New York State Department of Environmental Conservation
625 Broadway • Albany, New York 12233-7011

275 Franklin Street Site Immediate Investigation Work Assignment

Buffalo, Erie County, New York

Work Assignment Number D004439 - 3

Field Activities Plan

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Prepared By:

Malcolm Pirnie, Inc.

50 Fountain Plaza, Suite 600
Buffalo, NY 14202
716-667-0900

0266-377

MALCOLM PIRNIE

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1. Project Background

The New York State Department of Environmental Conservation (NYSDEC) issued a Work Assignment (# D004439-3) to Malcolm Pirnie, Inc. (Malcolm Pirnie) for the preparation of a Work Plan to implement a soil vapor intrusion (SVI) and subsurface drilling investigation. The Work Assignment will require implementation of investigations designed to collect air, soil and groundwater samples from properties located adjacent to 275 Franklin Street in Buffalo, New York (Figure 1). Previous investigations at the Franklin Street address identified elevated levels of chlorinated solvents in sampled media. The investigations were completed under the auspices of the NYSDEC Brownfield Cleanup Program (BCP) (Site # C915208). The BCP site is comprised of the properties at 275-279 Franklin Street.

Under the NYSDEC Brownfield Cleanup Program, the Buffalo Development Corporation (BDC) completed investigation activities at the 275 Franklin Street site located in the City of Buffalo, Erie County, New York. The BCP site was historically used as a dry cleaning establishment. The investigation activities identified soil and groundwater contaminated with tetrachloroethene (PCE). The presence of PCE, a compound commonly associated with dry cleaning operations, corroborated the results of the earlier records search. Due to the offsite migration of PCE, and the presence of a residential apartment structure on the adjoining downgradient property, further investigation of the adjacent property is warranted.

The BCP site was used for various purposes since the late 1800s. 275-277 Franklin St. previously contained a structure that was used by a dry cleaning business from approximately 1951 through the early 2000s. This parcel became delinquent in property taxes and the City of Buffalo foreclosed on the site for back taxes in 2004. The site was sold by the City in 2005 and was acquired by the volunteer. The building on the parcel at 275 Franklin was subsequently demolished in 2005. The parcel was graded and paved over and is currently being used as a surface parking lot. 279 Franklin St. parcel was used for residential purposes from the late 1800s through the 1950s, and as a parking lot from the early 1980s to present.

The limited investigations performed on each of the respective parcels constituting the BCP site identified tetrachloroethene (PCE), a chlorinated solvent commonly used by dry cleaners, in soils and groundwater at the 275-277 Franklin St. parcel with groundwater levels up to 137 mg/l. A subsequent BCP remedial investigation (RI) was conducted at the site in late 2006. Preliminary results from the RI confirm onsite groundwater contamination at levels up to 9.7 mg/l. Based on the elevated concentrations of PCE

located on the site, the disposal of hazardous waste (chlorinated solvents) at the site may represent a significant threat to the public health and environment. Preliminary results from the RI also confirmed offsite groundwater contamination and offsite migration of PCE in groundwater at levels up to 18 mg/l as analyzed from groundwater collected from an offsite piezometer (PZ-11). A potential down gradient receptor includes an adjoining apartment building. Chlorinated solvent vapors were detected during soil vapor evaluations at the 279 Franklin St. parcel and the 432 Pearl St. parcel. Vapor intrusion of chlorinated solvents will be investigated within the apartment building located at 267 Franklin St.

The proposed SVI and subsurface investigations will be conducted under the NYSDEC State Superfund Standby Contract No. D004439-3. An initial step in the Work Assignment is preparation of this Field Activities Plan, which describes the anticipated field activities. The elements of this Field Activities Plan were prepared in accordance with the most recent and applicable guidelines and requirements of NYSDEC and the New York State Department of Health (NYSDOH).

2. Field Investigation

This Field Activities Plan (FAP) is designed to provide detailed, step-by-step procedures for the SVI indoor air sampling activities and the subsurface drilling activities at the site. The Plan will serve as the field procedures manual to be followed by all personnel. Adherence to these procedures will ensure the quality and defensibility of the data collected in the field. In addition to the field procedures outlined in this document, all personnel performing field activities must do so in compliance with: (1) the Generic Quality Assurance/Quality Control Plan for Work Assignments; and (2) appropriate Health and Safety guidelines found in the site-specific Health and Safety Plan.

The purpose of both SVI and subsurface investigations is to assess the concentration and extent of the potential presence of Chlorinated Volatile Organic Compounds (CVOCs) in the vicinity of the site. The overall goal of the indoor air sampling program is to evaluate the potential for vapor intrusion into two building structures and potential human exposures to VOCs. The air sampling program will be conducted in accordance with the October 2006 Final NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York. With similar focus, the drilling program will facilitate a supplemental characterization of subsurface soil and groundwater to assess the potential presence of CVOCs/DNAPL impacts to soil and groundwater.

The phased work described herein will require indoor air sampling and sub-slab soil vapor sampling in structures within the study area. The drilling program will then be performed to collect subsurface soil and groundwater samples. It is anticipated that the sampling activities will be conducted over a three week period; however this schedule is largely dependent on access issues and availability.

Indoor air and sub-slab vapor sampling will be performed at the building structures located at 265 and 267 Franklin Street. The NYSDEC will provide assistance with respect to sample location access given that sampling at these structures is contingent on approval by property owners.

2.1. SVI Sampling Program

For purposes of this FAP, two commercial structures are included in the SVI sampling program shown on the Site Plan (Figure 2). The SVI study will generally include the following:

- Conducting interviews with building/property owners and/or tenants using air quality questionnaires available from the New York State Department of Health (NYSDOH);
- Conducting a survey of household chemicals present;
- Collecting sub-slab vapor, first floor air, ambient air, and crawlspace air.

The building inspection procedures are described in Section 2.1.1 The following samples will be collected from locations approved by the NYSDEC :

- One indoor air sample from the breathing zone in subgrade living spaces or basement area per structure (if applicable); sample will be collected from a central location
- One indoor air sample from the first floor breathing zone per structure (if applicable) ;
- Up to three (3) sub-slab vapor samples centrally located beneath the basement concrete slab; and
- A minimum of one outdoor (ambient) air sample per day of sampling.

An active approach utilizing laboratory batch-certified Summa canisters and flow controllers will be used to evaluate the indoor air and sub-slab vapor quality. Individual Summa canisters and individual flow controllers will have low-level certifications performed by the laboratory supplying the canisters and flow controllers. Samples will be collected over an approximate 2-hour period. One indoor air sample will be collected from the living/working space in each building structure, one from the basement and a second from the first floor unless the basement also represents the lowest level living/working space. Up to three sub-slab vapor samples will be collected in structures with competent floors or slabs. Additional indoor air samples may be collected at the direction of NYSDEC.

Helium tracer gas testing will be performed prior to collection of each sub-slab soil vapor sample within each structure. The sampling program will be conducted in accordance with the October 2006 Final NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York. Procedures for tracer gas testing are summarized in Section 2.1.3, below.

A minimum of one outdoor ambient air sample will be collected concurrently with the indoor air samples in the immediate vicinity upwind of the structures where indoor air samples are being collected. Field notes describing each day's activities will be recorded on a Daily Observation Log, which is provided in Attachment A.

The samples will be labeled and shipped following procedures outlined in Sections 2.4.1, 2.4.2 and 2.4.4. Air and sub-slab soil vapor samples will be analyzed by a NYSDOH Environmental Laboratory Approval Program (ELAP) certified laboratory for VOCs utilizing the United States Environmental Protection Agency (USEPA) Method TO-15 for the following CVOC and BTEX analytes:

- Tetrachloroethene
- Trichloroethene
- cis-1,2-Dichloroethene
- trans-1,2-Dichloroethene
- Vinyl chloride
- 1,1,1-Trichloroethane
- Methylene chloride
- 1,1-Dichloroethene
- Benzene
- Ethylbenzene
- Toluene
- Xylenes

Table 1 summarizes the number of samples anticipated to be collected during the site investigation effort:

Table 1.
Air Sampling by USEPA Method TO-15[(a)]

	Sub-Slab	Indoor Air	Ambient Air
Approximate Number of Samples	5	4	1
Duplicates	1	0	0
Total Number of Analyses	6	4	1

(a) The minimum reporting limits for analyzing all samples with EPA Method TO-15 are 0.25 µg/m^3 for trichloroethene, and 1.0 µg/m^3 for all other compounds.

Duplicate samples will be collected at the rate of 1 duplicate sample per 20 original samples. Field duplicates for sub-slab samples will be collected by attaching a stainless steel T-fitting supplied by the laboratory to two Summa canisters with attached regulators. The T-fitting will split the flow coming from the sample into two canisters set

up adjacent to each other and each collecting air or sub-slab vapor at identical flow rates. For collection of sub-slab vapor samples, the T-fitting inlet will be attached to the sub-slab sample tubing. For sampling, both Summa canister valves are opened and closed simultaneously.

The NYSDEC Project Manager will contact the property owners and discuss the sampling program. Malcolm Pirnie will be responsible for scheduling the sampling.

2.2. Building Inspection

Once the building owners have been contacted by the New York State Department of Environmental Conservation (NYSDEC), appointments will be made to conduct owner/occupant interviews and building inventory of chemicals on the same day as initiating air and sub-slab vapor sampling. Malcolm Pirnie will coordinate the scheduling of the owner appointment interviews with the DEC representative(s). Prior to sampling at each of the selected buildings, an inspection will be conducted to identify and inventory products that could interfere with interpretation of the sampling results. During this inventory, a questionnaire will be completed to provide details of the construction and history of the structure. A sketch of the building layout will be completed and will include locations of structural deficiencies such as cracks and gaps in floor slabs and foundation walls. The sketch will also document heating, ventilation, and air conditioning (HVAC) systems. During the inventory, sampling locations will be selected in consultation with the building owner and plotted on the sketch. Locations of sampling points will be defined by approximate distance and bearing (relative to true north) from perimeter walls of the structure.

An inspection of general site conditions will be performed at each property prior to the air sampling. The inspection will include the following activities:

- Completion of the NYSDOH Indoor Air Quality Questionnaire and Building Inventory included in the October 2006 Final NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York. The questionnaire is provided in Attachment B. NYSDEC or Malcolm Pirnie personnel will complete the questionnaire with the building owners. As part of the questionnaire, a basement household chemical product inventory will be prepared and a first floor product inventory will be prepared, as permitted by the building owner.
- Documentation of weather conditions outside and temperature inside.
- Ambient air (indoor and outdoor) screening using field equipment capable of measuring in parts per million (i.e., ppm using a mini-RAE photo-ionization detector).
- Evaluation of HVAC systems and other ventilation (windows, etc.).
- Selection of air sampling locations.

The product inventory will consist of a general description of areas where chemicals are stored and the types and approximate numbers of chemicals present. The general procedures to be followed during the surveys are summarized below:

- Identify all areas on the building level that may be used for storage of chemical containers;
- Record the general types and approximate quantities of chemicals stored and VOCs present in the atmosphere in the areas of chemical storage;
- Use a photo ionization detector (PID) capable of measuring in parts per million to measure the presence of total organic vapors in those areas where chemicals are found; and
- Note other potential sources that may influence air quality testing including new construction/remodeling/painting, new carpeting, and freshly dry-cleaned clothing.

2.1.2 Indoor Air Sampling Procedures

Indoor air samples will be collected in accordance with the October 2006 Final NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York and the following procedures:

Place canister in desired sampling location. Canister will be a 6-Liter (L) canister with a vacuum gauge and flow controller. The canister must be certified clean (in accordance with EPA Method TO-15) and under a vacuum pressure of no more than -25 inches of mercury (in Hg). Flow controllers will be set for a 2-hour collection period.

Make sure all valves, gauges, and filters are properly attached.

Open valve ½ turn or as indicated in the laboratory specifications. Manufacturer or laboratory protocols will be followed when operating the valve on the sample containers.

Record initial vacuum pressure, time, and date on field data form.

2.1.3 Sub-Slab Sampling Procedures

The collection of sub-slab samples will be in accordance with the October 2006 Final NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York and the following procedures:

1. Visually assess the condition of the floor. Select an area for sampling that is out of the line of traffic and away from major cracks and other floor penetrations (sumps, pipes, etc.). The location will ideally be central to the building, and away from the foundation walls, cracks in the slab, apparent penetrations and buried pipes. Take a digital photograph of the area before drilling or sampling for use as a reference when the area is being restored to pre-sampling conditions. Photographs will not be taken if the building owner objects.
2. Review all locations with the building owner prior to drilling any hole.

3. In locations where only linoleum tile is available, AND THE BUILDING OWNER AGREES, drill a small (¼-inch or 3/8-inch diameter) hole through the tile and slab. Place the sample tubing into the hole and seal to the floor with clay. In locations where bare concrete is available, drill a 1-inch diameter hole 1-inch into the concrete floor slab using an electric hammer drill.
4. Drill a ¼-inch diameter hole through the 1-inch hole completely through the concrete floor slab, but no more than 2-inches below the bottom of the slab.
5. Remove the concrete dust within the 1-inch drilled hole using a wire brush. Gently sweep concrete dust away from the drill hole and wipe the floor with a dampened towel. Concrete dust can be cleaned up with a brush and pan or vacuum equipped with a HEPA filter only after sample collection has been completed entirely.
6. Insert inert Teflon tubing (¼-inch outside diameter [OD]) approximately 3 feet long into the hole drilled in the floor, extending no further than the bottom of the floor slab.
7. Place modeling clay around the tubing at the floor penetration.
8. Helium tracer-gas testing will be conducted at all of the structures tested to ensure that an effective seal has been established. To conduct a helium tracer gas test:
   8.1. Place a small plastic container over the sampling point, with three holes drilled in it, for helium introduction, ambient air release, and sub-slab probe tubing.
   8.2. Fill the container with laboratory grade helium and measure using a helium detector to ensure a greater than 90% concentration of helium in the enclosure.
   8.3. Attach a disposable syringe and the sampling tube to a 3-way valve and purge approximately 1 liter of air/vapor at a consistent flow rate that is less than or equal to 0.2 liters per minute. The purged sub-slab vapor will be released into a Tedlar® bag as to not influence the indoor air quality.
   8.4. The Tedlar® bag will be tested outdoors using the helium detector capable of reading to PPM levels and percent levels (if the tracer gas test was conducted) and a PID capable of reading PPB levels of VOCs, with all readings being recorded.
   8.5. If concentrations (> 10%) of tracer gas are observed in the Tedlar® bag, the probe seal will be enhanced to reduce the infiltration of air and retested.
9. Place canister on a stable surface (floor) adjacent to the sample tube, remove the brass cap, and attached sample tube to the canister flow controller. Canister will be a 6-Liter (L) canister with a vacuum gauge and flow controller. The canister must be under a vacuum pressure of no more than -25 inches of mercury (in Hg). Flow controllers will be set for a 2-hour collection period. Samples will be collected at a consistent flow rate that is less than 0.2 liters per minute.
10. Record the canister's serial number on the chain of custody (COC) and field notebook/sample form. Assign sample identification on canister ID tag and record on

COC and field notebook/sample form. For property owner privacy, do not use a sample identifier containing the name or address of the property or property owner.

11. Record gauge pressure; vacuum gauge pressure must read -25 in. Hg or less or the canister cannot be used. Connect the sample tubing to the canister inlet fitting. Open canister valve in accordance with manufacturer and laboratory protocols to initiate sample collection at the laboratory's preset flow rate.
12. Record the start time on the COC in the field notebook/sample form and take a digital photograph of canister setup and surrounding area. Photographs will not be taken if the building owner objects.

