■■■■■■ ***STANDARD OPERATING PROCEDURE***

DECONTAMINATION

June 2007

Environet, Inc.

PRESERVING EARTH'S RESOURCES FOR THE FUTURE

Environet
650 Iwilei Road, Suite 204
Honolulu, Hawai'i 96817

Table of Contents

Section 1 Purpose and Scope ***3***

Section 2 Procedure ***4***

2.1 Equipment List 4
2.2 Personnel Decontamination 4
2.3 Sampling Equipment Decontamination 5
2.4 Drilling and Heavy Equipment Decontamination 6
2.5 Waste Handling 6
2.6 Documentation 7

Section 3 Quality Assurance Requirements ***8***

Section 1
Purpose and Scope

This document defines the standard operating procedure (SOP) for decontamination of personnel and equipment engaged in sampling activities. This SOP serves as a supplement to the project work plan, and the project Health and Safety Plan (HSP). It is intended that these procedures described below be used together with the project work plan, the project HSP, and other SOPs.

The overall objective of the sampling program is to obtain samples that accurately characterize the chemical contamination present at the sampling site. Extraneous contaminant materials can be brought onto the sampling location and/or introduced into the medium of interest during the sampling program (e.g., by improperly cleaning the split spoon sampler between individual soil samples). Trace quantities of these contaminant materials can consequently be captured in a sample and lead to false positive analytical results, and, ultimately, to an incorrect assessment of the contaminant conditions associated with the Site. Decontamination of sampling equipment (e.g., bailers, pumps, tubing, soil and sediment sampling equipment) and field support equipment (e.g., drill rigs, vehicles) is therefore required prior to use to ensure that sampling cross-contamination is prevented, and that on-site contaminants are not carried off-site.

Section 2
Procedure

Equipment and personnel must be thoroughly decontaminated prior to entering the environmental investigation area (exclusion zone). Upon leaving the exclusion zone, all personnel and equipment must be thoroughly decontaminated. In addition, decontamination may be necessary from sample site to sample site within the exclusion zone. Proper decontamination of equipment and personnel will decrease the potential for cross contamination and reduce adverse health effects.

This procedure describes the decontamination of personnel, soil drilling and sampling equipment, monitoring well installation and sampling equipment, and tools used during field investigation activities. These procedures will remain in place unless modified by the site specific work plan or HSP.

2.1 Equipment List

The following is a list of equipment that may be needed to perform decontamination:

Plastic sheeting
Scrub brushes
Wash tubs
Buckets
Scrapers, flat blade
Hot water - high-pressure sprayer
Disposal drums (55-gallon with secure lids)
Sponges or paper towels
Alconox/Liquinox detergent (or equivalent)
Potable tap water
Laboratory-grade deionized water
Garden-type water sprayers
Isopropyl alcohol
Hand soap
Hand wipes

2.2 Personnel Decontamination

A temporary personnel decontamination line will be set up around each exclusion zone. If contamination is not encountered, a dry decontamination station may be established which consists of discarding of disposable personal protective equipment (PPE).

If real-time monitoring instruments indicates that contamination has been encountered, (i.e., action levels are exceeded requiring an upgrade from initial PPE levels), or if the initial PPE is Level B or C, a complete personnel decontamination station will be established.

The temporary decontamination line should provide space to wash and rinse boots, gloves, and all sampling or measuring equipment and a container to dispose of used disposable items such as gloves, tape, or tyvek.

The decontamination procedure for field personnel in Level B or C PPE shall include (also see the HSP):

Glove and boot wash in an Alconox solution
Glove and boot rinse
Duct tape removal
Outer glove removal
Coverall (Tyvek) removal
Respirator or self-contained breathing apparatus (SCBA) removal
Inner glove removal

2.3 Sampling Equipment Decontamination

The following steps will be used to decontaminate sampling equipment:

- Personnel will dress in suitable PPE to reduce personal exposure as required by the HSP.
- Sampling equipment will be decontaminated prior to sampling activities, between sample locations, and at the end of sampling activities.
- Gross contamination on equipment will be scraped off at the sampling site.
- Equipment that will not be damaged by water will be placed in a wash tub containing Alconox or equivalent detergent along with tap water and scrubbed with a scrub brush or similar tool.
- Equipment will be rinsed with tap water, then with isopropyl alcohol and then a final rinse with deionized/distilled water.
- Groundwater sampling pumps will be “turned on” to allow detergent, tap water, and deionized/distilled water to cycle through the pump.
- The equipment will be allowed to air dry.
- Equipment that may be damaged by water will be carefully wiped clean using a sponge and detergent water and rinsed with deionized water. Care will be taken to prevent any equipment damage.
- Rinse and detergent water will be replaced with new solutions between borings or sample locations or as determined necessary by the field manager.

Following decontamination, equipment will be placed in a clean area or on clean plastic sheeting to prevent cross contamination. If the equipment is to be transported, it will be

covered or wrapped in aluminum foil (preferred method), plastic sheeting, or heavy-duty trash bags to minimize potential airborne contamination.

The following guidelines will be followed in the field at all times to ensure sample integrity and to prevent any cross contamination of samples.

- A clean pair of disposable latex gloves will be worn each time a different location is sampled and shall be changed each time the gloves come into contact with a material that has not been properly decontaminated.
- Sample collection activities will proceed from the least contaminated area to the most contaminated area when this information is available.

2.4 Drilling and Heavy Equipment Decontamination

Drilling rigs will be decontaminated at the decontamination station. The following steps may be used to decontaminate drilling and heavy equipment:

- Personnel will dress in suitable PPE to reduce personal exposure as required by the HSP.
- Drilling and heavy equipment will be decontaminated prior to drilling, between locations, and at the end of drilling.
- Remove as much soil and debris as possible from augers and tools at the borehole or sampling location.
- Equipment that will not be damaged by water, such as drill rigs, augers, drill bits, and shovels, will be sprayed and then rinsed with potable water. Care will be taken to adequately clean the insides of the hollow-stem augers.
- If augers and tools are visibly contaminated, clean tools in large tub so that decontamination water is contained.
- During soil sampling, the split spoon sampler and sample sleeves shall be decontaminated by the field crew and not the drilling contractor.
- After cleaning, place augers and tools on plastic sheeting on the cleaned bed of the support truck or the cleaned auger rack on the drill rig.
- Any decontamination water that was generated during drilling and heavy equipment decontamination shall be placed in 55-gallon drums or other suitable storage tank and the source of the water (i.e., borehole where tools were last used) shall be marked on the drum or tank.

An alternative to the above would be to steam clean auger flights.

2.5 Waste Handling

Any waste generated during decontamination activities will be collected and handled according to the procedures outlined in the project work plan and the SOP for waste handling.

2.6 Documentation

Sampling personnel will be responsible for documenting the decontamination of sampling and drilling equipment. The documentation will be recorded with waterproof ink in the sampler's field notebook with consecutively numbered pages. The information entered in the field book concerning decontamination should include the following:

Decontamination personnel
Date and start/end times
Decontamination observations
Weather conditions

Section 3
Quality Assurance Requirements

Equipment rinsate samples will be taken of the decontaminated sampling equipment to verify the effectiveness of the decontamination procedures. The sampling procedure will include rinsing deionized water through or over a decontaminated sampling tool (such as a split spoon sampler or groundwater pump) and collecting the rinsate water into the appropriate sample bottles, which will be sent to the laboratory for analysis. The rinsate procedure, including the sample number, will be recorded in the field notebook. The frequency of rinsate sample collection and the laboratory analysis required are described in the project work plan. The handling and documentation procedures of the rinsate sample are described in the Containerizing, Preserving, Handling, and Shipping Samples SOP.

■■■■■ *STANDARD OPERATING PROCEDURE*

DRUM HANDLING

March 2001

Environet
500 Alakawa Street, Suite 202B
Honolulu, Hawaii 96817

Table of Contents

Section 1 Purpose and Scope..... 1-1

Section 2 Hazard Awareness and Regulatory Considerations..... 2-1

2.1 Hazard Awareness 2-1
2.2 Personal Protective Equipment (PPE) 2-1
2.3 Regulatory Considerations..... 2-1

Section 3 Drum Handling Procedures..... 3-1

3.1 Movement of Drums..... 3-1
3.2 Inspection of Drums..... 3-1
3.3 Spill Control During Drum Handling 3-1
3.4 Opening Drums..... 3-2
3.5 Drum Overpacking 3-2

Section 1
Purpose and Scope

This document defines the standard operating procedure (SOP) for the handling of drums (primarily 55-gallon drums) during the Johnston Island site characterization report. This SOP serves as a supplement to the Sampling and Analysis Plan (SAP) that is included in the Work Plan (WP). This document is intended to be used together with the SAP and other SOPs.

Section 2
Hazard Awareness and Regulatory Considerations

2.1 Hazard Awareness

A variety of work site activities may require unearthing, moving, lifting, overpacking, or sampling drums. Such activities are inherently hazardous and will always require special health and safety precautions. Drum handling presents numerous serious physical hazards including back injury, crushing, bruising, laceration, and severe trauma from mishandling. Drum contents may represent a fire or explosion hazard or may consist of shock-sensitive or pyrophoric materials. Drum contents may be pressurized or be acutely toxic. Contents may be corrosive or irritating or have other toxic effects. Drum handling may, therefore, represent both physical and chemical hazards.

2.2 Personal Protective Equipment (PPE)

The appropriate PPE ensemble for drum handling (and sampling) can vary significantly depending on the particular job conditions. Supplied air equipment (SCBAs or airlines) may be appropriate respiratory protection for a wide range of potential exposures. Full face air-purifying respirators may be adequate for other situations. Some drums may be safely handled without respiratory protection. The types of gloves, coveralls (coated or uncoated), boots, and other PPE can also vary based on hazard evaluation. The selection of the appropriate PPE should ultimately be performed by a Environet's Health and Safety Officer, as part of the site-specific Health and Safety Plan (HSP).

2.3 Regulatory Considerations

The primary regulation dealing with drum handling in hazardous waste operations is section (J) of 29 CFR 1910.120. These OSHA regulations are unique to hazardous waste operations and do not cover all contingencies.

Section 3
Drum Handling Procedures

3.1 Movement of Drums

The movement of full 55-gallon drums solely by hand is not recommended. Full drums should be moved with a dolly, hoist, sling, drum carrier, front end-loader, or other specialized device. A hydraulic drum grappler works well in certain applications. When drums are being moved, suspended, or overpacked, personnel should stand well clear of the drum.

3.2 Inspection of Drums

Prior to any handling, drums with unknown contents should be visually inspected for any words, symbols or labels on the drum surface which would indicate the nature of its contents. A careful inspection should also be made for signs of leakage, rusting, corrosion, or bulging. If the drum is of unusual construction or material, such as nickel or stainless steel, it may contain a particularly hazardous or sensitive material. The type of drumhead and type of bungs (if any) should be inspected. If the whole drum lid is removable, it may be designed to contain solid materials. If it has a bung (or bungs) it may be designed to contain a liquid. If the drum has a polyethylene or PVC liner, it may have been designed to contain a corrosive material. The top of the drum and the area around the bungs should be inspected for any signs of crystal formation, staining or unusual materials on the surface. An experienced drum handler may, on occasion, lightly tap the exterior of the drum or rock it very lightly to attempt to determine the level or amount of material in the drum. The drum may need to be photographed and numbered during the inspection process.

3.3 Spill Control During Drum Handling

Spills or leaks may occur during drum movement and handling. Absorbent materials (clay, oil-dry, etc.) should be readily available in sufficient quantity to absorb spilled or leaked material. Where large spills could occur, a containment berm should be constructed around the area. A special pad for drum handling (concrete, HDPE, etc.) with containment berms may be required for certain types of work. Spill control should be performed by appropriately trained personnel wearing adequate PPE. A Spill Plan should be part of the HSP.

