cenovus ENERGY

Gas Detection Practice

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Table of Contents

Appendices

1.0 Purpose

The Gas Detection Practice outlines the practices for detection and monitoring of flammable and toxic atmospheres and competency requirements. The intent of this practice is to maintain the safety of workers attending a Cenovus worksite and to meet regulations specific to fire and explosion hazards.

This practice in part responds to Cenovus's Environment, Health, and Safety Management System (EH&SMS) Element 5 – *Regulatory* and the regulatory requirements of Alberta and Saskatchewan as listed in Appendix A.

2.0 Scope/Application

This Gas Detection Practice applies to Cenovus's worksites and encompasses contracted work activities. This will assure consistency and compliance with company, industry, and regulatory expectations relating to gas detection training.

3.0 Rules

a) Employees who are assigned to field operations and regularly attend worksites or facilities must have and use a personal gas detector and be competent in its operation and maintenance.

b) The personal gas detector head configurations that include but are not limited to carbon monoxide, carbon dioxide, oxygen, combustible gas and/or hydrogen sulphide are to be determined based on site-specific circumstances and hazards. The local EH&S Coordinators, local instrumentation, or engineering resources can assist in the configuration and selection of site/circumstance-specific gas detection equipment.

c) The primary purpose of a personal gas detector is to provide a "Go – No Go" indicator for initial entry and while monitoring a worksite to warn of impending danger. Personal gas detectors are not recommended for gas sampling or purging where specific levels must be determined.

d) Atmospheres must be tested from the outside first before entering a work area and continuously monitored while progressing into and working in the area.

e) If testing for confined space entry, employees or contractors must also be trained in confined space entry procedures (see **Respiratory Protection** Code of Practice and **Confined Space Entry** COP for details).

f) The manufacturer's instructions for personal gas detectors must be immediately available and followed during its use, operation, and maintenance.

g) The "self check" and "bump test" must be carried out daily and recorded into daily journals, logbooks, or data recording devices.

h) Facility-fixed detection systems for gas and fire detection are included into the facility design at the facility engineer's discretion.

i) A maintenance and calibration program must be in place for personal gas detectors that meets the manufacturer's recommendations.

j) Those regularly attending facilities with fixed fire and/or gas detection systems must be familiar with the basic functionality, operation, and warning indicators. This includes but is not limited to fire eyes, fire loops, beacons, horns, ventilation systems, gas detector limits and settings, shutdown keys and ESD stations, bypass procedures, facility isolation, and depressurize design.

k) Occasionally and for various reasons, fixed detection systems must be bypassed. The bypass system must be designed to eliminate the chance of forgetting to remove the bypass. Contact your Supervisor for site-specific gas detection bypass rules.

l) Visitors with personal gas detectors must have authorization from local operations to attend any worksite. Visitors without personal gas detectors must be accompanied and directly supervised by local field operations personnel.

m) Reasonable efforts will be extended to ensure that fire and explosion hazard potential at worksites and facilities are identified to contractors. Where a facility or worksite is not equipped with fixed gas detection equipment, contractors are responsible to conduct initial gas detection and continuous monitoring to ensure their work activities do not produce a hazardous atmosphere or their activities are not impacted by unforeseen hazardous atmospheres generated from their surroundings.

n) Contractors are to supply functional gas detection equipment and workers who are competent in its operation, maintenance, and limitations.