2.1.4 Termination of Sample Collection

1. Within 2 hours, ensure that the sample canister has a negative pressure of at least -1 in. Hg.
2. Record the final gauge pressure, close the canister valve, and record the stop time on the COC and in the field notebook/sample form.
3. Disconnect the sample tubing and pressure gauge/flow controller from canister, if applicable.
4. Install plug on canister inlet fitting and place the sample container in the original box.
5. Complete the sample collection log with the appropriate information and log each sample on the COC form.
6. Remove temporary subsurface probe and properly seal hole in the slab with cement. Restore the surrounding areas to pre-existing conditions.
7. All canisters will be returned at the completion of the field sampling to the laboratory by overnight shipment or courier and in accordance with any laboratory specifications (i.e. holding time requirements). Some sampling may be conducted during evenings and weekends depending on building owner and resident availability.

2.2 Subsurface Drilling Program

For purposes of this FAP, a drilling program will be implemented to facilitate soil and groundwater sampling activities. The drilling program will generally include the following:

- Site visit(s) to identify drilling locations that may be impacted by the proximity of overhead/underground utilities, right-of - way or access issues;
- Advancement of up to 10 boreholes to facilitate the installation of 10 groundwater monitoring wells
- Collection of sub-surface soil and groundwater samples;

The drilling and sampling procedures are described below in Sections 2.11 through 2.16

The following samples will be collected:

- Twelve (12) subsurface soil samples will be collected during the advancement of six (6) deep groundwater monitoring wells.
- Contingent upon soil screening results, up to 2 soil samples will be collected from each of the 6 deep borehole locations;
- Twelve groundwater samples will be collected from the 10 newly installed monitoring wells and two existing piezometers.

Field notes describing each day's activities will be recorded on a Daily Observation Log, which is provided in Attachment A.

The subsurface drilling investigation will be limited to the offsite areas shown on Figure 3. This investigation is intended to characterize the extent of CVOC impacts in soil and groundwater in offsite areas.

2.2.1 Number and Location of Soil Borings

Up to 10 soil borings will be advanced to characterize the overburden stratigraphy and facilitate the installation of groundwater monitoring wells. The proposed soil borings and investigation well locations are shown on Figure 3. The proposed borings will be advanced as:

- Four well couplets consisting of a shallow and deep (S/D) well boring.
- Two deep well borings advanced adjacent to an existing shallow piezometer.

The purpose and number of test borings for the area of investigation are summarized below:

Investigation Borings	No. of Soil Borings	Targeted Depth	Purpose
Deep	6	Top of bedrock	1. Installation of overburden/bedrock interface wells 2. Characterization of overburden soils and DNAPL at bedrock interface
Shallow	4	Water table	1. Installation of shallow groundwater wells 2. Shallow groundwater characterization

Dependant on the borehole location, the overburden thickness is expected to be 50 to 55 feet. All test borings will be converted into monitoring wells.

2.2.2 Drilling Methodology

A truck-mounted drilling rig provided and operated by a licensed drilling subcontractor will be used to advance the investigation well borings. Dependant on the type of well to be installed, each boring will be advanced through overburden materials to a proposed depth anticipated to be 8' below saturated conditions (~25'bgs) for shallow wells or to auger refusal on the top of bedrock (~50' bgs) at the proposed deep well locations.

All borings will be advanced using 4-¼ inch I.D. hollow-stem augers capable of producing a borehole with a nominal outside diameter of approximately 8 inches. At the well couplet locations, the deep borehole will be drilled first and incrementally advanced to characterize borehole stratigraphy and identify the approximate depth of the saturated water table conditions. Two-inch O.D. split-spoon samples will be continuously collected to recover soil materials, visually characterize the soil, assess the depth to the shallow overburden water table and confirm the depth of competent bedrock. The soil samples will be screened with a PID to obtain a qualitative estimate of total volatile organic vapor concentrations. The on-site Malcolm Pirnie representative will record the PID measurements, physical characteristics of the soil using a modified Burmiester/ Unified Soil Classification System (USCS), depth to water, and other pertinent observations on stratigraphic Overburden Borehole Logs.

Malcolm Pirnie anticipates that borehole and monitoring well installation activities will be conducted in Level D Personal Protective Equipment (PPE). Proper safety precautions will be taking during the drilling and sampling tasks as provided in the Site Specific Health and Safety Plan (Appendix C). All non-dedicated, down-hole drilling equipment will be decontaminated on a temporary decontamination pad using potable water and hot water provided by a portable steam cleaner between soil boring locations. Water generated during decontamination and development activities will be purged to the ground surface or to the nearest stormwater drain.

The drilling subcontractor will install the wells using standard hollow-stem auger drilling and well installation techniques.

2.2.3 Sample Collection/Classification

Continuous split-spoon sampling will be conducted using a 2-inch outer diameter, 27-inch long split-spoon sampler as per American Standard Testing Method (ASTM) D-1586, "Penetration Test and Split-Barrel Sampling of Soils" to facilitate the characterization of overburden stratigraphy at each deep borehole location. Split-spoon overburden soil samples will continuously be collected from the ground surface to the top of bedrock. A maximum of two (2) soil samples will be collected at each of the deep borehole locations based on visual or olfactory observations and PID screening results.

The samples will be labeled and shipped in accordance with procedures outlined in Sections 2.4.2 and 2.4.4. Soil and groundwater samples will be analyzed by a NYSDOH Environmental Laboratory Approval Program (ELAP) certified laboratory for VOCs utilizing the United States Environmental Protection Agency (USEPA) Method 8260.

Table 2 summarizes the number of samples anticipated to be collected during the drilling investigation component:

Table 2.

Soil and Groundwater Sampling by USEPA Method 8260

	Subsurface Soil	Groundwater
Approximate Number of Samples	12	12
Duplicates and QA/QC	3	3
Total Number of Analyses	15	15

Duplicate samples of selected media will be collected at the rate of 1 duplicate sample per 20 original samples. Additional QA/QC samples that include MS/MSD aliquots will be analyzed in accordance with approved Quality assurance Project Plan (QAPP) protocols. The NYSDEC Project Manager will contact property owners that may be impacted by field activities to discuss the sampling program.

2.2.4 Characterization and Disposal of Investigation-Derived Waste

Malcolm Pirnie will subcontract with a disposal subcontractor to characterize and dispose of the soil material generated during site activities. Malcolm Pirnie will provide oversight of the characterization and removal of the investigation-derived soil, and a NYSDEC representative will authorize all appropriate waste documents. Subsequent to the disposal of this material, Malcolm Pirnie will provide NYSDEC with a bill of lading, waste manifest or similar certification attesting to the proper disposal of this material.

2.3. Monitoring Well Installation and Development Methodology

Subsequent to the advancement of borings to total depth, a total of four shallow and six deep groundwater monitoring wells will be installed during this investigation. The deep wells will be installed such that the bottom of the screened interval will be placed on the competent bedrock surface. The shallow wells will be constructed such that the screened interval will straddle the shallow groundwater table. The drilling subcontractor will install the wells using the standard well installation techniques described in section 4.7 of the "New York State Department of Environmental Conservation, Superfund Standby Contract, Program Quality Assurance Project Plan, Contract no. D002472, April 1994,

ABB Environmental Services" shown in Appendix D. The wells will be constructed using 2-inch diameter, flush joint Schedule 40 PVC well materials. Well screens will be 10 feet in length with a machine slotted 0.010-inch slot size. The investigation wells will be completed with locking (keyed alike) steel protective flush mount casings, set into the grout seal drainage pad. The on-site geologist will complete the appropriate well construction diagram included in Appendix D for reporting purposes.

After allowing the newly installed monitoring wells to set for at least 48 hours, each of the wells will be developed by Malcolm Pirnie and/or the drilling subcontractor. The development procedure will require the removal of groundwater and periodically surging the water in the well to loosen and remove fines from the well screen and sandpack. Development methodology will follow the Generally Acceptable Procedure for Monitoring Well Development attached in Appendix E wherein measurements of purged water volumes as well as water quality including temperature, pH, conductivity, and turbidity will be recorded during the development process.

Subsequent to completion of the drilling program a licensed surveyor will survey all air sampling and soil boring/monitoring well locations.

2.3.1. Groundwater Sampling Program

A groundwater sampling program will be performed to determine the nature and extent of groundwater contamination and to aid in the assessment of fate and transport of contaminants in the groundwater at the Site. Groundwater samples will be collected to provide characterization of volatile organic contaminants in groundwater. Samples will be collected from all of the newly installed monitoring wells as well two existing piezometers identified as PZ-11 and PZ-14 located in the parking lot north of the apartment building at 267 Franklin Street. The groundwater sampling program will consist of one event that will occur upon completion of the well installation and development tasks.

After water level measurements are taken in each monitoring well, Malcolm Pirnie will purge and sample the monitoring wells. Disposable or dedicated groundwater sampling equipment will be used to avoid cross-contamination between monitoring wells. A minimum of three well volumes will be removed from each monitoring well prior to sampling. Periodically, Malcolm Pirnie will collect purged water for measurement of the parameters pH, temperature, turbidity, and specific conductance. Groundwater samples will be collected after the stabilization of the field parameter values to within 10% of the previous readings. Groundwater samples will then be collected using a dedicated bailer from each of the wells and submitted for analysis of volatile organic compounds The proposed number of samples and analysis is shown above in Table 2 of Section 2.2.3.

The groundwater purged from the monitoring wells will be purged to the ground surface or to a storm sewer.

2.3.2. Groundwater Measurement and Mapping

After completion of the Site survey, water levels in the monitoring wells will be measured to evaluate the groundwater flow direction(s) in both shallow and deep flow regimes. The water level data will be referenced to a benchmark to be established during this investigation. The measurements will be plotted and contoured to create groundwater potentiometric surface maps. This information will be used to map the water table surface and determine groundwater flow directions. The maps will support the definition of local variations in groundwater gradients and help define seasonal effects that may impact groundwater flow direction(s) in the Site area.

The measurement and mapping of the groundwater elevations will occur immediately prior to the groundwater sampling event. An electronic water level indicator with an interface capability will be used to measure the depth to water and check for the presence of DNAPL in each monitoring well to the nearest one-hundredth of a foot. The water level indicator will be decontaminated between wells to prevent cross-contamination. The depth from the top of each well casing to the top of water will be recorded in a field logbook.

2.4. Ancillary Field Procedures

2.4.1. Sample Labeling (Air Samples)

The procedures described in this section will be conducted to prevent misidentification and to aid in the handling of environmental samples collected during the SVI study. The following information will be placed on the laboratory supplied sample label for each sample:

- Site name – 275 Franklin
- Sample identification – see below
- Date/time
- Sampler's initials
- Analysis required (SVI) – TO-15
- Analysis required (Subsurface)

The serial number of the canister and regulator used during sampling will also be noted on the Summa canister identification tag and on the COC.

The following terminology shall be used for the SVI structure sample identification:

C915208-offsite-SS-xx- *sample date* (for sub-slab locations)

C915208-offsite -BA-xx- *sample date* (for basement indoor air)

C915208-offsite -FF-xx- *sample date* (for first floor indoor air)

C915208-offsite -OA-xx- *sample date* (for outdoor ambient air)

If multiple sub-slab samples in a single residence, they are identified as SSA, SSB, SSC, etc.

2.4.2. Sample Labeling (soil and groundwater)

The following terminology shall be used for the soil boring and groundwater sample identification:

C915208-offsite -SB-[MW-ID]-[depth] - *sample date*

C915208-offsite -GW-xx-[MW-ID]- *sample date*

Field duplicate samples will be assigned a unique identification alphanumeric code that specifies the date of collection, the letters FD (for field duplicate) and an ascending number that records the number of duplicate samples collected that day. For example, the first field duplicate sample of subsurface soil collected on April 22, 2008 would be assigned the following sample number using the code shown below:

C915208-offsite-SB-20080422-FD-1

Subsequent duplicates of similar media if collected on the same day would be assigned FD-2, FD-3 etc. Field sampling crew will record the duplicate sample information on the field sampling log and also in the field book.

2.4.3. Field Documentation

Field notebooks will be used during all on-site work. A dedicated field notebook will be maintained by the field technician overseeing the site activities. Field activities will be photo-documented.

The field sampling team will maintain sampling records that include the following data:

- Sample Identification
- Date and time of sample collection
- Identity of samplers
- Sampling methods and devices

- Purge volumes (soil vapor)
- Volume of soil vapor sample extracted
- The Summa canister vacuum before and after samples collected
- Chain of Custody and shipping information

The following forms/logs will be completed:

- Field Log Book - weather-proof hand-bound field book
- Questionnaire and Building Inventory Form
- Sampling Field Log
- Chain of Custody Form

2.4.4. Sample Shipping

Proper documentation of sample collection and the methods used to control these documents are referred to as chain-of-custody procedures. Chain-of-custody procedures are essential for presentation of sample analytical chemistry results as evidence in litigation or at administrative hearings held by regulatory agencies. Chain-of-custody procedures also serve to minimize loss or misidentification of samples and to ensure that unauthorized persons do not tamper with collected samples.

The procedures used in this SVI study follow the chain-of-custody guidelines outlined in NEIC Policies and Procedures, prepared by the National Enforcement Investigations Center (NEIC) of the U.S. Environmental Protection Agency Office of Enforcement:

- The chain-of-custody (COC) record should be completely filled out, with all relevant information.
- The original COC goes with the samples. It should be placed in a Ziploc bag and placed inside the box containing a Summa canister. The sampler should retain a copy of the COC.
- Summa canisters are shipped in the same boxes the laboratory used for shipping.
- Place the laboratory address on top of sample box/cooler. Affix custody seals across box lid flaps or cooler lid. Cover seals with wide, clear tape.
- Ship samples via overnight carrier within three days of sample collection if possible.

2.5. Field Sampling Instrumentation

Owned and rented field sampling equipment should require no maintenance beyond decontamination between sampling locations. The use of disposable filters for the PID (i.e. mini- RAE) is recommended. Calibration procedures for electronic instruments can be found in the equipment operating manuals. Calibration and maintenance procedures

for the common instrumentation that will be used during field investigations are discussed in the equipment operating manuals. A copy of the manufacturer's operating manual for each instrument will be kept with the instrument or the operator. Field sampling equipment will be calibrated as recommended by the manufacturer.

2.6. Site Survey

A planimetric survey will be conducted to establish a base map of the site. The site survey will establish site boundaries surrounding the BCP Site at 275 Franklin Street, adjacent properties at 265, 267 Franklin Street and portions of offsite properties. All newly installed monitoring wells, two piezometers (PZ-11 and PZ-14) and all air sampling locations will be located and surveyed.

Malcolm Pirnie will subcontract a surveyor, licensed by the State of New York, to conduct a field survey at the Site. The survey will include existing physical and cultural features of the Site, including property boundaries. Additionally, the surveyor will install or reference a permanent, on-site benchmark. To the extent possible,the survey will establish the horizontal and vertical measurements of the SVI sampling locations, monitoring wells and all locations sampled during the investigation.

Based on the field survey, the surveyor will prepare a site map that will include an appropriate horizontal scale, a horizontal control reference (NAD 83), and a vertical control reference (National Geodetic Vertical Datum 1988). The site map will contain cultural features, label names, monitoring wells, explanatory notes, and a title block. Additionally, the surveyor will measure the elevations of the sampled wells to the nearest hundredth of a foot. The elevations to be measured at each of the 12 wells include ground surface or flush-mount casing and the top of riser.

All surveys will be signed, sealed and certified by a Licensed Land Surveyor. The subcontractor will obtain sufficient documentation and evidence to render a survey plat that is correct as well as accurate. Such information may include, but is not limited to, other surveys, record deeds, title reports, original fact maps, public records, and state and county municipal maps.