3.4 Opening Drums

A non-sparking bung wrench should be used for removing bungs to gain access to the drum interior. An appropriately rated fire extinguisher should be on hand ready for use to control incipient fires. OSHA specifies that a "suitable shield" be placed between the employee and the drum being opened to protect the employee in case of accidental explosion. If there appears to be real danger of accidental explosion, the drum should be opened remotely. One of the best ways to do this is to use a bronze spike mounted on the end of a backhoe arm. The backhoe operator looks out through a clear explosion shield. The spike is used to punch a hole through the surface of the drum. A variety of pneumatic and hydraulic remote drum-operating devices may be available. The efficiency of their use must be evaluated on a case-by-case basis.

3.5 Drum Overpacking

Leaking fifty-five gallon drums are usually overpacked into an 85-gallon overpack drum. There are a variety of ways to perform this safely. It can be done by vertical suspension and insertion or it may be done by sliding the two drums together horizontally (laying down). If the drum to be overpacked is suspended, it must be firmly held by a scissor clamp or other positive gripping device.

Do not contact the drum with hands while it is suspended. Use a board or other device to steady or position the drum which is being overpacked. If a forklift is used, the operator must have specialized training prior to performing drum overpacking. Horizontal overpacking may be a safer technique in some cases. However, great care must be exercised to avoid back injury when pushing the overpacked drum into an upright position.

■■■■■ *STANDARD OPERATING PROCEDURE*

EMERGENCY PROCEDURES

June 2007

Environet, Inc.

PRESERVING EARTH'S RESOURCES FOR THE FUTURE

Environet
2850 Pa'a Street, Suite 212
Honolulu, Hawai'i 96819

Table of Contents

Section 1 Purpose ***.....3***

Section 2 Types of Emergencies ***.....3***

2.1 Medical Emergencies.....3
2.2 Accidents 3
2.3 Safety Equipment Problems.....4

Section 3 Advance Planning ***.....4***

Section 4 Training ***.....5***

Section 5 Medical Surveillance Information ***.....5***

Section 6 Emergency Equipment ***.....5***

Section 7 Safety Practices ***.....5***

Section 8 Documentation ***.....6***

Section 1 Purpose

The purpose of this Standard Operating Procedure is to provide guidance in preparing for contingency or emergency situations during field activities. Accidents can and do happen. However, with adequate planning and preparedness resulting consequence can be minimized or prevented.

Emergency preparedness starts with advanced planning. It requires anticipation of potential problems or hazards. Proper emergency preparedness involves use of the project health and safety plan that may address emergency situations. It involves training, site orientation of personnel, medical information of personnel, and availability of emergency equipment and services.

Section 2 Types of Emergencies

There are three major categories of emergencies that can occur during hazardous waste site investigations. They are medical emergencies, accidents, and safety equipment problems.

2.1 Medical Emergencies

Medical emergencies can be described as situations that present a significant threat to the health of personnel involved in site investigations. These can result from chemical exposures, heat stress, cold stress, and poisonous insect or snake bites. Medical emergencies must be dealt with immediately and proper care should be administered. This may be in the form of first aid and emergency hospitalization.

2.2 Accidents

Accidents can result from physical hazards on a site. These hazards can include tripping, catching, cutting, and may be associated with debris on a site or heavy equipment used in the investigation. Accidents may include:

- Broken bones;
- Burns;
- Sprains;

- Puncture wounds;
- Electrical shock; and
- Cuts by contaminated materials.

Appropriate medical attention must be provided to individuals involved in site investigations who have suffered an accident.

2.3 Safety Equipment Problems

A source of emergency may develop due to malfunction or other problem associated with safety equipment being utilized by investigative personnel. These types of problems may or may not result in emergency situations. However, safety equipment problems must be corrected before proceeding with field investigative activities. Safety problems may include:

- Leaks or tears in protective clothing;
- Failure of respiratory protective devices (SCBA, air-purifying respirators); and
- Encountering contaminants for which prescribed protective equipment may not be suitable.

Section 3 Advance Planning

Advance planning should be practiced and include assessments of potential hazards or problems that may be encountered. Emergency preparedness should be addressed in the site safety plan. It should consider:

- Hazard evaluation;
- Emergency precautions;
- Hospital/poison control centers (telephone numbers);
- Emergency transportation systems (fire, police, ambulance);
    - Emergency routes (maps, dry runs); and
    - Escape routes:
        - On-site escape (rapid evacuation to safe area)
        - Off-site escape (best means of evacuation from site).

Section 4 Training

Investigative teams should include personnel with training in first aid and CPR. Personnel should become familiar with site area, available equipment, and emergency services available.

Section 5 Medical Surveillance Information

Personnel should be aware of any special medical problems of individual team members. This may include allergies, insect stings, poison plants, penicillin, etc.

Section 6 Emergency Equipment

Provisions should be made to have appropriate emergency equipment available and in proper working condition. This equipment may include:

- First aid kits;
- Eye wash kits - fill and pressurize;
- Fire extinguisher;
- Emergency oxygen;
- Splints;
- Stretcher;
- Blankets; and
- Life vests.

Equipment should be checked before commencing site investigation activities, and defective equipment repaired or replaced before performing site investigation. Provisions should be made for redundant or back-up safety equipment.

Section 7 Safety Practices

The following safety practices should be utilized to prevent or deal with emergency situations:

1. A continuous line-of-sight should be maintained between work party downrange and personnel at the command post. Personnel stationed beyond the command post, in

order to maintain the line-of-sight with the work party, must be outfitted with appropriate protective equipment.

2. Person should be dressed to same degree as the work party in order to provide an extra man for any needed rescue effort.
3. Communications should be maintained and work party must have system for rapid and clear distress call back to command post.
4. Check to insure that all preplanning information is correct.
5. Maintain thorough knowledge of expected weather conditions. Avoid working in wet weather, electrical storms, extremely hot conditions, or extremely cold conditions.
6. Thoroughly understand tasks to be performed.
7. Thoroughly brief all team members on all aspects of the tasks.

Section 8 Documentation

Records should be maintained with regard to emergency situations. Incident/Accident Reports should be filed in the event of an incident or accident (see OP SOP-103).

■■■■■■ ***STANDARD OPERATING PROCEDURE***

FIELD EQUIPMENT CALIBRATION, OPERATION, AND MAINTENANCE

April 2010

Environet, Inc.
PRESERVING EARTH'S RESOURCES FOR THE FUTURE

650 Iwilei Road, Suite 204
Honolulu, Hawai'i 96817

This page is intentionally left blank.

Table of Contents

List of Acronyms iii

Section 1 Purpose and Scope 1-1

Section 2 Calibration Procedures 2-1

2.1 Horiba Multiparameter Probe 2-1
2.2 MiniRAE 2000 Portable VOC Monitor 2-4
2.3 GEM 2000 Gas Meter 2-5
2.4 LANDTEC GA-90 Landfill Gas Analyzer 2-7

Section 3 Operation Procedures 3-1

3.1 Horiba Multiparameter Probe 3-1
3.2 MiniRAE 2000 Portable VOC Monitor 3-1
3.3 GEM 2000 Gas Meter 3-1
3.4 LANDTEC GA-90 Landfill Gas Analyzer 3-2

Section 4 Maintenance Procedures 4-1

4.1 Horiba Multiparameter Probe 4-1
4.2 MiniRAE 2000 Portable VOC Monitor 4-2
4.3 GEM 2000 Gas Meter 4-4
4.4 LANDTEC GA-90 Landfill Gas Analyzer 4-4

Section 5 Documentation 5-1

Tables

Table 5-1: Field Equipment Calibration and Maintenance 5-3

Appendices

Appendix A: Equipment Calibration Log

Appendix B: Groundwater Sampling Log, Soil Boring Log, and Landfill Gas Monitoring Log

Appendix C: Certificate of Calibration/Equipment User Logs

This page is intentionally left blank.

List of Acronyms

%	percent
ºC	degrees Celsius
°F	degrees Fahrenheit
cc	cubic centimeter
CH_4	methane
cm	centimeter
CO_2	carbon dioxide
COND	conductivity
DEP	depth
DO	dissolved oxygen
H_2O	water
LCD	liquid crystal display
LED	light emitting diode
m	meter
mg/L	milligrams per liter
ml	milliliter
N_2	nitrogen
NTU	Nephelometric Turbidity Unit
O_2	oxygen
pH	hydrogen activity
PID	photo-ionization detector
psig	pound-force per square inch gauge
S/m	siemens per meter
SOP	standard operating procedure
TURB	turbidity
VOC	volatile organic compound
WP	Work Plan

This page is intentionally left blank.

Section 1 Purpose and Scope

This document defines the standard operating procedure (SOP) for calibrating, operating, and maintaining equipment commonly used during field investigation activities. This SOP serves as a supplement to the Work Plan (WP). This procedure is intended to be used together with the WP and other SOPs.

This page is intentionally left blank.

Section 2 Calibration Procedures

2.1 Horiba Multiparameter Probe

To obtain correct measurements, the Horiba Multiparameter Probe must be calibrated each day before performing measurements. In general, calibration is done by adjusting the probe with standard solution(s). Calibration, operation, and maintenance of the multiparameter probe should follow the manufacturer's specific instructions.

The specific calibration procedures for the Horiba Multiparameter Probe will consist of the following procedures:

Auto Calibration Method

1. Fill the calibration beaker to the marked line with hydrogen activity (pH) 4 standard solution (use the 100-4 pH standard solution manufactured by Horiba).

2. Wash the Horiba probe sensor in distilled water three times and then immerse in the pH 4 solution.

3. Press the POWER key.

4. While "AUTO" is displayed, press the CAL key in one of the measurements modes pH, conductivity (COND), turbidity (TURB), dissolved oxygen (DO), and depth (DEP). "AUTO" and "CAL" appear and the instrument enters the auto calibration mode.

5. Press the ENT key to start auto calibration. Upon completion of all the pH, COND, TURB, DO, and DEP modes, "End" will be displayed. The instrument is now calibrated.

6. Complete the calibration form, and record the time and the standard solution temperature in the field notebook. The 100-4 pH standard solution contents at 25 degrees Celsius (ºC) are as follows: pH (4.01); COND (0.449 siemens per meter (S/m)); TURB (0 Nephelometric Turbidity Unit (NTU)); DO (8.52 milligrams per liter (mg/L)); and DEP (0 meter (m)).

7. Press the MEAS key to return to the measurement mode.

Manual Calibration Method

Manual pH Calibration

1. Wash the sensor three times using distilled water, then pour pH 7 standard solution into the calibration beaker to the marked line, and immerse the sensor in it.

2. Press the POWER key.

3. While "MAN" is displayed, press the CAL key twice in the pH measurement mode.

4. Use the UP/DOWN keys to input the value for the pH 7 standard solution at the measurement temperature.

5. Press the ENT key.

6. Wash the sensor three times using distilled water, then pour pH 4 or pH 9 standard solution into the calibration beaker to the marked line, and immerse the sensor in it.

7. After the zero calibration of the pH sensor, press the CAL key to make sure that the instrument is in the manual span calibration mode.

8. Use the UP/DOWN keys to set the value for the pH 4 or pH 9 standard solution at the measurement temperature.

9. Press the ENT key. The manual span calibration starts.

10. Press the MEAS key to return to the measurement mode.

Manual Conductivity Calibration

1. Wash the conductivity sensor three times using distilled water. Completely remove the water on the sensor and calibrate the instrument in the atmosphere.

2. Press the CAL key twice in the conductivity measurement mode.

3. Use the UP/DOWN keys to set the value to 0.0.

4. Press the ENT key.

5. Wash the sensor three times using distilled water, then pour standard solution into the calibration beaker, and immerse the sensor in it.

6. After the zero calibration of the conductivity sensor, press the CAL key to make sure that the instrument is in the manual span calibration mode.

7. Use the UP/DOWN keys to set the standard solution value.

8. Press the ENT key. The manual span calibration starts.

9. Press the CAL key and use each standard solution and perform steps 1 and 4 (above) for calibration.

10. Press the MEAS key to return to the measurement mode.

Manual Turbidity Calibration

1. Wash the sensor three times using distilled water, then place some distilled water into the calibration beaker, and immerse the sensor in it.

2. Press the CAL key twice in the turbidity measurement mode.

3. Use the UP/DOWN keys to set the value to 0.0.

4. Press the ENT key.

5. Wash the sensor three times using distilled water, then pour standard solution into a calibration beaker, and immerse the sensor in it.

