (Remember a physical street address is required by AHERA).
- Walk through building one last time to verify that you have identified all the suspect homogeneous areas.
- Review Chain-of-Custody document for completeness and verify the number of samples and sample numbers for the suspect materials collected during the inspection.

SOP-28

LEAD-BASED PAINT SAMPLE COLLECTION

PLANNING & PREPARATION

Prior to commencing building inspection activities the following tasks should be performed:

- Schedule the inspection with the site contact so adequate notice can be given to building occupants and/or tenants and review historical information regarding any previous lead-based paint activities at the site.
- Determine the hours of operation for the facility.
- Develop a project schedule agreeable with the building owner, including arrival time at the site and time of initial meeting with site personnel.
- Review any previous lead-based paint inspection reports, lead risk assessments, or lead-hazard screens.
- Collect all materials necessary for the inspection.
- Insure that all the XRF components are in its case. Equipment in the case should include; XRF with battery, spare battery, battery charger, charger cords, bar-code reader wand, XRF Computer interface cable, building component barcode pages, lead calibration pages, leak test documentation, and XRF source documentation.
- Insure that both batteries are fully charged and ready to go. Note that batteries will slowly lose a charge from sitting in the case and should be recharged before going into the field.
- Obtain the XRF Performance Characteristic Sheet for the instrument to be used for the inspection. Review it to determine the inconclusive range for the XRF.
- Follow radiation safety procedures when handling or using the XRF, as it is a potential source of radiation. Radiation dosimeter badges are assigned to personnel who routinely use the XRF instruments.
- For multi-family buildings, determine how many units can be considered homogeneous, based on the HUD Guidelines and determine the number of units required to be sampled.

Purpose

To identify the specific requirements for lead-based paint sample collection in the field

Goal and Objective

To employ a method of lead-based paint sample collection to ensure staff safety and to prevent cross contamination between sites and sample locations

Equipment Needs

X-Ray Fluorescence Spectrum Analyzer (XRF)

Ladder to access areas

Flashlight to aid in visibility

Air tight sampling containers (film canisters or centrifuge tubes)

Plastic drop cloth to spread beneath the area to be sampled

Heat gun, scraper or other tool appropriate for extracting samples

Required forms

Cloth (pre-moistened) for cleaning up debris and tools

Vacuum cleaner equipped with high efficiency particulate air (HEPA) filters

XRF INSPECTION PROCEDURE

Inspections should be performed using the currently recognized standard protocol developed by HUD. General guidelines for conducting the inspection for lead-based paint are described below:

Calibration of XRF

- Take at least three calibration check readings prior to the commencement of the lead-based paint inspection. These calibration check readings should be repeated every four hours, every time the XRF is turned on, or at the conclusion of the sampling job, which ever is more frequent.
- The XRF calibration check readings are taken on the red 1.02 mg/cm2 Standard Reference Material (SRM) paint film, developed by the National Institute of Standards and Technology (NIST). These films can be obtained by calling (301) 975-6776 and referencing SRM #2579.
- Calibration check readings should be taken through the red 1.02 mg/cm2 SRM paint film when the film itself is at least 12 inches away from any source of lead. For example, the red NIST SRM film should not be placed on a tool box or suitcase or on a surface coated with lead-based paint to take calibration check readings.
- The red NIST SRM film should be attached to a wooden board measuring about 6 inches long by 4 inches wide by 1 inch thick or attached directly to the XRF probe. Readings can then be taken while standing further than a foot from the wall. Alternatively, the red NIST SRM film can be placed on top of a 12 inch piece of Styrofoam or some other lead-free material as recommended by the manufacturer before taking readings.
- Each time calibration check readings are made, three nominal-time readings should be taken on the red NIST (1.02 mg/cm2) SRM film and the results recorded. The average of the three calibration check readings should be computed and also recorded.
- Large differences of calibration check reading averages from 1.02 mg/cm2 may alert the lead-based paint inspector to problems in the instrument's performance. The calibration check reading averages should not differ from 1.02 mg/cm2 by more than the calibration check tolerance specified in the XRF Performance Characteristics Sheet for the specific instrument used.
- If the observed calibration check average minus 1.02 is greater than the calibration check tolerance, the instructions provided by the manufacturer should be followed in order to bring the instrument back into control before any more XRF testing is done. All readings taken by the suspended instrument since the last successful calibration check test should be repeated. If a backup XRF instrument is used as a replacement, the backup instrument must successfully pass the initial calibration check test before retesting the affected test locations.

Equipment Needs

(Continued)

Pen and indelible ink pen for labeling sample containers and completing field forms

Camera for photographic documentation

Disposable protective clothing, gloves and bootees

Personal respirator, either a negative pressure full or half mask with HEPA cartridges

Safety equipment required for the particular site (safety glasses, hearing protection, hard hat, steel-toed boots, etc.)

Radiation Dosimeter Badre

Laptop for downloading XRF readings

Single-Family Housing

- Obtain a drawing of the building and exterior areas.
- Perform a walk-through of the building with building personnel to familiarize yourself with the layout of the building. An inventory of suspect paint in the house should be completed prior to any XRF testing. It may be also done on a room-by- room basis during testing.
- Determine the testing combinations in each room equivalent or on each exterior building component. An inventory of the painted surfaces in interior rooms, on exterior walls, and on surfaces in other exterior areas, such as fences, playground equipment, and garages, should be conducted.
- A testing combination is characterized by the room equivalent, component, substrate, and visible color of the paint. A completed inventory of the painted components in a room equivalent is a list of the testing combinations in that room equivalent.
- A room equivalent is an identifiable part of a residence, such as a room, a house exterior side, or an exterior area. Hallways, stairways, and exterior areas, such as porches, back yards, and each side of the house, are all examples of room equivalents. Closets or other adjoining areas to room equivalents should be designated room equivalents if large (for example, a walk-in closet) or if obviously dissimilar (for example, a different color) from the adjoining room equivalent. In most closets are not considered room equivalents.
- Each room equivalent is made up of components. Components can be located inside or outside the dwelling. For example, components in a bedroom could be the
- ceiling, floor, walls, a door and its casing, the window sash, and window casings. All components that are coated with paint, varnish, shellac, stain, or other coating should also be tested. Some components may be grouped if painting histories are identical as described below.
- Take at least one XRF Reading on each testing combination.
- Using the XRF Performance Characteristic Sheet, determine whether or not a substrate correction is necessary for that testing combination. If necessary, determine the substrate correction value using the method specified in the HUD Guideline.
- XRF results are corrected for substrate bias by subtracting a correction value determined separately in each house for each type of substrate. The substrate is the material underneath the paint. Substrates are generally classified into one of six substrate types: brick, concrete, drywall, metal, plaster, and wood. These substrate types are intended to include a broad range of materials. For example, the concrete substrate type includes poured concrete, precast concrete, and concrete block. If the true substrate is not one of the six types, the substrate type that most closely matches the true substrate should be selected. For substrates on top of substrates, such as plaster over concrete, the substrate directly beneath the painted surface should be used.

  The correction value is an average of XRF readings taken from test locations that have been scraped clean of their paint covering to expose the substrate. A criterion for selecting these test locations is that their initial XRF results should be less than 2.5 mg/cm2. If test locations with XRF results equal to or greater than 2.5 mg/cm2 are selected, the outcome might "overcorrect" XRF results. Therefore, only test locations with initial XRF results less than 2.5 mg/cm2 should be chosen. If all initial readings on a substrate type are above 2.5 mg/cm2, the locations with the lowest initial reading should be chosen. This will help ensure that XRF readings taken from non-

representative portions of substrates and other underlying materials, such as hidden nails and pipes, are not used to compute the substrate correction. It is important to note that some XRF results may not need to be corrected for substrate bias depending on the specific instruments used and the specifications in the XRF Performance Characteristics Sheet.

Using the same XRF instrument, take a reading on the first bare substrate area. Record the substrate and XRF readings. Repeat this procedure for each bare substrate area and record the readings on the same form. A variant to this step is to first cover the bare area with an NIST SRM film prior to taking the readings. The need for this variation will be specified in the XRF Performance Characteristics

- Sheet for affected XRF instruments and instructions will be provided explaining how to compute the correction value when this variation is used. Compute the correction value for each necessary substrate type in the house by computing the average of all readings.
- Take at least one XRF Reading on each testing combination.
- Using the XRF Performance Characteristic Sheet, determine whether or not a substrate correction is necessary for that testing combination. If necessary, determine the substrate correction value using the method specified in the HUD Guidelines.
- Classify the XRF results as negative, positive, or inconclusive. For inconclusive readings, collect a bulk sample of the inconclusive paint for laboratory analysis. If sampling is not desired, inconclusive readings must be assumed positive.
- Record the locations, component, substrate, and color of paint found to be positive for lead or assumed to be positive for lead. The recorded location of the material should include room and side of the room. Component should be the component being tested. Substrate should be one of the six substrate types described above. For practical purposes, paint is almost always differentiated by color. Since more than one color may be observed when paint is peeling or the substrate is damaged, both "white" and "blue over green" would be acceptable color entries.

Multi-Family Housing

- Obtain a list of all units, common areas, and exterior site areas.
- Obtain a drawing of the building and exterior areas.
- Perform a walk-through of the building with building personnel to familiarize yourself with the layout of the building.
- Determine, using the HUD Guidelines, the areas that can be grouped together and the minimum number of units to be inspected. The minimum number of units to be sampled can be determined by using Table 7.3 located in Chapter 7 of the HUD Guidelines.
- Select units to be inspected using the random technique explained in the HUD Guidelines.
- For each unit, common area, or exterior site to be tested, determine the testing combinations in each room equivalent.
- Take at least one XRF Reading on each testing combination.
- Using the XRF Performance Characteristic Sheet, determine whether or not a substrate correction is necessary for that testing combination. If necessary, determine the substrate correction value using the method specified in the HUD Guidelines.

- Classify the XRF results as negative, positive, or inconclusive.
- Record location of materials found positive for lead or assumed to be positive for lead.

FIELD FORMS

Since the information required for a lead-based paint inspection report is gathered in the field, accurate and complete forms are required.

LABORATORY ANALYSIS OF PAINT CHIP SAMPLES

For XRF results that fall into the inconclusive range and for areas that cannot be tested using XRF instruments due to project budget constraints or other reasons, a paint-chip sample should be collected from suspect painted surfaces and sent to a laboratory for lead determination.

If the sampled portions of the building are to remain in-place, lead analysis should be conducted by EPA Method 6010, and results should be reported in mg/cm2, the primary unit of measure. Results may be reported as percent by weight if the dimensions of the surface area cannot be accurately measured or if all paint within the sampled area cannot be appropriately removed. In these cases, results should not be reported in mg/cm2, but in mg/kg or weight percent.

If the sampled portions of the building are to be demolished and disposed of, lead analysis should be conducted according to TCLP procedure (EPA Method 1311) for waste characterization purposes.

If it is necessary to remove a paint-chip sample for laboratory analysis, only one paint-chip sample is needed for each testing combination. The paint-chip sample location should be representative of the paint on the entire testing combination. If the testing combination is replicated, one representative paint-chip sample should be taken from one randomly selected replicate.

Collect at least four square inches of material to ensure that the laboratory has a sufficient sample to conduct the analysis and that it is representative of the testing material sampled. Samples collected should be placed in sealable rigid container such as screw top, plastic centrifuge tubes rather than plastic bags which generate static electricity. Paint-chip collection should include, as a priority, collection of all the paint layers, while minimizing any collection of actual substrate. If substantial substrate material is included, results should be reported in mg/cm2 to avoid a downward bias in results.

Assign a unique sample ID number to each bulk paint sample. This ID number should be placed on the sampling container when it goes to the certified laboratory for analysis. Record the ID number and the sample location on the sample area diagrams, the room by room summary sheets, and the chain-of-custody form. This must be done carefully so that there is no uncertainty about the location and identity of each sample collected. Make sure that no two samples have the same ID number.

QUALITY ASSURANCE

After inspection is completed perform a field quality assurance including the following tasks.

- Review all inspection forms for completeness.
- Walk through building one last time to verify that you have identified all the homogeneous areas of paint suspected to be lead-based.

- Review Chain-of-Custody documents for completeness and verify that the number of samples, the sample numbers for the bulk samples collected.

SOP-29

AIR SAMPLING FOR ASBESTOS AND LEAD

This SOP describes the field equipment and sampling methods for the collection of air samples for asbestos fibers and/or lead dust. This SOP is based on the SOP developed by Region 8 of the U.S. Environmental Protection Agency for the Sampling of Asbestos Fibers in Air.

GENERAL SAMPLING PROCEDURE

Samples are collected by drawing air through a fine-pore filter in order to trap suspended particulate matter, including asbestos and lead suspended in air. For asbestos, the filters are examined using an appropriate microscopic technique to observe, characterize, and quantify the number of asbestos fibers on the filter. For lead, the sample cassettes are packaged and shipped in accordance with SOP-4, and analyzed in accordance with NIOSH 7082 for detection of lead in air.

Sampling in dusty conditions should be avoided, if possible. High levels of dust and particulate may clog or overload the filter. Sampling flow rate and time should be adjusted to avoid filter overload in dusty conditions.

Air samples will be collected using filter cassettes pre-loaded with 0.8 micron mixed cellulose ester (MCE) filters. The crease between the cassette base and cowl should be sealed with a shrink band or adhesive tape to hold the cassette together and reduce the potential for contamination. Samples will be collected using an air sampling pump capable of maintaining a constant flow rate between 2 to 10 liters per minute.