3. Laboratory Analysis and Data Validation

Air sample analyses will be performed by a NYSDOH Environmental Laboratory Approval Program (ELAP) certified laboratory for VOCs using USEPA Method TO-15 . In accordance with the October 2006 Final NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York, the analysis for indoor and outdoor air samples will achieve minimum reporting limits of 1.0 µg/m^3 for each compound except for TCE, which will have a minimum reporting limit of 0.25 µg/m^3.

Similarly, analyses for soil and groundwater samples will be performed by a NELAP certified laboratory for the following parameters:

- Volatile Organic Compounds (VOCs) by USEPA Method 8260B;

The collection and reporting of reliable data is the primary focus of the sampling and analytical activities. Laboratory and field data will be reviewed to ensure that the procedures are effective and that the data generated provide sufficient information to achieve the project objectives. Limitations of the data will also be noted. A qualified independent third party will evaluate the soil and groundwater analytical data according to NYSDEC-Division of Environmental Remediation Data Usability Summary Report (DUSR) guidelines and as described in the Generic QAPP. A Data Validation/Usability Report will be included in the final summary report.

4. Reporting

4.1 Interim Data Reports

The laboratory will provide analytical results within 21 days of receipt of the samples and a third-party data validator will provide a Data Usability Summary Report (DUSR) within 30 days of receipt of the laboratory data package. A preliminary, non-validated data report will be provided to NYSDEC within 30 days of completion of each of the SVI and soil sampling activities. The data reports will describe field activities and include tabulated data.

4.2 Summary Report

A report summarizing the investigation activities will be submitted to the NYSDEC. The report will consist of a brief discussion of the field activities, a tabulated summary of air, soil and groundwater analytical results compared to applicable NYSDEC and NYSDOH standards and guidance values will be provided. Analytical data will be compared to the following criteria:

- Air - Guidance for Evaluating Soil Vapor Intrusion in the State of New York (NYSDOH, 2006) and U.S. Environmental Protection Agency's (USEPA) Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (USEPA, 2002)
- Soil - NYSDEC's soil cleanup objectives (SCO) for restricted-residential and commercial land use (NYSDEC, 2006)
- Groundwater – NYSDEC Class GA Groundwater Quality Standards

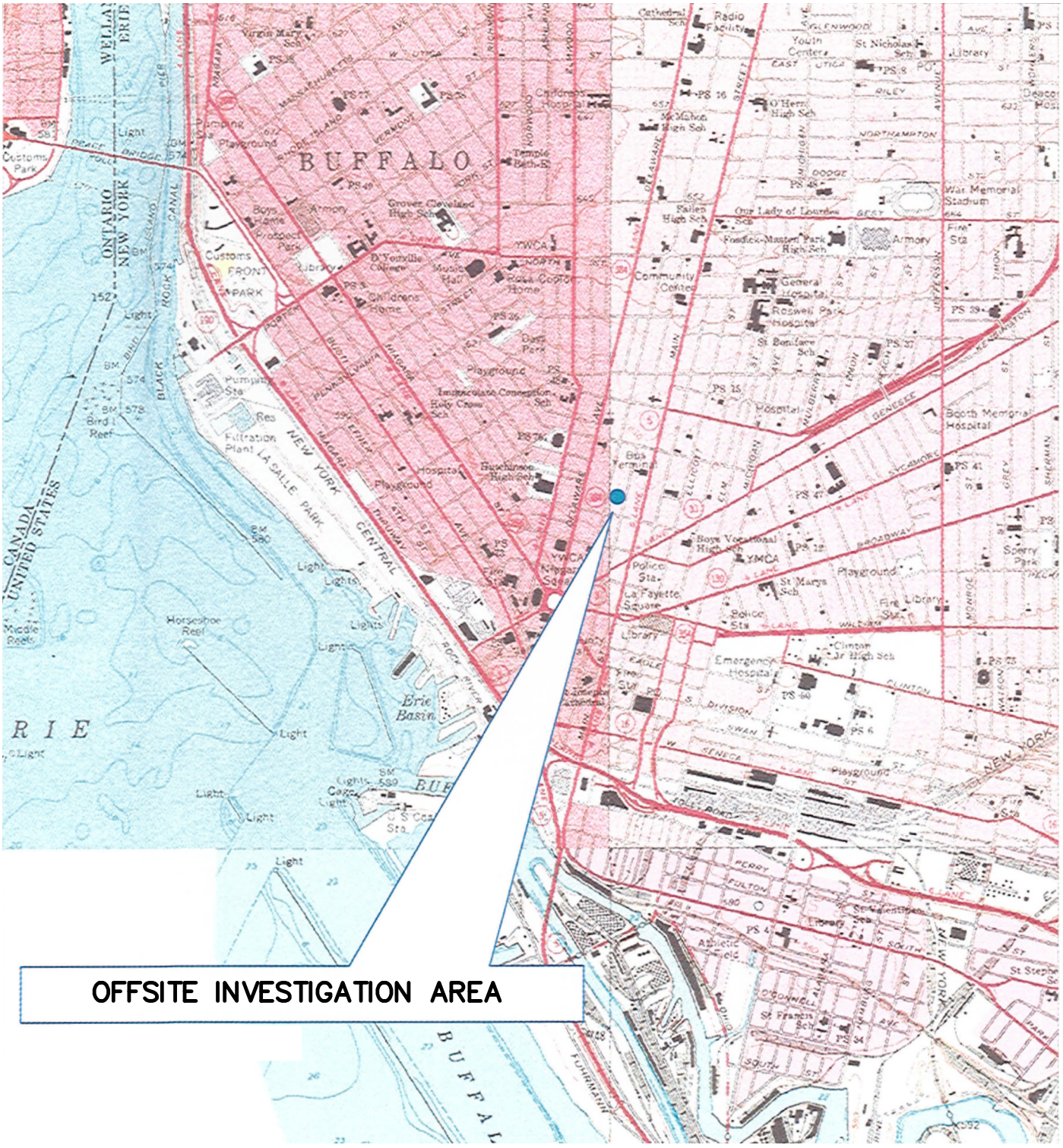
Daily observation reports, field notes, building questionnaires, product inventory, photographic log and relevant sampling information (canister pressures, equipment identification numbers, and sample times, types, and locations) will support the inclusion of mapped sampling locations, groundwater flow and analytical results.

New York State Department of Environmental Conservation
Field Activities Plan

Figures

0266-377 / BUF

MALCOLM PIRNIE



REF: 0266F001

MALCOLM PIRNIE	FRANKLIN STREET SITE PREPARED FOR NYSDEC BUFFALO, NEW YORK	SITE LOCATION AND VICINITY MAP 275 FRANKLIN STREET WORK PLAN NOT TO SCALE	MALCOLM PIRNIE, INC. APRIL 2008 FIGURE 1

XREFS: IMAGES:F:\Projects\0266377 - 275 Franklin\Images\SOW_SVI_Franklin St Offsite_12_0001.jpg
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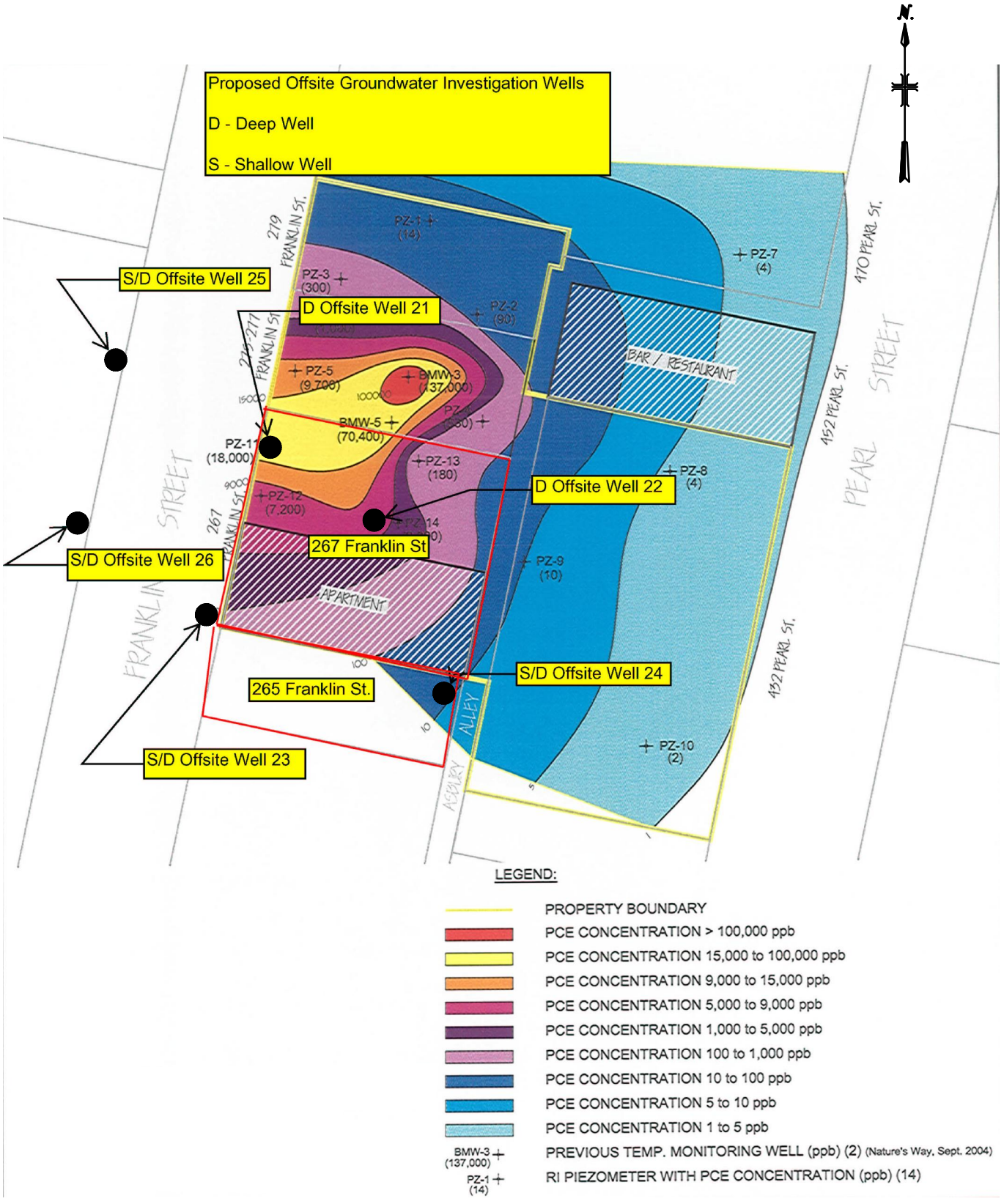
REF: 0266F002

MALCOLM PIRNIE	FRANKLIN STREET SITE PREPARED FOR NYSDEC BUFFALO, NEW YORK	SITE PLAN 275 FRANKLIN STREET WORK PLAN NOT TO SCALE	MALCOLM PIRNIE, INC. APRIL 2008 FIGURE 2



REF: 0266F003

MALCOLM PIRNIE

FRANKLIN STREET SITE
PREPARED FOR NYSDEC
BUFFALO, NEW YORK

PROPOSED WELL LOCATION MAP
275 FRANKLIN STREET
WORK PLAN
NOT TO SCALE

MALCOLM PIRNIE, INC.
APRIL 2008
FIGURE 3

XREFS: IMAGES:F:\Projects\0266377 - 275 Franklin\Images\Pages from SOW_SVI_Franklin St Offsite_0001.jpg
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Attachment A
Investigation Forms

- **Daily Observation Log**
- **Overburden Borehole Log**
- **Overburden Monitoring Well Construction Diagram**
- **Well Purging and Sampling Log**

MALCOLM PIRNIE

DAILY OBSERVATION REPORT

Day:_____ Date:_____

NYSDEC

Division of Environmental Remediation
275 Franklin Street SVI/GW Investigation
NYSDEC Site # C-915208

Contract # D-004439-3

Buffalo, New York

Temperature: (F) (am) (pm)

Wind Direction: (am) (pm)

Weather: (am)
(pm)

Arrive at site (am)

Leave site: (pm)

HEALTH & SAFETY:

Are there any changes to the Health & Safety Plan? Yes ( ) No ( )
(If yes, list the deviation under items for concern)

Are monitoring results at acceptable levels?

Soil	Yes ( )	n/a ( )	* No ( )
Waters	Yes ( )	n/a ( )	* No ( )
Air	Yes ( )	n/a ( )	* No ( )

- *If No, provide comments*

OTHER ITEMS:

Site Sketch Attached: Yes ( ) No ( )
Photos Taken: Yes ( ) No ( )

DESCRIPTION OF DAILY WORK PERFORMED:

PROJECT TOTALS:

SAMPLING (Soil/Water/Air)

Contractor Sample ID:	DEC Sample ID:	Description:

DAILY OBSERVATION REPORT Day:_____ Date:_____

CONTRACTOR/SUBCONTRACTOR EQUIPMENT AND PERSONNEL ON SITE:

(Name of contractor) personnel:

(Name of Subcontractor) personnel:

(Name of contractor) equipment:

(*Indicates active equipment)

Other Subcontractors:

VISITORS TO SITE:

1.

PROJECT SCHEDULE ISSUES:

PROJECT BUDGET ISSUES:

ITEMS OF CONCERN:

COMMENTS:

ATTACHMENT(S) TO THIS REPORT:

SITE REPRESENTATIVE:

Name: (*signature*)
cc:

DAILY PHOTOLOG

MALCOLM PIRNIE

OVERBURDEN BOREHOLE LOG

Project : ____________________
Project No.: ____________________
Client: ____________________
Location: ____________________

Surface Elev.: ____________________
Ref. Elev.: ____________________
Contractor: ____________________
Driller: ____________________
Rig Type: ____________________

Borehole No.: ____________________
Date Started: ____________________
Date Finished: ____________________
Drilling Method: ____________________
Water Depth (bgs): ____________________
Logged By: ____________________

Depth (BGS)	Sample ID	Sample Type	Blows / 6 inches	Recovery / Length (ft.)	Soil Classification / Symbol (Include depths)	**Lithology Description and Remarks** *Density/Consistency, Color, Plasticity, Soil Types, Texture, Fabric, Bedding, Mois*	Moisture *(dry, moist, wet, saturated)*	PID Scan (ppm)	PID Headspace (ppm)

Notes:

