Health, Safety, Environment & Regulatory

Portable Gas Detection Practice

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1.0 Purpose

The purpose of the Portable Gas Detection Practice is to provide an overview of portable gas detection systems at Cenovus and set a minimum standard for the correct use and care of portable gas detectors used to protect workers from exposure to hazardous atmospheres.

2.0 Scope

The Portable Gas Detection Practice applies to all Cenovus worksites and encompasses all Cenovus work activities.

Contractors are responsible for implementing an effective portable gas detection program while working at Cenovus sites and supplying portable gas detectors to their workers.

Information regarding fixed gas detectors for buildings shall be directed to the automation team.

3.0 Why Portable Gas Detection?

We perform atmospheric gas testing to protect workers from three categories of hazards:

- Unsafe oxygen level (e.g., deficient/enriched oxygen level);
- Flammable gases and vapours (e.g., methane, hydrocarbons); and
- Toxic gases and vapours (e.g., H_2S, benzene, HCl etc.)

The purpose of gas testing is to inform workers of an immediately dangerous atmosphere, quantify the health and safety risk of an atmosphere, and/or help determine the need for additional controls (e.g., aid in the proper selection of respiratory protection).

4.0 Gas Detection Management Program

Where gas detectors are used to support activities of the asset teams, there should be a gas detection management program that encompasses the following aspects:

- Site-specific training on the selection, operation, and care of gas detection equipment
- Site-specific procedures for detection of a hazardous atmosphere
- Proactive maintenance of gas detection equipment
- Assignment of gas detection equipment to workers or work teams
- Recordkeeping of gas detection equipment bump testing and calibration
- Collection and analysis of gas detection equipment datalog events (if available)
- Tracking and trending of gas detection metrics (user compliance, equipment failure, sensor replacement schedule, etc.)
- Ordering and inventory of gas detection equipment, parts, accessories, and consumables

5.0 Selection

There are a number of gas detection monitors available on the market, each with its advantages and limitations. The table below describes the frequently used gas detectors at Cenovus work sites.

Gas Detector	Chemicals Detected	Intended Use	Notable Limitations
Single or multi-head monitor (Diffusive)	LEL, H_2S, CO, O_2, specified compound	Continuous local detection of select atmospheric gases	▪ LEL detection (catalytic bead sensor) is non-specific, has low accuracy in O_2 deficient atmosphere, is prone to sensor poisoning, and sensitivity decreases with age ▪ LEL detection (infrared sensor) is non-specific, does not detect hydrogen, and its output is nonlinear with concentration in a mixed gas environment ▪ Electrochemical sensors (H_2S, CO, O_2) rely on chemical reactions to work and have a limited life (1-3 years), and sensitivity decreases with age ▪ Compound-specific (chlorine, formaldehyde, ammonia) sensors have a limited life (1-3 years), and varying cross sensitivities with chemicals.
Single or multi-head monitor (Pumped)	LEL, H_2S, CO, O_2, specified compound	Continuous local or remote area sampling of select atmospheric gases	*In addition to the limitations above for diffusive monitors* ▪ A delay in response if an extended wand is used
Pull tube system (Gastec, Draeger)	Compound-specific (e.g. HCl, CO_2, Ammonia)	A snapshot measurement of a specific atmospheric gas/vapour	▪ A snapshot in time; cannot be used for continuous monitoring ▪ Relatively large margin of error (up to 25%) ▪ Interfering gases may skew results
Photoionization Detection (PID) Monitor	Volatile Organic Compounds	Continuous Leak Detection	▪ Non-specific ▪ Does not detect methane ▪ Readings drift as lamp gets dirty ▪ Readings not useful without knowing composition of airborne contaminants
Benzene PID Monitor	Benzene	Identification and quantification of airborne benzene concentrations	▪ Must be used in conjunction with a consumable scrubber tube ▪ Capacity of scrubber tube is reduced by usage, moisture and airborne hydrocarbons ▪ sensor interferences with a few different chemicals

Refer to manufacturer's instruction manuals for detailed description of gas detector characteristics.

The selection of a gas detector must consider the advantages and limitations of the underlying technologies and be appropriate for the atmospheric hazards present. Not all atmospheric hazards can be detected; a risk assessment must be conducted to address all hazards. Refer to Section 7.0 for further information.

6.0 Applications

The technologies described in Section 5.0 are deployed to serve several distinct purposes, as outlined below.

6.1 Stationary Area Monitoring

A stationary area monitor is installed as a temporary solution to supplement or replace existing fixed gas detection equipment if the installation of a fixed gas monitor in a building or area is not possible or feasible, is pending, or if it has been determined that additional monitoring is required in a particular location for a discrete period of time.