AIR PUMP CALIBRATION

Prior to sampling, the flow rate of the air pump should be set to the flow rate specified in the project specific Sampling and Analysis Plan (SAP), as follows:

1. Turn on the pump and let it run for a minimum of 5 minutes before calibrating the pump.
2. Remove the end plugs on a new filter cassette. Attach one end of a length of tygon tubing to the cassette base and attach the other end of the tubing to the pump's air inlet. Use another length of tubing to connect a flow meter to the cassette cap.

Purpose

To identify the specific requirements for air sampling for asbestos and lead

Goal and Objective

To employ a method of air sampling for asbestos and lead to ensure staff safety and to employ a consistent measuring method for air sampling of asbestos and lead

Equipment Needs

Air sampling pump

Asbestos sample filter cassettes with 0.8 micron filters.

Lead sample filter cassettes with 37 mm filters.

Tripod and spring clips

Tygon tubing

Air pump calibration equipment

Quart and gallon size re-sealable bags

Indelible ink pen for labeling sample containers

Camera for photographic documentation

Sample coolers, packing material

3. Hold the flow meter so that it is vertical and note the flow rate.
4. Adjust the flow rate drawn by the pump until it meets the flow rate specified in the SAP (+/- 5%).

Three separate flow rate measurements will be obtained before and after sampling. The mean value of these six flow rate measurements will be used to calculate the volume of air drawn through the filter cassette during sampling.

Equipment Needs
(Continued)

Personal respirator, either a negative pressure full or half mask with HEPA cartridges

Safety glass's for eye protection

SAMPLE COLLECTION

Position a tripod in the location to be sampled. Set up the tripod so that the filter cassette will be positioned at a height of 4 to 6 feet above the ground (i.e., within a typical breathing zone). Secure the filter cassette to the tripod with a spring clip. The cassette should be oriented so the open face of the cowl is pointing downward to avoid particulate entering the filter by precipitation. Remove the protective cap over the open face of the cowl and turn on the calibrated pump. Record the starting time, sample identification, and initial flow rate on the field form. The pump should be periodically checked during the collection of any samples over a period longer than two hours to ensure the pump is working properly and that the flow rate is stable. After the specified sampling time has elapsed, measure the ending pump flow rate and record the time and flow rate on the field form. Turn off the pump and remove the cassette. Place the end caps on the cassette and place a seal over the end caps in a manner that will prevent the removal of the end caps without tearing the seal.

IDENTIFICATION OF SAMPLES

Assign a unique sample ID number to each sample location. This ID number should be placed on the filter cassette prior to shipment to the certified laboratory for analysis.

SAMPLE ANALYSIS, PACKAGING, & SHIPMENT

Lead sample cassettes will be packaged and shipped in accordance with SOP-4, and analyzed in accordance with NIOSH 7082 for detection of lead in air. In general, air sample analysis for asbestos will be completed utilizing Phase Contrast Microscopy (PCM) techniques for field verification of asbestos, in accordance with the National Institute for Occupational Safety and Health (NIOSH) Method 582. Results from the air sampling event will be reported in fibers per cubic centimeter of air (f/cc) and measured against current Occupational Safety and Health Administration (OSHA) permissible exposure limits (PEL) for asbestos. If the OSHA PEL for asbestos is exceeded, or if gross contamination is observed by accredited asbestos personnel, the air sample cassettes will be packaged and shipped under chain-of-custody procedures to a recognized laboratory participating in the National Voluntary Laboratory Accreditation Program (NVLAP) for analysis in accordance with the NIOSH Method 7402, utilizing Transmission Electron Microscopy (TEM).

QUALITY CONTROL

The following quality control samples will be submitted:

- Field Blank – One field blank will be collected per sampling event. Field blanks will be collected by removing the end caps on a new filter cassette at a representative sample location. Hold the

cassette open for approximately 30 seconds. Close and seal the cassette as described above and submit it for analysis with the other sample cassettes. Field blanks are not required for lead sample collection.

- Lot Blank – For final clearance air sampling in schools or for consulting firms not participating in the Industrial Hygiene Proficiency Testing Program (consulting firms capable of performing filed verification of asbestos), one filter or "lot" blank will be submitted to a NVLAP accredited laboratory for TEM analysis. Whereby, one new filter cassette will be randomly selected and submitted with the sample cassettes for analysis and all filter cassettes for the sampling event will be rejected if any asbestos fiber is detected on any filter. However, for field verification of asbestos in industrial type settings or office buildings, boiler rooms, mechanical rooms, etc. "lot" blanks are generally analyzed by the accredited asbestos personnel utilizing PCM techniques.

SOP-30

MATERIAL METHAMPHETAMINE SAMPLING

This SOP describes the process that should be used to evaluate the presence of methamphetamine (meth) on building materials. The procedure described below provides guidance on how to systematically evaluate for meth when there is an indication that meth cooking occurred at the facility. Meth-related sampling should only be completed by a certified Meth Cleanup Contractor Supervisor.

SITE RECONNAISSANCE

When completing initial sampling, a site reconnaissance of the property should be completed to identify chemical usage and potential discharge of chemicals. Items to be evaluated during on-site inspection of the property should include:

- Attics and crawlspace areas
- Outbuildings
- Bathrooms for evidence of dumping
- Presence/absence of septic systems
- Discarded chemicals in potential or confirmed cooking areas, burn piles and waste disposal areas onsite

Whether additional assessment of these areas in addition to building materials is warranted, will depend on what is found during the site reconnaissance. Sampling approaches for these areas is not addressed in this SOP. You should consult with the project manager to devise a sampling strategy for these other areas.

After it has been confirmed the property was used for meth cooking through review of DEQ, Health Department, or Police records, or by visual reconnaissance of the property, interior finishes should be considered as contaminated with meth. Wipe samples should be collected to confirm/or deny the presence of meth as described in SOP-28 MethChek Immunoassay, the results of this screening determining whether additional analytical testing for meth is required. If the MethCheck Immunoassay wipe samples are positive for the presence of meth, an additional wipe sample of the material should be collected and analyzed for meth using EPA Method

8270C-modified. The same wipe sampling process described in SOP-28 should be used to complete the sampling.

Purpose

To identify the specific requirements for methamphetamine sampling

Goal and Objective

To employ a method of methamphetamine sampling that ensures staff safety and consistent sampling procedures

Equipment Needs

Disposable Coveralls w/ bootees (Tyvek® suit or equivalent)

Latex gloves

Safety glasses

½-face air purifying respirator

Tape (duct or equivalent)

Wax paper or plastic sheeting to place equipment on

Gauze

Spray bottle of alcohol

Sample container/vial

Indelible ink pen for labeling sample

Disposable bag for waste

Photo ionization detector (PID) for testing plumbing (e.g. sink drains)

SOP-31

PRECURSORY METHCHECK SAMPLING

PRECURSORY SAMPLING PREPARATION

MethChek Immunoassay sampling may be utilized during an initial inspections to detect for potential meth contamination. MethChek Immunoassay sampling may also be utilized to check cleanliness of a work area prior to final clearance wipe sampling.

- Put on clean latex gloves supplied in kit. Use a new pair of clean gloves for each test.
- Place wax paper on level surface in close proximity to sample area.
- Place Step 2 Extractor bottle on wax paper.
- Remove plunger from syringe and place on wax paper.
- Place supplied template (100 cm2) on test surface. It is recommended to tape template to surface.
- Prepare Step 1 Wetting Agent by removing cap and replacing cap with spray nozzle.
- Prime spray bottle in a waste can (or equivalent).
- Remove supplied gauze pad from package and spray gauze pad 2-times with Step 1
- Wetting Agent at a distance of approximately 4-inches.

PRECURSORY SAMPLE COLLECTION

- Use firm hand pressure, collect the sample by wiping the surface inside the template with moistened gauze pad in a "W", then "Z", and then "W", pattern. Try not to trap of push residue from sampling area under template. Also, when wiping try to orient the to concentrate the sample in one area on the gauze, which will enhance extraction.
- Insert gauze pad containing sample into syringe.
- Insert syringe into plunger and gently push gauze pad toward base of syringe, remove plunger.
- Hold syringe over the plastic tray, then open and pour Step 2 Extractor into syringe.
- Continue holding syringe tip over the plastic tray and slowly insert plunger into syringe, depressing the plunger to compress and extract the sample into the plastic tray. Continue depressing the plunger onto the gauze pad until liquid no longer flows.

Purpose

To identify the specific requirements for precursory methcheck sampling

Goal and Objective

To employ a method of precursory methcheck sampling that ensures staff safety and consistent sampling procedures

Equipment Needs

Gloves

Templates (10 cm x 10 cm)

Tape (duct or equivalent)

Plastic "disposable" Trays

Wax paper

Gauze

Swabs

Pipettes

Vials

Latex Gloves

Safety Glasses

Disposable test packet bag

Personal protective equipment (use discretion based on condition of sampling area)

- Place syringe tip in liquid in the plastic tray and slowly pull plunger halfway to draw sample back into syringe.
- Repeat the process by depressing the plunger to compress the gauze pad until liquid no longer flows.
- Remove and place Step 3 Cartridge from packet and place on wax paper.
- Use supplied disposable pipette to extract liquid from the plastic tray and place 3-drops of the extracted liquid into the sample well (marked "S") on the Step 3 Cartridge.
- Observe Step 3 Cartridge. Lines will appear within one minute, results will develop completely within 5-minutes. Do not disturb cartridge during sample development.
- See Reading MethChek Results on page 7 of the Operating Instructions Manual.
- Record and report results for client.
- MethChek results are reported in 0.05, 0.1, 0.5, and 1.5 micrograms per 100 cm2 for the lower limit of identification (LLOI).

SOP-32

ASBESTOS FIBER AIR SAMPLE COLLECTION

FINAL CLEARANCE VISUAL & AIR SAMPLE COLLECTION

Following asbestos abatement operations, abatement personnel will communicate that the abatement work is completed and the following tasks will be performed:

- Asbestos accredited personnel will meet asbestos abatement contractor on site.
- Don disposable protective clothing and personal respirator.
- Conduct a final clearance visual inspection of the work area containment to insure that all asbestos-containing building materials (ACBM) have been abated from the work area.
- Once the final clearance visual inspection has been completed, the abatement contractor will apply a thin layer of encapsulant to lock-down any loose fibers from the abatement operation.
- Allow work area to dry for approximately 1-hour.
- Accredited personnel will calibrate sampling pumps, not to exceed 16 LPM.
- Accredited personnel will re-enter the work area containment with sampling equipment.
- Place tripod stand, sample pump, tubing, and TEM air sample cassette in 5-different locations within the work area containment.
- Remove cap on TEM air sample cassette and turn pump on. Allow pump to run long enough to insure a sample volume of no less than 1,199 and no more than 1,599 liters of air.
- Stop sample pumps at the appropriate time to insure no less than 1,199 liter of air have been collected.

SAMPLE PREPARATION FOR SHIPMENT

- Insure that all caps are in place on TEM air sample cassette (*Note – Laboratories scheduled to perform TEM analysis will not accept any sample cassette with missing or dislodged caps).
- Insure labels are filled out completely (e.g. date, sample number, pump ID, flow rate, start time, and stop time).

Purpose

To identify the specific requirements for Asbestos Fiber Air Sample Collection

Goal and Objective

To employ a method of asbestos fiber air sample collection to ensure staff safety and consistent sampling procedures

Equipment Needs

5-high flow vacuum pumps capable of collecting air samples from .5-16 liters per minute (LPM)

5-tripod stands

7-TEM air sample cassettes with mixed cellulose ester (MCE) filters of .045µm pore size. (5-air sample cassettes for sample collection, one field blank (open 30-seconds), and one lab blank)

Labels and indelible ink pen for labeling air sample cassettes

Calibration instrument to calibrate air sample pumps

Extension cords

Box fan

Duct Tape (or equivalent).

Chain-of-Custody

Disposable protective clothing with bootees

- Use two pieces of duct tape (one for the tips of the air sample cassettes and one for the bottoms of the cassettes). Insure that the length of the duct tape is long enough, such that the seven sample cassettes can be placed on the duct tape. Wrap the duct tape up the side of the cassettes to seal the caps. Use the second piece of duct tape to secure the tips of the sample cassettes.
- Completely fill out the chain-of-custody and ship to a NVLAP (National Voluntary Laboratory Accreditation Program) laboratory.

Equipment Needs
(continued)

Personal respirator, either a negative pressure full or half mask with HEPA cartridges

SAMPLE ANALYSIS & MEASUREMENT

Request laboratory analysis - Asbestos Fiber Analysis by Transmission Electron Microscopy, Performed by EPA 40 CFR Part 763 Appendix A to Subpart E.

QUALITY ASSURANCE/QUALITY CONTROL

Laboratories will have QA/QC guidelines.

SOP-33

AMBIENT AIR SAMPLING WITH SORBENT TUBE FOR TO-17 ANALYSIS

GENERAL PROCEDURE – ACTIVE METHOD

1. Determine the desired flow rate and sampling time in accordance with Table 1 shown below. If low detection limits are desired (parts per million to parts per trillion range) between 1000 and 6000 mL of sample should be collected.

Table 1. Sampling Time, Flow Rate, and Volume Guide

Time (Minutes)	Flow Rate (mL/min) 20	50	80	100
5	100	250	400	500
10	200	500	800	1000
15	300	750	1200	1500
20	400	1000	1600	2000
30	600	1500	2400	3000
60	1200	3000	4800	6000

= Will result in high to mid ppb reporting limits
= Mid to low ppb reporting limits
= Low ppb to ppt reporting limits

2. Calibrate the flow rate of the air pump with the calibration tube attached (do not attach the sampling tube for this step), then turn off the sampling pump.