MALCOLM PIRNIE

OVERBURDEN MONITORING WELL SHEET

WELL NO. _____

PROJECT _____ START DATE _____ END DATE _____

PROJECT NO. _____ FIELD GEOLOGIST _____

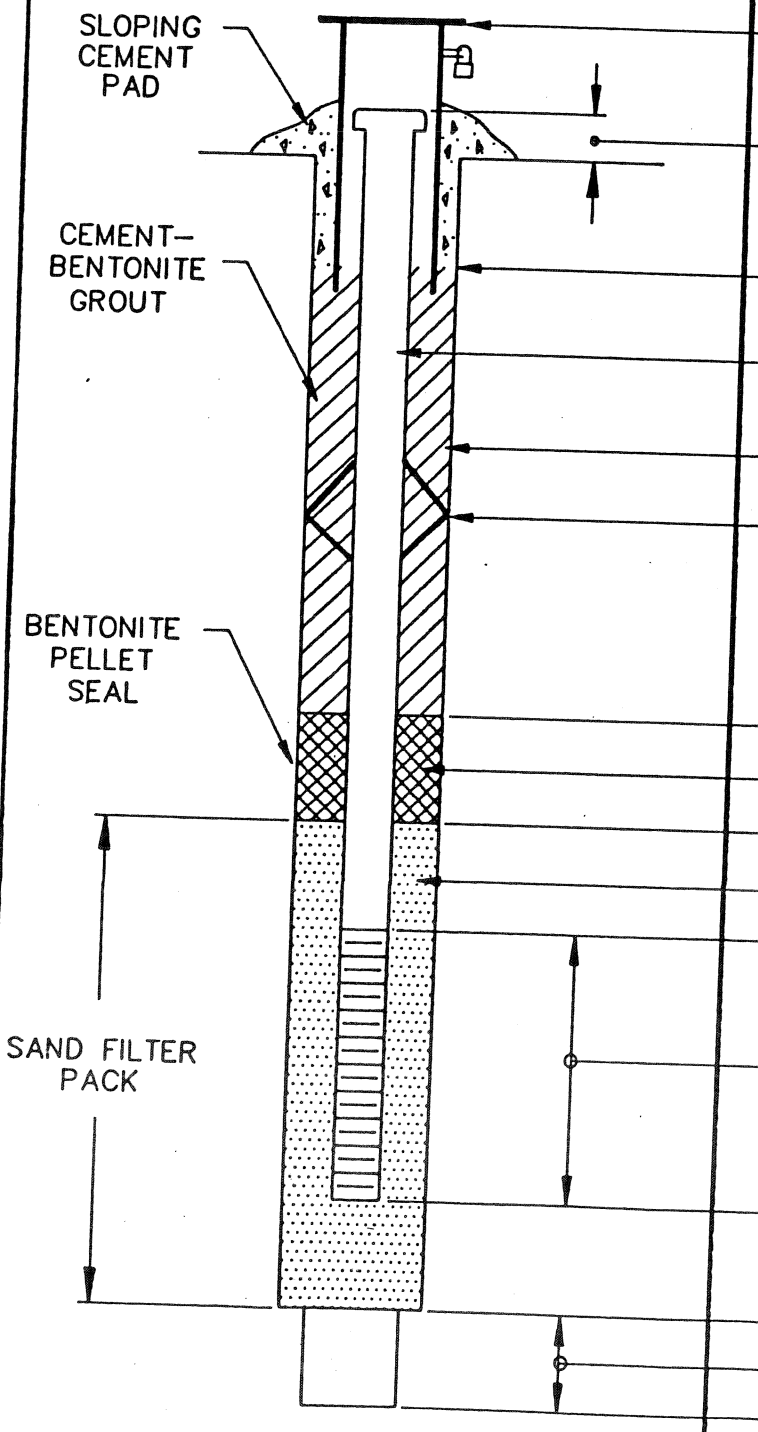
LOCATION _____

DRILLING CO. _____

DRILLER(S) _____

DRILLING METHOD(S) _____

DEVELOPMENT METHOD(S) _____



SIZE AND LENGTH OF LOCKABLE PROTECTIVE STEEL CASING _____

LOCKED? ___YES ___NO

STICK–UP _____

DEPTH TO TOP OF GROUT/ BOTTOM OF CEMENT _____

RISER DIAMETER AND MATERIAL _____

BOREHOLE DIAMETER _____

DEPTH TO CENTRALIZERS _____

DEPTH _____

PELLET SIZE _____

DEPTH _____

SAND SIZE _____

DEPTH _____

SCREEN DIAMETER, SLOT SIZE, AND MATERIAL _____

DEPTH _____

DEPTH _____

BACKFILL MATERIAL _____

BOTTOM OF BOREHOLE _____

NOTE: DEPTHS ARE FEET BELOW GRADE

MALCOLM PIRNIE

WELL NO.:

WELL PURGING AND SAMPLING LOG

PROJECT TITLE: _____

PROJECT NO.: _____

DATE: _____ STAFF: _____

PURGE METHOD: _____

SAMPLE METHOD: _____ TIME COLLECTED: _____

PURGING and SAMPLING DATA:

1. Total Casing and Sceen Length (ft.) _____
2. Casing Internal Diameter (in.) _____
3. Water Level Below Top of Casing (ft.) _____
4. Volume of Water in Casing (gal.) _____
5. Photoionization Detector at Wellhaed (ppm) _____

(Vol = 0.0408 [(2)^2 x { (1) - (3) }])

Constants for Calculating Borehole and Well Water Volumes							
Well Diam.	1"	2"	3"	4"	5"	6"	8"
Vol. (gal/ft)	0.04	0.17	0.38	0.66	1.04	1.50	2.60

Low Flow Stabilization Criteria	
pH	+/- 0.1
Cond.	3%
Turb.	10% if > 1 NTU
DO	10%
Temp.	3%
Eh	+/- 10 mV

PARAMETER	ACCUMULATED VOLUME PURGED										
Gallons	*Initial*										
Time (24 hr. clock)											
pH (s.u.)											
Conductivity (mS/cm)											
Turbidity (NTUs)											
Dissolved Oxygen (mg/l)											
Temperature (^{0}C)											
Eh (mV)											
Depth to Water (ft.)											
Purge (Flow) Rate											
Appearance											

Notes:

New York State Department of Environmental Conservation
Field Activities Plan

Attachment B: NYSDOH Indoor Air Quality Questionnaire And Building Inventory

0266-377 / BUF

MALCOLM PIRNIE

NEW YORK STATE DEPARTMENT OF HEALTH
INDOOR AIR QUALITY QUESTIONNAIRE AND BUILDING INVENTORY
CENTER FOR ENVIRONMENTAL HEALTH

This form must be completed for each residence involved in indoor air testing.

Preparer's Name _____ Date/Time Prepared _____

Preparer's Affiliation _____ Phone No._____

Purpose of Investigation_____

1. OCCUPANT:

Interviewed: Y / N

Last Name: _____ First Name: _____

Address: _____

County: _____

Home Phone: _____ Office Phone: _____

Number of Occupants/persons at this location _____ Age of Occupants _____

2. OWNER OR LANDLORD: (Check if same as occupant ___)

Interviewed: Y / N

Last Name: _____First Name: _____

Address: _____

County: _____

Home Phone: _____ Office Phone: _____

3. BUILDING CHARACTERISTICS

Type of Building: (Circle appropriate response)

Residential	School	Commercial/Multi-use
Industrial	Church	Other: _____

If the property is residential, type? (Circle appropriate response)

Ranch	2-Family	3-Family
Raised Ranch	Split Level	Colonial
Cape Cod	Contemporary	Mobile Home
Duplex	Apartment House	Townhouses/Condos
Modular	Log Home	Other:_____

If multiple units, how many? _____

If the property is commercial, type?

Business Type(s) _____

Does it include residences (i.e., multi-use)? Y / N If yes, how many? _____

Other characteristics:

Number of floors_____ Building age_____

Is the building insulated? Y / N How air tight? Tight / Average / Not Tight

4. AIRFLOW

Use air current tubes or tracer smoke to evaluate airflow patterns and qualitatively describe:

Airflow between floors

_____

_____

_____

Airflow near source

_____

_____

_____

Outdoor air infiltration

_____

_____

_____

Infiltration into air ducts

_____

_____

_____

5. BASEMENT AND CONSTRUCTION CHARACTERISTICS (Circle all that apply)

a. Above grade construction:	wood frame	concrete	stone	brick
b. Basement type:	full	crawlspace	slab	other _____
c. Basement floor:	concrete	dirt	stone	other _____
d. Basement floor:	uncovered	covered	covered with _____	
e. Concrete floor:	unsealed	sealed	sealed with _____	
f. Foundation walls:	poured	block	stone	other _____
g. Foundation walls:	unsealed	sealed	sealed with _____	
h. The basement is:	wet	damp	dry	moldy
i. The basement is:	finished	unfinished	partially finished	
j. Sump present?	Y / N			
k. Water in sump?	Y / N / not applicable			

Basement/Lowest level depth below grade: _____(feet)

Identify potential soil vapor entry points and approximate size (e.g., cracks, utility ports, drains)

_____

_____

6. HEATING, VENTING and AIR CONDITIONING (Circle all that apply)

Type of heating system(s) used in this building: (circle all that apply – note primary)

Hot air circulation	Heat pump	Hot water baseboard	
Space Heaters	Stream radiation	Radiant floor	
Electric baseboard	Wood stove	Outdoor wood boiler	Other _____

The primary type of fuel used is:

Natural Gas	Fuel Oil	Kerosene
Electric	Propane	Solar
Wood	Coal	

Domestic hot water tank fueled by: _____

Boiler/furnace located in:	Basement	Outdoors	Main Floor	Other_____
Air conditioning:	Central Air	Window units	Open Windows	None

Are there air distribution ducts present? Y / N

Describe the supply and cold air return ductwork, and its condition where visible, including whether there is a cold air return and the tightness of duct joints. Indicate the locations on the floor plan diagram.

_____

_____

_____

_____

7. OCCUPANCY

Is basement/lowest level occupied? Full-time Occasionally Seldom Almost Never

Level	**General Use of Each Floor (e.g., familyroom, bedroom, laundry, workshop, storage)**
Basement	_____
1st Floor	_____
2nd Floor	_____
3rd Floor	_____
4th Floor	_____

8. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY

a. Is there an attached garage? Y / N

b. Does the garage have a separate heating unit? Y / N / NA

c. Are petroleum-powered machines or vehicles stored in the garage (e.g., lawnmower, atv, car) Y / N / NA Please specify_____

d. Has the building ever had a fire? Y / N When?_____

e. Is a kerosene or unvented gas space heater present? Y / N Where? _____

f. Is there a workshop or hobby/craft area? Y / N Where & Type? _____

g. Is there smoking in the building? Y / N How frequently? _____

h. Have cleaning products been used recently? Y / N When & Type? _____

i. Have cosmetic products been used recently? Y / N When & Type? _____

j. Has painting/staining been done in the last 6 months? Y / N Where & When? _____

k. Is there new carpet, drapes or other textiles? Y / N Where & When? _____

l. Have air fresheners been used recently? Y / N When & Type? _____

m. Is there a kitchen exhaust fan? Y / N If yes, where vented?_____

n. Is there a bathroom exhaust fan? Y / N If yes, where vented?_____

o. Is there a clothes dryer? Y / N If yes, is it vented outside? Y / N

p. Has there been a pesticide application? Y / N When & Type?_____

Are there odors in the building? Y / N
If yes, please describe: _____

Do any of the building occupants use solvents at work? Y / N
(e.g., chemical manufacturing or laboratory, auto mechanic or auto body shop, painting, fuel oil delivery, boiler mechanic, pesticide application, cosmetologist

If yes, what types of solvents are used? _____

If yes, are their clothes washed at work? Y / N

Do any of the building occupants regularly use or work at a dry-cleaning service? (Circle appropriate response)

Yes, use dry-cleaning regularly (weekly) No
Yes, use dry-cleaning infrequently (monthly or less) Unknown
Yes, work at a dry-cleaning service

Is there a radon mitigation system for the building/structure? Y / N Date of Installation: _____
Is the system active or passive? Active/Passive

9. WATER AND SEWAGE

Water Supply:	Public Water	Drilled Well	Driven Well	Dug Well	Other: _____
Sewage Disposal:	Public Sewer	Septic Tank	Leach Field	Dry Well	Other: _____

10. RELOCATION INFORMATION (for oil spill residential emergency)

a. Provide reasons why relocation is recommended: _____

b. Residents choose to: remain in home relocate to friends/family relocate to hotel/motel

c. Responsibility for costs associated with reimbursement explained? Y / N

d. Relocation package provided and explained to residents? Y / N

11. FLOOR PLANS

Draw a plan view sketch of the basement and first floor of the building. Indicate air sampling locations, possible indoor air pollution sources and PID meter readings. If the building does not have a basement, please note.

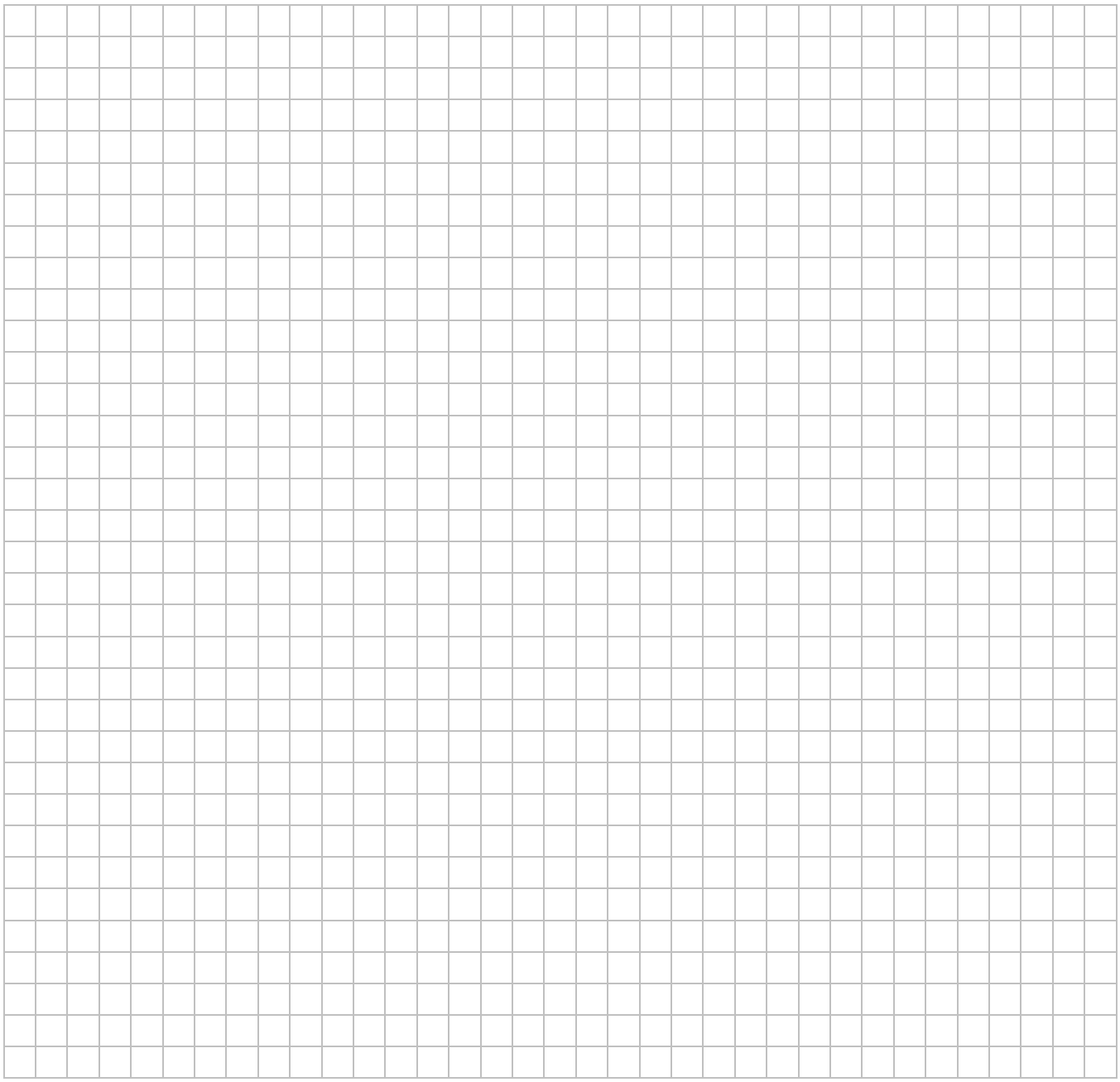
Basement:

First Floor:

12. OUTDOOR PLOT

Draw a sketch of the area surrounding the building being sampled. If applicable, provide information on spill locations, potential air contamination sources (industries, gas stations, repair shops, landfills, etc.), outdoor air sampling location(s) and PID meter readings.