6. After the zero calibration of the turbidity sensor, press the CAL key to make sure that the instrument is in the manual span calibration mode.

7. Use UP/DOWN keys to set the standard solution value.

8. Press the ENT key. The manual span calibration starts.

9. Press the MEAS key to return to the measurement mode.

Manual Dissolved Oxygen Calibration

1. Wash the sensor three times with distilled water and immerse the DO sensor completely in zero calibrated liquid.

2. Press the CAL key twice in the DO measurement mode.

3. After the display has stabilized, use the UP/DOWN keys to set the value to 0.0.

4. Press the ENT key. The manual calibration starts.

5. Wash the sensors three times with distilled water and immerse the DO sensor completely in span calibrated liquid.

6. After the zero calibration of the DO sensor, press the CAL key to make sure that the instrument is in the manual span calibration mode.

7. After the display has stabilized, use the UP/DOWN keys to set the amount of saturated DO in water at the temperature.

8. Press the ENT key.

9. Press the MEAS key to return to the measurement mode.

2.2 MiniRAE 2000 Portable VOC Monitor

WARNING: *The MiniRAE 2000 Portable VOC Monitor (Model PGM 7600) is classified as to intrinsic safety for use in class I division 1, groups A, B, C, D, or non-hazardous locations only. Do NOT proceed before reading the instrument manual.*

MiniRAE 2000 Portable VOC Monitor (Model PGM 7600) is a compact monitor designed as a broadband volatile organic compound (VOC) gas monitor and data logger for work in hazardous environments. It monitors VOCs using a photo-ionization detector (PID). It gives real time measurements and activates alarm signals whenever the exposure exceeds preset limits.

Primary Calibration

Primary calibration of the MiniRAE 2000 Portable VOC Monitor (Model PGM 7600) is accomplished annually at the factory using isobutylene-in-air standard calibration gas. The MiniRAE 2000 is also programmed at the factory with default alarm limits.

Fresh Air and Span Calibration

1. Press the MODE key for one second and release to turn on the instrument. The audio buzzer will beep once and the air pump will turn on. The display will show series of information as it runs through the start up menu.
2. Then the "Ready…" message or the instantaneous reading display "0.0 ppm" is displayed.
3. Press and hold down both N/- and MODE keys for three seconds to enter programming mode.
4. The first menu item "Calibrate/Select Gas?" will be displayed.
5. Release both N/- and MODE keys simultaneously.
6. Press Y/+ key to select "Calibrate/Select Gas?"
7. Press Y/+ to select "Calibrate/Select Gas?" sub-menu "Fresh Air Cal?"
8. Make sure that the MiniRAE is connected to a fresh air source (ambient air without detectable contaminant).
9. Press Y/+ key, the display shows "Zero in Progress", followed by "Wait" and a countdown timer.
10. After a 15 second pause, the display will show the message "update data… zeroed… reading = X.X ppm…"
11. Press any key or wait about 20 seconds, the monitor will return back to the "Fresh Air Calibration?" submenu.
12. Make sure the monitor is connected to a span gas source.
13. Press the Y/+ key at the "Span Cal?" to start the calibration. The display shows the gas name and the span value of the corresponding gas.

14. The display shows, “Apply Gas Now!” Turn on the valve of the span gas supply.
15. The display shows, “Wait… 30”, with a count-down timer showing the number of remaining seconds while the monitor performs the calibration.
16. When the countdown timer reaches zero, the display shows the calibrated value. The reading should be very close to the span gas value.
17. After a span calibration is completed, the display will show the message, “Update Data Span Cal Done! Turn Off Gas”.
18. Turn off the flow of gas. Disconnect the calibration adapter from the MiniRAE 2000.
19. Press any key and it returns back to “Span Gas Cal?”
20. Press and hold the MODE key for five seconds to turn off the instrument.

2.3 GEM 2000 Gas Meter

WARNING: *The GEM 2000 is not certified as intrinsically safe. The following procedure MUST NOT be done in a confined space or where there is any chance of sparking or ignition. No smoking, exposed lighting, or other sources of ignition should be in the area. On the GEM 2000, ensure that the exhaust gas is safe, not blocked and properly vented away from you. Ensure that no leaks are present. Unless all above conditions are maintained, an explosion could occur resulting in serious injury or death.*

Primary Calibration

Primary calibration of the GEM 2000 is accomplished at the factory using a gas mixture of 50 percent (%) methane (CH_4), 35% carbon dioxide (CO_2) for CH_4 and CO_2 calibration and gas mixture of 2% oxygen (O_2), balance nitrogen (N_2) for O_2 calibration. The primary calibration is performed annually.

Daily Calibration

1. Connect the calibration gas cylinder to the pressure regulator using the same gas mixtures as the one used for primary calibration.

2. Connect the pressure regulator to a one liter Tedlar bag using 24 inches of a 1/8 inch Tygon tubing.

3. Fully open the Tedlar bag fill/sample valve, then slowly open the pressure regulator valve and allow the gas measure to flow into the Tedlar bag. Once the Tedlar bag is full, shut the valve on the pressure regulator and on the Tedlar bag.

4. Connect one end of 1/8 inch Tygon tubing to the Tedlar bag and one end to the sample inlet of GEM 2000, use 1/8 inch quick disconnect to connect tubing to GEM 2000.

5. Once the instrument is on the appropriate screen, start opening the Tedlar bag fill/sample valve slowly and follow the steps below.

Methane and Carbon Dioxide Calibration Procedure:

1. Turn the instrument on and press key 1-Menu.

2. From the main menu, scroll down to select Field Calibration.

3. Zero the CH_4 as follows:

    a. Connect a zero CH_4 gas mixture to the instrument following the setup procedure above and allow calibration gas mixture to flow slowly into the GEM inlet port by opening the Tedlar Bag fill/sample valve, you may use 2.0% O_2/balance N_2. Allow gas to flow for at least 30 seconds or until reading stabilizes.

    b. Press Calibration Menu, then Zero Channels.

    c. Press Zero CH_4.

4. Connect 50% CH_4, 35% CO_2 gas mixture to GEM 2000 following the set up procedure above and allow the calibration gas mixture to flow slowly into the GEM inlet port by opening the Tedlar Bag fill/sample valve.

5. Allow gas to flow for 30 seconds, then Span gases as follows:

    a. Press 3-Edit Target Concentrations, and then enter gas concentrations by key in percentages as three digits for each gas in the corresponding column under row S. After keying in each value press Enter.

    b. Press enter Calibration Menu, then scroll down and press Enter to select Span Channels.

    c. Press Enter to select Span CH_4 at 50%; the screen will prompt a message, "Calibration Complete".

    d. Scroll down to select Span CO_2 at 35%; the screen will prompt a message, "Calibration Complete".

    e. Scroll down to select Span O_2 at 2.0%; the screen will prompt a message, "Calibration Complete".

6. Continue allowing gas to flow into the instrument and check current readings (row R). If current reading is within ±0.5 %, repeat span calibration again.

Oxygen Calibration Procedure

1. Turn the instrument on and press key 1-Menu.

2. From the main menu, scroll down to select Field Calibration.

3. Zero the O_2 as follows:

a. Connect a zero O_2 gas mixture to the instrument following the set up procedure above and allow the calibration gas mixture to flow slowly into GEM inlet port by opening the Tedlar Bag fill/sample valve, you may use 50% CH_4, 35% CO_2, balance N_2 mixture. Allow gas to flow for at least 30 seconds or until reading stabilizes.

b. Press Calibration Menu, then Zero Channels.

c. Scroll down and press enter Zero O_2.

4. Connect 2.0% O_2/balance N_2 mixture to the GEM 2000 following the set up procedure above and allow the calibration gas mixture to flow slowly into the GEM inlet port by opening the Tedlar Bag fill/sample valve.

5. Allow gas to flow for 30 seconds, then span gases as follows:

   a. Press enter Calibration Menu, then scroll down and select Span Channels.

   b. Scroll down to select Span O_2 at 2.0%, the screen will prompt a message "Calibration Complete".

6. Continue allowing gas to flow into the instrument and check current readings (row R). If the current reading is within ±0.5% of calibration gas concentration, calibration is satisfactory.

7. If current reading is greater that ±0.5% range, repeat span calibrations again.

2.4 LANDTEC GA-90 Landfill Gas Analyzer

WARNING: *The LANDTEC GA-90 is not certified as intrinsically safe. The following procedures MUST NOT be done in a confined space such as vaults, excavations, indoors, or where there is any chance of sparking or ignition. Ensure that exhaust gas is safe, not blocked and properly vented away from you. Ensure no leaks are present. Unless all above conditions are maintained, an explosion could result causing serious injury or death.*

Primary Calibration

The GA-90 is a portable scientific field instrument that does require factory calibration using various gas mixtures in an environmental chamber at recommended six month intervals under normal landfill usage. Factory calibration has been designed to give the best possible results over a wide range of conditions; however, the instrument's accuracy can be improved in specific operating ranges by performing "field calibration." At any time, the GA-90 can be reset by returning to the "factory settings." This clears the GA-90 of any user calibration setting and restores the GA-90 to its original factory calibration.

Field Calibration

Field calibration should be performed prior to taking a series of gas or pressure readings. It is important to field calibrate the GA-90 on-site after the instrument has stabilized at working temperature. Field calibration is menu-guided and can be completed in about 10 minutes.

To perform field calibration, the following items are required:

1. gas mixture of 50% CH_4 and 35% CO_2;

2. gas mixture of 2% O_2 and 98% N_2;

3. pressure regulators for the above cylinders capable of regulating in the range of 0 to 5 pound-force per square inch gauge (psig) fitted with connectors suitable for ¼ inch Tygon tubing;

4. regulator/flow meter capable of measuring in the range of 100 to 600 cubic centimeter (cc) per minute maximum with fitting suitable for ¼ inch Tygon tubing or LANDTEC regulator which is set to deliver the required flow; and

5. interconnecting lengths of ¼ inch Tygon tubing.

Gas Calibration

1. Connect the calibration gas cylinder to the pressure regulator.

2. Connect the sample input line.

3. Connect a second 24 inches of ¼ inch Tygon tubing to the exhaust nozzle of the GA-90. Direct exhaust away from you and out of the immediate area.

4. Turn the calibration gas cylinder valve two turns.

5. If using LANDTEC regulator, no flow meter is required. Turn off cylinder valve.

6. If not using the LANDTEC regulator, adjust the regulator discharge pressure to 2 psig and the flow meter to 300 cc per minute. Pinch the gas supply hose that will attach to the GA-90. The regulator discharge pressure should not climb greater than 5 psig. Turn off the cylinder valve.

7. Turn unit on by pressing the red on/off key. The warning screen will appear for five seconds. This is a reminder that the GA-90 is not to be used in confined areas such as vaults, excavations, or indoors.

8. Press Key 0 to go to the Main Menu Screen. All GA-90 functions are accessed from the Main Menu Screen.

9. Press Key 1 “General Utilities” on the Main Menu Screen.

10. Press Key 9 “More” followed by Key 5 “Gas Calibration”.

11. There are four possible choices. The first allows a field calibration to be performed on the GA-90 for CH_4, the second for CO_2, the third for O_2, and the fourth returns the GA-90 to the original factory settings.

Methane Calibration- Zero Methane

1. Press Key 1 “CH_4 Calibration”.

2. Press Key 1 “Zero CH_4”. A CH_4 percentage will not display until the IR Bench warms up. A plus or negative sign may appear on the far left of the display. This symbol can be ignored. **Note: Do not perform this procedure in the presence of CH_4.**

3. Pressing Key 5 “Pump” turns on the GA-90 sample pump. There should be no calibration hose attached to the GA-90 during this procedure. The GA-90 will be drawing in a sample of normal air **which must be free of CH_4**. Run the pump for five minutes.

4. Press Key 1 “Zero Level”. If the “CH_4 Not Zeroed” Screen displays, return to the Gas Calibration Screen by pressing Key 0 “Exit”. Recheck that no CH_4 was present and re-zero the CH_4. If the problem persists, proceed to the Factory Settings Calibration section of this manual.