3. Allow sample tubes to reach ambient temperature, including the tube to be used for a field blank.

4. Record the tube serial number on the chain of custody form. Do not mark on the tube or label the tube directly.

5. Place the sampling pump at the desired sampling location. If sampling from the center of the room at breathing height of 3 to 5 feet, use a tripod to suspend the pump at the appropriate location. Use inert straps, string, or chains to suspend the pump (do not use tape, which may off-gas contaminants).

6. Attach inert tubing to the pump as an adapter from the pump to the sampling tube.

Purpose

To describe field sampling methodology for ambient air using sorbent tube, including both active pumping and passive sorption techniques.

Goal and Objective

To ensure sorbent tube samples are collected correctly and consistently in the field.

Equipment Needs – Active Method

Sampling tube with wrenches for each end

Air sampling pump (20 to 100 mL/min)

Airflow calibrator

Tripod (optional)

Equipment Needs – Passive Method

Sampling cartridge with diffusive body, supporting plate, glass case, and stopper such as Radiello system by Supelco

Shipping Case for Tube

Sample ID Bag

Tripod (optional)

7. Using wrenches, remove the caps from the end of the tube (do not remove the identification clip from the tube).

8. Place the outlet end of the tube into the tubing connected to the pump. The grooved inlet end of the tube should be facing away from the pump.

9. Turn on the pump, and note the time and date.

10. Operate the pump for the pre-determined amount of time (see Step 1), then shut the pump off and note the time and date, total duration of sampling, and sampled volume. (Do not exceed the sampled volume recommended for the tube and analytical method, for example use a maximum volume of 6 L for typical conditions.)

11. Recap both ends of the tube using the original fittings from that tube. Turn caps only ¼ turn past finger-tight, otherwise tubes may become damaged and/or unusable.

12. Pack sample tubes (including field blank) in plastic shipping cases, then enclose each sample in a labeled plastic bag. Place the enclosed samples in a cooler with frozen ice packs or other sealed cooling media to keep the samples near 4°C. Place the chain of custody form in the cooler, seal the cooler, and ship the cooler to the laboratory.

GENERAL PROCEDURE – PASSIVE METHOD

1. Verify whether the expected overall concentration of all air contaminants exceed 2,000 micrograms per cubic meter. If no, use standard media such as Cabograph. If yes, use activated charcoal media.

2. When ready to sample, note the date and time on the Radiello label, and on the sample bag using a non-solvent marking instrument (i.e. do not use Sharpie pens or similar).

3. Remove the cartridge from the plastic shipping case and glass tube, and put it in the diffusive (yellow) body in an upright vertical position. (Do not touch the cartridge with exposed fingers. Do keep the associated parts together in one sample bag.)

4. Ensure that the cartridge is seated completely flush with the top of the diffusive body. If the cartridge is sticking out even a small amount such as a millimeter, tap on the bottom of the diffusive body to cause the cartridge to seat properly. (Do not touch the sides of the diffusive body.)

5. With the cartridge still in a vertical position to retain the seated cartridge, screw the diffusive body into the supporting plate.

6. Place the assembled device in the sampling location. (See Item 5 of Active Method for breathing zone sampling using a tripod. If outdoors, provide protection from precipitation.)

7. At the end of sampling, record the date and time on the Radiello label and sample bag, unscrew the diffusive body, transfer the cartridge into the glass tube, seal the tube with stopper. Put the glass tube in the plastic shipping case, then place the sample into the sample bag. Peel the label off the supporting plate and attach it to the sample bag. Fill out the chain of custody form in conformance with the accurate sampling interval listed on the label, and ship the sample(s) to the laboratory.

SOP-34

SAMPLING GROUNDWATER WITH A HYDRASLEEVE™

Before installing a HydraSleeve™ in any well, you will need to know the following:

- Inside diameter of the well
- Length of the well screen
- Water level in the well
- Position of the well screen in the well
- Total depth of the well

Non-disposable equipment to be placed down the well must be decontaminated.

Field sampling forms must be completed for each well to document sampling.

COLLECTING WATER SAMPLES

Label each sample container with the project number(s), sample location, well owner, date, military time, sampler's initials, preservative, and analysis required.

Always wear sterile gloves when handling and discharging the HydraSleeve™. Assemble the HydraSleeve™ using the manufacturer's instructions.

Before deploying the HydraSleeve™ in the well, obtain the depth-to-water measurement to establish the preferred position of the HydraSleeve™ in the well. Measure the precise amount of tether needed to suspend the sleeve in the well, make sure to account for the need to leave a few feet of tether at the top of the well to allow recovery of the sleeve.

Deploy and retrieve the sampling unit per the attached instructions provided by GeoInsight.

The recovered HydraSleeve™ and the sample release tubing should be disposed as per the waste management plan for the site.

Purpose

To describe field sampling methodology for collection of ground-water samples directly from the screened interval of a well without having to purge the well prior to sample collection.

Goal and Objective

To ensure appropriate sample collection from within the screen using a single-use disposable) sampler.

Equipment Needs

HydraSleeve ™ and discharge tube (designed for one-time use only)

Spring Clip

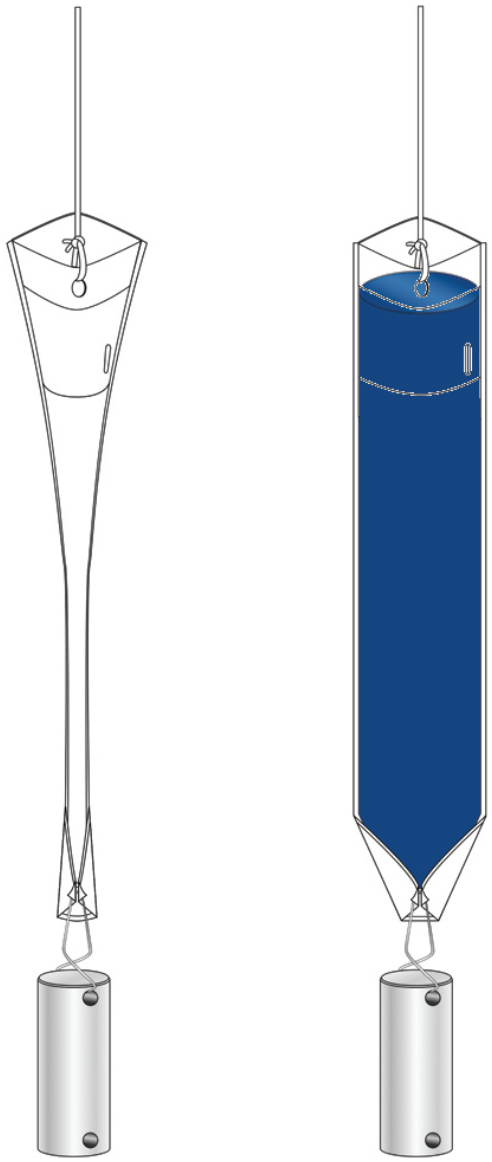
Weight and Weight Clip

Suspension cord, generally disposed after one use unless it is dedicated to the well.

HYDRASleeve™

Simple by Design US Patent No. 6,481,300; No. 6,837,120 others pending

Standard Operating Procedure: Sampling Ground Water with a HydraSleeve



This Guide should be used in addition to field manuals appropriate to sampling device (i.e., HydraSleeve or Super Sleeve).

Find the appropriate field manual on the HydraSleeve website at http://www.hydrasleeve.com.

For more information about the HydraSleeve, or if you have questions, contact: GeoInsight, 2007 Glass Road, Las Cruces, NM 88005, 1-800-996-2225, info@hydrasleeve.com.

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Table of Contents

Introduction 1

Applications of the HydraSleeve 1

Description of the HydraSleeve 3

Selecting the HydraSleeve Size to Meet Site-Specific Sampling Objectives 4

HydraSleeve Deployment 5

- Information Required Before Deploying a HydraSleeve 5
- HydraSleeve Placement 6

Procedures for Sampling with the HydraSleeve 8

- Measurement of Field Indicator Parameters 11
- Alternate Deployment Strategies 11

Post-Sampling Activities 14

References 15

Introduction

The HydraSleeve is classified as a no-purge (passive) grab sampling device, meaning that it is used to collect ground-water samples directly from the screened interval of a well without having to purge the well prior to sample collection. When it is used as described in this Standard Operating Procedure (SOP), the HydraSleeve causes no drawdown in the well (until the sample is withdrawn from the water column) and only minimal disturbance of the water column, because it has a very thin cross section and it displaces very little water (<100 ml) during deployment in the well. The HydraSleeve collects a sample from within the screen only, and it excludes water from any other part of the water column in the well through the use of a self-sealing check valve at the top of the sampler. It is a single-use (disposable) sampler that is not intended for reuse, so there are no decontamination requirements for the sampler itself.

The use of no-purge sampling as a means of collecting representative ground-water samples depends on the natural movement of ground water (under ambient hydraulic head) from the formation adjacent to the well screen through the screen. Robin and Gillham (1987) demonstrated the existence of a dynamic equilibrium between the water in a formation and the water in a well screen installed in that formation, which results in formation-quality water being available in the well screen for sampling at all times. No-purge sampling devices like the HydraSleeve collect this formation-quality water as the sample, under undisturbed (non-pumping) natural flow conditions. Samples collected in this manner generally provide more conservative (i.e., higher concentration) values than samples collected using well-volume purging, and values equivalent to samples collected using low-flow purging and sampling (Parsons, 2005).

Applications of the HydraSleeve

The HydraSleeve can be used to collect representative samples of ground water for all analytes (volatile organic compounds [VOCs], semi-volatile organic compounds [SVOCs], common metals, trace metals, major cations and anions, dissolved gases, total dissolved solids, radionuclides, pesticides, PCBs, explosive compounds, and all other analytical parameters). Designs are available to collect samples from wells from 1” inside diameter and larger. The HydraSleeve can collect samples from wells of any yield, but it is especially well-suited to collecting samples from low-yield wells, where other sampling methods can’t be used reliably because their use results in dewatering of the well screen and alteration of sample chemistry (McAlary and Barker, 1987).

The HydraSleeve can collect samples from wells of any depth, and it can be used for single-event sampling or long-term ground-water monitoring programs. Because of its thin cross section and flexible construction, it can be used in narrow, constricted or damaged wells where rigid sampling devices may not fit. Using multiple HydraSleeves deployed in series along a single suspension line or tether, it is also possible to conduct in-well vertical profiling in wells in which contaminant concentrations are thought to be stratified.

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As with all groundwater sampling devices, HydraSleeves should not be used to collect groundwater samples from wells in which separate (non-aqueous) phase hydrocarbons (i.e., gasoline, diesel fuel or jet fuel) are present because of the possibility of incorporating some of the separate-phase hydrocarbon into the sample.

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Description of the HydraSleeve

The HydraSleeve (Figure 1) consists of the following basic components:

- A suspension line or tether (A.), attached to the spring clip or directly to the top of the sleeve to deploy the device into and recover the device from the well. Tethers with depth indicators marked in 1-foot intervals are available from the manufacturer.
- A long, flexible, 4-mil thick lay-flat polyethylene sample sleeve (C.) sealed at the bottom (this is the sample chamber), which comes in different sizes, as discussed below with a self-sealing reed-type flexible polyethylene check valve built into the top of the sleeve (B.) to prevent water from entering or exiting the sampler except during sample acquisition.
- A reusable stainless-steel weight with clip (D.), which is attached to the bottom of the sleeve to carry it down the well to its intended depth in the water column. Bottom weights available from the manufacturer are 0.75" OD and are available in three sizes: 5 oz. (2.5" long); 8 oz. (4" long); and 16 oz. (8" long). In lieu of a bottom weight, an optional top weight may be attached to the top of the HydraSleeve to carry it to depth and to compress it at the bottom of the well (not shown in Figure 1);
- A discharge tube that is used to puncture the HydraSleeve after it is recovered from the well so the sample can be decanted into sample bottles (not shown).
- Just above the self-sealing check valve at the top of the sleeve are two holes which provide attachment points for the spring clip and/or suspension line or tether. At the bottom of the sample sleeve are two holes which provide attachment points for the weight clip and weight.

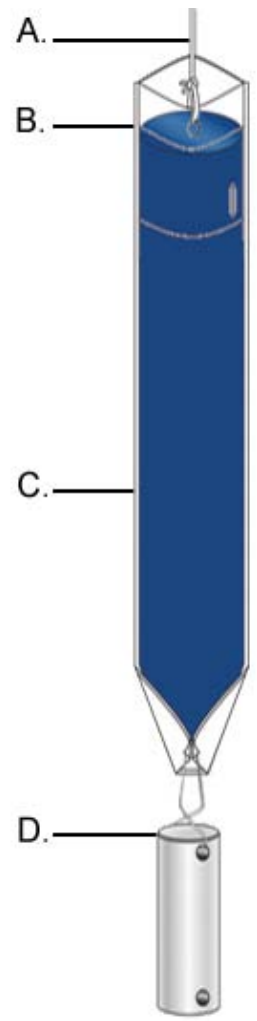

Figure 1. HydraSleeve components.

Note: The sample sleeve and the discharge tube are designed for one-time use and are disposable. The spring clip, weight and weight clip may be reused after thorough cleaning. Suspension cord is generally disposed after one use although, if it is dedicated to the well, it may be reused at the discretion of the sampling personnel.