Also indicate compass direction, wind direction and speed during sampling, the locations of the well and septic system, if applicable, and a qualifying statement to help locate the site on a topographic map.



13. PRODUCT INVENTORY FORM

Make & Model of field instrument used: _____

List specific products found in the residence that have the potential to affect indoor air quality.

Location	Product Description	Size (units)	Condition*	Chemical Ingredients	Field Instrument Reading (units)	Photo** Y / N

* Describe the condition of the product containers as **Unopened (UO), Used (U),** or **Deteriorated (D)**
** Photographs of the **front and back** of product containers can replace the handwritten list of chemical ingredients. However, the photographs must be of good quality and ingredient labels must be legible.

New York State Department of Environmental Conservation
Field Activities Plan

Attachment C:
Site Specific Health and Safety Plan

0266-377 / BUF

MALCOLM PIRNIE

SITE SPECIFIC HEALTH AND SAFETY PLAN

MALCOLM PIRNIE

SECTION 1: GENERAL INFORMATION AND DISCLAIMER		PROJECT NUMBER:	0266377
PROJECT NAME:	275 Franklin Street Offsite Investigation	CLIENT NAME:	New York State DEC
PROJECT MANAGER:	Jim Richert	DEPUTY PROJECT MANAGER:	John Hilton
PREPARED BY:	John Hilton	DATE:	04/08/08

NOTE: This site specific Health and Safety Plan - Short Form (HASP-SF) has been prepared for use by **Malcolm Pirnie, Inc.** employees for work at this site / facility. **The plan is written for the specific site / facility conditions, purposes, tasks, dates and personnel specified, and must be amended and reviewed by those personnel named in Section 4 if these conditions change.** Malcolm Pirnie, Inc. is not responsible for its use by others.

Subcontractors shall be solely responsible for the health and safety of their employees and shall comply with all applicable laws and regulations. In accordance with 1910.120(b)(1)(iv) and (v), Malcolm Pirnie, Inc. will inform subcontractors of the site / facility emergency response procedures, and any potential fire, explosion, health, safety or other hazards by making this Site Specific Health and Safety Plan and site information obtained by others available during regular business hours. All contractors and subcontractors are responsible for: (1) developing their own Health and Safety Plan, including a written Hazard Communication Program and any other written hazard specific or safety programs required by federal, state and local laws and regulations, that details subcontractor tasks, potential or actual hazards identified as a result of a risk analysis of those tasks, and the engineering controls, work practices and personal protective equipment to be utilized to minimize or eliminate employee exposure to the hazard; (2) providing their own personal protective equipment; (3) providing documentation that their employees have been health and safety trained in accordance with applicable federal, state and local laws and regulations; (4) providing evidence of medical surveillance and medical approvals for their employees; and (5) designating their own site safety officer responsible for ensuring that their employees comply with their own Health and Safety plan and taking any other additional measures required by their site activities.

Providing a copy of this Malcolm Pirnie plan to subcontractors, does not establish, nor is it intended to establish a "joint employer" relationship between the Contractor and Malcolm Pirnie. This allowance does not establish, nor is it intended to establish, a direct or indirect employer/employee relationship with subcontractor's employees.

THIS SITE SPECIFIC HASP MUST BE REVIEWED AND APPROVED BY CORPORATE HEALTH AND SAFETY FOR ONE OR MORE OF THE FOLLOWING CONDITIONS: IF AN UPGRADE TO "LEVEL C" OR ABOVE IS ANTICIPATED; A PERMIT REQUIRED CONFINED SPACE ENTRY OR ENTRY INTO AN EXCAVATION IS ANTICIPATED; SAMPLING OF UNKNOWN DRUMS AND/OR IN UNKNOWN CONDITIONS IS ANTICIPATED, OR IF THERE MAY BE RADIATION LEVELS GREATER THAN 0.5 mR (500µR)/HOUR.

SECTION 2: EMERGENCY INFORMATION

(A) LOCAL RESOURCES	SERVICE NAME	TELEPHONE NUMBER
EMERGENCY MEDICAL SERVICES	First Call Inc.	911
HOSPITAL (Map attached)	Kenmore Mercy Hospital	911 or (716) 447-6204
FIRE DEPARTMENT	Buffalo Fire Department	911
POLICE / SECURITY	Buffalo Police Department	911
HAZMAT/ SPILL / OTHER RESPONSE	911	911

(B) CORPORATE RESOURCES

MALCOLM PIRNIE 24 / 7 EMERGENCY / INCIDENT TELEPHONE NUMBERS		(800) 478-6870 (24 HOURS)
CORPORATE HEALTH AND SAFETY **	JOSEPH GOLDEN, EMT-P, CET, CHMM	(914) 641-2978 WHI
FIER PROJECTS	JANE WEBER, CET	(914) 641-2559 WHI
MUNI/WEG/CMRT PROJECTS	LAURA LEE-CASEY,	(914) 641-2707 WHI
CORPORATE HEALTH PHYSICIST	LES SKOSKI	(201) 398-4377 NNJ
WORKERS COMP / OSHA LOG	LAURA LEE-CASEY, CHST, CET, EMT-P	(914) 641-2707 WHI
LEGAL DEPARTMENT **	JERRY CAVALUZZI	(914) 641-2950 WHI

**** TO BE NOTIFIED IN CASE OF ACCIDENT**

SECTION 3: PROJECT INFORMATION

(A) SITE / FACILITY INFORMATION:

SITE NAME: 275 Franklin Steet

ADDRESS: 275 Franklin

TOWNSHIP/ COUNTY: Buffalo, Erie County, NY

☐ FEDERAL ☒ STATE

SITE CLIENT CONTACT: Gene Melnyk

PHONE NUMBER: (716) 851-7220

SITE SAFETY CONTACT: N/A

☐ MUNICIPAL / REGIONAL ☐ PRIVATE

(B) SITE CLASSIFICATION: (check all that apply)

☐ HAZARDOUS (RCRA)	☐ UST / LUST	☐ REFINERY
☒ HAZARDOUS (CERCLA / STATE)	☒ BROWNFIELD	☐ WTP / WWTP
☐ CONSTRUCTION	☐ CHEMICAL PLANT	☐ OTHER:
☐ LANDFILL (NON-HAZARDOUS)	☐ MANUFACTURING	
☐ ACTIVE	☒ INACTIVE	

(C) TYPE OF FIELD ACTIVITY

☐ HAZARDOUS WASTE	☐ SOLID WASTE	☐ CONSTRUCTION
☒ HYDROGEOLOGY	☒ ENVIRONMENTAL	☒ AIR / ODOR
☐ WASTE WATER	☐ WATER	☐ OTHER:

(D) FIELD OBJECTIVES (Check all that apply)

		SAMPLING:	
☐ PRE-JOB VISIT	☐ AUDIT	☐ AIR	☐ SEDIMENT
☒ CONTRACTOR OVERSIGHT	☐ OTHER:	☐ SURFACE WATER	☒ SUBSURFACE SOIL
☐ CONSTRUCTION MGMT		☒ GROUND WATER	☐ LANDFILL
☐ INSPECTION		☐ WASTE WATER	☒ OTHER
☐ INVESTIGATION SURVEY		☐ WASTE STREAM	

DATE(S) OF FIELD ACTIVITIES: Spring 2008

(E) FIELD TASKS

MALCOLM PIRNIE TASKS

M1. Soil Vapor Intrusion and Air sampling

M2. Soil Boring/Groundwater Monitoring Well installation

M3. Groundwater and subsurface soil Sampling

M4.

TASKS PERFORMED BY OTHERS

01. Soil Boring

02. Well Installation

03. Survey

04.

SECTION 4: PROJECT SAFETY ORGANIZATION, HEALTH AND SAFETY TRAINING, AND MEDICAL MONITORING

(A) PROJECT HEALTH AND SAFETY ROLES, RESPONSIBILITIES AND COORDINATION

PROJECT OFFICER	The Project Officer (PO) is ultimately responsible for project performance. The PO seeks and gets appropriate approvals for risk management decisions (e.g. from Regional/Practice Director(s), Legal Council, Corporate Health and Safety), and selects and effective and qualified project team. The PO supports the Project Manager or Deputy Project Manager with appropriate resources.
PROJECT MANAGER DEPUTY PROJECT MANAGER	The Project Manager (PM) has the responsibility for executing the project in accordance with the scope of work and good engineering practice. The PM will supervise the allocation of resources and staff to implement specific aspects of this HASP and may delegate authority to expedite and facilitate any application of the program. The PM implements and executes an effective program of site-specific personnel protection and accident prevention. The Project Manager reports to the Project Officer. Deputy Project Managers (DPM) are assigned all duties and responsibilities of the Site Safety Officer in his/her absence.
CORPORATE HEALTH & SAFETY	Corporate Health and Safety is responsible for Malcolm Pirnie's overall Health and Safety Program and provides project guidance on air monitoring methodology, data interpretation and assistance in determining appropriate project engineering controls, work practices, and personal protective equipment. Corporate Health and Safety also reviews and approve HASPs in accordance with Section 1.
SITE SAFETY OFFICER ALTERNATE SITE SAFETY OFFICER (S)	The Site Safety Officer (SSO) is responsible for interpreting and implementing the site health and safety provisions set out in this HASP, and will guide the efforts of field team personnel in their day-to-day compliance with this HASP. The SSO has the ability and authority to make necessary changes or additions to this HASP and provide technical assistance to field team personnel on problems relating to worksite safety. The SSO has the authority to correct safety-related deficiencies in materials or practice and to call a Project STOP in the most serious cases. Alternate Site Safety Officer (ASSO) is assigned all duties and responsibilities of the Site Safety Officer in his/her absence.
PUBLIC INFORMATION OFFICER:	The Public Information Officer (PIO) is responsible for all public, press and other news media request for information, and is the only person authorized to provide such information
SITE RECORDKEEPER:	The Site Recordkeeper is responsible for the documentation of all related heath and safety data documentation, including but not limited to metrological data, instrument calibration, accident and injury reports, and air monitoring data.
FIELD TEAM LEADER:	The Field Team Leader (FTL) is responsible for leading "on-site" activities of field team personnel, and to ensure field team personnel perform only those tasks that have been identified in this HASP.
FIELD TEAM PERSONNEL	Field personnel have the following health and safety responsibilities: • Implement the procedures set forth in the HASP; • Take all reasonable precautions to prevent injury to themselves and their fellow employees; and • Perform only those tasks that they believe they can do safely, and immediately report any accidents and/or unsafe conditions in accordance with Section 1.

(B) PROJECT TEAM - The following Malcolm Pirnie personnel are designated to carry out the stated project job functions on site. THE SITE SAFETY OFFICER, OR A DESIGNATED ALTERNATE WILL BE ON-SITE DURING **ALL** SITE ACTIVITIES. (NOTE: One person may carry out more than one job function.)

PROJECT MANAGER: Jim Richert

PROJECT OFFICER: Daniel Loewenstein

SITE SAFETY OFFICER: Adam Mazenauer

ALTERNATE SAFETY OFFICER(S): Dwight Symonds

PUBLIC INFORMATION OFFICER: Jim Richert

SITE RECORDKEEPER: John Hilton

FIELD TEAM LEADER: John Hilton

FIELD TEAM PERSONNEL: Adam Mazenauer

Dwight Symonds

John Hilton

The following subcontractors and governmental agencies have been informed by Malcolm Pirnie of emergency response procedures, and any potential fire, explosion, health, safety or other hazards of the site / facility by making this Site Specific Health and Safety Plan and site information obtained by others available during regular business hours. Subcontractors and governmental agencies shall be solely responsible for the health and safety of their employees and shall comply with all applicable laws and regulations as described in **Section 1** of this plan.

SUBCONTRACTOR(S): Buffalo Drilling, Inc.

OM P Popli

FEDERAL AND STATE AGENCY REPS: Gene Melnyk (NYSDEC)

OTHER AGENCY REPS:

(C) HEALTH AND SAFETY TRAINING, MEDICAL MONITORING, AND FIT TESTING PROGRAM

The following project staff is included in the Malcolm Pirnie Health and Safety Training and Medical Monitoring programs. The details of these programs can be found in the Health and Safety Policies and Written Programs. (NOTE: At least one CPR/First Aid Trained person must be on-site during HAZWOPER and confined space entry activities.)

	HAZWOPER TRAINING				OTHER TRAINING								
NAME	INITIAL (DATE)	8HR (DATE)	MGR (DATE)	DOT (DATE)	CSE (DATE)	CPR / First Aid / (DATE)		BBP	MEDICAL (DATE)	FIT TEST MAKE / SIZE / TYPE			(DATE)
John Hilton	06/89	05/07	06/89			07/03	07/05	06/02	07/07	NOR	SML	FF	05/07
Brad Walker	05/00	05/07	06/03			12/04	07/05	05/07	11/07	NOR	M-L	FF	05/07
Adam Mazenauer	05/06				05/07				05/07				
Dwight Symonds	11/05	05/07							05/07				

SECTION 5: HAZARD ANALYSIS

(A) **ACTUAL OR POTENTIAL PHYSICAL HAZARDS** – (Check all that apply to Malcolm Pirnie activities)

- ☐ ANIMALS / PLANTS
- ☐ ASBESTOS / LEAD
- ☐ CHEMICAL EXPOSURE (See Section 5B/5C)
- ☐ CONFINED SPACE (See Section 12)
- ☐ DEMOLITION
- ☒ DRILLING
- ☐ DRUM HANDLING
- ☐ DUST, HARMFUL
- ☐ DUST, NUISANCE
- ☐ ELECTRICAL
- ☐ EXCAVATIONS (See Section 13)
- ☐ EXTREME COLD (See Section 10)
- ☐ FALL, >6' VERTICAL
- ☐ FALLING OBJECTS
- ☐ HEAT STRESS
- ☐ HEAVY EQUIPMT
- ☐ HEAVY LIFTING
- ☐ HOT WORK
- ☐ HUNTING SEASON
- ☐ IMMERSION
- ☐ IONIZING RADIATION
- ☐ LIGHT RADIATION (i.e., Welding, High Intensity)
- ☐ LIMITED CONTACT
- ☐ MOVING PARTS (LO / TO)
- ☒ NOISE (> 85 dB)
- ☐ NON-IONIZING RADIATION
- ☐ OVERHEAD OBJECTS
- ☐ POWERED PLATFORMS
- ☒ POOR VISIBILITY
- ☐ ROLLING OBJECTS
- ☐ SCAFFOLDING
- ☐ SHARP OBJECTS
- ☐ STEEP / UNEVEN
- ☐ TERRAIN
- ☐ TRAFFIC (STRUCK BY)
- ☐ OTHER: _____

(B) **PRESENCE OF HAZARDOUS MATERIALS STORED OR USED ON SITE** (CHECK ALL THAT APPLY)

☐ YES By Client / Owner ☐ YES By Malcolm Pirnie (See Section 11) ☒ NO

TYPE

- ☐ EXPLOSIVES
- ☐ COMPRESSED GASES
- ☐ FLAMMABLE / COMBUSTIBLE LIQUIDS
- ☐ FLAMMABLE / REACTIVE SOLIDS
- ☐ OXIDIZERS
- ☐ TOXIC / INFECTIOUS
- ☐ RADIOACTIVE
- ☐ CORROSIVE
- ☐ MISCELLANEOUS
- ☐ HAZARDOUS WASTE (Stored)

(C) **CHEMICAL HAZARDS OF CONTAMINANTS INFORMATION**

(1) IDENTIFIED CONTAMINANTS - Known or suspected hazardous/toxic materials (attach historical information, physical description, map of contamination and tabulated data, if available)

SUBSTANCES INVOLVED	CHARACTERISTICS	MEDIA	ESTIMATED CONCENTRATIONS	LOWEST PEL, or TLV
Chlorinated Solvents	VO, TO	SL,GW	Unknown	

Media types: GW (ground water), SW (surface water), WW (wastewater), AIR (air), SL (soil), SD (sediment), WL (waste, liquid), WS (waste, solid), WD (waste, sludge), WG (waste, gas), OT (other).