A stationary area monitor may be positioned at the perimeter of an area to signal a breach of hazardous vapours, or between the point of release and the workers to provide warning of imminent exposure.

Examples of stationary area monitors include BW Rig Rat, Otis Instrument Gen II Gas Detection, and RAE Systems MeshGuard.

6.2 Handheld Area Monitoring

Handheld area monitors typically draw air in with an active internal pump and may be used with an extended wand for reach. They are usually operated by a worker and generally used to screen a work area for the presence of a hazardous gas. A pumped handheld monitor equipped with an extend wand is crucial when detecting gases in hard-to-reach areas (e.g., confined space entry, inaccessible areas).

Examples of handheld area monitors include UltraRAE 3000, Industrial Scientific MX6 (with pump), RAE Systems VRAE, and BW Honeywell GasAlertMax XT.

6.3 Personal Monitoring

A personal gas monitor intended for life safety protection alerts the user to an immediately dangerous atmosphere. It must be worn in the worker's breathing zone, which is defined as the zone within a 6- to 9-inch radius of a worker's nose and mouth. Wearing a personal gas monitor anywhere outside the breathing zone is not acceptable.

Examples of personal gas monitors include Industrial Scientific MX4 and BW Honeywell GasAlertQuattro.

7.0 Use Considerations

7.1 Alarm Set Points

Refer to table below for the portable gas detector alarm set points as they relate to the occupational exposure limits.

Gas/ Vapour	12-hour OEL[1]	8-hour OEL	Other Applicable Limits
H_2S	5 ppm	10 ppm **[low alarm]**	15 ppm (ceiling) **[high alarm]** 100 ppm (IDLH)
LEL	-	-	Less than 10%, hot work allowed with continuous monitoring Greater than 10% **[low alarm]**, no hot work allowed Greater than 20% **[high alarm]**, no work allowed Greater than 40%, rescue not allowed
CO	12.5 ppm	25 ppm **[low alarm]**	200 ppm **[high alarm]** 1,200 ppm (IDLH)
O_2	-	-	Maintain between 19.5 **[low alarm]** – 23% **[high alarm]**
Benzene	0.25 ppm	0.5 ppm	2.5 ppm (STEL) 500 ppm (IDLH)
HCl	-	-	2 ppm (ceiling) 50 ppm (IDLH)
Cl_2	-	0.5 ppm	1 ppm

In Alberta, worker exposure to any substance listed in the OHS Code (Schedule 1, Table 2) must be kept as low as reasonably achievable and must not exceed its occupational exposure limit or ceiling limit listed in Table 2 at any time.

In Saskatchewan, worker exposure to any substance listed in the OHS Regulations (Table 21) must be kept as low as reasonably achievable and must not exceed the contamination limit listed in Table 21.

[1] *the 12-hour OEL is an adjusted value of the 8-hour OEL for some chemicals to account for longer work periods. Workers who work 12-hour workdays will adhere to the 12-hour OELs, where applicable, and not the 8-hour OELs. It should be noted that the 12-hour OEL and 8-hour OEL are not ceiling limits but averaged values over the course of the specified period.

7.2 General Considerations

Cenovus asset teams should conduct gas detection activities in accordance with the gas detection procedures developed as part of the site-specific *Gas Detection Management Program*[2], outlined in Section 4.0. The gas detection procedures may be incorporated into operating procedures. The scenarios for which gas detection may be required include but are not limited to:

- General workarounds of process areas;
- Line breaks;
- Confined space entries; and
- Hot work

Notwithstanding the above, in all cases where you suspect a gas release of unknown concentrations, approach the area with extreme caution and ensure there is sufficient space between yourself and the release. Use a handheld detector appropriate for the gas release as a guide and use the extended wand to create distance. Don SCBA/SABA as appropriate.

In addition, keep in mind the following conditions when using gas detection equipment:

- Verify the intrinsic safety ratings of gas detectors prior to using them in a hazardous atmosphere.
- The use of a portable gas detector does not replace sound engineering or administrative controls to mitigate the presence of a hazardous atmosphere.
- There is no portable gas detector that is 100% accurate and precise. Sensor interference is a limitation of all gas detectors. In addition, a detector may take up to a minute to reflect the true concentration of a contaminant in air; it may take longer if a probe with tubing is used to extend reach. Users must read and understand the limitations of their portable gas detectors prior to use.
- A typical portable gas monitor is rated for -20°C weather though it may continue to work in colder temperatures for brief periods. Refer to Safety Advisory *Managing Gas Detectors in Cold Temperatures* for advice on using gas detectors below -20°C weather.