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Selecting the HydraSleeve Size to Meet Site-Specific Sampling Objectives

It is important to understand that each HydraSleeve is able to collect a finite volume of sample because, after the HydraSleeve is deployed, you only get one chance to collect an undisturbed sample. Thus, the volume of sample required to meet your site-specific sampling and analytical requirements will dictate the size of HydraSleeve you need to meet these requirements.

The volume of sample collected by the HydraSleeve varies with the diameter and length of the HydraSleeve. Dimensions and volumes of available HydraSleeve models are detailed in Table 1.

Table 1. Dimensions and volumes of HydraSleeve models.

Diameter	Volume	Length	Lay-Flat Width	Filled Dia.
2-Inch HydraSleeves				
Standard 625-ml HydraSleeve	625 ml	< 30”	2.5”	1.4”
Standard 1-Liter HydraSleeve	1 Liter	38”	3”	1.9”
1-Liter HydraSleeve SS	1 Liter	36”	3”	1.9”
2-Liter HydraSleeve SS	2 Liters	60”	3”	1.9”
4-Inch HydraSleeves				
Standard 1.6-Liter HydraSleeve	1.6 Liters	30”	3.8”	2.3”
Custom 2-Liter HydraSleeve	2 Liters	36”	4”	2.7”

HydraSleeves can be custom-fabricated by the manufacturer in varying diameters and lengths to meet specific volume requirements. HydraSleeves can also be deployed in series (i.e., multiple HydraSleeves attached to one tether) to collect additional sample to meet specific volume requirements, as described below.

If you have questions regarding the availability of sufficient volume of sample to satisfy laboratory requirements for analysis, it is recommended that you contact the laboratory to discuss the minimum volumes needed for each suite of analytes. Laboratories often require only 10% to 25% of the volume they specify to complete analysis for specific suites of analytes, so they can often work with much smaller sample volumes that can easily be supplied by a HydraSleeve.

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HydraSleeve Deployment

Information Required Before Deploying a HydraSleeve

Before installing a HydraSleeve in any well, you will need to know the following:

- The inside diameter of the well
- The length of the well screen
- The water level in the well
- The position of the well screen in the well
- The total depth of the well

The inside diameter of the well is used to determine the appropriate HydraSleeve diameter for use in the well. The other information is used to determine the proper placement of the HydraSleeve in the well to collect a representative sample from the screen (see HydraSleeve Placement, below), and to determine the appropriate length of tether to attach to the HydraSleeve to deploy it at the appropriate position in the well.

Most of this information (with the exception of the water level) should be available from the well log; if not, it will have to be collected by some other means. The inside diameter of the well can be measured at the top of the well casing, and the total depth of the well can be measured by sounding the bottom of the well with a weighted tape. The position and length of the well screen may have to be determined using a down-hole camera if a well log is not available. The water level in the well can be measured using any commonly available water-level gauge.

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HydraSleeve Placement

The HydraSleeve is designed to collect a sample directly from the well screen, and it fills by pulling it up through the screen a distance equivalent to 1 to 1.5 times its length. This upward motion causes the top check valve to open, which allows the device to fill. To optimize sample recovery, it is recommended that the HydraSleeve be placed in the well so that the bottom weight rests on the bottom of the well and the top of the HydraSleeve is as close to the bottom of the well screen as possible. This should allow the sampler to fill before the top of the device reaches the top of the screen as it is pulled up through the water column, and ensure that only water from the screen is collected as the sample. In short-screen wells, or wells with a short water column, it may be necessary to use a top-weight on the HydraSleeve to compress it in the bottom of the well so that, when it is recovered, it has room to fill before it reaches the top of the screen.

Example

2” ID PVC well, 50’ total depth, 10’ screen at the bottom of the well, with water level above the screen (the entire screen contains water).

Correct Placement (figure 2): Using a standard HydraSleeve for a 2” well (2.6” flat width/1.5” filled OD x 30” long, 650 ml volume), deploy the sampler so the weight (an 8 oz., 4”-long weight with a 2”-long clip) rests at the bottom of the well. The top of the sleeve is thus set at about 36” above the bottom of the well. When the sampler is recovered, it will be pulled upward approximately 30” to 45” before it is filled; therefore, it is full (and the top check valve closes) at approximately 66” (5 ½ feet) to 81” (6 ¾ feet) above the bottom of the well, which is well before the sampler reaches the top of the screen. In this example, only water from the screen is collected as a sample.

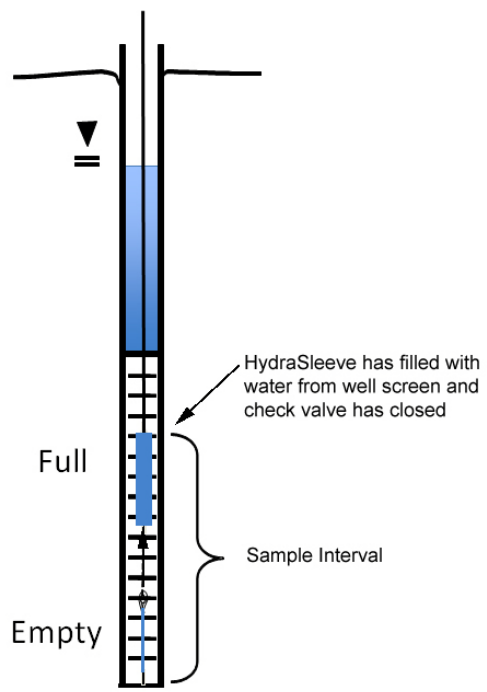

Figure 2. Correct placement of HydraSleeve.

Incorrect Placement (figure 3): If the well screen in this example was only 5' long, and the HydraSleeve was placed as above, it would not fill before the top of the device reached the top of the well screen, so the sample would include water from above the screen, which may not have the same chemistry.

The solution? Deploy the HydraSleeve with a top weight, so that it is collapsed to within 6" to 9" of the bottom of the well. When the HydraSleeve is recovered, it will fill within 39" (3 ¼ feet) to 54" (4 ½ feet) above the bottom of the well, or just before the sampler reaches the top of the screen, so it collects only water from the screen as the sample.

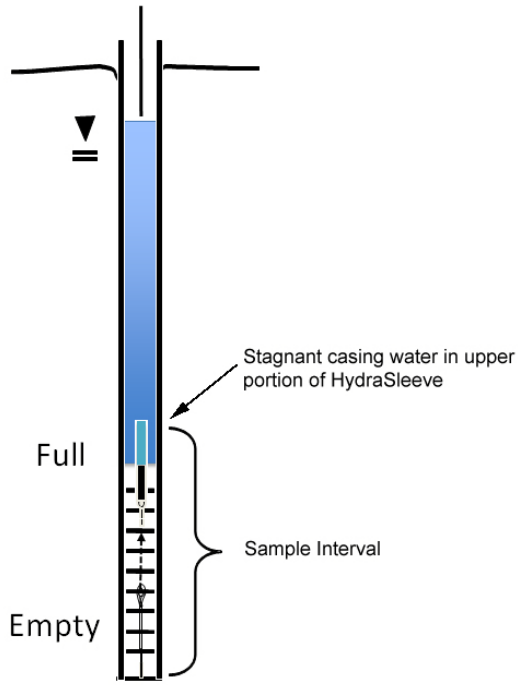

Figure 3. Incorrect placement of HydraSleeve.

This example illustrates one of many types of HydraSleeve placements. More complex placements are discussed in a later section.

Procedures for Sampling with the HydraSleeve

Collecting a ground-water sample with a HydraSleeve is a simple one-person operation.

Note: Before deploying the HydraSleeve in the well, collect the depth-to-water measurement that you will use to determine the preferred position of the HydraSleeve in the well. This measurement may also be used with measurements from other wells to create a ground-water contour map. If necessary, also measure the depth to the bottom of the well to verify actual well depth to confirm your decision on placement of the HydraSleeve in the water column.

Measure the correct amount of tether needed to suspend the HydraSleeve in the well so that the weight will rest on the bottom of the well (or at your preferred position in the well). Make sure to account for the need to leave a few feet of tether at the top of the well to allow recovery of the sleeve

Note: Always wear sterile gloves when handling and discharging the HydraSleeve.

I. Assembling the HydraSleeve

1. Remove the HydraSleeve from its packaging, unfold it, and hold it by its top.
2. Crimp the top of the HydraSleeve by folding the hard polyethylene reinforcing strips at the holes.
3. Attach the spring clip to the holes to ensure that the top will remain open until the sampler is retrieved.
4. Attach the tether to the spring clip by tying a knot in the tether.

Note: Alternatively, attach the tether to one (NOT both) of the holes at the top of the Hydrasleeve by tying a knot in the tether.

5. Fold the flaps with the two holes at the bottom of the HydraSleeve together and slide the weight clip through the holes.
6. Attach a weight to the bottom of the weight clip to ensure that the HydraSleeve will descend to the bottom of the well.

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II. Deploying the HydraSleeve

1. Using the tether, carefully lower the HydraSleeve to the bottom of the well, or to your preferred depth in the water column

   During installation, hydrostatic pressure in the water column will keep the self-sealing check valve at the top of the HydraSleeve closed, and ensure that it retains its flat, empty profile for an indefinite period prior to recovery.

Note: Make sure that it is not pulled upward at any time during its descent. If the HydraSleeve is pulled upward at a rate greater than 0.5'/second at any time prior to recovery, the top check valve will open and water will enter the HydraSleeve prematurely.

2. Secure the tether at the top of the well by placing the well cap on the top of the well casing and over the tether.

Note: Alternatively, you can tie the tether to a hook on the bottom of the well cap (you will need to leave a few inches of slack in the line to avoid pulling the sampler up as the cap is removed at the next sampling event).

III. Equilibrating the Well

The equilibration time is the time it takes for conditions in the water column (primarily flow dynamics and contaminant distribution) to restabilize after vertical mixing occurs (caused by installation of a sampling device in the well).

- Situation: The HydraSleeve is deployed for the first time or for only one time in a well

  The HydraSleeve is very thin in cross section and displaces very little water (<100 ml) during deployment so, unlike most other sampling devices, it does not disturb the water column to the point at which long equilibration times are necessary to ensure recovery of a representative sample.

  In most cases, the HydraSleeve can be recovered immediately (with no equilibration time) or within a few hours. In regulatory jurisdictions that impose specific requirements for equilibration times prior to recovery of no-purge sampling devices, these requirements should be followed.

- Situation: The HydraSleeve is being deployed for recovery during a future sampling event

  In periodic (i.e., quarterly or semi-annual) sampling programs, the sampler for the current sampling event can be recovered and a new sampler (for the next sampling event)

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deployed immediately thereafter, so the new sampler remains in the well until the next sampling event.

Thus, a long equilibration time is ensured and, at the next sampling event, the sampler can be recovered immediately. This means that separate mobilizations, to deploy and then to recover the sampler, are not required. HydraSleeves can be left in a well for an indefinite period of time without concern.

IV. HydraSleeve Recovery and Sample Collection

1. Hold on to the tether while removing the well cap.

2. Secure the tether at the top of the well while maintaining tension on the tether (but without pulling the tether upwards)

3. Measure the water level in the well.

4. In one smooth motion, pull the tether up between 30” to 45” (36” to 54” for the longer HydraSleeve) at a rate of about 1’ per second (or faster).

   The motion will open the top check valve and allow the HydraSleeve to fill (it should fill in about 1 to 1.5 times the length of the HydraSleeve). This is analogous to coring the water column in the well from the bottom up.

   When the HydraSleeve is full, the top check valve will close. You should begin to feel the weight of the HydraSleeve on the tether and it will begin to displace water. The closed check valve prevents loss of sample and entry of water from zones above the well screen as the HydraSleeve is recovered.

5. Continue pulling the tether upward until the HydraSleeve is at the top of the well.

6. Decant and discard the small volume of water trapped in the Hydrasleeve above the check valve by turning the sleeve over.

V. Sample Collection

Note: Sample collection should be done immediately after the HydraSleeve has been brought to the surface to preserve sample integrity.

1. Remove the discharge tube from its sleeve.

2. Hold the HydraSleeve at the check valve.

3. Puncture the HydraSleeve just below the check valve with the pointed end of the discharge tube

4. Discharge water from the HydraSleeve into your sample containers.

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Control the discharge from the HydraSleeve by either raising the bottom of the sleeve, by squeezing it like a tube of toothpaste, or both.

5. Continue filling sample containers until all are full.

Measurement of Field Indicator Parameters

Field indicator parameter measurement is generally done during well purging and sampling to confirm when parameters are stable and sampling can begin. Because no-purge sampling does not require purging, field indicator parameter measurement is not necessary for the purpose of confirming when purging is complete.

If field indicator parameter measurement is required to meet a specific non-purging regulatory requirement, it can be done by taking measurements from water within a HydraSleeve that is not used for collecting a sample to submit for laboratory analysis (i.e., a second HydraSleeve installed in conjunction with the primary sample collection HydraSleeve [see Multiple Sampler Deployment below]).

Alternate Deployment Strategies

Deployment in Wells with Limited Water Columns

For wells in which only a limited water column exists to be sampled, the HydraSleeve can be deployed with an optional top weight instead of a bottom weight, which collapses the HydraSleeve to a very short (approximately 6” to 9”) length, and allows the HydraSleeve to fill in a water column only 36” to 45” in height.