Characteristics: CA (corrosive, acid), CC (corrosive, caustic), IG (ignitable), RA (radioactive), VO (volatile), TO (toxic), RE (reactive), BIO (infectious), UN (unknown), OT (other, describe

(2) DESCRIBE POTENTIAL FOR CONTACT WITH EACH MEDIA TYPE FOR EACH OF THE MPI TASKS LISTED IN SEC 3 (E):

MPI TASK	ROUTE OF EXPOSURE (INHAL/INGEST/CONTACT/ABSORB)	POTENTIAL FOR CONTACT (HIGH / MEDIUM / LOW)	METHOD OF CONTROL
1	Contact	Low	WORK PRACTICES/PPE
2	Contact	Low	WORK PRACTICES/PPE

The Site Safety Officer will brief the MPI field team on symptoms and signs of overexposure to chemical hazards

SECTION 6: SITE CONTROL MEASURES

(A) WORK ZONES - EXCAVATIONS, DRILLING OPERATIONS, AND HEAVY EQUIPMENT

John Hilton has been designated to coordinate access control and security for Malcolm Pirnie operations on site. It is a Malcolm Pirnie policy that Malcolm Pirnie personnel will establish a safe working area and that a perimeter be established a safe distance from excavators, drill rigs and other heavy equipment.

These boundaries are identified by: CAUTION TAPE/ CONES FORMING PERIMETER 15 FEET FROM WORK AREA

No unauthorized person should be within this area.

(B) WORK ZONES - CONTAMINATION

The prevailing wind conditions are WESTERLY direction. A wind direction indicator is used to determine daily wind

These boundaries are identified by:

No unauthorized person should be within this area.

SECTION 7: SAFETY PROCEDURES / EQUIPMENT REQUIRED

Identify all procedures and equipment needed to eliminate or minimize exposure to hazards identified in Section 5.

- ☐ AIR MONITORING EQUIPMENT (See Section 9)
- ☒ BARRIER TAPE
- ☐ COMMUNICATIONS - ONSITE
- ☒ COMMUNICATIONS - OFFSITE (i.e., cell/digital phones if no other means)
- ☐ CONFINED SPACE PROGRAM & EQUIPMENT (See Section 12)
- ☐ EYE WASH
- ☐ EMERGENCY SHOWERS
- ☐ EMERGENCY AIR HORN
- ☐ FALL PROTECTION PROGRAM & EQUIPMENT
- ☒ FIRE EXTINGUISHER(S) - ABC
- ☒ FIRST AID KIT / BBP KIT
- ☐ FLOTATION DEVICE (USCG)
- ☐ GFCI EXTENSION CORDS
- ☐ HARNESS(S) / LIFELINE(S)
- ☐ INSECT / TICK REPELLANT
- ☐ HUNTING SEASON
- ☐ LADDER(S)
- ☐ LIGHTING - HAND HELD
- ☒ LIGHTING - FIXED / EMERGENCY
- ☐ LOCKOUT/TAGOUT PROGRAM & EQUIPMENT
- ☐ MSDSs – ATTACHED (See Section 11)
- ☐ MSDSs - FACILITY / OTHERS
- ☒ PPE - PHYSICAL HAZARDS (See Section 15)
- ☐ PPE - CHEMICAL HAZARDS (See Section 15)
- ☐ RESPIRATORY PROTECTION PROGRAM & EQUIPMENT (APR) (See Section 15)
- ☐ RESPIRATORY PROTECTION PROGRAM & EQUIPMENT (SAR) (See Section 15)
- ☒ TRAFFIC CONES
- ☐ VENTILATION EQUIPMENT
- ☐ OTHER:

SECTION 8: COMMUNICATIONS AND SAFE WORK PRACTICES

(A) COMMUNICATIONS - ONSITE

Whenever possible, communications between site personnel should be face-to-face. When verbal communications is not possible, radio communications shall be established.

In case of radio communications failure, or when respiratory protection is in use, the following hand signals will be used:

OK; I AM ALL RIGHT; I UNDERSTAND	THUMBS UP
NO; NEGATIVE	THUMBS DOWN
NEED ASSISTANCE	BOTH HANDS ON TOP OF HEAD
DANGER - NEED TO LEAVE AREA, NO QUESTIONS	GRIP PARTNERS WRIST WITH BOTH HANDS
HAVING DIFFICULTY BREATHING	HANDS TO THROAT

(B) COMMUNICATIONS - OFF SITE

If applicable, telephone communication to the Command Post should be established as soon as practical.

Telephone numbers that can be used to reach the command post are: 716-667-0900 (Office) and Personal Cell Phones

(C) SAFE WORK PRACTICES

1. A "BUDDY SYSTEM" IN WHICH ANOTHER WORKER IS CLOSE ENOUGH TO RENDER IMMEDIATE AID WILL BE IN EFFECT. CLIENTS AND/OR CONTRACTORS MAY SERVE AS A "DESIGNATED BUDDY."
2. WHERE THE EYES OR BODY MAY BE EXPOSED TO CORROSIVE MATERIALS, SUITABLE FACILITIES FOR QUICK DRENCHING OR FLUSHING SHALL BE AVAILABLE FOR IMMEDIATE USE (SEE SECTION 7).
3. DO NOT KNEEL ON THE GROUND WHEN CHEMICAL PROTECTIVE CLOTHING IS BEING USED.
4. IF DRILLING EQUIPMENT IS INVOLVED, HAVE A CURRENT UTILITY SURVEY, AND KNOW WHERE THE 'KILL SWITCH' IS.
5. CONTACT WITH SAMPLES, EXCAVATED MATERIALS, OR OTHER CONTAMINATED MATERIALS MUST BE MINIMIZED.
6. ALL ELECTRICAL EQUIPMENT USED IN OUTSIDE LOCATIONS, WET AREAS OR NEAR WATER MUST BE PLUGGED INTO GROUND FAULT CIRCUIT INTERRUPTER (GFCI) PROTECTED OUTLETS (SEE SECTION 7).
7. IN THE EVENT OF TREACHEROUS WEATHER-RELATED WORKING CONDITIONS (I.E., THUNDERSTORM, LIMITED VISIBILITY, EXTREME COLD OR HEAT) FIELD TASKS WILL BE SUSPENDED UNTIL CONDITIONS IMPROVE OR APPROPRIATE PROTECTION FROM THE ELEMENTS IS PROVIDED.
8. SMOKING, EATING, CHEWING GUM OR TOBACCO, OR DRINKING ARE FORBIDDEN EXCEPT IN CLEAN OR DESIGNATED AREAS.
9. USE OF CONTACT LENSES NEAR CHEMICALS OR DURING USE OF RESPIRATORY PROTECTION IS PROHIBITED AT ALL TIMES.
10. GOOD HOUSEKEEPING PRACTICES ARE TO BE MAINTAINED.
11. SITE / FACILITY SPECIFIC SAFE WORK PRACTICES:

NOT APPLICABLE

SECTION 9: ENVIRONMENTAL MONITORING ☐ THIS SECTION NOT APPLICABLE TO SITE ACTIVITIES

(A) The following environmental monitoring instruments shall be used on site at the specified intervals and recorded in the site logbook. (NOTE: If monitoring period is "OTHER", monitoring schedule will be attached to this plan.)

EQUIPMENT	MONITORING PERIOD				ACTION LEVEL
☐ Combustible Gas Indicator	☐ Continuous	☐ Hourly	☐ x Day	☐ Other	
☐ O_2 Meter	☐ Continuous	☐ Hourly	☐ x Day	☐ Other	
☐ Toxics: ☐ CO ☐ H_2S	☐ Continuous	☐ Hourly	☐ x Day	☐ Other	
☐ Other: _____	☐ Continuous	☐ Hourly	☐ x Day	☐ Other	
☒ PID (Lamp 10.6 eV)	☐ Continuous	☐ Hourly	☐ x Day	☒ Other	5 ppm
☐ FID					
☐ Colorimetric tubes:					
_____	☐ Continuous	☐ Hourly	☐ x Day	☐ Other	
_____	☐ Continuous	☐ Hourly	☐ x Day	☐ Other	
☐ Radiation: ☐ α ☐ β ☐ gamma	☐ Continuous	☐ Hourly	☐ x Day	☐ Other	
☐ Respirable Dust Meter	☐ Continuous	☐ Hourly	☐ x Day	☐ Other	
☐ Noise Meter	☐ Continuous	☐ Hourly	☐ x Day	☐ Other	
☐ Other:	☐ Continuous	☐ Hourly	☐ x Day	☐ Other	
_____	☐ Continuous	☐ Hourly	☐ x Day	☐ Other	
_____	☐ Continuous	☐ Hourly	☐ x Day	☐ Other	

(B) Monitoring equipment is to calibrated according to manufacturers' instructions. Record calibration data and air concentrations in the Health and Safety on-site log book.

(C) Recommended Action Levels for Upgrade or Downgrade of Respiratory Protection, or Site Shutdown and Evacuation. These are average values. Consideration should be given to the potential for release of highly toxic compounds from the waste or from reaction by-products. Levels are for persistent (> 10 min) breathing zone measurements in non-confined spaces. **For unexpected conditions, stop all work and contact Corporate Health and Safety.**

<u>Oxygen Levels</u>

Less than 19.5%	Level B necessary for work to start / continue. Consider toxicity potential.
19.5% to 23.5%	Work may start / continue. Investigate changes. Continuous monitoring.
Greater than 23.5%	PROHIBITED WORK CONDITION

<u>Flammability / Explosive Hazards</u>

Less than 10% of LEL	Work may start / continue. Consider toxicity potential.
10% to 25% of LEL	Work may start / continue. Continuous monitoring.
Greater than 25% of LEL	PROHIBITED WORK CONDITION.

<u>Uncharacterized Airborne Organic Vapors or Gases</u>

Background*	Work may start / continue. Continue to monitor conditions.
Up to 5 meter units (m.u. or "ppm") above background	Level C necessary for work to start / continue. Continuous monitoring. Use Colorimetric tubes to characterize vapors.
Up to 50 m.u. above background	Level B necessary for work to start / continue. Continuous monitoring.
Greater than 50 m.u.	PROHIBITED WORK CONDITION.

*** Off-site clean air measurement**

<u>Characterized Airborne Organic Vapors or Gases</u>**

Up to 50% of TLV, or PEL or REL	Work may start / continue. Continue to monitor conditions.
Up to 25 times the TLV, or PEL or REL	Level C necessary for work to start / continue. Continuous monitoring.
Up to 500 times the TLV, or PEL or REL	Level B necessary for work to start / continue. Continuous monitoring.
Greater than 500 times the TLV, or PEL or REL	PROHIBITED WORK CONDITION.

** **Use mixture calculations (% allowed = $3C_NEL_N$) if more than one contaminant is present.**

<u>Radiation</u>

Less than 0.5 mR/Hour (500 μR)	Work may start / continue. Continue to monitor conditions.
Up to 1 mR/Hour above background	Work may start / continue with Radiation Safety Officer present on site.
Greater than 1 mR/Hour above background	PROHIBITED WORK CONDITION.

SECTION 10: PERSONAL MONITORING ☐ THIS SECTION NOT APPLICABLE TO SITE ACTIVITIES

(A) PERSONAL EXPOSURE SAMPLING (Consider if high levels of noise or high concentrations of lead, mercury or arsenic are present)

The following personal monitoring will be in effect on site: SIGNIFICANT NOISE IS NOT EXPECTED – NO PERSONAL MONITORING WILL BE IMPLEMENTED.

A copy of personal monitoring results is to be sent to Corporate Health and Safety for inclusion in the Employee's Confidential Exposure Record File.

(B) HEAT / COLD STRESS MONITORING

The expected air temperature will be 20-60 ºF. If it is determined that heat stress or cold stress monitoring is required (mandatory for heavy exertion in PPE at temperatures over 70ºF, or at temperatures under 40ºF or wind chill equivalent), the following procedures shall be followed (describe procedures in effect, for heat stress i.e., monitoring body temperature, body weight, pulse rate; for cold stress i.e., appropriate clothing, shelter breaks):

HEAT AND COLD STRESS MONITORING BY PERSONAL OBSERVATION WILL BE PERFORMED.

SECTION 11: HAZARD COMMUNICATION PROGRAM ☒ THIS SECTION NOT APPLICABLE TO SITE ACTIVITIES

If chemicals are introduced to the site by Malcolm Pirnie (e.g., decontamination liquids, preservatives, etc.), a copy of the Malcolm Pirnie Hazard Communication Program and Material Safety Data Sheets (MSDSs) of chemicals introduced by Malcolm Pirnie to the site is attached to this plan. The Site Safety Officer will review this information with all field personnel prior to the start of the project, and will inform other employers (e.g., Owner, Contractor and Subcontractors) the availability and location of this information. The Comprehensive List of Chemicals introduced by Malcolm Pirnie to this site is:

All chemicals being introduced to the site, hazardous/potentially hazardous samples prepared at the site, and/or any hazardous materials previously sent to the site, **that will be stored at the site or will be transported from the site by common carrier**, will be packaged, labeled and identified as hazardous materials in accordance with U.S. Department of Transportation (DOT) and/or International Air Transport Association (IATA) regulations by a trained HazMat employee.

(NOTE: At multi-employer sites, the Site Safety Officer will obtain information, if applicable, on hazardous chemicals other employers may produce or introduce to the job site to which Malcolm Pirnie employees may be exposed, including the location of their written hazard communication program(s), labeling program(s), and Material Safety Data Sheet(s).

SECTION 12: CONFINED SPACE ENTRY ☒ THIS SECTION NOT APPLICABLE TO SITE ACTIVITIES

If a permit-required confined space entry will be made on site, a copy of the Malcolm Pirnie Confined Space Entry Program, and a completed Malcolm Pirnie Confined Space Pre-Entry Inspection Check List will be attached to this plan. A Confined Space Entry Permit must be completed and posted outside the confined space prior to entry, and the entry will follow the Malcolm Pirnie Confined Space Entry written program. Permits are to be saved and logged with project documentation.

SECTION 13: EXCAVATION SAFETY ☒ THIS SECTION NOT APPLICABLE TO SITE ACTIVITIES

Excavations being created in order to accomplish Malcolm Pirnie tasks or in progress during Malcolm Pirnie inspection of other activities or tasks, shall be shored or slopped or otherwise protected to prevent accidental collapse prior to entry, in accordance with Subpart F of 29 CFR 1926. It is Malcolm Pirnie policy that Malcolm Pirnie personnel will not enter trench or excavated areas without approval of Corporate Health and Safety. If an entry into an excavation by Malcolm Pirnie personnel is necessary, a Excavation Plan identifying the Competent Person and the protective measure to be used (i.e., sloping, shoring, trench box) will be attached to this plan.

SECTION 14: DECONTAMINATION PROCEDURES ☒ THIS SECTION NOT APPLICABLE TO SITE ACTIVITIES

Personnel and equipment leaving the Exclusion Zone shall be thoroughly decontaminated. The Site Safety Officer is responsible for monitoring adherence with this decontamination plan.

