Portable Gas Detection CoW Technical Standard

Version	Date	Approver
1.0	March 31, 2024	JO EHS

Introduction

The Portable Gas Detection Standard establishes requirements for the conditions, type, and frequency of gas testing as well as the selection, operation, and maintenance of equipment necessary to conduct atmospheric testing. The intent of this standard is to reduce the likelihood of personal exposure or injury, property damage, or adverse environmental impact from hazardous atmospheres that may exist in the workplace.

This standard establishes the minimum requirements for atmospheric testing using portable gas detection equipment. Atmospheric testing (also referred to as gas testing in this document) is the analysis of atmospheres using instruments and equipment of sufficient sensitivity and specificity to identify and evaluate potential hazards (i.e., oxygen deficiency/enrichment, combustible gases, toxic substances, dusts, fumes, vapors) that may exist or have the potential to arise. Additionally, this standard includes requirements for the verification of gas detection results against acceptable concentrations to authorize and safely perform work.

Scope

This standard does not address:

- Occupational hygiene exposure monitoring
- The use of portable gas detection equipment as personal protection equipment (PPE) for the purpose of alerting wearers of a potential hazardous atmosphere
- Fixed gas detection/monitoring equipment

Requirements

The following sections provide minimum requirements for Portable Gas Detection as well as supporting guidance to clarify the intent of those requirements.

- Requirements of this standard **shall** be met.

General Portable Gas Detection Requirements

1.	**Requirement:**	**a. JO shall perform gas testing for the following activities, except where there is no potential for a hazardous atmosphere:** **i. Confined Space Entry** **ii. Hot Work in a Hazardous (Classified) area** **iii. Excavation** **iv. Isolation of Hazardous Energy (opening process equipment)** **v. Emergency Response (e.g., leaks, spills)** **b. JO shall identify additional activities that have the potential for a hazardous atmosphere requiring gas testing. These may include process and production operations, handling or storage of hazardous materials or cargo (e.g., manufacturing facilities, drilling and productions facilities, storage tanks, ships/shipyards, tank cars, hazardous waste sites).**
	Guidance:	The following list provides examples of situations that may not have potential for hazardous atmosphere: • Downgraded confined spaces • Hot work in a designated safe hot work area • Opening isolated process equipment with contents that do not have the potential of producing a hazardous atmosphere or have been verified as cleaned of all residual contents • Excavation work in greenfield operations
2.	**Requirement:**	**a. JO shall use active gas testing/monitoring for initial, follow-up, and revalidation gas testing.** **b. The Qualified Gas Tester shall determine the frequency of gas testing (continuous or follow-up) and personnel authorized to perform gas testing/monitoring for activities/areas not specifically defined in this standard or other CoW technical standards.**
	Guidance:	When testing/monitoring the air in spaces that are located remotely from the instrument/detector, active gas detection (e.g., gas monitors utilizing a pump to pull a sample of air across a sensor) through the use of tubing or other attachments is necessary. Examples of situations where such active gas detection should be used include the testing of drains, openings, confined spaces, low-lying areas, or other sites where gases or vapors can accumulate.
3.	**Requirement:**	**JO shall test and evaluate gases in the following order:** **a. Oxygen content** **b. Flammable or explosive gases and vapors** **c. Toxic gases and vapors (e.g., hydrogen sulfide (H2S), benzene)**

	Guidance:	Ensure that there is adequate atmospheric oxygen inside the monitoring area, per the equipment manufacturer's recommendation, for the correct operation of the combustible gas sensor.
4.	**Requirement:**	**Work shall not begin or continue unless gas test results conform with approved safe operating limits per Appendix D, applicable legal requirements, or Joint Operations standards (whichever is more stringent) or until appropriate controls are in place and functioning to safely perform work in the atmosphere present (e.g., use of respiratory protection, ventilation etc.).** **a. If safe operating limits have not been established for the target gas or vapor to be evaluated, consult with Occupational Hygienist/HSE Specialist/ Safety engineer and/or apply industry standards/guidance.**
5.	**Requirement:**	**a. Work shall commence within 30 minutes of initial gas testing for the following activities:** **i. Confined Space Entry** **ii. Hot Work in a Hazardous (Classified) Area** **iii. Excavation** **iv. Isolation of Hazardous Energy** **b. Other activities requiring initial gas testing as defined by the JO shall commence within one (1) hour of initial gas testing.** **c. If work has not commenced within the established time parameters for initial gas testing, the area shall be tested again and verified to be within acceptable limits, with controls in place (if applicable), prior to beginning work unless continuous gas testing is being used.**
6.	**Requirement:**	**JO shall define procedures for assessing potentially hazardous conditions in situations where the atmosphere cannot be safely assessed without potentially exposing gas testing personnel to the hazardous atmosphere.**
	Guidance:	Procedures may include requirements for additional personal protective equipment (PPE) (e.g., supplied air respiratory protection or self-contained breathing apparatus (SCBA)) and/or refer to requirements in other existing procedures (e.g., confined space rescue, emergency response).
7.	**Requirement:**	**Atmospheres that are potentially stratified shall be tested according to applicable legal requirements, Joint Operations standards, and/or industry standards/guidance.**
	Guidance:	Atmospheres may contain a mixture of vapors that can stratify inside a vessel, depression, enclosed space, etc. Knowledge of the vapor density of the gases in the atmosphere to be tested is necessary to determine if a stratified atmosphere may exist and will require testing at various heights to fully characterize the area. Gases can be: • Lighter (float) than air (e.g., methane)