5. When the “CH_4 Zeroed OK” Screen appears, press Key 0 “Exit” to return to the CH_4 Calibration Screen. Press Key 2 “Calibrate CH_4 Span” and proceed to the next section.

Methane Calibration- Methane Span

1. Connect the ¼ inch Tygon tubing from the calibration gas regulator/flow meter to the GA-90 gas sample port. Attach, if not already attached, the Tygon tubing to the exhaust port of the GA-90. Direct the exhaust away from you and out of the immediate area.

2. Turn on the calibration gas mixture of CH_4 and CO_2. The pump does not have to be on.

3. If not using LANDTEC supplied regulator, check the calibration gas flow at 300 cc and pressure no greater than 2 psig.

4. Allow calibration gas to flow into the GA-90 for two minutes or until the instrument gas reading stabilizes. After two minutes, read the CH_4 gas concentration on the screen. It should be stable and not changing more than a few tenths of one percent at the 15% gas level, 1% at the higher gas level.

5. Press Key 1 “Enter Gas Con” and input the CH_4 concentration of the calibration gas using the keyboard. Enter the percentage as three digits (e.g., 50% CH_4 would be input as 500).

6. Press Key 0 “Exit”. A “Caution Re-Calibrate” Screen will appear. Press Key 1 “Yes” and one of two messages will appear:

a. If the "Calibration OK" Screen flashed, proceed to step seven.

b. If the "Calibration Gas Not Accepted" Screen appears, press Key 1 "Yes" and re-enter CH_4 percentage. If the calibration gas percentage is still not accepted, press Key 0 "No" and start the procedure again from zero CH_4. If the problem persists, proceed to Factory Settings Calibration section of this manual.

7. If CO_2 is to be calibrated, press Key 0 twice to return to the Gas Calibration Screen.

8. If no further calibration is required, turn off the calibration gas cylinder. Remove gas hose attached to gas sample port. Leave the exhaust port hose connected. Turn on the pump and purge the instrument with air for 60 seconds (CH_4 concentration should read 0.00%). Press Key 0 to return to Main Menu Screen.

Carbon Dioxide Calibration

1. Press Key 2 "CO_2 Calibration" on the Gas Calibration Screen.

2. Press Key 1 "Enter Gas Con". Input the CO_2 concentration of the calibration gas using the keyboard. Enter the percentage as three digits (e.g., 35% CO_2 would be input as 350). Press Key 0 "Exit".

3. Press Key 1 "Yes" on the Caution Re-Calibrate Screen. One of two messages will appear.

   a. If the "Calibration OK" screen flashed, proceed to step four.

   b. If the "Calibration Gas Not Accepted" Screen appears, press Key 1 "Yes" and re-enter the CO_2 percentage. If the screen still appears, press Key 0 "No" and start the procedure again. If the problem persists, proceed to the Factory Setting Calibration section of this manual.

4. If O_2 is to be calibrated, press Key 0 to return to the Gas Calibration Screen.

5. If no further calibration is required, turn off the calibration gas cylinder. Remove the gas hose attached to gas sample port. Leave the exhaust port hose connected. Turn on the pump and purge instrument with air for 60 seconds (CO_2 concentration should read 0.00%). Press Key 0 twice to return to Main Menu Screen.

Oxygen Calibration- Zero Oxygen

1. There are two calibration gas mixtures used for the calibration of O_2. The CH_4/CO_2 calibration gas previously used to calibrate the CH_4 and CO_2 and a second calibration gas with a mixture of O_2 and N_2 will be used to set the O_2 level.

2. Press Key 3 "O_2 Calibration" on the Gas Calibration Screen.

3. Press Key 1 "Zero O_2". Read the O_2 Gas Concentration on the screen. It should read very near to 0.00% and not change more than a few tenths of one percent.

4. Press Key 1 “Zero Level”. One of two of the following screens will appear:

    a. If the “O_2 NOT Zeroed” screen displays, return to the O_2 Calibration Screen. Recheck hose for air leaks and that the calibration gas contains no O_2. The gas used must be O_2 free. Re-zero the O_2. If the problem persists, proceed to instructions contained in the Factory Settings Calibration section of this manual.

    b. If the “O_2 Zeroed OK” Screen displays, turn off the calibration gas and remove the hose to the GA-90 from the flow regulator. Press Key 0 “Exit” to return to the O_2 Calibration Screen.

Oxygen Calibration- Oxygen Span

Note: The calibration gas used in this procedure is a mixture of O_2 and balance gas. The O_2 concentration by volume can be 2 to 5% with the remainder N_2. The instructions assume a 4% O_2/96% N_2 mixture will be used.

1. Press Key 2 “Calibrate O_2 Span” on the O_2 Calibration Screen.

2. Change the calibration gas mixture to O_2/N_2. Install the regulator/flow meter on the new calibration gas mixture. Check and adjust the gas flow to 300 cc and pressure to 2 psig if not using the LANDTEC regulator/flow meter. Turn off the gas.

3. Connect the ¼ inch Tygon tubing from the calibration gas regulator/flow meter to the GA-90 gas sample port. Attach, if not already attached, the Tygon tubing to the exhaust port of the GA-90. Direct the exhaust away from you and out of the immediate area.

4. Turn on the calibration gas mixture.

5. Check the calibration gas flow (300 cc) and pressure (2 psig) if not using the LANDTEC regulator.

6. Allow the calibration gas to flow into the GA-90 for two minutes or until the O_2 reading stabilizes. After two minutes, read the O_2 gas concentration from the screen. It should be stable and not changing more than a few tenths of one percent.

7. Press Key 1 “Enter Gas Con” and input the O_2 concentration of the calibration gas using the keyboard. Enter the percentage using three digits (e.g., 2% O_2 would be input as 020). Press Key 0 “Exit”.

8. Press Key 1 “Yes” on the Caution Re-Calibrate Screen. One of two screens will appear.

    a. If the “Calibration Gas NOT Accepted” Screen appears, press Key 1 “Yes” and enter the percentage of O_2 gas. If the screen still appears, press Key 0 “No” and return to the O_2 Calibration Menu. Start the procedure again. If the problem persists, proceed to the Factory Settings Calibration section of this manual.

b. If the "Re-Calibrated OK" Screen appears, press Key 0 "Exit" to return to the O_2 Calibration Screen. Turn off the calibration gas and remove the calibration gas hose attached to the gas sample port. Leave the exhaust port hose connected. Press Key 5 "Pump" to purge instrument with air for 60 seconds.

9. Optional Step Upper O_2 Scale Calibration-The GA-90 was just calibrated on 0 to 5% O_2 scale. The 5 to 21% scale can be calibrated using normal air. While on the O_2 Calibration Screen press Key 5 "Pump" and enter an O_2 concentration of 21.0% even though the screen will seldom reach more than 20.6%. You have just calibrated the upper O_2 scale. To exit, press Key 0 until the Main Menu screen appears.

Factory Settings Calibration

Note: This procedure eliminates the field calibration done in the above procedures. It is sometimes necessary to bring the GA-90 back to factory settings before trying to field calibrate the unit.

1. From the Gas Calibration Screen, press Key 5 "Factory Settings".

2. Press Key 1 "Yes".

3. After loading the factory setting, the CH_4 and O_2 calibration must be re-zeroed prior to use.

Section 3 Operation Procedures

3.1 Horiba Multiparameter Probe

1. After the probe is calibrated, immerse the sensor in the sample.
2. Select the measurement item. Press the MEAS key to switch measurements.
3. Record measurement data in the groundwater sampling log or store measurement data in the instrument memory.
4. After completion of measurement, turn the power to the instrument off.
5. Wash off the sensor using distilled water and then wipe off the water drops.
6. Pour about 20 milliliters (ml) distilled water in the probe cap and install it on the sensor probe.

3.2 MiniRAE 2000 Portable VOC Monitor

1. After the MiniRAE 2000 is calibrated, it is ready for immediate operation.
2. Press the MODE key for one second and release to turn on the instrument. The audio buzzer will beep once and the air pump will turn on. The display will show series of information as it runs through the start up menu.
3. Then the "Ready…" message or the instantaneous reading display "0.0 ppm" is displayed.
4. Press and hold the MODE key for five seconds to turn off the instrument.

3.3 GEM 2000 Gas Meter

1. After the GEM 2000 is calibrated, it is ready for immediate measurement.
2. Turn the instrument on. The instrument will perform a self-test sequence taking approximately 20 seconds.
3. Upon self-test completion, the instrument automatically enters the read gas levels screen.
4. Connect well sample gas outlet to GEM 2000 and allow gas to flow into the GEM inlet port by opening the well sample outlet valve.
5. Allow gas to flow for 30 seconds, then record and/or save readings.
6. To turn the instrument off, press and hold the On/Off button for 15 seconds.

3.4 LANDTEC GA-90 Landfill Gas Analyzer

1. After the LANDTEC GA-90 is calibrated, additional General Utilities functions should be addressed prior to sampling.

    a. Key 1 “Check Time/Date” to make sure the data collected is properly date stamped.

    b. Key 9 “More”, then Key 4 “Check Memory” to see if there is enough space in the GA-90 for the reading. Otherwise the memory will have to be cleared.

    c. Key 3 “Gas Alarms” if you wish to have the GA-90 alert you to unusual gas conditions.

    d. Key 7 “Battery” to check if the battery is charged.

2. The proper hoses must be connected from the GA-90 to a wellhead in order to collect data.

    a. Connect the Tygon hose to the Sampling Port to measure pressure when connected to wellhead static pressure port by tubing.

    b. Connecting to the Pressure Port measures impact pressure when connected to wellhead impact pressure port by the tubing.

    c. The Exhaust Port must be kept clear. If blocked while operating, over pressurization and damage to internal components and the case could occur.

    d. The Receptacle Port is used for battery recharging, data downloading, and temperature readings.

3. Press Key 2 on the Main Menu Screen.

4. Press Key 1 “Yes” on the Read Using ID Screen. The Enter ID Screen will display.

    a. Press Key 1 “Scroll” to scroll through ID information. Press Key 2 to select the desired ID.

    b. Press Key 2 “Manual” on the Enter ID Screen to assign each monitoring point a unique identification. This code must be eight characters long and may be a combination of letters and numbers. Typically, the landfill name or an abbreviation is used for the first four characters and one letter and three numbers for the second four characters. Enter the ID code using number and/or letter mode (Use the BLUE Key to switch between numbers and letters). For letters, press Key 1 “Cursor Up” and/or Key 6 “Cursor-Down” and enter each letter by pressing Key 0 “Enter”.

5. Once ID information has been correctly entered, press the Key 1 “Read Gas Levels”

Pressure Measurements

1. If the ID requires a pressure measurement, a screen will ask whether you wish to zero. Press Key 1 for "Yes" and remove all hoses and press any key. Ensure that the pressure indicated is 000.00 in water (H_2O). If not, zero again.

2. Once pressure is zeroed, press Key 0 "Exit". Reconnect the hose to the pressure port and press any key to continue.

3. The well or probe pressure will be shown. Press Key 1 to store this reading. The Reading Stored Screen will be shown for three seconds before returning to the previous screen. An updated pressure may be stored by repeating this step.

Gas Measurements

1. To continue to gas measurement, press Key 0. After reconnecting the hose to the sample port, press any key.

2. Press Key 5 "Pump" to turn the pump on and draw a gas sample. Allow readings on the left side of the screen to become stable (about 60 seconds) before pressing Key 6 "Store".

3. Press Key 5 "Pump" to turn the pump off.

4. Press Key 1 "LEL" to display the Lower Explosive Limit Screen. Press Key 0 "Exit" when finished.

Gas Sample Temperature and Probe Depth

1. Press Key 2 "More" to display gas sample temperature and probe depth.

2. Leading zeros must be inserted for both temperature and depth (e.g., 78 degrees Fahrenheit (°F) would be entered as 078 and 5 feet 6 inches would be entered as 00506).

3. Press Key 6 "Store" and Key 4 "ID" to advance to next programmed ID.

4. After pressing Key 4 "ID", the pump will automatically shut off if it is still on. Press Key 5 "Purge" and follow screen instructions to perform purge. You should purge after each sample.