Multiple Sampler Deployment

Multiple sampler deployment in a single well screen can accomplish two purposes:

- It can collect additional sample volume to satisfy site or laboratory-specific sample volume requirements.
- It can accommodate the need for collecting field indicator parameter measurements.
- It can be used to collect samples from multiple intervals in the screen to allow identification of possible contaminant stratification.

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It is possible to use up to 3 standard 30” HydraSleeves deployed in series along a single tether to collect samples from a 10’ long well screen without collecting water from the interval above the screen.

The samplers must be attached to the tether at both the top and bottom of the sleeve. Attach the tether at the top with a stainless-steel clip (available from the manufacturer). Attach the tether at the bottom using a cable tie. The samplers must be attached as follows (figure 4):

- The first (attached to the tether as described above, with the weight at the bottom) at the bottom of the screen
- The second attached immediately above the first
- The third (attached the same as the second) immediately above the second

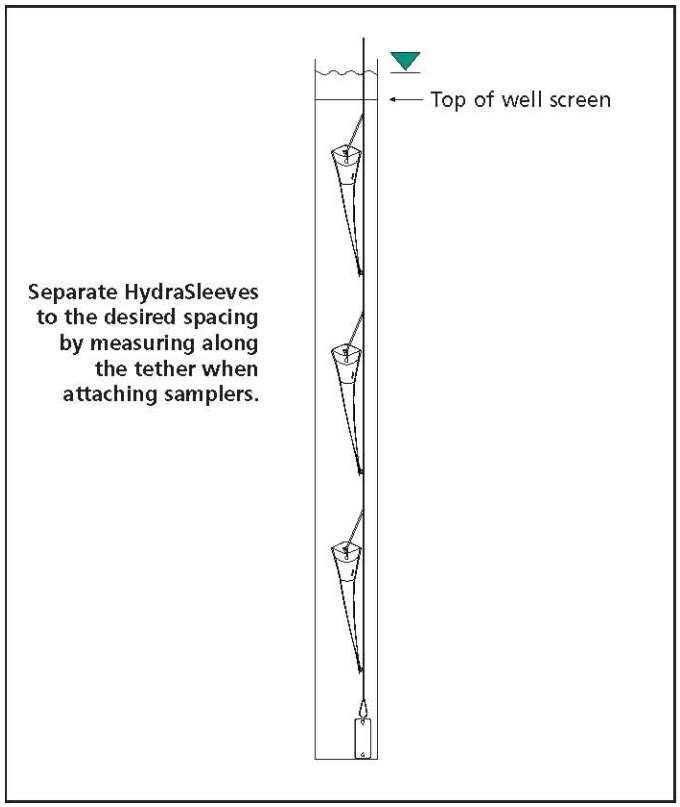

Figure 4. Multiple HydraSleeve deployment.

Alternately, the first sampler can be attached to the tether as described above, a second attached to the bottom of the first using a short length of tether (in place of the weight), and the third attached to the bottom of the second in the same manner, with the weight attached to the bottom of the third sampler (figure 5).

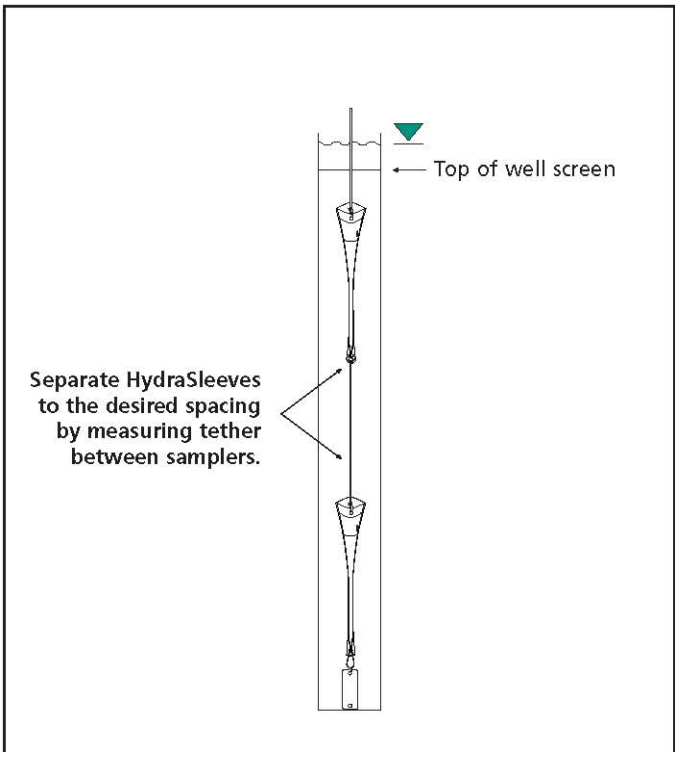

Figure 5. Alternative method for deploying multiple HydraSleeves.

In either case, when attaching multiple HydraSleeves in series, more weight may be required to hold the samplers in place in the well than would be required with a single sampler. Recovery of multiple samplers and collection of samples is done in the same manner as for single sampler deployments.

Post-Sampling Activities

The recovered HydraSleeve and the sample discharge tubing should be disposed as per the solid waste management plan for the site. To prepare for the next sampling event, a new HydraSleeve can be deployed in the well (as described previously) and left in the well until the next sampling event, at which time it can be recovered.

The weight and weight clip can be reused on this sampler after they have been thoroughly cleaned as per the site equipment decontamination plan. The tether may be dedicated to the well and reused or discarded at the discretion of sampling personnel.

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References

McAlary, T. A. and J. F. Barker, 1987, Volatilization Losses of Organics During Ground-Water Sampling From Low-Permeability Materials, Ground-Water Monitoring Review, Vol. 7, No. 4, pp. 63-68

Parsons, 2005, Results Report for the Demonstration of No-Purge Ground-Water Sampling Devices at Former McClellan Air Force Base, California; Contract F44650-99-D-0005, Delivery Order DKO1, U.S. Army Corps of Engineers (Omaha District), U.S. Air Force Center for Environmental Excellence, and U.S. Air Force Real Property Agency

Robin, M. J. L. and R. W. Gillham, 1987, Field Evaluation of Well Purging Procedures, Ground-Water Monitoring Review, Vol. 7, No. 4, pp. 85-93

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FIELD INVESTIGATION PLANNING FORM

1019 1st Avenue North

Billings, Montana

APPENDIX E

Appendix D - Field Investigation Planning Form

Project Name:	Virdon Property
Project Number:	350.0181.000
Project Address:	1019 1st Avenue North
Project City:	Billings, Montana 59101
Date:	
Investigation Date(s):	
Site Contact:	Randy Stone
Client Contact:	Patrick Klugman
EPA / DEQ Manager:	Greg Davis (EPA) & Brandon Kingsbury (DEQ)

Required Check Offs	**Yes**	**No**
DEQ/EPA Approved SAP		
SAP Reviewed by Field Staff		
Utility Locate Number		
Owner Notified		
Health & Safety Plan		
Sample Location Map		
Holding Times Work		
Project Budget Reviewed		

Overall Reason for Investigation: The purpose of the Phase II ESA is to determine whether the historic use of the Site properties and adjacent properties has resulted in soil, soil vapor, and/or groundwater impacts that would preclude commercial reuse or redevelopment of the Site. This SAP was prepared on behalf of the Big Sky Economic Development (BSED) using U.S. Environmental Protection Agency (EPA) Brownfields Assessment Grant funds.

Sampling Methods

Total # of Samples	Analytical Parameters	Media	Natural or QC Sample?	Analytical Method #	Sample Containers	Preservative	Hold/Extraction Time	Sample Locations
22	VPH	Soil	Natural	MDEP VPH	8oz Glass Jar	< 6°C, no headpace	7/28 Days	Locations B-1 through B-11. Two SOIL samples at each location. One sample from highest impacts and one from just above the groundwater interface. If no impacts observed, then collect one sample midway between the ground surface and the soil-groundwater interface.
22	EPH	Soil	Natural	MDEP EPH	8oz Glass Jar	< 6°C	7/40 Days	
(up to) 11	VPH	Groundwater	Natural	MDEP VPH	40mL vials	pH<2 HCl; < 6°C	14 Days	All borings with sufficient groundwater (up to eleven total).
(up to) 11	VOCs	Groundwater	Natural	EPA 8260B				
(up to) 11	EPH	Groundwater	Natural	MDEP EPH	1L Amber Glass	pH<2 HCl; < 6°C	14/40 Days	
(up to) 11	Metals (RCRA 8)	Groundwater	Natural	EPA 6010B/7471	500 mL HDPE	pH<2 HNOpH<2 HNO_3	180 Days	
2	APH	Soil Vapor	Natural	MDEP APH	6L Summa	none	30 days	Locations SV-1 and SV-2
2	EPA TO-15	Soil Vapor	Natural	TO-15	6L Summa	none	30 days	
2	EPA TO-15 SIM	Soil Vapor	Natural	TO-15 SIM	6L Summa	none	30 days	
2	Helium	Soil Vapor	Natural	EPA 3C Modified	6L Summa	none	30 days	
1	EPH	Groundwater	QC - DUP	MDEP EPH	1L Amber Glass	pH<2 HCl; < 6°C	14/40 Days	One blind duplicate groundwater sample will be collected from one boring and analyzed for all COPCs.
1	VPH	Groundwater	QC -DUP	MDEP VPH	40mL vials	pH<2 HCl; < 6°C	14 Days	
1	VOCs	Groundwater	QC -DUP	EPA 8260	40mL vials	pH<2 HCl; < 6°C	14 Days	
1	Metals (RCRA)	Groundwater	QC -DUP	EPA 6010B/7471	125 ml plastic/glass	HNO_3; < 6°C	180 Days (28 Days for Hg)	
2	EPH	Distilled H_2O	QC - ERB	MDEP EPH	1L Amber Glass	pH<2 HCl; < 6°C	14/40 Days	One ERB sample will collected from soil sampling equipment for all paramters and one ERB sample will be collected from groundwater sampling equipment for all parameters. Trip Blanks will need to be supplied by Pace Laboratory and analyzed for VPH and VOCs.
3	VPH	Distilled H_2O	QC - ERB, TB	MDEP VPH	40mL vials	pH<2 HCl; < 6°C	14 Days	
3	VOCs	Distilled H_2O	QC - ERB, TB	EPA 8260	40mL vials	pH<2 HCl; < 6°C	14 Days	
2	Metals (RCRA)	Distilled H_2O	QC - ERB	EPA 6010B/7471	125 ml plastic/glass	HNO_3; < 6°C	180 Days (28 Days for Hg)	

Lab Pack:

Laboratory: Pace Analytical (ALS for Soil Vapor)

Shipping by:

Other Instructions:

Project Manager: _____ Field Staff: _____

NewFields

(Form to be finalized and signed prior to commencing field work.)

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Pace Analytical™ www.pacelabs.com

Section A **Required** Client Information:	Section B **Required** Project Information:	Section C Invoice Information:
Company:	Report To:	Attention:
Address:	Copy To:	Company Name:
		Address:
Email To:	Purchase Order No.:	Pace Quote Reference:
Phone: / Fax:	Project Name:	Pace Project Manager:
Requested Due Date/TAT: **Standard**	Project Number:	Pace Profile #:

Page: **of**

REGULATORY AGENCY

☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER

☐ UST ☐ RCRA ☐ OTHER _____

Site Location ***STATE:*** _____

Section D
Required Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
WIPE	WP
AIR	AR
OTHER	OT
TISSUE	TS

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED: COMPOSITE START DATE	COLLECTED: COMPOSITE START TIME	COLLECTED: COMPOSITE END/GRAB DATE	COLLECTED: COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test (Y/N)												Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1																															
2																															
3																															
4																															
5																															
6																															
7																															
8																															
9																															
10																															
11																															
12																															

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

SIGNATURE of SAMPLER: **DATE Signed (MM/DD/YY):**

Temp in °C | Received on Ice (Y/N) | Custody Sealed Cooler (Y/N) | Samples Intact (Y/N)

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

SUMMARY OF ANALYTICAL METHODS, REPORTING LIMITS, AND REGULATORY ACTION LIMIT

1019 1st Avenue North

Billings, Montana

APPENDIX F

Table F-1
Reporting Limits Compared to Screening Levels: Soil
Virdon Property
Billings, Montana

Analytical Method	Target Analyte	CAS Number	PACE Reporting Limits		Montana Tier 1 RBSLs Subsurface Soil (<10 ft to GW)	EPA Industrial RSLs	[Screening Level] > [Reporting Limit]	Comment
			MDL (mg/kg)	PRL (mg/kg)			Subsurface Soil	
Extractable Petroleum Hydrocarbons (EPH)								
MDEP EPH	Total Extractable Hydrocarbons	TEH	2.61	10	200	--	TRUE	
	Aliphatic (C09-C18)	C09-C18	2.61	10	2000	--	TRUE	
	Aliphatic (C19-C36)	C19-C36	2.61	10	100000	--	TRUE	
	Aromatic (C11-22)	C11-22	2.61	10	400	--	TRUE	
Volatile Petroleum Hydrocarbons (VPH)								
MDEP VPH	Total Purgeable Hydrocarbons	TPH	0.16	10	---	--	TRUE	
	Aliphatic (C5-C8)	C5-C8	0.096	5	200	--	TRUE	
	Aliphatic (C9-C12)	C9-C12	0.281	5	1000	--	TRUE	
	Aromatic (C9-C10)	C9-C10	0.221	1	10	--	TRUE	
	MTBE	1634-04-4	0.018	0.05	0.08	0.3	TRUE	
	Benzene	71-43-2	0.012663	0.025	0.04	0.2	TRUE	
	Toluene	108-88-3	0.014138	0.05	10	60	TRUE	
	Ethylbenzene	100-41-4	0.014724	0.05	10	30	TRUE	
	Xylenes	1330-20-7	0.043974	0.2	200	300	TRUE	
	Naphthalene	91-20-3	0.099	0.6	9	20	TRUE	