_____ Decontamination protocol shall be used with the following decontamination stations:

(1) _____

(2) _____

(3) _____

(4) _____

(5) _____

(6) _____

(7) _____

(8) _____

(Other) _____

The following decontamination equipment is required: _____

☐ Decon Pad (Plastic Sheet) ☐ Dry Brushes ☐ Buckets Other _____

☐ Trash Cans/Bags ☐ Wet Brushes ☐ Hose / Spray _____

springwater/alconox soap solution Will be used as the decontamination solution

SECTION 15: PERSONAL PROTECTIVE EQUIPMENT

TASK *	RESPIRATORS & CARTRIDGE[1]	USE ** (See Section 16)	CLOTHING ***	GLOVES	BOOTS	OTHER
1	N/A	N/A	N/S	N	SL	HH
2	N/A	N/A	N/S	N	SL	N/A

* Same as Section 3E

**UP = Upgrade
CONT = Continuous

***** NOTE:** PPE use will be in accordance with Malcolm Pirnie's Health and Safety Policy and Written Programs.

CODES:

RESPIRATORS[1]
HF = Half Face APR
FF = Full Face APR
ESCBA = Escape Bottle
SAR = Airline
SCBA = SCBA

CARTRIDGES[1]
P = Particulate
OV = Organic Vapors
AG = Acid Gas
Mult = Multi-Gas/Vapor
Other

CLOTHING
N/S = No Special
C = Coveralls
T = Tyvek
Sx = Saranex
PT = PE Tyvek

GLOVES[2]
Co = Cotton
Le = Leather [3]
L = Latex
N = Nitrile
B = Butyl
Neo = Neoprene
V = Viton
PVC = Polyvinyl Chloride
PVA = Polyvinyl Alcohol
Other:

BOOTS
SL = Leather Safety
H = Hip (Fireman)
O = Latex overboots

OTHER
HH = Hard Hat [3]
G = Safety Glasses [3]
GP = Glare Protection
GI = Goggles - Impact
GS = Goggles - Splash
FS = Face Shield
HP = Hearing Protection [3]
RV = Reflective Vests [3]

[3] **Should be considered for all field jobs**

[1] - List all that apply, i.e., FF w/ OV/AG/P

[2] - Use same codes for clothing and boots of same material

Respiratory protection will be upgraded under the following conditions: NO UPGRADE ANTICIPATED BASED ON SITE CONDITIONS

IF SITE CONDITIONS CHANGE, WORK WILL BE HALTED AND HASP AMENDED TO INCLUDE RESPIRATORY PROTECTION.

The following cartridge change out schedule is to be followed onsite (attach any calculations to plan):

N/A

SECTION 16: EMERGENCY ACTION PLAN

The following standard emergency response procedures will be used by onsite personnel. The Site Safety Officer shall be notified of any onsite emergencies and be responsible for ensuring that the appropriate procedure are followed.

(A) EVACUATION

All work activities are suspended and the site is to be EVACUATED IMMEDIATELY, when there is a threat to life or health as determined by individual good judgment, i.e. fire, hazardous chemical spill, dangerous gas leak, severe weather (i.e., tornado); or when notified by other site / facility staff and local fire or police officials.

If an evacuation is called for, the emergency alarm system for weather-related, medical, fire and other evacuation emergencies is:

PERSONAL NOTIFICATION OR HAND SIGNALS

Evacuation from the Exclusion Zone should whenever possible occur through the decontamination line. In those situations where egress in this manner cannot occur, the following emergency escape routes have been designated (document on map if possible):

N/A

Once evacuated off site, all staff should gather at Nearest Cross Street which is a minimum of 250 feet away from the incident

(B) FIRE OR EXPLOSION

Upon discovery of a fire or an explosion, the above-designated emergency signal shall be sounded and all personnel shall assemble at the decontamination line. The fire department is to be notified and all personnel moved to a safe distance (minimum 250') from the involved area.

If a person's clothing should catch fire, burning clothing may be extinguished by having the individual drop to the floor and roll. If necessary, physically restrain the person and roll them around on the floor to smother the flames. Use a fire blanket or extinguisher if one is readily available and you have been trained in its use. Call emergency medical services if not already done so.

If a person's clothing should become saturated with a chemical, douse the individual with water from the nearest safety shower if available. Consult the chemical Material Safety Data Sheets (MSDSs) for further information. Call emergency medical services if indicated by the MSDSs.

NEVER RE-ENTER THE SITE / FACILITY until the emergency has been declared over and permission to re-enter has been given by site / facility health and safety staff or local fire or police officials. If any staff is unaccounted for, notify an individual in charge.

(C) MEDICAL EMERGENCY

If you discover a medical emergency and are by yourself, CALL OUT FOR HELP. When someone arrives, tell them to call for help. If no one comes or you know you are alone, provide whatever care you can for 1 minute, then make the call yourself. (See Section 2)

Upon notification of an injury in the Exclusion Zone, the designated emergency signal shall be sounded. All site personnel shall assemble at the decontamination line. The SSO or alternate should evaluate the nature of the injury, and the affected person should be decontaminated to the extent possible prior to movement to the Support Zone. The onsite CPR/FA personnel shall initiate the appropriate first aid, and contact should be made for an ambulance (and other emergency services as needed) and with the designated medical facility (if required). No persons shall reenter the Exclusion Zone until the cause of the injury or symptoms is determined.

The hospital is 10 minutes from the site. Ambulance response time is 10 minutes. N/A of N/A was contacted on _____ and briefed on the situation, the potential hazards, and the substances involved. When IDLH conditions exist, arrangements should be made for onsite standby of emergency services.
A map for directions to the nearest hospital is attached to this plan. If not, the directions are: SEE ATTACHED MAP

(D) SAFETY EQUIPMENT FAILURE

If any other equipment (i.e., air monitoring) on site fails to operate properly, the FTL and/or SSO shall be notified to determine the effect of this failure on continuing operations on site. If the failure affects the safety of personnel or prevents completion of the Work Plan tasks, all personnel shall leave the work area until the situation is evaluated and appropriate actions taken.

(E) FOLLOW UP

In all situations, when an on site / facility emergency results in evacuation of the work area, or a “large spill” has occurred, staff shall not resume work until:

- The conditions resulting in the emergency have been corrected;
- The hazards reassessed by the SSO and Corporate Health and Safety;
- The HASP has been reviewed by the SSO and Corporate Health and Safety; and
- Site personnel have been briefed on any changes in the HASP by the SSO.

SECTION 17: SPILL CONTAINMENT / CONTROL ☒ THIS SECTION NOT APPLICABLE TO SITE ACTIVITIES

For most chemicals introduced to the worksite, or under control of Malcolm Pirnie employees, spills of chemicals would be considered incidental and would be controlled in the immediate area of the spill. Such spills shall be handled utilizing precautions appropriate for the chemical characteristics specified in the MSDS for the chemical including spill control methods and selection and use of minimum personal protective equipment.

For chemicals introduced to the worksite, or under control of Malcolm Pirnie employees, that would cause a ″large spill″ (greater than 55 gallons), a copy of the appropriate Emergency Response Guidebook (ERG) guide shall be attached to this plan, and a spill response contractor shall be identified in Section 2.

SECTION 18: EMPLOYEE ACKNOWLEDGEMENTS

PLAN REVIEWED BY:		DATE
Project Manager:		
Project Leader:		
Local H&S Coordinator:		
Corporate H & S		

I acknowledge that I have read the information on this HASP, attached Material Safety Data Sheets (MSDSs), DOT Emergency Response Guides, and Health and Safety Programs.
I understand the site / facility hazards as described and agree to comply with the contents of the plan.

EMPLOYEE (Print Name)

VISITOR (Print Name)

ATTACHED DOCUMENTS

☐ MSDS(s)	☐ Hazard Communication Written Program	☐ Confined Space Entry Written Program	☐ DOT ERG Guides
☒ Site Map	☒ Personal Protective Equipment Written Program	☐ Excavation Safety Plan	☐ Respiratory Protection Program
☒ Hospital Directions	☐ Emergency Action Plan	☐ Evacuation Routes	☐ Cartridge Change Out Calculations
☐ Other			

New York State Department of Environmental Conservation
Field Activities Plan

Attachment D:
ABB Well Construction Protocols

MALCOLM PIRNIE

PI meter should be recorded. A description of the drum contents should be recorded (color, consistency, etc.).

Solids can be sampled from the drums using several methods: a bucket auger, hand auger, or hand scoop. As the drums to be sampled are open to the atmosphere, all of these methods can be used. When the drum has been sampled, all sampling equipment should be decontaminated as described in the site-specific HASP.

4.7 MONITORING WELL/PIEZOMETER INSTALLATION

The objectives for each monitoring well and/or piezometer may vary from site to site and from well to well. The objectives will be clearly defined in the Work Plan before the monitoring system is designed. Monitoring wells serving different purposes require different types of construction. The objectives for installing monitoring wells may include:

- determining groundwater flow direction and velocity
- sampling or monitoring for contaminants
- determining aquifer characteristics (e.g., hydraulic conductivity testing)
- performing site remediation (e.g., injection or recovery wells)

In cases where only groundwater flow or velocities are to be determined, piezometers, cluster wells, or well points may be used.

Well Materials. Well riser pipe materials are specified by diameter, type of materials, and thickness of pipe. Well screens require an additional specification of slot size. Well specifications are presented in the Work Plan and/or site-specific QAPP.

The selection of well material depends on the method of drilling, the type of contamination expected, natural water quality, and anticipated depth. The cost may also be a consideration. The two most-commonly used materials are polyvinyl chloride (PVC) and stainless steel. PVC is generally preferred to stainless steel because it is light-weight, less expensive, non-corrosive, and generally easier to work with. However, PVC may deteriorate in the presence of

ketones, aromatics, alkyl sulfides, and some chlorinated hydrocarbons. In such cases stainless steel may be preferred.

When the aquifer is bedrock, a well screen may not be necessary (the well is simply an open hole in bedrock). Unconsolidated materials such as sands, clay, and silts, require a well screen. The screen slot size should be selected to retain 90 percent of the filter pack material or in situ aquifer material, after development (Driscoll, 1989). The gradation of the filter pack material will be selected based on the gradation of the native soils within the screened interval. A screen slot size of 0.010-inches is generally used when a screen is necessary and site conditions are not known.

The thickness of pipe depends on the strength required for the well. In general, larger diameter pipe requires greater thickness to maintain adequate strength. Similarly, driven well points require greater strength, and therefore greater thickness, than wells installed inside drilled borings.

Well Design. The well depth and diameter are tailored to the specific monitoring needs of each site and generally depends on the purpose of the monitoring system and the geologic setting. The decision concerning the depth of placement and length of the well screen is based on the following information:

- aquifer depth, thickness, and characteristics (e.g., permeability and specific yield)
- anticipated depth, thickness, and characteristics (e.g., density relative to water) of the contaminant plume
- head distribution and estimated flow in the aquifer
- fluctuation in groundwater levels

In most situations, screen lengths are 5 to 10 feet.

Standard well inside diameters are 2, 4, 6, or 8 inches. For most groundwater monitoring and sampling programs, a 2-inch ID well is preferred. Pumping tests for determining aquifer characteristics may require larger diameter wells; however, in situ hydraulic conductivity testing can be performed during drilling or after well installation in small diameter wells. Other considerations in selecting well diameters include the types and size of the sampling equipment, and any in situ instrumentation that may be used in the well.

In general, the borehole diameter should be at least 4 inches larger than the well riser pipe diameter to provide an annular space of at least 2 inches for placement of filter pack, seal, and grout or backfill.

Well Installation. Monitoring well installation details will be recorded in the field geologists' notebook and on an overburden or bedrock Monitoring Well Sheet (Figures 4-11 and 4-12).

Materials placed in the annular space between the borehole and the riser include filter pack, bentonite seal, and grout. In general, all of these materials may be installed via a tremie pipe placed in the annular space. In shallow wells, these materials may be emplaced from the ground surface, but the rationale and procedures must be described in the site-specific Work Plan and/or site-specific QAPjP.

The filter pack is usually a fine to medium uniform sand. The exact filter pack gradation should be chosen to retain approximately 60 percent of the aquifer material after well development (Driscoll, 1989). The filter pack is installed around the well screen and extending 2 to 3 feet above the top of the screen. At least 2 feet of bentonite pellets will be placed above the filter pack.

The bentonite expands by absorbing water and serves to isolate the screened interval from the rest of the annular space and the formation. If the bentonite seal is emplaced above the water table, care must be taken to adequately hydrate the pellets before proceeding with well construction. If the seal is below the water table the bentonite slurry may be tremied into place.

Grout is placed from the top of the bentonite to the ground surface. Grout generally consists of a cement-bentonite mixture or Portland cement. Grout seals minimize the possibility of surface run-off reaching the screened interval, and replaces material removed from the boring during drilling minimizing hole collapse and subsidence around the well.

In certain cases, the borehole may be drilled to a depth greater than the well installation depth. For these cases, the well is backfilled to the desired depth with bentonite and sand is placed between the bottom of the well and the bentonite.

MALCOLM PIRNIE

OVERBURDEN MONITORING WELL SHEET

WELL NO. _____

PROJECT _____ START DATE _____ END DATE _____

PROJECT NO. _____ FIELD GEOLOGIST _____

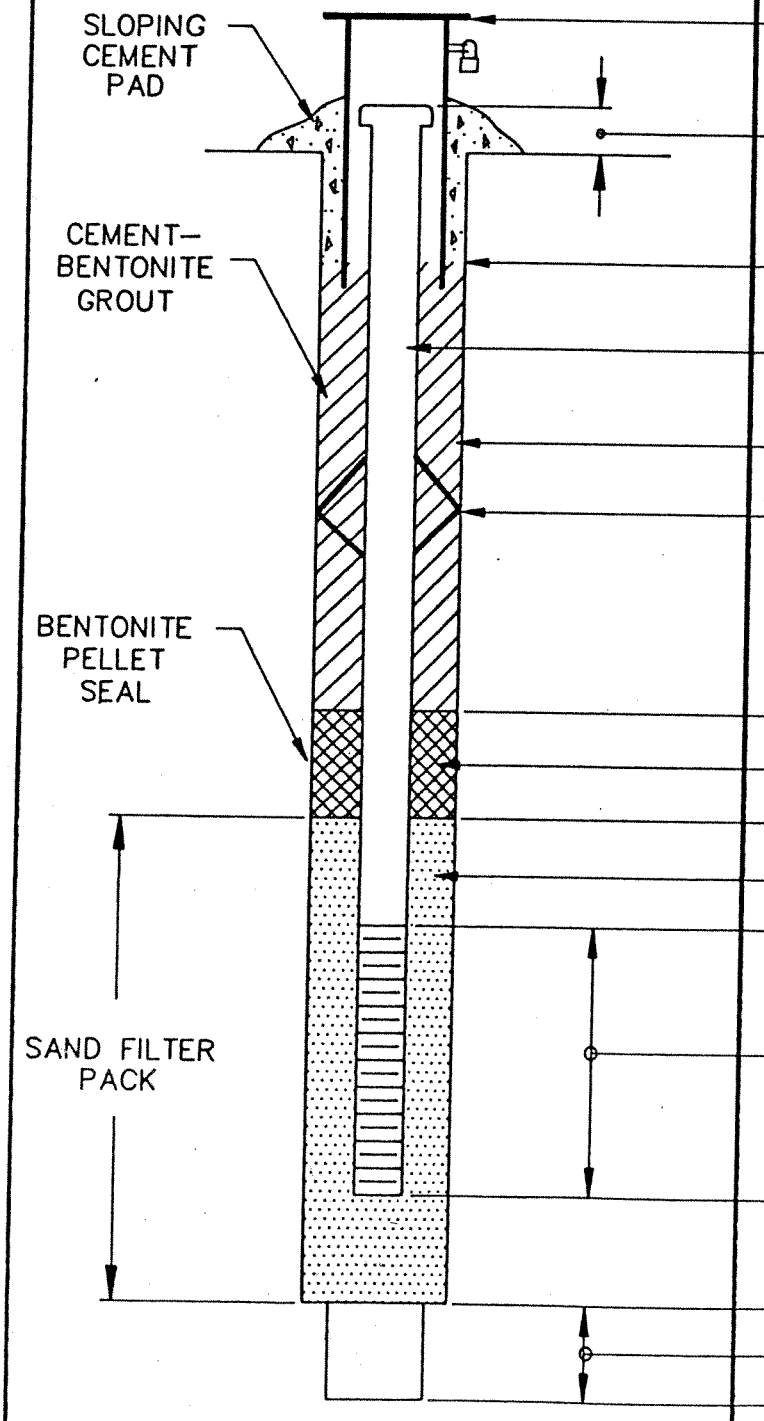
LOCATION _____

DRILLING CO. _____

DRILLER(S) _____

DRILLING METHOD(S) _____

DEVELOPMENT METHOD(S) _____



SIZE AND LENGTH OF LOCKABLE PROTECTIVE STEEL CASING _____

LOCKED? ___YES ___NO

STICK–UP _____

DEPTH TO TOP OF GROUT/ BOTTOM OF CEMENT _____

RISER DIAMETER AND MATERIAL _____

BOREHOLE DIAMETER _____

DEPTH TO CENTRALIZERS _____

_____

_____

_____

_____

DEPTH _____

PELLET SIZE _____

DEPTH _____

SAND SIZE _____

DEPTH _____

SCREEN DIAMETER, SLOT SIZE, AND MATERIAL _____

DEPTH _____

DEPTH _____

BACKFILL MATERIAL _____

BOTTOM OF BOREHOLE _____

NOTE: DEPTHS ARE FEET BELOW GRADE

Well sections and all materials coming in contact with the well must be cleaned before installation. The screen and well-riser pipe can be placed in the boring either manually or using the rig to hold the pipe, depending on the weight of the well. The pipe is lowered and sections added until desired screen depth is reached. No glues or solvent-cement will be used in well construction monitoring wells. When the screen and riser are in place, the filter pack, bentonite seal, and grout are installed using tremie pipes. The well is completed with a vented PVC cap.