5. Press Key 1 "Next ID" to begin with the next sample and repeat above steps. If an alternate ID needs to be located, select Key 2 "Retry" and select an alternate ID.

Read Gas-Logging Function

Six hours of automatic gas data logging is possible as long as the batteries are fully charged. The logging time interval is from five to 60 minutes. The well to be logged must have an ID already stored.

1. Connect hose to gas sample port.

2. Press Key 8 to start the logging function.

3. Input a sampling time interval of five to 60 minutes and press Key 0 to exit.

4. The next screen allows the user to select the running time for the pump. There are five choices ranging from 15 to 90 seconds. Input a time and press Key 0 to exit.

5. To end logging, press Key 0 “Stop Logging”.

Section 4 Maintenance Procedures

4.1 Horiba Multiparameter Probe

Sensor Probe

After use, wash with distilled water and wipe off all contamination. Pour about 20 ml of distilled water into the probe cap, install it on the sensor probe, and store in the carrying case.

In order to use the instrument regularly for a long time, store it after wiping off all contamination from the cable, sensor probe, and sensors.

TEMP/COND/TURB Unit

1. To remove contamination, remove the lid from the cell.

2. Clean the unit in distilled water. If the unit is severely contaminated, use an absorbent cotton to remove contamination.

3. Attach the lid to the cell block before storage.

pH/ORP Sensor

To remove contamination, use a piece of gauze dampened with detergent and wipe off the contamination.

For long-term storage, remove the sensor from the sensor probe and check that the internal solution replenishment port is closed. Then, attach a seal to the liquid junction and attach the rubber caps before storage.

For monthly maintenance, replace the internal solution as described below:

1. remove the sensor from the sensor probe using a sensor spanner;

2. open the internal solution replenishment rubber stopper and remove the internal solution with a syringe;

3. inject new internal solution to the level near the rubber stopper. Be careful to avoid air bubbles from coming in the solution; and

4. attach the sensor to the sensor probe.

DO Sensor

To remove contamination, wipe off contamination with gauze to avoid damage to the diaphragm.

For long-term storage, remove the DO sensor from the sensor probe using a sensor spanner. Set the supplied short socket and store the sensor in a cool (0 to 10 ºC), dark place.

To replace the diaphragm:

1. Cut a diaphragm sheet to about 3 x 3 centimeters (cm) in size. Do not get any fingerprints or dust on the center part of the square.

2. Detach the DO sensor from the sensor probe.

3. Detach the protection tube that holds the diaphragm in place.

4. Detach the diaphragm retaining ring and diaphragm. Replace the diaphragm retaining ring and diaphragm if damaged or no longer functional.

5. Set the sensor in the replacement stand and fill the internal solution with the attached syringe until the sensor tip is soaked with the solution.

6. Fit the diaphragm retaining ring into the diaphragm retaining plate. Then, lay the diaphragm over the sensor and carefully cover with the ring and plate so that the diaphragm does not wrinkle. Finally, remove the retaining plate.

7. Cut the draped edge of the diaphragm to the shape of the sensor.

8. Check that there are no bubbles inside the sensor and tighten the protection tube securely.

9. Check that the diaphragm is tightly attached and that it is not wrinkled.

4.2 MiniRAE 2000 Portable VOC Monitor

Battery Charging and Replacement

Recharge the MiniRAE 2000 before and after fieldwork. A fully charged battery runs a MiniRAE 2000 monitor for 10 hours continuously. The charging time is less than 10 hours for a fully discharged battery. The battery may be replaced in the field (in an area known to be non-hazardous) if required.

Replacing Battery Pack

1. Turn off the power of the MiniRAE 2000.

2. Unscrew the two battery compartment screws located on the bottom of the monitor and remove the cover.

3. Remove the battery pack from the compartment.

4. Replace with a fully charged spare battery pack inside the battery compartment. Make sure the battery pack is oriented properly inside the compartment.

5. Close the battery cover and tighten the two screws.

Replacing Alkaline Battery Adapter

1. Insert four fresh "AA" size alkaline batteries into the alkaline battery holder. Make sure that the polarity of the batteries is correct.

2. Follow the same procedure as described above to replace the battery holder.

Note: The internal charging circuit is designed to prevent charging to alkaline batteries.

PID Sensor and Lamp Cleaning/Replacement

Note: Normally the cleaning procedure is not needed. Clean the PID sensor module, the lamp, and the lamp housing only when one of the following happened:

1. the reading is inaccurate even after calibration;

2. the reading is very sensitive to air moisture; or

3. a chemical liquid has entered into the unit and damaged the unit.

Use of the water trap filter will help prevent contamination.

To access the sensor components and lamp, gently unscrew the lamp-housing cap. Remove the sensor adapter with the gas inlet probe and the metal filter together. Then, hold the PID sensor and pull straight out to avoid bending the electrical pins on the sensor. A slight gentle rocking motion helps to release the sensor.

To Clean the PID Sensor:

1. Place the entire PID sensor module into analytical grade methanol.

2. Dry the sensor thoroughly. ***Never touch the electrodes of the sensor by hand.***

3. Use a methanol-soaked cotton swab to wipe off the lamp housing where it contacts the sensor when the sensor is installed.

4. Turn over the sensor so that the pins point out and up and the sensor cavity is visible. Examine the sensor electrodes for any corrosion, damage, or bending out of alignment. The metal sensor electrode "fingers" should be flat and straight. If necessary, carefully bend the sensor fingers to ensure that they do not touch the Teflon portions and that they are parallel to each other. Make sure that the nuts on the sensor pins are snug but not over tight. If the sensor is corroded or otherwise damaged, it should be replaced.

4.3 GEM 2000 Gas Meter

Battery/Charging

The battery used in the GEM 2000 is a Nickel Metal Hydride manufactured as an encapsulated pack from six individual cells. This type of battery is not susceptible to "memory effects" although it is not recommended that the unit be given short-term charges. When the flashing light emitting diode (LED) indicates "Charging Complete", disconnect the charger.

The battery charger indicates when the unit is charging, charged, or if there is a fault. A full charge should take approximately two hours.

Taking Probe Readings

Prior to going to the test site, ensure:

- the water trap has a clean and dry filter;
- the inlet-port particulate filter is clean and dry;
- a supply of spare filters is available;
- the battery has a good charge;
- the CH_4, CO_2, and O_2 readings have been auto-zeroed, without gas concentration present; and
- check the span calibration with a known concentration calibration gas.

Travel to the site with the instrument in the vehicle's interior – not in the trunk or truck bed, where it may be subjected to extremes of temperature and possible shock damage. This may cause erroneous readings.

When moving around the site, protect the instrument from strong direct sunlight, heavy rain, or wind-chill. Strong direct sunlight can raise the temperature of the instrument beyond its operating range. If this occurs, the liquid crystal display (LCD) will appear almost black and the contrast setting cannot alter the contrast.

4.4 LANDTEC GA-90 Landfill Gas Analyzer

Battery/Charging

The internal battery pack of the GA-90 is designed to be recharged many times but as with all nickel-cadmium cells, certain rules should be observed or the batteries will not provide their full power or charge cycles.

1. Discharge the batteries by setting logging function for a five minute interval and pump running to 90 seconds. The unit will run until batteries are discharged.

2. Charge batteries for at least 14 hours. LANDTEC chargers will not over charge batteries.

3. Never try to operate the GA-90 while batteries are charging.

4. When charging the battery overnight, lay the GA-90 flat or stand upright.

5. If the unit is to be stored for a long period, charge the internal batteries prior to storage. Re-charge the unit every two months during storage and store flat or the O_2 sensor may ultimately dry out. This condition can be corrected with normal use.

Battery Shut-Off

A circuit within the GA-90 continuously monitors the battery voltage. If the battery voltage falls below a predetermined level, the unit will automatically shut itself off in order to prevent memory loss. If the unit shuts itself off, the unit requires a full charge of 14 hours to restore the battery to its maximum level.

Battery Low Symbol

When the battery voltage drops below 60% capacity, a Battery Symbol will appear on the top right corner of the display screen. Approximately two hours of full pump power remain when the symbol is displayed.

Automatic Power-Off

The GA-90 has an automatic power-off time to conserve battery power. If no key is pressed for 15 minutes, the unit will automatically switch itself off (no stored readings will be lost).

Emergency Battery Power

In emergencies, the GA-90 may be operated with six "C" sized alkaline batteries. To use alkaline cells, remove the nickel-cadmium battery pack by using a Phillips screw driver on the back battery compartment and insert the "C" cells. DO NOT use the battery charger in conjunction with standard alkaline batteries. They can explode if re-charged.

Cleaning

The polycarbonate membrane panel may be wiped clean with soapy water and a damp cloth if required.

Dust Caps

Always keep the protective dust caps in place when ports and connectors are not in use.

Filters

The unit is equipped with two filters. One filter is in-line in the sample hose and can be easily accessed by unscrewing the filter holder. The second filter is located just inside the sample port inlet. This filter can be accessed by unscrewing (counter-clockwise) the port using a screwdriver or small coin. Inspection/replacement instructions are as follows:

1. Both filters are sealed with o-rings. Periodically inspect the o-rings to check their condition. Replace the o-rings when they become nicked, cut, swelled, or otherwise damaged. DO NOT OVERTIGHTEN O-RINGS.

2. Replace the filter when the sample pump has difficulty drawing a sample of gas into the unit or a "Flow Fail" message appears on the screen and a continuous audible warning is heard.

Storage and Travel

1. Store the GA-90 in its protective hard case when taking it from site to site.

2. When in use, keep the GA-90 in its protective soft case.

3. The unit should not be left out in direct sunlight for long periods of time as this will raise the temperature inside the case which could cause damage to components. The GA-90 may not operate or may operate erratically if it gets too hot. Let it cool before trying to use.

Section 5 Documentation

The Field Team Leader and Site Health and Safety Officer will review calibration and maintenance records on a regular basis to ensure that required maintenance is being performed. These activities will be recorded in the field logbook to document that established calibration and maintenance procedures have been followed. Entries made on the equipment calibration log regarding the status of any field equipment will contain, but are not necessarily limited to, the following information:

- date and time of calibration;
- name of person conducting the calibration;
- type of equipment being serviced, and identification number (such as serial number);
- reference standard used for calibration (such as pH buffer solutions);
- calibration and/or maintenance procedure used; and
- other pertinent information.

Field instruments will be checked and calibrated prior to their use on site, and batteries will be charged and checked daily where applicable. Equipment that fails calibration and/or becomes otherwise inoperable during the field investigation will be removed from service and segregated to prevent inadvertent use. Such equipment will be properly tagged to indicate that it should not be used until the nature of the problem can be determined. Equipment requiring repair or recalibration must be approved for use by the Site Manager or Site Health and Safety Officer prior to placement back into service. Equipment that cannot be repaired or recalibrated will be replaced.

All field instruments will be properly protected against inclement weather conditions during the field investigation. Each instrument is specially designed to maintain its operating integrity during variable temperature ranges that are representative of ranges that will be encountered during expected working conditions. At the end of each working day, all field equipment will be taken out of the field and placed in a dry room for overnight storage.

This page is intentionally left blank.

Table 5-1: Field Equipment Calibration and Maintenance

Equipment	Calibration Procedure	Calibration Frequency	Maintenance Procedure
Horiba U22 Multiparameter Probe	Two-point calibrate instrument. Auto calibrate instrument.	Every six months. Before each day's use.	Wash probe after every measurement. Replace ORP/pH sensor internal fluid monthly. Replace DO diaphragm as needed. Check battery charge and replace if necessary.
MiniRAE 2000	Factory calibrate instrument. Calibrate using 100 ppm isobutylene.	Annually. Before each day's use.	Charge battery daily.
GEM 2000	Factory calibrate instrument. Calibrate instrument using standard gas mixtures.	Annually. Before each day's use.	Charge battery daily.
LANDTEC GA-90	Factory calibrate instrument. Calibrate instrument using calibration gases.	Every six months. Before each day’s use.	Charge battery daily. Replace filters and o-rings as necessary.