4.0 General Gas Detection Considerations

a) No matter what type of gas detector is being used, the concentration displayed by the detector is the value being detected at the sampling point. Adequate sampling strategies that cover the entire work area and the gas characteristics should be a consideration for initial entry assessment and monitoring of a work area.

b) Personal gas detectors are not effective unless they are turned on, are less effective in overly rich gas concentrations, and are not capable of reading very low concentrations of gas or to measure specific concentrations such as the toxic level, explosive/flammability values, or oxygen levels of that gas.

c) Consideration should be given to the following operational issues that impact the readings of a personal gas detector:

    1) Temperature extremes

    2) Oxygen content of the gas stream

    3) Exposure to condensed moisture

    4) Unnecessary exposure to high concentrations

    5) Exposure to catalytic sensor poisons such as cleaning solvents, lubricants, chlorine, sulphur, or silicone compounds

    6) Radio frequency interference from two-way radios or cellphones

d) It is not recommended to use electronic portable multi-head gas detectors for measuring operational levels of hydrogen sulphide gas as the H_2S head can easily be over ranged. Utilize specific substance H_2S meters.

e) Some gases such as sulphur dioxide, fluorine, chlorine, bromine, iodine, and oxides of nitrogen will interfere with accurate readings of oxygen content if they are present in unusually high concentrations. Strongly acidic gases may interfere with the detector's function as well. The most commonly encountered interfering gas is carbon dioxide, which after **ten minutes** can produce an untrue oxygen reading.

f) Function testing personal gas detectors includes a "self check" and "bump test".

    1) The **self check** is an automatic function where the detector itself checks battery level, alarm status, and any faults.

    2) The **bump test** is where the sensors are exposed to a known concentration of gas. The manufacturer's procedures for bump testing, care, use, storage and disposal of calibration gas cartridges should be reviewed. Regulations require that the results of the bump test are recorded. Again, the manufacturer's instructions should provide a log sheet template.

    The minimum notation for a **self check** would be "Detector self check – Green to go". For **bump test**, the requirements are date, test gas, expected and actual test results, 1st and 2nd level alarms, user name and initials.

    Note: Detectors that **fail** the self check or bump test must be removed from use, tagged, and serviced.

g) Oxygen detectors are designed to provide warning that an oxygen-deficient atmosphere is present. Generally, an alarm is activated whenever the oxygen level falls below or rises above a pre-selected limit (19.5% to 23.0%). Oxygen meters often have a sampling hose and a rubber aspirator bulb for drawing gas samples and a meter for reading oxygen content. An oxygen-deficient atmosphere is one where the oxygen content has dropped below 19.5% by volume.

h) Toxic gas detectors are commonly known as tube-type gas detectors, which measure the levels of toxic gases using detector tubes. Air is drawn into the tube by means of bellows or a piston-like vacuum pump. Tubes may contain layers of granular carrier material impregnated with a pigment reagent, which is specific to a certain gas. The length of the discoloured layer determines gas concentration.

i) Combustible gas detectors can detect explosive gas vapours and typically alarm at set points that correspond to the lower explosive limit (LEL) and upper explosive limit (UEL) range of the calibration gas. Readings are represented in % of LEL/UEL. Combustible gas meters are designed to measure specific LEL and may have two ranges of operation:

    1) A low range for precise measurement where only a small amount of gas is present, and

    2) A high range which measures all gas concentrations.

j) The following table describes the key characteristics of hazardous substances that are commonly found in the oil and gas industry.

Flammable Gas or Liquid	*Specific Gravity	**Vapour Density	Lower Explosive Limit (LEL)	Upper Explosive Limit (UEL)
Methane	-	0.06	5.3%	15.0%
Ethane	-	1.04	3.0%	12.5%
Propane	-	1.56	2.3%	9.5%
Butane	-	2.0	1.9%	8.5%
Hydrogen sulphide	-	1.189	4.0%	46.0%
Carbon monoxide	-	0.97	12.5%	74.0%
Varsol (stoddard solvent)	0.64 – 0.66	2.5	1.1%	5.9%
Gasoline (50 to 100 octane)	<1.0	3.0 – 4.0	1.3%	6.0%
Diesel	0.865	-	1.0%	6.0%
Methanol	0.79	1.11	6.0%	36.5%
Drilling fluid (Envirovert)	.97 – 1.20	4.0	0.7%	6.0%
Crude oil	0.7 – 1.1	3.0 – 5.0	1.0%	7.0%

*** Specific gravity** – comparison of the weight of a liquid/solid to the weight of water. Values less than (1) indicate a substance that is lighter than water.