7.3 Area Monitoring Considerations

Portable gas detection instruments provide air monitoring in the immediate vicinity of the instrument inlet only. To adequately assess the hazard of a large area, sampling strategies that involve taking multiple samples throughout the work area must be employed. The characteristics of the contaminant should also be considered (e.g., consider potential for stratification of gases in confined space).

[2] Foster Creek and Christina Lake operations have developed a joint *Oil Sands Operations Portable Gas Detection Management Standard*.

A pumped monitor offers no greater protection than a diffusive monitor. The main advantage of a pumped monitor is that an extended wand can be attached to sample a location far or hard to reach from the user.

Portable gas detectors should not be used for process stream gas sampling unless specifically designed to do so.

7.4 Personal Monitoring Considerations

A personal detector must be worn in areas where exposure to a hazardous atmosphere is possible.

A personal detector must be worn in a live facility unless otherwise deemed not necessary following a risk assessment.

A 4-head monitor capable of detecting H_2S, LEL, CO, and O_2 is the default choice in a typical oil and gas facility. Site-specific hazards that dictate the addition or removal of sensors require a risk assessment.

The presence of a fixed gas detection system does not replace the need for a personal gas detector for life safety protection.

A personal gas detector is not a substitute for a handheld area monitor and should not be intentionally placed in a hazardous environment in order to avoid the risk of over-ranging or poisoning the sensors, leaving the worker vulnerable and unprotected by a gas detector.

7.5 Risk Assessment

The selection of a portable gas detector requires a risk assessment involving subject matter experts from Operations, and Health and Safety (including Occupational Health & Wellness, and Process Safety). The risk assessment must take into consideration the following topics:

- Chemical hazards present
- Existing engineering controls for chemical hazards
- Existing available fixed gas detection
- Expected releases
- Process upset scenarios
- Maintenance and repairs
- Portable gas detection availability, limitations, training and maintenance requirements

8.0 Calibration & Maintenance

Gas detection equipment must be maintained as per manufacturer's specifications, and at a minimum:

- Users of electronic gas detectors must bump equipment daily or prior to use
- Users of electronic gas detectors must calibrate equipment as per manufacturer's specifications

- A maintenance and calibration program must be in place for gas detectors that includes:
  - Recordkeeping of bump tests and calibrations
  - Cleaning
  - Storage
  - Battery maintenance
  - Sensor and filter replacement
  - Ordering of spare parts

9.0 Roles and Responsibilities

The following responsibilities apply to this practice:

Table 1: Roles and Responsibilities

Role	Description
Site Leadership	• Providing resources for facility design, construction and maintenance that minimizes the potential for a toxic or unsafe atmosphere • Ensuring resources for the purchase, use, training, and maintenance of portable gas detectors

Cenovus Supervisors	• Being knowledgeable in:
	  • The Portable Gas Detection Practice
	  • Site-specific procedures
	  • Applicable industry codes of practice
	• Ensuring compliance with all provincial regulatory requirements
	• Identifying the atmospheric hazards and potential hazards that may be encountered during an assigned task, and in consultation with Health & Safety, determining the appropriate portable gas detection equipment to use
	• Identifying young and/or new workers and offering coaching, if necessary
	• Ensuring that all workers:
	  • Hold a valid Cenovus Gas Detection Awareness Certificate
	  • Are trained in procedures used to complete work requiring a portable gas detector
	• Ensuring that all portable gas detection equipment are maintained as per Cenovus's practice and/or the manufacturer's specifications
	• Taking immediate and appropriate action when a toxic or unsafe atmosphere is suspected or detected
	• Reviewing SDSs and ensuring WHMIS labelling is

Role	Description
	correct • Ensuring that appropriate rescue and first aid procedures are in place • Conducting training drills on the use and maintenance of respiratory protective equipment • Ensuring employees are clean-shaven and wearing personal monitors and PPE, when required
Workers	• Complying with all of Cenovus's safe work procedures and operating practices • Having a valid Cenovus Gas Detection Awareness certification, if required • Being aware of potentially toxic or unsafe atmospheres, and the impact of such atmospheres on assigned work duties • Wearing and correctly using personal protective and respiratory protective equipment, as required • Immediately evacuating a worksite should a personal monitor or facility alarm sound • Reporting to the Work Site Supervisor any alarm events, sour spills, incidents and/or unusual conditions, and stopping work if necessary
Health & Safety	• Assisting the asset team in complying with this Practice and all associated procedures • Responding to questions or concerns relating to the interpretation of this Practice and all associated procedures • Providing assistance to the business unit regarding the selection, use and maintenance of gas detection equipment, along with training and technical support for employees
Occupational Hygiene	• Provide expertise on portable gas monitoring and detection • Review and revise the Portable Gas Detection Practice, as required • Review and revise associated eLearning materials, as required

10.0 Training and Competency

Competency describes the knowledge and skills required to successfully perform the technical aspects of a job. A worker must be able to demonstrate competency in safely performing work tasks or using equipment

10.1 Training

It is expected that all personnel involved in this process will have training and the appropriate competency to perform their roles. Users of portable gas detection systems are required to:

- Complete the *Gas Detection – An Introduction* eLearning Module on TRACCESS; and
- Complete equipment-specific eLearning Module(s) on TRACCESS

All personnel requiring to use portable gas detection must be trained upon hire and every three years thereafter.