Appendix A: Equipment Calibration Log

Equipment Calibration Log

Project Name: _____ **Project No**. _____

DATE	TIME	INITIALS	INSTRUMENT	CALIBRATION SOLUTION OR GAS CONCENTRATION	ADJUSTMENTS REQUIRED AND COMMENTS

Appendix B: Groundwater Sampling Log, Soil Boring Log, and Landfill Gas Monitoring Log

GROUNDWATER SAMPLING LOG

WELL ID: _____ LOCATION: _____ PROJECT NO: _____

INITIAL WATER LEVEL: _____ DATE: _____ TIME: _____

TOTAL DEPTH OF WELL: _____ PERSONNEL INVOLVED: _____

LENGTH OF SATURATED ZONE: _____ WEATHER CONDITIONS: _____

VOLUME OF WATER TO BE REMOVED: _____ METHOD OF REMOVAL: _____

WATER LEVEL AFTER PURGING: _____ PUMPING RATE: _____

WELL PURGE DATA:

TIME	VOLUME REMOVED	pH	COND (mS/cm)	TURBIDITY (NTU)	DO (mg/l)	TEMP (^{o}C)	SALINITY (%)	REDOX (ORP) (mV)

SAMPLE RETRIEVAL METHOD: _____

SAMPLE ID: _____

SAMPLE COLLECTION TIME: _____

SAMPLED BY: _____

APPEARANCE OF SAMPLE:

COLOR _____

TURBIDITY _____

SEDIMENT _____

OTHER _____

COMMENTS AND OBSERVATIONS: _____

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES: _____

NUMBER AND TYPES OF SAMPLE CONTAINERS FILLED: _____

DECONTAMINATION PROCEDURES: _____

SAMPLES DELIVERED TO: _____ TRANSPORTERS: _____

SAMPLE DELIVERY DATE: _____ SAMPLE DELIVERY TIME: _____

CAPACITY OF CASING (GALLONS/LINEAR FOOT)
2"-0.16; 4"-0.65; 6"-1.47; 8"-2.61; 10"-4.08; 12"-5.87

SOIL BORING LOG

Project Name:		**BORING:**	
Project Number:		**SHEET:**	_____of _____
Date:	Drilled By:	Rig Type:	
Logged By:	Sampling Method:	Hammer Weight (lb):	
Total Depth (ft):	Sampling Equipment:	Hammer Drop (in):	
Water Depth (f During Drilling _____	Hours After	_____ Hours After	
Northing (ft):	Easting (ft):	Elevation (ft):	
Borehole Backfill:	Comments:		

Depth (feet)	Samples: Type	Samples: Number	Sampling Resistance	Recovery	PID Reading (ppm)	Graphic Log	Material Description	Notes

Notes: Sample Types: B = Bulk, CAL = California Spoon, GEO = Geoprobe, SS = Split Spoon
T = trace, S = slight, M = moderate, H = highly, ft = feet, ppm = parts per million
NA = not applicable, NE = not encountered, PID = photoionization detector

Landfill Gas Monitoring Log

Project Name: _____

Project No.: _____ Instrument Type/No.: _____

Date: _____ Calibration Date: _____

Sampler: _____ Ambient Air Readings:

CH_4: _____

CO_2: _____

O_2: _____

Hg: _____

Gas Vent/Probe No.	CH_4[1]	CO_2[1]	O_2[1]	Pressure (mmHg)		% LEL[2]	Sample Time	Remarks
Gas Vents:				***Closed***	***Open***			
GV-01								
GV-02								
GV-03								
GV-04								
GV-05								
GV-06								
GV-07								
GV-08								
GV-09								
Gas Probes:								
GP-01								
GP-02								
GP-03								
GP-04								
GP-05								
Office Structure:								

Notes:

[1]Gas concentrations are shown as percent volume

[2]LEL = lower explosive limit which is 5% by volume for methane (CH_4)

Comments: _____

Appendix C: Certificate of Calibration/Equipment User Logs

Certificate of Calibration/Equipment User Log

Instrument Name: LANDTEC GA-90 Landfill Gas Analyzer

CERTIFICATE OF CALIBRATION

Date Calibrated	Expiration	Comments
29-Jan-10	29-Jul-10	

EQUIPMENT USER LOG

User Name	Date Out	Date Returned	Comments

Certificate of Calibration/Equipment User Log

Instrument Name: MiniRAE 2000 Portable VOC Monitor

CERTIFICATE OF CALIBRATION

Date Calibrated	Expiration	Comments
27-Feb-10	27-Feb-10	

EQUIPMENT USER LOG

User Name	Date Out	Date Returned	Comments

Certificate of Calibration/Equipment User Log

Instrument Name: GEM 2000 Gas Meter

CERTIFICATE OF CALIBRATION

Date Calibrated	Expiration	Comments

EQUIPMENT USER LOG

User Name	Date Out	Date Returned	Comments

Certificate of Calibration/Equipment User Log

Instrument Name: Horiba Multiparameter Probe

CERTIFICATE OF CALIBRATION

Date Calibrated	Expiration	Comments

EQUIPMENT USER LOG

User Name	**Date** Out	**Date** Returned	Comments

Standard Operating Procedures for Soil Vapor Sampling
Red Hill Bulk Fuel Storage Facility
FISC, Pearl Harbor

I. Equipment Needed
   a. Extension cord
   b. Electric pump
   c. 15/16 Socket and ratchet drive
   d. PPBRAE Plus Photo-Ionization Detector (PID)
   e. 10 PPM Isobutylene
   f. Vacuum chamber
   g. Dedicated field notebook
   h. Field forms
   i. Box of nitrile gloves
   j. Ear protection
   k. Flashlight

II. Set up Procedures
   a. Calibrate PPBRAE Plus
      i. Zero cal the PPBRAE Plus outside of the tunnel by attaching the glass VOC zeroing tube and the tube adapter directly onto the PPBRAE probe
         1. Zero tube is single use (THROW AWAY AFTER SINGLE USE)
      ii. Span cal with 10 PPM Isobutylene
      iii. DO NOT attach the plastic filter until after the PID has been calibrated
      iv. Check difference in readings after attaching the plastic filter. If the filter is used it may raise the ambient readings significantly. If so, change the filter to a new one.
   b. Place all equipment right next to the well being tested
   c. Connect the extension cord to the 120V outlet (usually located on the second steel post down from each tank, except 15 and 20)
   d. Run the cord and attach it to the pump
   e. Open the well cover with the 15/16 socket and ratchet drive (place the cover and bolts at a convenient location out of the way)
   f. Take the ziplock bags out of the well compartment, and place them conveniently to the side
   g. Identify the deep, medium, and shallow probes using the reflective tags attached, or the color coded tape (white=deep; blue=mid; orange=shallow)

III. Sampling Procedures
   a. Purging
      i. Connect the purge tube to the intake nozzle on the pump
      ii. Open the valve by making it parallel to the rest of the apparatus
      iii. Turn on the pump, and purge for 5 minutes (record purge time!)
   b. While purging
      i. Identify the appropriate ziplock with the dedicated tedlar bag and tygon tubing inside, and take them out (white=deep; blue=mid; orange=shallow)
      ii. Place the tedlar bag inside the vacuum chamber
      iii. Attach the tygon tube to the vacuum chamber (note: take the metal ferrals off the tube before inserting the nut, then place them back on again, and attach)

iv. Connect the tygon tube to the tedlar bag inside the vacuum chamber then open the bag's valve **no more than one rotation**
v. Take the appropriate tube from inside the vacuum chamber and snap on the white plastic tip to the outside of the chamber

c. Taking Samples
i. Once purging is complete turn off the pump then detach the purge tube from the pump and replace it with the open end of the tube on the vacuum chamber
ii. Insert the open end of the tygon tube into the purge tube
iii. Be sure the bag valve and purge valves are open, and close the vacuum chamber
iv. Start the pump and cover the compression hole to fill the tedlar bag.
v. Observe the bag to prevent overfilling
vi. Once the bag is full open the vacuum chamber, close the bag's valve, then turn off the pump (if air is escaping from bag when lid is opened then try again, however, only partially cover the compression hole to relieve the pressure in the chamber while vapors are slowly collected in the tedlar bag)
vii. Detach the tedlar bag and reattach it to the PID
viii. Be sure the PID is on survey mode, open the bag valve and begin testing
ix. **Once numbers begin to appear** on the PID screen take readings every 10 seconds for 30 seconds.
x. Once the 30 seconds is up press "MODE" then "Y" to stop
xi. The average will be taken from the 3 noted values, and the peak from the PID
xii. Place the PID back on survey mode

d. Close the purge valve and begin purging the next probe
e. While purging
i. Deflate and close the tedlar bag valve then return it to the ziplock bag
ii. Detach the tygon tube and return it to the ziplock bag
iii. Begin preparations for the next sample with the appropriate dedicated tygon tubing and tedlar bags
iv. Continue this process until all points at the location has been tested

IV. Tear down Procedures
a. Make sure all valves are closed and bags are deflated before returning them back into the well compartment
b. Close all purge valves then secure the well cover
c. Unplug the pump and prepare the extension cord for the next location
d. Be sure to test the PID in the main tunnel between each location, record background levels (if it reads more than typical background for the day, change the plastic filter)

■■■■■■ *STANDARD OPERATING PROCEDURE*

GROUNDWATER SAMPLING

June 2007

Environet, Inc.
PRESERVING EARTH'S RESOURCES FOR THE FUTURE

2850 Pa'a Street, Suite 212
Honolulu, Hawai'i 96819

Table of Contents

Section 1 Purpose and Scope ***3***

Section 2 Procedures ***4***

2.1 Equipment List 4
2.2 Monitoring Well Purging 4
2.2.1 Low-flow Purging 5
2.2.2 Non Low-flow Purging 5
2.2.3 General Purging Procedures 5
2.3 Groundwater Sample Collection 6
2.3.1 General Sample Collection Procedures 6
2.4 Sample Management 7

List of Attachments

Attachment 1 ***Groundwater Sampling Log***
Attachment 2 ***Chain of Custody Form***

Section 1
Purpose and Scope

This document defines the standard operating procedure (SOP) for collecting groundwater samples from groundwater monitoring wells. This SOP serves as a supplement to the procedures described in the project work plan. The procedures described in this SOP are intended to be detailed enough so personnel following these procedures will collect representative samples. The sample locations and frequency of collection are specified in the project work plan. Groundwater sample collection will be conducted in accordance with this SOP and applicable requirements of equipment operation and maintenance (O&M) manuals and the project health and safety plan (HSP). These procedures are intended to be used together with the project work plan and other SOPs.

Section 2
Procedures

Groundwater samples will be collected using hand bailers or low-flow pump.

2.1 Equipment List

The following is a list of equipment that may be needed to perform groundwater sampling. Other items may be added as field conditions warrant or as determined by the field manager.

- Health and safety monitoring equipment and personal protective equipment (as specified in the HSP
- Water level indicator
- Water quality kit
- Sample containers, preferably already containing appropriate preservatives
- Sample labels
- Indelible marker
- Groundwater sampling log (see Attachment 1)
- Chain of custody form (see Attachment 2)
- Disposable latex or nitrile gloves
- Purge water storage containers
- Paint marker
- Ice cooler with ice
- Ziploc type re-sealable plastic bags
- Hand tools (wrenches, utility knife, etc.)

In addition, the following equipment may be required depending upon the methodology employed to obtain the sample:

- Teflon or disposable polyvinyl chloride (PVC) bailers, verify diameter of well to be sampled
- Nylon twine or monofilament (e.g., fishing line)
- Pump; electrical, pneumatic, or peristaltic
- Pump discharge tubing
- Power source for pump
- Decontamination equipment

2.2 Monitoring Well Purging

All monitoring wells shall be purged prior to sample collection. The period between purging and sample collection shall not be greater than 24 hours. If a newly installed monitoring well

is to be sampled, than purging will not occur until 24 hours after the well has been installed and developed. The volume of water to be removed from each well during purging will depend on the purging and sample collection method.

2.2.1 Low-flow Purging

Low-flow purging, is an EPA-approved method of collecting groundwater samples that is an alternative to the industry-standard of purging three casing volumes. Low-flow purging has several benefits over the traditional method, including the following:

- Low-flow purging minimizes disturbance of sediment particles in the well, leading to less turbid samples;
- Low-flow purging minimizes aeration of the samples, improving the quality and representativeness of volatile organic compound (VOC) analysis;
- The volume of purge water is generally significantly reduced when utilizing low-flow purging techniques, saving costs associated with transport, treatment, and disposal of purge water.