When the well is completed and grouted to the surface, a protective steel casing is often placed over the top of the well. This casing generally has a hinged cap and must be able to be locked to prevent vandalism. The protective casing is larger in diameter than the well and is set over the well into the wet grout or is cemented in place. Protective casings can be above ground or flush-mounted. Above ground protective casings will have weep holes to allow drainage. Special care must be taken with flush-mounted installations to ensure that surface drainage does not enter the well. The protective casing and surface cement should extend below the frost line to prevent heaving.

Well Development. Well development is a process of pumping or purging a new monitoring well, designed to stabilize and increase the permeability of the filter pack around the well screen and to restore the permeability of the formation which may have been reduced by drilling operations. The selection of the well development method will be made by the site hydrogeologist based on the drilling methods, well construction and installation details, and the site geology. Monitoring wells should be allowed to set for a minimum of 24 hours before well development to allow for the seal and grout to set. (NYSDEC TAGM 4007). Any equipment introduced into the well will be decontaminated in accordance with the procedures presented in the HASP. Water levels will be taken from each well before and after development (NYSDEC TAGM 4007). To avoid aeration of the filter pack, the water level will not be allowed, to the extent feasible, to fall below the top of the filter pack during development.

Well development may be accomplished using one of several methods including:

- Overpumping, which uses a pump (e.g., submersible or peristaltic) or compressed air (air lift) to remove water from the well.

- Surge block which uses a plunger, the approximate diameter of the well, to agitate water in and out of the screen. No water is removed from the well.

- Compressed air which develops a well by either backwashing (forcing water out of the well and reducing pressure to let water flow back in) or surging (releasing a large volume of air suddenly into an open well below the water table producing a strong surge due to resistance of water head, friction and inertia). Water is pumped from the well using airlift.

In accordance with NYSDEC TAGM 4007, well development will continue until the pumped water has a turbidity reading of 50 NTUs or less. Field measurements of turbidity, temperature, pH, and specific conductivity will be recorded for each well volume removed. Should a well fail to achieve the required turbidity within a reasonable amount of time (to be specified in the site-specific Work Plan), field personnel will provide the field data to the site manager who will contact the NYSDEC Project Manager for guidance on how to proceed. An average of two weeks should be allowed between development and subsequent sampling or water level measurements to allow the aquifer to re-equilibrate.

Well development will be documented in the field notebook and on the Well Development Record (Figure 4-13).

4.8 TESTING

Testing activities include those field tasks that do not involve the collection of environmental samples, such as remote-sensing geophysical surveys, aquifer testing, and rock coring.

4.8.1 Geophysical Methods

Geophysical methods are remote-sensing techniques that provide information about subsurface conditions. This information is used to plan locations of explorations including, test pits, monitoring wells, and borings. The principles, instrumentation, methodology, and techniques of data evaluation of ground

New York State Department of Environmental Conservation
Field Activities Plan

Attachment E:
Generally Acceptable Procedure for Monitoring Well Development

MALCOLM PIRNIE

GENERALLY ACCEPTABLE PROCEDURE

FOR

MONITORING WELL DEVELOPMENT

INTRODUCTION

Drilling a borehole for monitoring well installation or sampling disrupts the natural alignment of soil particles in the formation adjacent to the borehole. With some drilling methods, bentonite or other fine-grained materials are added to drilling fluids to generate drilling mud, which is used to maintain an open borehole. The physical disturbance of the subsurface soils, and in some cases the use of drilling mud, affects the hydraulic conductivity of the saturated formation adjacent to the well and can create a "skin" of fine-grained material along the annulus of the borehole. The objectives of well development are to restore the natural alignment of soil particles to the extent possible, remove finer-grained particles and drilling fluids in and adjacent to the well, and ensure that water in the well is representative of formation groundwater. The appropriate development method to use will vary according to the hydraulic characteristics of the aquifer, the drilling method used, and the type of well completion. Of the various methods available for use in developing wells, mechanical surging, pumping, backwashing, and bailing are best suited for developing monitoring wells.

TECHNIQUES AND ASSOCIATED EQUIPMENT

The necessary equipment, monitoring instruments and field procedures are presented herein for four monitoring well development techniques. Since other procedures may be applicable depending on site conditions, references are provided for more complex development needs, including predevelopment techniques. Development using any of these methods should not be initiated less than 24 to 48 hours after final grouting of the monitoring well (USACE, 1998).

1. **Mechanical Surging**

   Operation of a piston-like device (surge block) in combination with periodic purging of water from the well is a very effective development method, even in stratified formations with variable hydraulic conductivity. The surge block should be constructed with rubber disks secured to stainless steel or PVC pipe with a pipe fitting on top to attach it to drill rods or HDPE tubing. The rubber discs on the surge block should be slightly smaller than the inside diameter of the well. The surge block is carefully lowered into the well and an up-and-down plunging action is used to alternately force water to flow into and out of the well, similar to a piston in a cylinder. The use of a surge block can agitate and mobilize particulates around the well screen. Periods of surging should be alternated with periods of water extraction from the well so that sediment

brought into the well is removed. Surging should initially be gentle to assure that water can come into the well and that the surge block is not so tight as to damage the well pipe or screen. For short well screens (1.6 m (5 ft) or less) in relatively homogeneous formations, the surge block does not have to be operated within the screen interval. However, if the screened interval includes materials of high and low hydraulic conductivities, the block may have to be operated gently within the screen.

Equipment needed for mechanical surging would include:

- Surge block
- HDPE pipe if drilling rig not used
- Water-level probe
- Pump or bailer for purging
- Graduated bucket or flow meter to measure volume of water removed
- Multi-parameter field instrument (at a minimum able to measure pH, specific conductance, turbidity, and temperature)

2. **Backwashing**

Backwashing is the reversal of flow through a well screen by first drawing water up through the well with a pump and then releasing the water back into the well. When supplemented with periodic purging, backwashing facilitates the removal of fine-grained materials from the formation surrounding the borehole. The well is pumped until water reaches the surface. At this point the pump is shut off, and water in the hose is drained by gravity creating a reversed flow through the well screen. At times this method can be effective; however in low hydraulic conductivity formations the flow may not be sufficient to achieve the desired results.

Equipment needed for backwashing would include:

- Water-level probe
- Pump for purging
- Tubing with no backflow preventer or check valve
- Graduated bucket or flow meter to measure volume of water removed
- Multi-parameter field instrument (at a minimum able to measure pH, specific conductance, turbidity, and temperature)

3. **Bailing**

The use of bailers is an effective way of manually developing small diameter wells that have a high static water table or are relatively shallow in depth (generally less than 20 feet). Since the diameter of the bailer is commonly close to the same diameter as the well screen, the bailer agitates the water in the well in much the same manner as a surge block. The well should be surged using the bailer for 10 to 20 minutes prior to beginning bailing. To have its most effective surging action, the bailer should be operated throughout the screened interval. Bottom loading bailers can extract sediment that has settled

to the bottom of the well by rapid short upward/down motions of the bailer at the bottom of the well.

Equipment needed for bailing would include:

- Water-level probe
- Weighted, bottom-filling bailer (sized appropriately depending on well diameter)
- Graduated bucket or flow meter to measure volume of water removed
- Multi-parameter field instrument (at a minimum able to measure pH, specific conductance, turbidity, and temperature)

4. **Overpumping**

Overpumping is a commonly used development method and consists of pumping a well at a higher rate than water will be extracted during purging or sampling events. This overpumping, however, is usually only successful in relatively non-stratified, relatively homogeneous and permeable formations. By pumping the well at a higher rate than expected during sampling, the particulates may be mobilized and removed. Overpumping should be supplemented with the use of a bottom discharge/filling bailer, (for sediment removal). During development, water should be removed throughout the entire water column in the well by periodically lowering and raising the pump intake.

A disadvantage of only pumping the well is that the smaller soil grains of the filter pack may be bridged in the screen or in the filter pack, as the direction of flow is only toward the screen. To overcome this, overpumping is often used in conjunction with backwashing or surging. This technique is probably the least effective because the well development is occurring in the most permeable zones, often near the top of the well screen (Driscoll 1986). Additionally, overpumping may actually compact finer-grained soils.

Equipment needed for overpumping would include:

- Water-level probe
- Pump for purging
- Graduated bucket or flow meter to measure volume of water removed
- Multi-parameter field instrument (at a minimum able to measure pH, specific conductance, turbidity, and temperature)

PROCEDURES

Well development can be conducted by a drilling contractor or manually by field personnel. In either case, the techniques discussed above should be used and the procedures below should be followed and documented.

1. **Preparation**

In preparation of monitoring well development:

- Coordinate site access and obtain keys to well locks.
- Obtain information on each well to be developed (i.e., drilling method, well diameter, well depth, screened interval, anticipated contaminants).
- Obtain a water level meter, a weighted tape to measure well depth, air monitoring instruments and materials for decontamination, if necessary, and water quality instrumentation capable of measuring, at a minimum, pH, specific conductivity, temperature, and turbidity.
- Assemble graduated containers for temporary storage and measurement of water removed during well development. Containers must be structurally sound, compatible with anticipated contaminants, and easy to manage in the field. The use of truck-mounted or roll-off tanks may be necessary in some cases; alternately, a portable water treatment unit (i.e., activated carbon) may be used to treat the purge water.

2. **Operation**

Development should be performed as soon as it is practical after the well is installed, but no sooner than 48 hours after well completion to allow grout to set. No water shall be added to the well to assist development without prior approval of the regulatory agency. In some cases, small amounts of potable water could be added to help develop a poor yielding well. If practicable, at least five times the amount of water added should be recovered from the well to ensure that all added water is removed from the formation.

For typical well development, a minimum of three borehole volumes of water should be removed and water quality parameters should be measured in the field until it is evident that water purged from the well is representative of formation water. A borehole volume includes the volume of the water column in the well and the volume of water in the saturated portion of the filter pack. Assume 30 percent porosity of the filter pack unless more site-specific information is available. If drilling fluids were used or lost to the formation during well installation, a minimum of five times the estimated quantity of un-recovered water should be removed in addition to the minimum three borehole volumes.

Use the attached Monitoring Well Development/Purging Log and follow these procedures to develop a monitoring well:

- Assemble necessary equipment on a plastic sheet surrounding the well.
- Record pertinent information in the site or personal logbook (client, project, personnel, date, time, location ID, weather conditions, etc.).
- Open monitoring well and measure air quality at the top of casing and in the breathing zone as appropriate.

- Measure and record depth to water and the total depth of the monitor well. Calculate the water column and borehole volume of the well. Note hard or soft bottom to indicate presence or absence of fines in the well.
- Begin development and measure the initial pH, temperature, turbidity, and specific conductivity (at a minimum) of the water and record in the site logbook. Note the initial color, clarity, and odor of the water.
- Continue to develop the well and periodically measure the water quality parameters indicated in step 5 (above). Depending on project objectives, development should proceed until these water quality parameters stabilize, or until the water has a turbidity of less than a predetermined threshold, preferably between 5 and 50 nephelometric turbidity units (NTUs). This may not be obtainable in some fine-grained formations.
- Measure and record the volume of water removed during development, either with a flow meter or a graduated container. Estimate and record the well recovery rate if water is purged during development.
- Containerize or treat water produced by development of contaminated or suspected contaminated wells. Each container must be clearly labeled with the well ID, date collected, and sampling personnel. Determination of the appropriate disposal method will be based on the analytical results from each well and regulatory requirements.
- Note the final water quality parameters in the logbook along with the following data:
  - Well designation (location ID)
  - Date(s) of well installation
  - Date(s) and time of well development
  - Static water level before and after development
  - Quantity of water removed, and initial and completion time
  - Type and capacity of pump or bailer used
  - Description of well development techniques

3. **Post-Operation**

Follow these procedures to demobilize upon completing well development:

- Decontaminate all equipment;
- Secure and label holding tanks or containers of development water; and
- Review analytical results and determine the appropriate water disposal method.

REFERENCES

Driscoll, Flecther G., 1986. *Groundwater and Wells.* Johnson Screens, pp 497-507.

U.S. Army Corps of Engineers, 1998. *Engineering and Design - Monitoring Well Design, Installation, and Documentation at Hazardous Toxic, and Radioactive Waste Sites.* Publication Number EM 1110-1-4000.

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WELL NO.:

WELL PURGING AND SAMPLING LOG

PROJECT TITLE: _____

PROJECT NO.: _____

DATE: _____ STAFF: _____

PURGE METHOD: _____

SAMPLE METHOD: _____ TIME COLLECTED: _____

PURGING and SAMPLING DATA:

1. Total Casing and Sceen Length (ft.) _____
2. Casing Internal Diameter (in.) _____
3. Water Level Below Top of Casing (ft.) _____
4. Volume of Water in Casing (gal.) _____
5. Photoionization Detector at Wellhaed (ppm) _____

(Vol = 0.0408 [(2)^2 x { (1) - (3) }])

Constants for Calculating Borehole and Well Water Volumes							
Well Diam.	1"	2"	3"	4"	5"	6"	8"
Vol. (gal/ft)	0.04	0.17	0.38	0.66	1.04	1.50	2.60

Low Flow Stabilization Criteria	
pH	+/- 0.1
Cond.	3%
Turb.	10% if > 1 NTU
DO	10%
Temp.	3%
Eh	+/- 10 mV

PARAMETER	ACCUMULATED VOLUME PURGED										
Gallons	*Initial*										
Time (24 hr. clock)											
pH (s.u.)											
Conductivity (mS/cm)											
Turbidity (NTUs)											
Dissolved Oxygen (mg/l)											
Temperature (^{0}C)											
Eh (mV)											
Depth to Water (ft.)											
Purge (Flow) Rate											
Appearance											

Notes: