Multiple Gas Detection Meters
FSOP 3.1.2 (February 25, 2013)
Ohio EPA Division of Environmental Response and Revitalization

1.0 Scope and Applicability

1.1 Multiple gas detection meters are a class of portable instruments used to monitor the presence or absence of several classes of atmospheric gases or conditions in real time. These instruments are typically used for initial site entry and health and safety monitoring at a site (FSOP 1.1, Initial Site Entry). Other uses may include screening of soil gas probes or leak detection (e.g., tanks, vessels, process lines).

1.2 Although there is a wide range and combination of detection sensors available, instruments owned or used by the agency are typically equipped with sensors for the detection of oxygen, explosive atmospheres and two other gases, generally carbon dioxide, carbon monoxide, hydrogen sulfide or methane. These instruments are commonly referred to as “four gas meters” because they typically have four detection sensors, however, the number of sensors may vary. For example, several multiple gas meters are available with a built in photoionization detector for the detection of ionizable molecules in addition to the four sensors listed above (FSOP 3.1.1, Photoionization Detector). In addition, some instruments may be designed to measure the temperature and pressures from solid waste landfill gas monitoring or extraction wells.

2.0 Health and Safety Cautions

2.1 Hazardous vapor or gas may be present in concentrations requiring use of personal protective equipment (PPE) such as respiratory protection (Table 1, FSOP 1.1, Initial Site Entry). Ambient (breathing zone) air conditions need to be monitored.

2.2 Consult the instrument manual to determine if the instrument is intrinsically safe prior to use in potentially flammable atmospheres.

2.3 Combustible gas indicator (CGI) or lower explosive limit (LEL) sensors are designed to operate under normal atmospheric oxygen concentrations (20.9% v/v) and will not function properly in oxygen-deficient or oxygen-enriched environments. When using a CGI/LEL sensor, the user should concurrently monitor the ambient percentage of oxygen. If oxygen monitoring data are not available the CGI/LEL readings cannot be considered reliable.

2.4 Many instruments are equipped with audio and visual alarms that may be set at threshold limits for the gas or condition of concern. Default alarm levels are generally set by the manufacturer but should be checked to be or set in accordance with the specified limits in the site specific health and safety plan.

2.5 If a CGI/LEL sensor indicates potentially explosive atmospheric conditions, or other sensors indicate the presence of oxygen-deficient, oxygen-enriched or toxic atmospheres, evacuate the area immediately. (Refer to Table 1 of FSOP 1.1,

Initial Site Entry, and to the site health and safety plan for action levels and responses.)

3.0 Procedure Cautions

3.1 The user should be familiar with the operation of the instrument being used. Consult the instrument manual for operating and calibration instructions specific to the instrument prior to use.

3.2 Instrument should be serviced and/or cleaned and calibrated annually by a service center authorized by the instrument manufacturer.

3.3 Do not use calibrant gas ("mixed gas") for "zero" calibration as the calibrant gas may have a different percentage of oxygen than atmosphere (20.9%).

3.4 Always transport the instrument in a protective case or secure the instrument during transport.

4.0 Personnel Qualifications

Ohio EPA personnel performing field sampling activities must meet DERR's qualifications for performing work at uncontrolled hazardous waste sites as described.

5.0 Equipment and Supplies

5.1 Calibrant gas (e.g., mixed gas consisting of known concentrations that instrument sensors may detect)
5.2 Regulator for cylinder
5.3 Log book, log sheets, or appropriate field form
5.4 Pens or markers
5.5 PPE appropriate for site-specific work activities
5.6 Instrument with operation manual
5.7 Protective case for instrument transport
5.8 Inert tubing with "tee" connector
5.9 Tedlar® bag

6.0 Procedure

6.1 Consult the instrument manual for both general procedures and instrument-specific operating functions prior to using the instrument.

6.2 Make sure instrument is fully charged before use. Bring a spare or backup battery if necessary.

6.3 Turn the instrument on and allow it to warm up. Some instruments will indicate a "ready" prompt in the instrument display when ready for use. Make sure the pump is running. Check for warnings on instrument display during warm up.

Check the alarm levels to be sure they are consistent with site specific health and safety plan.

6.4 Calibrate the instrument according to manufacturer's instructions before use:

6.4.1 The instrument may be calibrated directly from the cylinder using a flow regulator of appropriate flow rate (equal to or slightly higher than the pump capacity) or a pressure demand regulator. Use a piece of tubing to connect the regulator to the instrument probe. If the regulator flow rate is significantly higher than the pump flow, then a "tee" may be inserted in the tubing to bleed of excess calibrant gas.

6.4.2 An alternate calibration method is to fill a clean Tedlar® bag with the calibrant gas by first connecting the cylinder to the bag with the regulator and tubing and allowing the bag to inflate after opening the valve on the bag. Next, close the valve on the bag, attach the instrument probe to the bag with a length of tubing and open the bag valve when ready to calibrate.

6.5 Zero the instrument with a clean air source or to ambient or background air and ensure that the instrument is zeroed or record background readings before use. If using a cylinder of clean air for zeroing, make sure cylinder contains 20.9% oxygen. Calibrate the instrument with cylinder of mixed gas of known concentration. When calibrating with a cylinder of mixed gas, an oxygen content of less than atmospheric percentage (e.g., 18.0 – 19.5 %) is recommended to verify that the instrument is accurately detecting oxygen-deficient conditions.

6.6 Use the instrument for monitoring in accordance with the site specific health and safety plan and FSOP 1.1, Initial Site Entry or site specific work plan.

6.7 Observe and record the instrument readings as appropriate.

7.0 Data and Records Management

Refer to FSOP 1.3, Field Documentation

8.0 References

FSOP 1.1, Initial Site Entry

FSOP 1.3, Field Documentation

FSOP 3.1.1, Photoionization Detector