This purging method requires that groundwater be purged at approximately one liter/minute or less (varies slightly depending upon the aquifer) so that drawdown of the well water level is 0.3 feet or less. Purging is considered complete when successive water quality parameter measurements (minimum of three) have stabilized to within ten percent. Water quality parameters to be measured include: conductance, dissolved oxygen, pH, salinity, temperature, and turbidity. Purging will continue until water quality parameters have stabilized.

2.2.2 Non Low-flow Purging

If methods other than low-flow are used, than a minimum of three (3) times the submerged monitoring well casing volume of water will be removed during purging, and purging will be considered complete when successive water quality parameter measurements (minimum of three) have stabilized to within ten percent.

2.2.3 General Purging Procedures

The following are monitoring well purging procedures, all measurements, calculations and observations shall be recorded on the Groundwater Sampling Log:

- All field personnel shall wear the appropriate level of personal protective equipment (PPE) during purging.
- Decontaminate all non-dedicated equipment that will be inserted into the monitoring well.
- Measure the depth to groundwater (relative to a fixed reference point) before purging.

- Calculate the minimum volume of groundwater to be removed based on the well diameter, total depth of the well, and the depth to groundwater measurement.
- Purge groundwater by bailing or pumping, place purged water into a suitable container or discharge to an approved location.
- Collect water quality parameter measurements at a rate of about one for every 10 percent of the minimum required volume to be removed (e.g., one measurement every 3 gallons if the minimum volume to be removed is 30 gallons).
- Continue purging until the water quality parameters have stabilized and the minimum required volume has been removed.
- Label the purge water storage container with the following information using a paint marker:
  - Location or project identification
  - Source identification (e.g. monitoring well identification number)
  - The words "Purge Water"
  - Date of generation

During well purging, water quality parameter measurements and sample collection, minimize splashing and spillage of groundwater. Secure purge water container(s) after sample collection has been completed in an approved temporary storage location.

2.3 Groundwater Sample Collection

Groundwater sample collection shall be conducted in the following sequence:

- Volatile organic compounds (VOC) analyses samples (e.g., TPH gas, BTEX)
- Total petroleum hydrocarbon (TPH) analysis samples (except gasoline fraction)
- Semivolatile organic compounds (SVOC) analyses samples
- Other organic analyses samples
- Inorganic analyses samples

VOC samples shall be collected into volatile organic analysis (VOA) vials with Teflon lined caps. Place sufficient quantity of sample into to the VOA vials so that the liquid crowns above the top of the vial opening. Slowly screw the Teflon lined cap into place, the cap should bulge slightly. Turn the vial upside down and tap vigorously and observe for air bubbles in the vial. There shall be no air bubbles in the VOA vial. Repeat sample collection procedure if air bubbles are observed.

2.3.1 General Sample Collection Procedures

All field personnel shall wear the appropriate level of PPE during sample collection.

When using a low-flow pump, groundwater shall be collected from the end of the sample tubing directly into the appropriate sample container. Do not place the sample tubing into the sample container. Be cautious not to over fill the sample containers.

When using bailers, lower and raise the bailer slowly, especially within the water column, to minimize disturbance of the groundwater. Groundwater shall be transferred into appropriate sample containers from the bottom end of the bailer, not poured from the top, using a sample filling tube (usually a short tube supplied with the bailer that has diagonally cut openings). Utilize VOC sample dispenser when available (usually an adapter that fits onto the end of a bailer that has a small diameter discharge tube).

2.4 Sample Management

After all of the required sample containers have been filled, the containers shall be labeled individually. At a minimum, the following information will be record on the sample container label:

- Project identification
- Monitoring well identification
- Unique sample identification number
- Sample collection date
- Sample collection time
- Initial(s) of person(s) collecting sample
- Required laboratory analyses
- Sample preservative

The same information shall also be recorded in a field note book.

The sample containers should be placed into individual Ziploc type re-sealable plastic bags, then into an insulated cooler with ice for preservation. In the case of VOA vials, all vials for a particular sample (usually 3 to 5) can be placed into the same bag. The samples shall be maintained at 2° - 4° C until delivery to the laboratory.

The samples shall be managed under chain of custody documentation from collection to receipt by the analytical laboratory. Chain of custody means the sample are under direct observation by project personnel at all times or under lock and key with the person who has custody holding the only key. Chain of custody documentation shall be completed by the field manager.

Attachments

GROUNDWATER SAMPLING LOG

WELL ID:_____ LOCATION:_____ PROJECT NO:_____

INITIAL WATER LEVEL:_____ DATE:_____ TIME:_____

TOTAL DEPTH OF WELL:_____ PERSONNEL INVOLVED:_____

LENGTH OF SATURATED ZONE:_____ WEATHER CONDITIONS:_____

VOLUME OF WATER TO BE REMOVED:_____ METHOD OF REMOVAL:_____

WATER LEVEL AFTER PURGING:_____

WELL PURGE DATA:

TIME	VOLUME REMOVED	pH	COND (mS/cm)	TURBIDITY (NTU)	DO (mg/l)	TEMP (°C)	SALINITY (%)

SAMPLE RETRIEVAL METHOD:_____ APPEARANCE OF SAMPLE:_____

COLOR:_____

SAMPLE ID:_____ TURBIDITY:_____

SAMPLE COLLECTION TIME:_____ SEDIMENT:_____

OTHER:_____

COMMENTS AND OBSERVATIONS:_____

NUMBER AND TYPES OF SAMPLE CONTAINERS FILLED:_____

DECONTAMINATION PROCEDURES:_____

SAMPLES DELIVERED TO:_____ TRANSPORTERS:_____

SAMPLE DELIVERY DATE:_____ SAMPLE DELIVERY TIME:_____

CAPACITY OF CASING (GALLONS/LINEAR FOOT)
2"-0.16; 4"-0.65; 6"-1.47; 8"-2.61; 10"-4.08; 12"-5.87

■■■■■■ ***STANDARD OPERATING PROCEDURE***

HEARING CONSERVATION

June 2007

Environet, Inc.

PRESERVING EARTH'S RESOURCES FOR THE FUTURE

Environet
2850 Pa'a Street, Suite 212
Honolulu, Hawai'i 96819

Table of Contents

Section 1 Purpose ***3***

Section 2 Hazard Information ***3***

Section 3 Requirements ***3***

Section 4 Responsibilities ***4***

Section 5 Noise Exposure Monitoring ***4***

Section 6 Training ***4***

Section 7 Hearing Protectors ***5***

Section 8 Audiometric Testing ***5***

Section 9 Access to Information, Recordkeeping ***6***

Section 1 Purpose

The purpose of this Operating Procedure (OP) is to establish Environet, Inc. (EI) procedures and responsibilities for the administration of a hearing conservation program. A proper hearing conservation program will reduce the risk of occupationally induced hearing loss and provide education and guidance for the prevention of "lifestyle" induced hearing loss.

Section 2 Hazard Information

Excessive noise exposure can cause both temporary and permanent effects on hearing. The temporary effects of excessive noise include ringing in the ears, interference with communication, and hearing threshold changes. The effect of long-term excessive noise includes varying degrees of noise induced hearing loss.

The damaging effects of noise are dependent on the noise intensity (decibels), the time of exposure, the noise frequency (Hertz), and individual susceptibility. The Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs) and American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) set exposure limits based on exposure per day (in hours) and sound intensity (in decibels A scale or dBA). Exposures above these limits require use of hearing protection (plugs or muffs) to reduce the sound level or the use of noise engineering controls to reduce the sound level.

It is known that noise intensity above 85 dBA for prolonged periods will induce hearing loss. Eighty-five dBA represents a noise level where normal conversation is difficult and individuals will be shouting or talking into the ear of the person to be understood.

Section 3 Requirements

OSHA regulations issued in late 1981 require a hearing conservation program for workers exposed to 85 dBA as an 8-hour time-weighted average.

The OSHA regulation addresses several requirements for a good hearing conservation program. These requirements are as follows:

- Noise exposure monitoring
- Audiometric testing
- Hearing protectors
- Training programs
- Access to information
- Recordkeeping and posting

Section 4 Responsibilities

Each employee has the responsibility to comply with all aspects of this Operating Procedure. Managers with input from the Health and Safety Officer (HSO)'s and Site Safety Officer (SSO)'s are responsible for enforcing the provisions of this Operating Procedure as it applies to field work. Scheduling of audiograms (accomplished through Medical Surveillance) and training are the responsibility of the HSO and Corporate Health and Safety Officer (CHSO).

Section 5 Noise Exposure Monitoring

The SSO with assistance from the HSO and/or CHSO will determine when noise monitoring is required for jobs where EI employees are potentially exposed to excessive noise. The SSO/HSO will perform noise monitoring as necessary and make recommendations to assure compliance with Section 212.3 of this Operating Procedure. Engineering controls, ear protection, and posting may be required to comply with Section 212.3. In jobs where EI is working in a client's noisy area, EI personnel will comply with the client's existing hearing conservation program. If a client has a noisy area and has no hearing conservation program, EI will establish a plan for its employees and subcontractors to be in compliance with Section 212.3.

Section 6 Training

All workers required to wear hearing protectors will be trained in their proper use. In addition, all workers who may be exposed to greater than 85 dBA will be provided refresher training.

This training will include at least the following: (1) Effects of noise on hearing; (2) the purpose, selection, fitting, use and care of hearing protectors; and (3) the purpose of audiometric testing and an explanation of the test procedure.

Section 7 Hearing Protectors

When hearing protectors are required the employee must have received training on the proper use. Proper noise reduction ratings will be applied by the HSO/CHSO to the noise in the environment.

Hearing protectors act as barriers to reduce sound entering the ear. Noise Reduction Ratings (NRR) for each product reflects the effectiveness of the protector chosen. Generally, muffs offer a greater NRR (25-30 dBA) than plugs (15-25 dBA). Comfort is an important factor when wearing ear protection over many hours; it is recommended to try different types of plugs or muffs to determine the best combination of comfort and fit.

Section 8 Audiometric Testing

Audiograms are administered upon employment and annually/biennially thereafter. The audiograms are conducted by the medical clinics approved for EI physicals and must meet all the applicable requirements (including Appendices C, D, and E of the OSHA Std. Title 29 Code of Federal Regulations (CFR) 1910.95). The local medical clinic in consultation with Greaney Medical will comply with applicable provisions of Title 29 CFR 1910.95(g) with regard to recordkeeping.

Section 9 Access to Information, Recordkeeping

Each office shall have a copy of Title 29 CFR 1910.95 available for any employee requesting access to the standard. Employee training aids shall also be available to any employee. All noise monitoring data shall be retained for at least two years and Greaney Medical shall maintain the audiometric results for thirty years beyond the last date of employment.

■■■■■ *STANDARD OPERATING PROCEDURE*

INCIDENT REPORTING

June 2007

Environet, Inc.
PRESERVING EARTH'S RESOURCES FOR THE FUTURE

Environet
2850 Pa'a Street, Suite 212
Honolulu, Hawai'i 96819

Table of Contents

Section 1 Purpose and Scope ***3***

Section 2 Definitions ***3***

Section 3 Reporting Procedures ***3***

3.1 Reporting Format 3
3.2 Responsible Party 3
3.3 Filing 3
3.4 Major Incidents 4

Section 1 Purpose and Scope

All safety and health incidents shall be reported to Environet (EI) management and Safety and Health Coordinator. Prompt investigation and reporting of incidents will reduce the risk of future incidents, better protect EI employees, and reduce EI liability.

Section 2 Definitions

A safety and health incident is any event listed below:

- Illness resulting from chemical exposure or suspected chemical exposure.
- Physical injury to EI employees or subcontractors regardless of whether the injury requires medical attention.
- Fire or explosion resulting from activities performed by EI and its subcontractors.
- Property damage resulting from activities performed by EI and its subcontractors.
- Vehicular accidents occurring on-site, while traveling to and from client locations, or with any company-owned vehicle.
- Infractions of safety rules and requirements.
- Unexpected chemical exposures.
- Complaints from the public regarding EI field operations.