Notes:
*Montana Tier 1 Risk-Based Corrective Action Guidance for metals in soil, published by MDEQ, dated September 2009.
mg/kg - milligrams per kilogram
CAS - Chemical abstracts service registry number
MDL - Method Detection limit
MRL - Method reporting limit
RBSLs - Risk based Screening Levels
GW - Groundwater
EPA - Enviornmental Protection Agency
RSLs - Regional screening levels

Table F-2
Reporting Limits Compared to Screening Levels: Groundwater
Virdon Property
Billings, Montana

Analytical Method	Target Analyte	CAS Number	PACE Reporting Limits		Montana Tier 1 Groundwater RBSLs (ug/L)	DEQ 7 Numeric Water Quality Standards	[Screening Level] > [Reporting Limit]	Comment
			MDL (ug/L)	PRL (ug/L)			Groundwater	
Extractable Petroleum Hydrocarbons (EPH)								
EPH	Total Extractable Hydrocarbons	TEH	69.1	200	1000	--	TRUE	
	Aliphatic (C09-C18)	C09-C18	100	200	1000	--	TRUE	
	Aliphatic (C19-C36)	C19-C36	5	200	1000	--	TRUE	
	Aromatic (C11-22)	C11-22	19	200	1000	--	TRUE	
Volatile Petroleum Hydrocarbons (VPH)								
VPH	Total Purgeable Hydrocarbons	TPH	2.578	20	1000	--	TRUE	
	Aliphatic (C5-C8)	C5-C8	2.71462	20	700	--	TRUE	
	Aliphatic (C9-C12)	C9-C12	1.666	20	1000	--	TRUE	
	Aromatic (C9-C10)	C9-C10	10	20	1000	--	TRUE	
	Benzene	71-43-2	0.19185	0.5	5.0	5	TRUE	
	Ethylbenzene	100-41-4	0.15411	0.5	700	700	TRUE	
	Methyl-tert-butyl ether	1634-04-4	0.49053	1	30	30	TRUE	
	Naphthalene	91-20-3	0.25003	5	100	100	TRUE	
	Toluene	108-88-3	0.084	0.5	1000	1000	TRUE	
	Xylene (Total)	1330-20-7	0.52989	2	10000	--	TRUE	
	m&p-Xylene (co-elute)	108-38-3	0.141	1	--	10000	TRUE	
		106-42-3	0.141	1	--	10000	TRUE	
	o-Xylene	95-47-6	0.24789	1	--	10000	TRUE	
Volatile Organic Compounds (VOCs)								
EPA Method 8260	1,1,1,2-Tetrachloroethane	630-20-6	0.5	1	--	--	TRUE	
	1,1,1-Trichloroethane	71-55-6	0.264	1	--	200	TRUE	
	1,1,2,2-Tetrachloroethane	79-34-5	0.5	1	--	2	TRUE	
	1,1,2-Trichloroethane	79-00-5	0.127	1	--	3	TRUE	
	1,1,2-Trichlorotrifluoroethane	76-13-1	0.5	1	--	--	TRUE	
	1,1-Dichloroethane	75-34-3	0.159	1	--	--	TRUE	
	1,1-Dichloroethene	75-35-4	0.199	1	--	7	TRUE	
	1,1-Dichloropropene	563-58-6	0.5	1	--	--	TRUE	
	1,2,3-Trichlorobenzene	87-61-6	0.5	1	--	--	TRUE	
	1,2,3-Trichloropropane	96-18-4	1.22	4	--	--	TRUE	
	1,2,4-Trichlorobenzene	120-82-1	0.5	1	--	70	TRUE	
	1,2,4-Trimethylbenzene	95-63-6	0.5	1	--	--	TRUE	
	1,2-Dibromo-3-chloropropane	96-12-8	2	4	--	0.2	FALSE	Laboratory will be asked to report to MDL
	1,2-Dibromoethane (EDB)	106-93-4	0.148	1	--	0.004	FALSE	Laboratory will be asked to report to MDL
	1,2-Dichlorobenzene	95-50-1	0.16	1	--	600	TRUE	
	1,2-Dichloroethane	107-06-2	0.131	1	--	4	TRUE	
	1,2-Dichloropropane	78-87-5	0.142	4	--	5	TRUE	
	1,3,5-Trimethylbenzene	108-67-8	0.5	1	--	--	TRUE	
	1,3-Dichlorobenzene	541-73-1	0.5	1	--	600	TRUE	
	1,3-Dichloropropane	142-28-9	0.5	1	--	--	TRUE	
	1,4-Dichlorobenzene	106-46-7	0.5	1	--	75	TRUE	
	2,2-Dichloropropane	594-20-7	0.174	4	--	--	TRUE	
	2-Butanone (MEK)	78-93-3	2.5	5	--	--	TRUE	
	2-Chlorotoluene	95-49-8	0.138	1	--	--	TRUE	
	4-Chlorotoluene	106-43-4	0.0825	1	--	--	TRUE	
	4-Methyl-2-pentanone (MIBK)	108-10-1	2.5	5	--	--	TRUE	
	Acetone	67-64-1	10	20	--	--	TRUE	
	Allyl chloride	107-05-1	0.446	4	--	--	TRUE	
	Benzene	71-43-2	0.15	1	--	5	TRUE	
	Bromobenzene	108-86-1	0.132	1	--	--	TRUE	
	Bromochloromethane	74-97-5	0.115	1	--	--	TRUE	
	Bromodichloromethane	75-27-4	0.202	1	--	10	TRUE	
	Bromoform	75-25-2	2	4	--	80	TRUE	
	Bromomethane	74-83-9	2	4	--	10	TRUE	
	Carbon tetrachloride	56-23-5	0.159	1	--	3	TRUE	
	Chlorobenzene	108-90-7	0.0661	1	--	100	TRUE	
	Chloroethane	75-00-3	0.241	1	--	--	TRUE	
	Chloroform	67-66-3	0.161	1	--	70	TRUE	
	Chloromethane	74-87-3	0.341	4	--	30	TRUE	
	cis-1,3-Dichloropropene	10061-01-5	0.127	4	--	4	TRUE	
	Dibromochloromethane	124-48-1	0.5	1	--	4	TRUE	
	Dibromomethane	74-95-3	0.185	4	--	--	TRUE	
	Dichlorodifluoromethane	75-71-8	0.5	1	--	1000	TRUE	
	Dichlorofluoromethane	75-43-4	0.202	1	--	--	TRUE	
	Diethyl ether (Ethyl ether)	60-29-7	0.141	4	--	--	TRUE	
	Ethylbenzene	100-41-4	0.165	1	--	700	TRUE	
	Hexachloro-1,3-butadiene	87-68-3	0.5	1	--	5	TRUE	
	Isopropylbenzene (Cumene)	98-82-8	0.5	1	--	--	TRUE	
	Methyl-tert-butyl ether	1634-04-4	0.169	1	--	30	TRUE	
	Methylene Chloride	75-09-2	2	4	--	5	TRUE	
	Naphthalene	91-20-3	2	4	--	100	TRUE	
	Styrene	100-42-5	0.0627	1	--	100	TRUE	
	Tetrachloroethene	127-18-4	0.157	1	--	5	TRUE	
	Tetrahydrofuran	109-99-9	1.99	10	--	--	TRUE	
	Toluene	108-88-3	0.11	1	--	1000	TRUE	
	Trichloroethene	79-01-6	0.0906	0.4	--	5	TRUE	
	Trichlorofluoromethane	75-69-4	0.216	1	--	10000	TRUE	
	Vinyl chloride	75-01-4	0.082	0.4	--	--	TRUE	

Table F-2
Reporting Limits Compared to Screening Levels: Groundwater
Virdon Property
Billings, Montana

Analytical Method	Target Analyte	CAS Number	PACE Reporting Limits		Montana Tier 1 Groundwater RBSLs (ug/L)	DEQ 7 Numeric Water Quality Standards	[Screening Level] > [Reporting Limit]	Comment
			MDL (ug/L)	PRL (ug/L)			Groundwater	
Volatile Organic Compounds (VOCs) - Continued								
EPA Method 8260	Xylene (Total)	1330-20-7	0.404	3	--	--	TRUE	
	cis-1,2-Dichloroethene	156-59-2	0.133	1	--	70	TRUE	
	m-Xylene (coelute)	108-38-3	0.31	2	--	10000	TRUE	
	p-Xylene	106-42-3	0.31	2	--	10000	TRUE	
	n-Butylbenzene	104-51-8	0.5	1	--	--	TRUE	
	n-Propylbenzene	103-65-1	0.5	1	--	--	TRUE	
	o-Xylene	95-47-6	0.094	1	--	10000	TRUE	
	p-Isopropyltoluene	99-87-6	0.00725	0.05	--	300	TRUE	
	sec-Butylbenzene	135-98-8	0.00589	0.05	--	16	TRUE	
	p-Isopropyltoluene	99-87-6	0.5	1	--	--	TRUE	
	sec-Butylbenzene	135-98-8	0.5	1	--	--	TRUE	
	tert-Butylbenzene	98-06-6	0.5	1	--	--	TRUE	
	trans-1,3-Dichloropropene	10061-02-6	0.185	4	--	2	TRUE	
	trans-1,2-Dichloroethene	156-60-5	0.231	1	--	100	TRUE	
Dissolved Metals								
EPA 6010	Arsenic	7440-38-2	3.14847	20	--	10	TRUE	
	Barium	7440-39-3	5	10	--	1000	TRUE	
	Cadmium	7440-43-9	0.25118	3	--	5	TRUE	
	Chromium	7440-47-3	5	10	--	100	TRUE	
	Lead	7439-92-1	1.77956	10	--	15	TRUE	
	Selenium	7782-49-2	6.64761	20	--	50	TRUE	
	Silver	7440-22-4	0.62787	10	--	100	TRUE	
EPA 7470	Mercury	7439-97-6	0.026	0.2	--	2	TRUE	

Notes:
mg/L - micrograms per liter
CAS - Chemical abstracts service registry number
MDL - Method Detection limit
MRL - Method reporting limit
RBSLs - Risk based Screening Levels
GW - Groundwater
DEQ - Montana Department of Enviornmental Quality
EPA - Enviornmental Protection Agency

Table F-3
Reporting Limits Compared to Screening Levels: Soil Vapor
Virdon Property
Billings, Montana

Analytical Method	Target Analyte	CAS Number	ALS Reporting Limits		Industrial EPA/MDEQ RSLs (ug/m^3)	Soil Gas Screening Level* (ug/m^3)	[Screening Level] > [Reporting Limit]	Comment
			MDL (ug/m^3)	MRL (ug/m^3)			Soil Gas	
Air Phase Hydrocarbons (APH)								
	Aliphatic (C05-C08)	C05-C08	----	20	262.8	8760	TRUE	
	Aliphatic (C09-C12)	C19-C36	----	10	43.8	1460	TRUE	
	Aromatic (C09-10)	C09-C10	----	2.5	43.8	1460	TRUE	
EPA TO-15								
	1,1,1-Trichloroethane	71-55-6	0.17	0.50	na	22000	TRUE	
	1,1,2,2-Tetrachloroethane	79-34-5	0.15	0.50	na	4.2	TRUE	
	1,1,2-Trichloroethane	79-00-5	0.16	0.50	na	15	TRUE	
	1,1-Dichloroethane	75-34-3	0.16	0.50	na	5000	TRUE	
	1,1-Dichloroethene	75-35-4	0.17	0.50	na	2000	TRUE	
	1,2,4-Trichlorobenzene	120-82-1	0.16	0.50	na	60	TRUE	
	1,2,4-Trimethylbenzene	95-63-6	0.15	0.50	na	60	TRUE	
	1,2-Dibromo-3-chloropropane	96-12-8	0.099	0.50	na	1.1	TRUE	
	1,2-Dibromoethane (EDB)	106-93-4	0.16	0.50	0.022	0.73	FALSE	Laboratory will be asked to report to MDL
	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	76-14-2	0.19	0.50	na	na	na	
	1,2-Dichlorobenzene	95-50-1	0.15	0.50	na	2000	TRUE	
	1,2-Dichloroethane (DCA)	107-06-2	0.16	0.50	0.52	17.33	TRUE	
	1,2-Dichloropropane	78-87-5	0.16	0.50	na	40	TRUE	
	1,3,5-Trimethylbenzene	108-67-8	0.16	0.50	na	60	TRUE	
	1,3-Butadiene	106-99-0	0.22	0.50	0.46	15.33	TRUE	
	1,3-Dichlorobenzene	541-73-1	0.15	0.50	na	1100	TRUE	
	1,4-Dichlorobenzene	106-46-7	0.14	0.50	na	8000	TRUE	
	1,4-Dioxane	123-91-1	0.16	0.50	na	na	na	
	2-Butanone (MEK)	78-93-3	0.21	5.0	na	10000	TRUE	
	2-Hexanone	591-78-6	0.16	0.50	na	na	na	
	2-Propanol (Isopropyl Alcohol)	67-63-0	0.42	5.0	na	na	na	
	3-Chloro-1-propene (Allyl Chloride)	107-05-1	0.16	0.50	na	na	na	
	4-Ethyltoluene	622-96-8	0.16	0.50	na	na	na	
	4-Methyl-2-pentanone	108-10-1	0.16	0.50	na	na	na	
	Acetone	67-64-1	0.77	5.0	na	3500	TRUE	
	Acetonitrile	75-05-8	0.18	0.50	na	na	na	
	Acrolein	107-02-8	0.17	2.0	na	na	na	
	Acrylonitrile	107-13-1	0.17	0.50	na	na	na	
	alpha-Pinene	80-56-8	0.14	0.50	na	na	na	
	Benzene	71-43-2	0.16	0.50	1.78	59.33	TRUE	
	Benzyl Chloride	100-44-7	0.11	0.50	na	5	TRUE	
	Bromodichloromethane	75-27-4	0.15	0.50	na	14	TRUE	
	Bromoform	75-25-2	0.15	0.50	na	220	TRUE	
	Bromomethane	74-83-9	0.19	0.50	na	50	TRUE	
	Carbon Disulfide	75-15-0	0.15	5.0	na	16	TRUE	
	Carbon Tetrachloride	56-23-5	0.15	0.50	na	7000	TRUE	
	Chlorobenzene	108-90-7	0.16	0.50	na	600	TRUE	
	Chloroethane	75-00-3	0.17	0.50	na	100000	TRUE	
	Chloroform	67-66-3	0.17	0.50	na	11	TRUE	
	Chloromethane	74-87-3	0.15	0.50	na	240	TRUE	
	cis-1,2-Dichloroethene	156-59-2	0.16	0.50	na	350	TRUE	
	cis-1,3-Dichloropropene	10061-01-5	0.14	0.50	na	na	na	
	Cumene	98-82-8	0.15	0.50	na	na	na	
	Cyclohexane	110-82-7	0.29	1.0	na	na	na	
	Dibromochloromethane	124-48-1	0.16	0.50	na	10	TRUE	
	Dichlorodifluoromethane (CFC 12)	75-71-8	0.17	0.50	na	2000	TRUE	
	d-Limonene	5989-27-5	0.14	0.50	na	na	na	
	Ethanol	64-17-5	0.8	5.0	na	na	na	
	Ethyl Acetate	141-78-6	0.35	1.0	na	220	TRUE	
	Ethylbenzene	100-41-4	0.16	0.50	5.46	182	TRUE	
	Hexachlorobutadiene	87-68-3	0.14	0.50	na	11	TRUE	
	m,p-Xylenes	179601-23-1	0.3	1.0	na	70000	TRUE	
	Methyl Methacrylate	80-62-6	0.31	1.0	na	na	na	
	Methyl-tert-butyl ether	1634-04-4	0.17	0.50	52.37	1745.67	TRUE	
	Methylene Chloride	75-09-2	0.17	0.50	na	520	TRUE	
	Naphthalene	91-20-3	0.18	0.50	0.401	13.367	TRUE	
	n-Butyl Acetate	123-86-4	0.16	0.50	na	na	na	
	n-Decane	124-18-5	0.16	0.50	na	na	na	
	n-Heptane	142-82-5	0.17	0.50	na	na	na	
	n-Hexane	110-54-3	0.15	0.50	na	2000	TRUE	
	n-Nonane	111-84-2	0.15	0.50	na	na	na	
	n-Octane	111-65-9	0.18	0.50	na	na	na	
	n-Propylbenzene	103-65-1	0.16	0.50	na	na	na	
	o-Xylene	95-47-6	0.15	0.50	na	na	na	
	Propene	115-07-1	0.14	0.50	na	na	na	
	Styrene	100-42-5	0.15	0.50	na	10000	TRUE	
	Tetrachloroethene (PERC)	127-18-4	0.14	0.50	na	81	TRUE	
	Tetrahydrofuran (THF)	109-99-9	0.2	0.50	na	na	na	
	Toluene	108-88-3	0.17	0.50	2200	73333	TRUE	
	trans-1,2-Dichloroethene	156-60-5	0.19	0.50	na	700	TRUE	
	trans-1,3-Dichloropropene	10061-02-6	0.16	0.50	na	na	na	
	Trichloroethene	79-01-6	0.14	0.50	na	2.2	TRUE	
	Trichlorofluoromethane	75-69-4	0.17	0.50	na	7000	TRUE	
	Trichlorotrifluoroethane	76-13-1	0.17	0.50	na	na	na	
	Vinyl Acetate	108-05-4	0.65	5.0	na	28	TRUE	
	Vinyl Chloride	75-01-4	0.17	0.50	na	2000	TRUE	

Table F-3
Reporting Limits Compared to Screening Levels: Soil Vapor
Virdon Property
Billings, Montana

Analytical Method	Target Analyte	CAS Number	ALS Reporting Limits		Industrial EPA/MDEQ RSLs (ug/m^3)	Soil Gas Screening Level* (ug/m^3)	[Screening Level] > [Reporting Limit]	Comment
			MDL (ug/m^3)	MRL (ug/m^3)			Soil Gas	
EPA TO-15 SIM								
	1,1,1-Trichloroethane	71-55-6	0.0059	0.025	na	22000	TRUE	
	1,1,2,2-Tetrachloroethane	79-34-5	0.0072	0.025	na	4.2	TRUE	
	1,1,2-Trichloroethane	79-00-5	0.0079	0.10	na	15	TRUE	
	1,1-Dichloroethane	75-34-3	0.0061	0.025	na	5000	TRUE	
	1,1-Dichloroethene	75-35-4	0.0086	0.025	na	2000	TRUE	
	1,2,4-Trichlorobenzene	120-82-1	0.013	0.050	na	60	TRUE	
	1,2,4-Trimethylbenzene	95-63-6	0.0083	0.10	na	60	TRUE	
	1,2-Dibromo-3-chloropropane	96-12-8	0.0095	0.10	na	1.1	TRUE	
	1,2-Dibromoethane (EDB)	106-93-4	0.0079	0.025	0.022	0.73	TRUE	
	1,2-Dichlorobenzene	95-50-1	0.0083	0.025	na	na	na	
	1,2-Dichloroethane (DCA)	107-06-2	0.0084	0.025	0.52	17.33	TRUE	
	1,2-Dichloropropane	78-87-5	0.0073	0.025	na	40	TRUE	
	1,3,5-Trimethylbenzene	108-67-8	0.0073	0.10	na	60	TRUE	
	1,3-Butadiene	106-99-0	0.014	0.050	0.46	15.33	TRUE	
	1,3-Dichlorobenzene	541-73-1	0.0085	0.025	na	1100	TRUE	
	1,4-Dichlorobenzene	106-46-7	0.0081	0.025	na	8000	TRUE	
	1,4-Dioxane	123-91-1	0.0085	0.10	na	na	na	
	Acetone	67-64-1	0.056	2.5	na	3500	TRUE	
	Acrolein	107-02-8	0.039	0.20	na	na	na	
	Benzene	71-43-2	0.020	0.075	1.78	59.33	TRUE	
	Bromodichloromethane	75-27-4	0.0069	0.025	na	14	TRUE	
	Bromomethane	74-83-9	0.0093	0.025	na	50	TRUE	
	Carbon Tetrachloride	56-23-5	0.012	0.025	na	7000	TRUE	
	Chlorobenzene	108-90-7	0.0092	0.10	na	600	TRUE	
	Chloroethane	75-00-3	0.0085	0.025	na	100000	TRUE	
	Chloroform	67-66-3	0.018	0.10	na	11	TRUE	
	Chloromethane	74-87-3	0.019	0.050	na	240	TRUE	
	cis-1,2-Dichloroethene	156-59-2	0.0092	0.025	na	240	TRUE	
	cis-1,3-Dichloropropene	10061-01-5	0.0062	0.025	na	350	TRUE	
	Dibromochloromethane	124-48-1	0.0088	0.025	na	10	TRUE	
	Dichlorodifluoromethane (CFC 12)	75-71-8	0.017	0.050	na	2000	TRUE	
	Ethylbenzene	100-41-4	0.0097	0.10	5.46	182	TRUE	
	Hexachloro-1,3-butadiene	87-68-3	0.0092	0.10	na	na	na	
	m- & p-Xylene	179601-23-1	0.019	0.10	na	70000	TRUE	
	Methyl tert-Butyl Ether	1634-04-4	0.0093	0.025	52.37	1745.67	TRUE	
	Methylene Chloride	75-09-2	0.013	0.10	na	520	TRUE	
	Naphthalene	91-20-3	0.016	0.10	0.401	13.367	TRUE	
	o-Xylene	95-47-6	0.0089	0.10	na	na	na	
	Styrene	100-42-5	0.0074	0.10	na	10000	TRUE	
	Tetrachloroethene (PERC)	127-18-4	0.0082	0.025	na	81	TRUE	
	Toluene	108-88-3	0.011	0.10	2200	73333	TRUE	
	trans-1,2-Dichloroethene	156-60-5	0.0073	0.025	na	700	TRUE	
	trans-1,3-Dichloropropene	10061-02-6	0.0055	0.025	na	na	na	
	Trichloroethene	79-01-6	0.0085	0.025	na	na	na	
	Trichlorofluoromethane	75-69-4	0.015	0.050	na	7000	TRUE	
	Trichlorotrifluoroethane	76-13-1	0.0089	0.025	na	na	na	
	Vinyl Chloride	75-01-4	0.0076	0.025	na	2000	TRUE	

Notes:
ug/m^3 - micrograms per cubic meter of air
na - neither RSLs or soil gas screening risk levels published
---- APH hydrocarbon fractions are summations of many compounds and MDLs are not published
CAS - Chemical abstracts service registry number
MDL - Method Detection limit
MRL - Method Reporting limit
RSLs - Regional Screening Levels
DEQ - Montana Department of Enviornmental Quality
EPA - Enviornmental Protection Agency
*Montana does not have soil gas standards, so the soil gas screening level shown is **either** the Montana indoor air RSL divided by the indoor to sub-slab attenuation factor of 0.03 published by EPA in final vapor intrusion guidance, June 2015; **or**, the target shallow soil gas concentration to satisfy both the prescribed risk level and the target Hazard Index *(R=10-5, HI=1), published by EPA in draft vapor intrusion guidance, 2002.

Table F-4
Reporting Limits Compared to Screening Levels: Building Materials
Virdon Property
Billings, Montana

Target Analyte	Analytical Method	Reporting Limit	Regulatory Action Limit	Is the Reporting Limit low enough for decision-making purposes?
Asbestos	Building Materials: EPA 600/R-93/116	0.1 % (trace amount)	1% by weight or area	Yes. Building materials will be considered Asbestos Containing Materials (ACM) if they contain greater than 1 percent (1%) asbestos by area or weight based on the sampling results (40 CFR 763 and the Administrative Rules of Montana (ARM) 17.74.354).
Lead-Based Paint	XRF Spectrometer by HUD Protocol	0.1 mg/cm[1]	1.0 mg/cm[1]	Yes. Lead based paint will be considered potentially hazardous if the XRF results are above regulatory action limit.
	Paint Chip Testing by EPA Method 7420	0.02% (200 mg/kg)	0.5% (5,000 mg/kg)	

Notes:

mg/cm[1] = milligrams per square centimeter

mg/kg = milligrams per kilogram

Final Clearance Standard is the concentration in air that must be met to allow unrestricted reoccupation of a space following asbestos abatement. This threshold is defined in both federal law (40 CFR 763, AHERA) and the Administrative Rules of Montana (ARM) 17.74.357.

OSHA 8-hour PEL is the Permissable Exposure Limit established by the U.S. Occupational Safety & Health Administration (OSHA) as a time-weighted average, assuming abatement workers are using a 1/2-face respirator.

OSHA 1/2-hour Excursion Limit is the threshold that must not be exceeded in the first 1/2-hour of abatement, when disturbance is typically greatest.

MONTANA LAW DEFINING ASBESTOS INSPECTION REQUIREMENTS

1019 1st Avenue North

Billings, Montana

APPENDIX G

Linda McCulloch
MONTANA SECRETARY OF STATE

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Rule: 17.74.354

Prev Up Next

Rule Title: INSPECTION REQUIREMENTS FOR DEMOLITION AND RENOVATION ACTIVITIES

Department: ENVIRONMENTAL QUALITY
Chapter: NOISE, ASBESTOS CONTROL, METHAMPHETAMINE CLEANUP
Subchapter: Asbestos Control

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Latest version of the adopted rule presented in Administrative Rules of Montana (ARM):

Printer Friendly Version

17.74.354 INSPECTION REQUIREMENTS FOR DEMOLITION AND RENOVATION ACTIVITIES

(1) Prior to any demolition or renovation of a facility, the owner or operator shall ensure the facility or part of the facility where demolition or renovation actions will occur is thoroughly inspected by a department-accredited asbestos inspector in accordance with this subchapter.

(2) The owner or operator shall ensure that a copy of the inspection report is kept on site during the asbestos project. The owner shall ensure that the report is kept on site during subsequent renovations or demolition. The inspection report must be made available to the department upon request.