**** Vapour density** – comparison of the weight of a gas/vapour to the weight of air. Values less than (1) indicates a substance that is lighter than air.

5.0 Occupational Exposure Limits

Workers must **not** be exposed to a substance that exceeds the occupational exposure limits at any time.

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.

6.0 Training

Gas detection training is a prerequisite competency for those employees who attend Cenovus worksites and facilities as part of their routine duties.

a) The theory training covers the fundamentals around gas and detection and the practical component covers off the use and operation of site-specific gas detection equipment.

b) The theory training can be obtained through the **Describe Flammable Gas Measurement** Module in the Learning Management System (LMS). Cenovus also recognizes the PITS course, *Detection and Control of Flammable Substances for the Oil and Gas Industry*, as equivalent. Courses provided by other agencies must cover the same material in the same level of detail as the Cenovus or the PITS courses.

c) The practical training for site-specific equipment can be obtained from local instrumentation employees or can be delivered by the manufacturer or supplier of the site-specific gas detection equipment.

d) Competency for gas detection training must be recorded in LMS.

7.0 Roles and Responsibilities

Roles and responsibilities for safety documents are described in the link below:

Cenovus CEN-EHS234, Roles and Responsibilities Standard

Roles and responsibilities specific to the Gas Detection Practice are described below:

8.0 References

8.1 Internal References

1. Cenovus CEN-EHS089, *Gas Detection Training*

8.2 External Resources

1. CSA C22.2 No. 152–M1984 (R2006), *Combustible Gas Detection Instruments*
2. Work Safe Alberta, *Combustible Gas Meters – Function Testing (2006)*
3. Work Safe Alberta, *Misuse of Combustible Gas Meters (2006)*
4. *Dangerous Properties of Industrial Materials*, N. Irving SAX, 11th Edition
5. Enform, *Detection/Control of Flammable Substances for the Oil/Gas Industry (2001)*
6. Enform, *IRP Volume #18 - Fire and Explosion Hazard Management (2007)*
7. Human Development Consultants, *Describe Flammable Gas Measurement (2004)*

9.0

Management of Change

Proposed changes to this practice can be directed to EH&S Document Management

10.0 Definitions and Acronyms

General definitions and acronyms for safety documents are described in the link below:

Definitions and acronyms for safety documents are described in the link below:

Cenovus CEN-EHS243, Definitions and Acronyms

The following definitions and acronyms are specific to the Gas Detection Practice.

Bump Test means verifying the calibration and alarms settings by exposing the sensor head to a known concentration of test gas.

Self Check means an automatic function where the detector itself checks the battery level, alarm status, and any faults.

Appendix A

– Applicable Legislation

The Gas Detection Practice encompasses requirements of the following legislation.

1. **Alberta OHS Code (2009)**

   a) Part 2 – Hazard Assessment, Elimination and Control

      - All Applicable Sections

   b) Part 4 – Chemical Hazards, Biological Hazards and Harmful Substances

      - Section 16 – Worker Exposure to Harmful Substances

   c) Part 5 – Confined Spaces

      - Section 52 – Testing Confined Spaces

   d) Part 10 – Fire and Explosion Hazards

      - Section 139 – Hot Work
      - Section 171.1(3) – Welding

   e) Part 37 – Oil and Gas Wells

      - Section 780 – Well Swabbing

   f) Schedule 1, Table 2: *Occupational Exposure Limits for Chemical Substances*

2. **Saskatchewan OH&S Regulations (to 2009)**

   a) Part III – General Duties

      - All Applicable Sections

   b) Part XXIX – Oil and Gas

      - Section 439 – Drill Stem Testing

   c) Part XXI – Chemical and Biological Substances

      - Section 307 – Substances Listed in Table 21

   d) Appendix, Table 21: *Contamination Limits*