Section 3 Reporting Procedures

3.1 Reporting Format

Incident reports shall be prepared by completing Form SOP-103. This form may be obtained from any EI Health and Safety Officer (HSO) and is attached to this operating procedure.

3.2 Responsible Party

Reports of incidents occurring in the field shall be prepared by the Site HSO or, in the absence of the Site HSO, the supervising field engineer, witness, or injured/exposed individual.

3.3 Filing

A report must be submitted to the Safety and Health Coordinator within 24 hours of each incident involving medical treatment. The Safety and Health Coordinator will deliver a copy of the report to

the Vice President of Operations within 48 hours of each qualifying incident so that a Worker's Compensation Insurance Report can be filed if necessary.

3.4 Major Incidents

Incidents that include fatalities, hospitalization of employees or subcontractors, or involve injury/illness of the public shall be reported to the Project Manager and Safety and Health Coordinator as soon as possible. Any contact with the media should be referred to the Project Manager and Vice President of Operations. Major incidents that result in death or injury to 3 or more persons admitted to a hospital or damages in excess of $200,000 shall be reported to the Occupational Safety and Health Administration (OSHA).

EI SAFETY AND HEALTH INCIDENT REPORT

Project Name: _____

Project Number: _____

Date of Incident: _____

Time of Incident: _____

Location: _____

_____

TYPE OF INCIDENT (Check all applicable items)

☐ Illness ☐ Fire, explosion, flash

☐ Injury ☐ Unexpected exposure

☐ Property Damage ☐ Vehicular Accident

☐ Health & Safety Infraction

☐ Other (describe) _____

DESCRIPTION OF INCIDENT (Describe what happened and possible cause. Identify individual involved, witnesses, and their affiliations; and describe emergency or corrective action taken. Attach additional sheets, drawings, or photographs as needed.)

_____
_____
_____
_____
_____
_____
_____
_____
_____

Reporting Person:

_____ _____ _____

Print Name Signature Date

Reporting person must deliver this report to the EI Safety and Health Coordinator within 24 hours of the reported incident if medical treatment was required and within five days for all other incidents.

Reviewed by: _____ _____

Safety and Health Coordinator Date

Distribution:

- Vice President of Operations
- Project Manager

■■■■■ ***STANDARD OPERATING PROCEDURE***

SAMPLE HANDLING AND SHIPPING

June 2007

Environet, Inc.

PRESERVING EARTH'S RESOURCES FOR THE FUTURE

2850 Pa'a Street, Suite 212
Honolulu, Hawai'i 96819

TABLE OF CONTENTS

Section 1 Purpose and Scope ***3***

Section 2 Responsible Personnel ***4***

Section 3 Material and Equipment ***5***

Section 4 Procedures ***6***

4.1 Sample Containers and Presvative 6
4.2 Container Labeling, Decontamination, and Field Packaging 6
4.3 Chain of Custody 7
4.3.1 Tampering of Sample Containers 7
4.3.2 Chain of Custody Form 8
4.4 Field Data Documentation 8
4.5 Packaging and Shipping 9

List of Forms

Chain of Custody

Section 1
Purpose and Scope

This document defines the standard operating procedure (SOP) for sample handling and shipping including containerizing, preserving, handling, and shipping of samples collected during the site sample handling. This SOP serves as a supplement to the project work plan.

Section 2
Responsible Personnel

The Environet Site Manager is responsible for conducting and/or overseeing sample, handling, and shipping. The project organization and responsibilities are outlined in the project work plan.

Section 3
Material and Equipment

The following list of equipment is not intended to be task specific. The equipment and materials listed may be needed for sample handling, packaging, and shipping.

- 12 x 12 inch re-sealable plastic bags
- Large plastic trash bags
- Blue ice
- Shipping coolers (sample transport)
- Bubble wrap
- Latex gloves
- Self-adhesive sample labels
- Shipping Labels (i.e., "Fragile", "This Side Up", etc.)
- Shipping forms (provided by shipping courier)
- Tape (i.e., clear cellophane tape, packing tape (reinforced strapping or duct), and custody sealing tape)
- Detergent for sample container exterior decontamination (phosphate free)
- Refrigerator
- Wash/rinse tubs with brushes
- Distilled/deionized water (DI water)
- Pre-certified clean sample containers (e.g., glass, polyethylene), as specified in the SAP
- 4 x 4 inch Teflon® film (for capping core tubes, if used)
- Preservatives (e.g., hydrochloric acid, nitric acid), as specified in SAP
- pH paper
- Paper towels
- Disposable pipettes and bulb

Section 4
Procedures

The following procedures for containerizing, preserving, handling, and shipping samples meet criteria as specified by United States Army Corps of Engineers (USACE) guidelines.

4.1 Sample Containers and Preservative

Only sample containers certified as clean by the manufacturer or laboratory and meeting contract requirements will be used for environmental sample collection. The containers and preservatives may be obtained from the contracted analytical laboratory, their designated supplier, or a suitable supply company. Any preservative(s) required may be added to the container by the contracted analytical laboratory, field sampling team, and/or on-site chemist prior to, during or after sample collection (with the exception of volatiles).

Recommended sample containers, preservatives, and holding times for analytical methods, are shown in the Sampling and Analysis Plan (SAP).

4.2 Container Labeling, Decontamination, and Field Packaging

The sample bottles will be labeled by the field sampling team. Collection time and date will be completed in the field by the sampler. The labels will be filled out at the time of collection and indicate:

- Activity name and/or number
- Unique sample number
- Sample time and date
- Chemical preservative used
- Sample type (grab, composite)
- Analyses required
- Filtered/unfiltered
- Comments or special precautions, as needed
- Sampler's initials

The sample label will be marked with a waterproof pen. Clear tape will be placed over labels before sampling to assure that the labels remain legible.

After sampling, the exterior of the sample containers will be decontaminated according to the Decontamination SOP, and placed in coolers dedicated for sample transportation. The collected samples will be immediately placed in a cooler packed with wet ice, or other

appropriate means to bring the sample temperatures to 4° ± 2°C. Samples will not be frozen. The temperature in the coolers will be maintained at approximately 4°C by adding sealed plastic bags containing blue ice (or an equivalent) to the coolers.

4.3 Chain of Custody

Official custody of samples will be maintained and documented from the time of collection until the time that valid analytical results have been obtained or the laboratory has been released to dispose of the samples. The sampling team will be responsible for initiating the original chain of custody (COC) and will sign and date the COC when relinquishing sample custody. The COC and sample labels will be checked to verify that samples are accounted for and in good condition, and that no errors were made.

A sample is considered to be in a person's custody if any of the following conditions are met:

- The sample is in the person's physical possession.
- The sample is in the line of sight of the person after they have taken possession.
- The sample is secured by that person to prohibit any tampering.
- A sample is secured by the person in possession in an area which only authorized personnel can enter.

4.3.1 Tampering of Sample Containers

If, at any time after samples have been secured, custody seals on the cooler are identified as having been tampered with, this procedure will be followed to ensure that sample integrity has not been compromised.

- Check cooler to verify the temperature is between 2°C to 6°C.
- Check with personnel having access to sample coolers to verify possible inadvertent tampering.
- Check every sample container for any signs of tampering, such as loose lids, foreign objects in containers, broken or leaking containers, etc.
- Verify adequate and appropriate packaging.
- Document findings of the incident in the sample manager's logbook.

If it is determined that malicious tampering of samples has occurred and/or it is believed that sample integrity has been compromised, the subcontractor will immediately contact the site manager.

If it can be determined that sample integrity has not been compromised based on the above criteria, document findings in a logbook.

4.3.2 Chain of Custody Form

A three-page carbonless COC form will be used. A COC is shown at the end of this SOP. The original and second (or yellow) copy will be included with the samples to be shipped enclosed in a plastic bag and taped inside the lid of the cooler. The third (or pink) copy will be sent to the Environet Data/Sample Manager, and the photocopy of the original will remain on file with the field personnel. The contract laboratory will sign as having received the samples and return the yellow copy of the COC to Environet for verification by the Environet Data/Sample Manager. The yellow and pink copies will then be matched and filed to complete the chain of custody procedure for the field sampling efforts. The white (original) will be placed in the appropriate data package by the laboratory. The COC will include the following information:

- Unique sample number and sample location
- Project number
- Date and time of sample collection
- Signature or initials of collector or field custodian
- Laboratory designation
- Sample matrix
- Condition of sample cooler on receipt at the laboratory (includes temperature inside the cooler)
- COC number
- Signature and date blocks for personnel relinquishing or receiving sample custody
- Space for additional comments
- Name and phone number of emergency contact person
- Analyses requested
- Preservatives added to the sample
- Any nonconformance with this SOP identified by the laboratory

4.4 Field Data Documentation

Field descriptions, measurements, and observations will be recorded on the appropriate field data forms or logbook in accordance with the SAP and appropriate SOPs. The original data forms will be collected and filed on-site by the designated staff. Data will also be recorded in field logbooks. Field data will be filled out at the time a sample is taken and will include, but not be limited to, the following information:

- Sampling activity name and number
- Sampling point name and number
- Sample number
- Name(s) of collector(s) and others present
- Date and time of sample collection
- Sample container tag/label number (if appropriate)
- Preservative(s) used

- Requested analyses
- Sample matrix
- Filtered/unfiltered
- Designation of QC samples (ONLY for MS and MSD)
- Collection methods
- COC numbers
- Field observations and measurements during sampling (comment section)
- Signature of responsible observer

4.5 Packaging and Shipping

Samples will be packaged properly to prevent breakage of containers, leakage of contents, and to ensure the samples arrive at the analytical laboratory within the required temperature range of 2°C to 6°C. The following procedures will be followed during the packaging and shipping process.

- Check container lids and tighten as necessary.
- Wrap individual sample containers, if glass, with bubble wrap.
- Place sample containers in re-sealable plastic bags as secondary containment.
- Place sufficient amounts of bubble wrap in the bottom and sides of the shipping cooler to prevent movement of contents.
- Add double bagged ice to the cooler in quantities adequate to maintain required temperature of 2°C to 6°C. Line the bottom, sides and top of cooler to ensure proper shipment temperature. (Using six pieces of blue ice per 48 qt. cooler is not uncommon)
- Line the inside of the area created by the ice placement with a plastic trash bag and place the wrapped samples inside in an upright position.
- Tie shut the trash bag holding the samples.
- Fill excess space in the cooler with packing material (i.e. bubble wrap) to prevent movement of sample containers.
- Review the previously completed COC paperwork and sample packaging before proceeding.
- The white and yellow portions of the COC are then placed inside a plastic bag, and taped inside of the cooler lid.
- Close the cooler lid and seal with appropriate packaging tape in a manner to prevent inadvertent opening during shipment.
- Place two custody seals on the cooler in separate areas that would indicate if tampering had occurred.

The following markings will be placed on the top of the cooler:

- This end up

- Fragile
- Next day priority service
- Shipment delivery address
- Sender's return address
- A completed shipping bill should be made for the carrier of choice and taped to the top of the cooler using the envelope provided by the shipper.
- The express carrier should be called to arrange pick-up of the cooler(s), or delivered to the nearest carrier's office.
- The pink copy of the shipping bill should be retained by the sample manager for attachment to the pink copy of the corresponding COC(s).

An express carrier will be used to aid in meeting sample holding time requirements. The Environet Site Manager or designee is responsible for verifying that samples collected by the field team have been properly packed in ice chests and for verifying the accuracy and completeness of sample labels and COC forms.

The following is a summary of steps to be followed to verify that paperwork is complete:

- Prepare sample labels prior to sampling for sampling crew.
- Receive samples from decontamination/sampling crews.
- Check or complete the COC form(s).
- Pack samples in cooler and verify COC accuracy.
- Verify all labels and forms to meet shipping requirements.
- Photocopy the COC(s) and retain the photocopy and pink copy for Environet files.
- Send original COC(s) (white and yellow copy) to the contract laboratory.
- Photocopy field notes if required and send with COC.
- Obtain pink copy of shipping bill and staple to pink portion of corresponding COC(s).