(3) A department-accredited asbestos inspector conducting an inspection in accordance with this subchapter shall:

(a) visually inspect the areas that may be affected to identify the locations of all suspect ACM;

(b) touch all suspect ACM to determine whether it is friable;

(c) collect bulk samples from each surfacing material that is not assumed to be ACM in a statistically random manner that is representative of the surfacing material. Samples must be collected as follows:

(i) at least three bulk samples must be collected from each surfacing material area that is 1,000 ft^2 or less;

(ii) at least five bulk samples must be collected from each surfacing material area that is greater than 1,000 ft^2, but less than or equal to 5,000 ft^2; and

(iii) at least seven bulk samples must be collected from each surfacing material area that is greater than 5,000 ft^2;

(d) collect samples from thermal system insulation as follows:

(i) at least one bulk sample from each area of patched thermal system insulation that is not assumed to be ACM;

(ii) at least three random bulk samples from each type of thermal system insulation that is not assumed to be ACM;

(iii) no bulk samples where the accredited inspector has determined that the thermal system insulation is fiberglass, foam, glass, rubber, or other non-ACM;

(e) randomly collect at least three bulk samples from all mechanical system insulation and fittings, such as tees, elbows, and valves, that are not assumed to be ACM;

(f) randomly collect at least three bulk samples from each type of miscellaneous material that is not assumed to be ACM; and

(g) collect at least three bulk samples from any type of non-friable suspected ACM that is not assumed to be ACM.

(4) For inspections conducted under (3), the inspector shall ensure that:

(a) bulk samples are analyzed by persons or laboratories with proficiency demonstrated by current successful participation in a nationally recognized testing program such as the National Institute of Standards and Technology (NIST), National Voluntary Laboratory Accreditation Program (NVLAP), the round robin for bulk samples administered by the American Industrial Hygiene Association (AIHA), or an equivalent testing program accepted in writing by the department prior to analysis;

(b) except for wallboard system samples, bulk samples are not composited for analysis,

but are analyzed for asbestos content by polarized light microscopy (PLM) using the "Method for the Determination of Asbestos in Bulk Building Materials" (EPA/600/R-93/116) or another method acceptable to the department; and

(c) the sample analytical report includes:

(i) results of the analysis;

(ii) method of analysis;

(iii) name and address of each laboratory performing an analysis;

(iv) the laboratory's accreditation number;

(v) the date of analysis; and

(vi) the name and signature of the person performing the analysis.

(5) For the purposes of an inspection conducted under (3):

(a) a material is considered to be ACM if the analytical results of at least one sample collected from that material show that asbestos is present in an amount greater than one percent; and

(b) a material is considered not to be ACM only if the analytical results for all samples collected from the material show that asbestos is not present in an amount greater than one percent.

(6) For inspections conducted under (3), the asbestos inspector shall report the findings in a written inspection report to the owner of the building or the operator conducting the planned demolition or renovation activity. The asbestos inspection report must include:

(a) the site of the asbestos inspection;

(b) the scope and purpose of the inspection and how it corresponds to the extent of the planned renovation or demolition activity;

(c) the date of the asbestos inspection;

(d) the signature of the accredited inspector conducting the asbestos inspection;

(e) the inspector's accreditation number and expiration date;

(f) an inventory of all assumed asbestos-containing and sampled materials;

(g) all sample locations;

(h) where ACM is located by type;

(i) the areas where friable material is assumed to be ACM, and areas where non-friable material is assumed to be ACM;

(j) a copy of the sample analytical report, specified in (4)(c), with the name and address of each laboratory performing an analysis, the date of analysis, and the name and signature of the person performing the analysis; and

(k) information on whether it will be necessary to remove any ACM before any activity begins that would break up, dislodge, or similarly disturb the material.

(7) If the inspection required in (1) was not conducted or was improperly conducted prior to commencement of renovation or demolition activities, an inspection must be conducted in accordance with (3) as soon as possible upon discovery of the missing or improper inspection, and before any additional renovation or demolition activities occur, with the addition of the following:

(a) industry-recognized procedures must be employed for sampling and analyzing settled dust to determine the extent of any asbestos contamination. The department will provide a list of acceptable procedures upon request;

(b) air sampling may not be used by the department-accredited asbestos inspector as the sole means of evaluating whether asbestos is present; and

(c) the department-accredited asbestos inspector shall summarize sampling and analytical procedures and evaluation findings in a written report. A recommendation on whether a new or continued asbestos project is necessary based on the evaluation must be included in the written report. The report must be submitted to the department before any further renovation or demolition work occurs.

(8) The department may conduct its own asbestos inspection if it deems an inspection conducted under (7) deficient.

(9) An inspection conducted under (7) does not excuse any failure to complete the inspection required in (1).

History: 75-2-503, MCA; IMP, 75-2-503, MCA; NEW, 2006 MAR p. 1574, Eff. 6/23/06; AMD, 2011 MAR p. 2264, Eff. 10/28/11.

MAR Notices	Effective From	Effective To	History Notes
17-317	10/28/2011	Current	History: 75-2-503, MCA; IMP, 75-2-503, MCA; NEW, 2006 MAR p. 1574, Eff. 6/23/06; AMD, 2011 MAR p. 2264, Eff. 10/28/11.
	6/23/2006	10/28/2011	History: 75-2-503, MCA; IMP, 75-2-503, MCA; NEW, 2006 MAR p. 1574, Eff. 6/23/06.

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For questions regarding the content, interpretation, or application of a specific rule, please contact the agency that issued the rule.
A directory of state agencies is available online at http://www.mt.gov/govt/agencylisting.asp.

For questions about the organization of the ARM or this web site, contact sosarm@mt.gov.

DECISION FLOWCHARTS FOR BUILDING MATERIALS INSPECTION

1019 1st Avenue North

Billings, Montana

APPENDIX H

Decision Flowchart for Building Materials Inspection

APPENDIX I-1 • ASBESTOS

NewFields

SAMPLE

EVALUATE RESULTS

REQUIRED ACTION

DEMOLITION

A. Perform visual survey to identify suspect materials
B. Group materials into Homogeneous Areas (HAs)
C. Collect samples for asbestos analysis in accordance with the National Emissions Standards for Hazardous Air Pollutants (NESHAP) as specified in Montana Rule (ARM 17.74.354)

Non-Detect → No Action Required

Less Than 1% (Confirm via Point Count) → OSHA Regulations Apply. Workers Disturbing Material Should Use Respitory Protection in Accordance with 29 CFR Section 1926.1101

Greater Than 1% →
- Remove Under DEQ Permit Using a Montana-Accredited Abatement Contractor and Supervisor.
- Dispose of at a Specialized Landfill Licensed to Accept Asbestos.
- Renovation Only: If Desired, Manage In-Place by Encapsulating, Enclosing, or Repair. Label All Asbestos Containing Materials.

RENOVATION

Is there a renovation plan indicating the building materials that will be disturbed?

YES → MATERIALS TO BE DISTURBED SAMPLE, EVALUATE, & MANAGE as described under Demolition

NO → ALL MATERIALS: SAMPLE, EVALUATE, & MANAGE as described under Demolition

FIRE

Sample ash and recognizable building components. EVALUATE AND MANAGE as described under Demolition

Note for Air Testing During Asbestos Abatement: Multiple threshold levels for concentrations of asbestos fibers in the air must be met during abatement, and at final clearance prior to reoccupation of the former abatement work zone. These thresholds are listed in **Appendix F**

Decision Flowchart for Building Materials Inspection

APPENDIX I-2 • LEAD - BASED PAINT

(Only necessary for buildings constructed prior to 1978)

NewFields

SAMPLE

EVALUATE RESULTS

REQUIRED ACTION

DEMOLITION

Collect one composite bulk material sample representative of entire waste stream and perform leachability testing for lead via the Toxicity Characteristic Leaching Procedure (TCLP)

- TCLP Less Than 5.0 mg/L → **Not Hazardous:** Disposal at Class II Landfill
- TCLP Greater Than 5.0 mg/L → **Potentially Hazardous:** Sample Individual Painted Surface To Identify Location of Lead Concern, or Perform Disposal of Entire Waste Stream

RENOVATION

Is renovation area small (i.e., less than 3,000 square feet)?

SMALL

Use Paint Chip Testing to Evaluate Individual Painted Surfaces for Lead Concentration

- Less Than 5,000 mg/kg → **LBP Not Present:** No Special Protection Necessary for Removal
- Greater Than 5,000 mg/kg → **LBP Present:**

LARGE

Use X-Ray Fluorescence (XRF) Field Meter for Lead Concentration

- Less Than 1.0 mg/cm² → **LBP Not Present:** No Special Protection Necessary for Removal
- Greater Than 1.0 mg/cm² → **LBP Present:**

LBP Present:

- Use OSHA Regulation 1926.62 for Safe Worker Exposure Practices During Renovation
- Perform TCLP Testing of the Entire Waste Stream, as Described Under Demolition
- Sample Surface Soil Near the Building Exterior for Total Lead Content; Will be Considered Contaminated if Greater Than 400 mg/kg Total Lead

FIRE

Perform leachability testing as with Demolition

INSPECTOR CERTIFICATES

1019 1st Avenue North

Billings, Montana

APPENDIX I

CERTIFICATE OF TRAINING

Northern Industrial Hygiene, Inc.
certifies that

Heather Grotbo

1120 Cedar Street
Missoula, MT 59801

has received

Inspector Refresher Training

For the purpose of accreditation as required under Section 17.74.315 of the Administrative Rules of Montana and Section 206 of Title II of the Toxic Substance Control Act (TSCA)

Date: September 17, 2015 Expiration Date: September 18, 2016
Location: Missoula, Montana

Certification #IR15I17-07

Douglas G. Tisdell — *September 17, 2015*
Douglas G. Tisdell — *Date*

Northern Industrial Hygiene, Inc. 1325 Euclid Avenue, Suite #1 Helena, Montana 59601 (406) 443-3369

HEATHER C GROTBO

has met the requirements of Montana Administrative Rule 17.74.362 and/or 17.74.363 for accreditation in the following asbestos occupation(s) through the specified expiration date(s).

MTA-4080

Asbestos Inspector 09/17/2016

Kevin Blanton

MT DEQ Asbestos Control Program

Certificate of Achievement

This certificate is presented to

JOSEPH SCHMECHEL

515 HILLSDALE STREET, HELENA MT 59601

who has attended and successfully completed the E.P.A. approved and accredited Asbestos Hazard Emergency Response Act [AHERA] mandatory

24-Hour Initial Asbestos Inspector Course.

Training was conducted in accordance with 40 CFR Part 763 (AHERA), Title II of the Toxic Substance Control Act (TSCA).

Douglas O. Ingraham, Training Instructor	APRIL 11-13, 2016 Course Date(s)	APRIL 13, 2017 Expiration Date

Ingraham Environmental Inc.
Abatement, Training & Consulting
PO Box 545, 606 Utah, Butte MT 59703-0545 (406) 723-7885

Training Provided By:
Ingraham Environmental Inc.
PO Box 545, Butte, MT 59703
877-723-7885 or 406-723-7885
Fax 406-723-7885 or email class@ieimt.com

INI-1033
Certificate Number

Certificate of Satisfactory Completion

Ryan McGee

Address: PO Box 7886, Helena, MT 59604
has successfully completed course training and accreditation requirements for
the **Montana 4-Hour Asbestos Inspector Refresher Course**
in accordance with Administrative Rules of Montana Title 17, Chapter 74, Subchapter 3.
Certificate Number: **ACM 040716-001**

Training Provider: Abatement Contractors of Montana, LLC
208 Commerce St
Missoula, MT 59808
(406) 549-8489

Approving Agency: Asbestos Control Program
Department of Environmental Quality
P.O. Box 200901
Helena, MT 59620-0901
and U.S. EPA

Course Date: **4/07/2016**

Expiration Date: **4/07/2017**

RYAN D MCGEE
has met the requirements of Montana Administrative Rule 17.74.362 and/or 17.74.363 for accreditation in the following asbestos occupation(s) through the specified expiration date(s).

MTA-1705

Asbestos Inspector	04/07/2017
Project Contractor/Supervisor	10/23/2016
Project Designer	03/09/2017

Shawna Page

Instructor

MT DEQ Asbestos Control Program

CERTIFICATE OF TRAINING

Northern Industrial Hygiene, Inc.
certifies that

Ryan McGee
P.O. Box 7886
Helena, MT 59604

has received

RYAN D MCGEE
has met the requirements of Montana Administrative Rule 17.74.362 and/or 17.74.363 for accreditation in the following asbestos occupation(s) through the specified expiration date(s).

MTA-1705

Asbestos Inspector	04/07/2017
Project Contractor/Supervisor	10/23/2016
Project Designer	03/09/2017

MT DEQ Asbestos Control Program

Project Designer Refresher Training

For the purpose of accreditation as required under Section 17.74.315 of the Administrative Rules of Montana and Section 206 of Title II of the Toxic Substance Control Act (TSCA)

Date: March 9, 2016 Expiration Date: March 10, 2017
Location: Helena, Montana
Certification #PDR16C09-04

Douglas G. Tisdell — *March 9, 2016*
Douglas G. Tisdell — *Date*

Northern Industrial Hygiene, Inc. 1325 Euclid Avenue, Suite #1 Helena, Montana 59601 (406) 443-3369

Certificate of Satisfactory Completion

Ryan McGee

Address: P.O. Box 7886, Helena, MT 59604

has successfully completed course training and accreditation requirements for the **Montana 8-Hour Asbestos Contractor Supervisor Refresher Course** in accordance with Administrative Rules of Montana 17.74.368

Certificate Number: **ACM 10232015-005**

Training Provider: Abatement Contractors of Montana, LLC
208 Commerce St
Missoula, MT 59807-8747
(406) 549-8489

Approving Agency: Asbestos Control Program
Department of Environmental Quality
P.O. Box 200901
Helena, MT 59620-0901
and U.S. EPA

Course Dates: **10/23/2015**

Expiration Date: **10/23/2016**

Shawna Page

Instructor