10.2 Competency

Competency describes the knowledge and skills required to successfully perform the technical aspects of a job. A worker must be able to demonstrate competency in safely performing work tasks or using equipment.

10.2.1 Competency Verification

Competency will be validated through formal, theory-based evaluations and practical skill demonstration. All theory-based training requires a written knowledge check (e.g. test, quiz, exam) that will be reviewed and assessed. Practical skill assessments of task completion and equipment use must be conducted by a competent H&S advisor or technician.

Workers may be required to attended additional training sessions or complete further on-the-job training if performance deficiencies are identified through formal assessments.

All written evaluations and practical skill assessments must be documented and retained in the worker's personnel file. Records may be maintained in hard copy or electronically.

11.0 Quality Assurance

11.1 Performance Measurement

Compliance with this practice and program effectiveness shall be assessed through program assessments and internal audits, or other measurement criteria as specified in the COMS Assurance Standard. Measurement can also be accomplished through the tracking of appropriate Key Performance Indicators (KPI).

Business functions or departments impacted by this practice must include compliance and program effectiveness verifications in their business assurance program. Performance will be monitored and reported within the responsible departments at least every three years.

Central Health and Safety Services will review Cenovus-wide program KPIs at a minimum every three years in conjunction with program review and update activities.

11.2 Management of Change

Proposed changes to this practice can be directed to H&S Programs and Projects.

11.3 Practice Verification

The document owner will complete and document reviews of this practice, as follows:

- At minimum once every three years
- If there is a significant regulation or industry best practice change that indicates the need for review
- If an incident investigation indicates the causes were related to unclear or inadequate written instructions described within this practice

If frequent and multiple variances are required due to operational needs, the reason(s) will be investigated and the document owner will determine if there is a business need to update the practice.

If submitted MOC requests indicate gaps or significant improvement opportunities, the document owner will determine if there is a business need to update the practice.

12.0 Glossary

Definitions and acronyms for safety documents are described in CEN-EHS243, H&S Definition and Acronym Standard. The following definitions and acronyms are specific to this document:

Table 2: Terms and Definitions

Term	Definition
Diffusive Monitor	A monitor that relies on the diffusion of gas or vapour molecules through air currents into the sensor chamber to detect the presence/concentration of the said gas/vapour.
Pumped Monitor	A monitor that uses a pump to actively draw air into the sensor chamber to detect the presence/concentration of gases and vapours.
Catalytic Bead Sensor	A sensor technology that infers the concentration of a combustible gas by comparing the resistance between the sensing element with elevated temperature due to the said gas and a reference element.
Infrared Sensor	A sensor technology that infers the concentration of a combustible gas by the absorption of infrared radiation by that gas
Pull tube system	A system of gas detection that relies on a change in colour in the detection tube, which is proportional to the concentration of gas causing the change in colour.
Photoionization Detector	A system of gas detection that replies on high energy UV to ionize gas molecules to produce a signal. The strength of the signal is proportional to the concentration of the gas.
Bump Test	A functional test to check that sensors react to incoming gases and the alarms work.

Term	Definition
Calibration	A process whereby the sensor is exposed to a known concentration of gas and adjusted to provide accurate readings.

Table 3: Acronyms, Initialisms and Abbreviations

Term	In Full
LEL	Lower Explosive Limit
PID	Photoionization Detector

13.0 References

13.1 External Documents

The following external documents support this practice:

Table 4: External Document References

Document Type or Number	Document Title
CSA C22.2 No. 152–M1984	Combustible Gas Detection Instruments

13.2 Internal Documents

The following Cenovus documents support this practice:

Table 5: Internal Document References

Document Type or Number	Document Title
CEN-EHS243	H&S Documentation Standard – Definitions and Acronyms
CEN-EHS12005	Managing Gas Detectors in Cold Temperatures
	Oil Sands Operations Gas Detection Management Standard
	Christina Lake Portable Gas Detection Procedure
	Foster Creek Portable Gas Detection Procedure