		• Same density (drift) as air (e.g., carbon monoxide or nitrogen) • Heavier (sink) than air (e.g., chlorine, carbon dioxide, or H2S)
8.	**Requirement:**	**JO shall define the actions and procedural steps to take if gas testing results exceed acceptable limits, with controls in place (if applicable), while work is in progress. These actions shall include but are not limited to the following:** **a. Stop work immediately.** **b. Evacuate personnel from the hazardous area.** **c. Assess, identify and implement additional / alternative controls as necessary to safely proceed with work.** **d. Conduct gas testing to verify results are within acceptable limits, with controls in place (if applicable).** **e. Revalidate work permits (if applicable).**
9.	**Requirement:**	**Portable gas testing instruments and equipment (including sensors and detectors) shall meet applicable legal requirements (e.g., ISO 9001 certification), manufacturer's recommendations, Joint Operations standards, and industry standards/guidance including but not limited to the following:** **a. LEL/combustible gas detection instruments and equipment to be used in potentially hazardous atmospheres shall be classified intrinsically safe by a recognized testing organization.** **b. Gas detection instruments shall be capable of measuring target compound (e.g., oxygen content, combustible/flammable limits and toxic gases and vapors) accurately to the lowest concentration at which the material becomes hazardous.** **i. When portable gas testing equipment is equipped with alarms, minimum alarm threshold values shall be set to alert workers that there is potentially hazardous atmosphere.**
	Guidance:	Non-intrinsically safe portable gas testing instruments and the preferred equipment for obtaining the most accurate gas testing results for the target compounds may be used in conjunction with intrinsically safe LEL/combustible gas detection instruments and equipment to verify safe operating parameters. Caution should be taken while around or using certain products and chemicals that can result in cross-sensitivity, cause false or negative reading(s) and/or act as poisons or inhibitors that may cause the immediate failure or reduced sensitivity of gas monitor sensors. • Some common items that may be a poison, inhibitor, or cause cross-sensitivity: – Acetylene gas – Alcohol based cleaners – Hand sanitizers

		– Hydrogen gas – Dish soaps – Methanol – Window/glass cleaners – Silicone containing hand/body creams/lotions – Silicone based cleaners and protectants – Bug repellants
10.	**Requirement:**	**Portable gas detection instruments and equipment shall be maintained, stored, inspected, calibrated, and functionally (bump) tested in accordance with manufacturer's instructions.** **a. If the manufacturer does not provide such instructions, the JO shall define these requirements in accordance with industry standards/guidance.** **b. Portable gas testing instruments shall be calibrated with certified calibration gases of known concentration, not exceeding its expiry date, per manufacturer's instructions.** **i. Calibration results shall be documented and retained in accordance with record retention requirements detailed in the Control of Work SHEERS Process.** **c. When an instrument does not pass a bump or calibration test, the instrument shall be removed from service until it is repaired or troubleshooted and passes a bump test and/or full calibration.** **i. JO shall define the procedure for repairing and returning portable gas detection instruments and equipment to service.** **d. Portable gas testing equipment, supplies and media (e.g., colorimetric tubes, calibration gases) shall not be altered, used if damaged, or used after expiration of the designated service life.**
	Guidance:	Many manufactures provide instrument docking stations that have the ability to perform automated calibrations and bump tests and store test records. JO may choose to collect and store this information electronically. This may require JO to ensure that the gas detection equipment used (i.e., Model and Serial Number) is captured in the Work Authorization documentation.
11.	**Requirement:**	**a. Follow-up gas testing shall be required under the following conditions:** **i. Prior to beginning work after a shift change occurs** **ii. Changes in operating conditions that could lead to a potentially hazardous atmosphere (e.g., process upset / disruption, emergencies, ambient temperature changes, other work activities)** **iii. As determined by the Qualified Gas Tester (QGT).**

		iv. **Whenever the work site is left unattended for a period exceeding those thresholds listed in requirement 5, without continuous gas monitoring** b. **JO shall define any additional conditions that require follow-up gas testing.**
12.	**Requirement:**	a. **Continuous gas testing shall be conducted:** i. **As defined by the CoW technical standards** ii. **As determined by the Hazard Analysis** iii. **As determined by the QGT** iv. **As required by the work permit and/or hazard analysis** b. **Jo shall determine additional activities and/or conditions for which continuous gas testing shall be required.**
13.	**Requirement:**	**Gas testing results (e.g., initial, follow-up, revalidation) shall be documented in accordance with the Work Authorization Standard.**
14.	**Requirement:**	**Personnel working in areas requiring gas testing shall be able to observe and have access to review initial and all subsequent gas test results.**
15.	**Requirement:**	**When an area is suspected to be contaminated (e.g., hazardous material spill or release), readings shall be taken on the approach to the area requiring testing considering instrument response time and Joint Operations or industry standards/guidance for assessing potentially contaminated areas.**
	Guidance:	JO procedures, plans, instructions, and/or guidance (e.g., emergency response, HAZWOPER, respiratory protection, personal protective equipment (PPE)) should detail the minimum PPE (e.g., supplied air respiratory protection or self-contained breathing apparatus (SCBA)) and controls required to approach an area of unknown contamination. Sampling should proceed from a known non-hazardous area upwind of the suspected area, identify the lowest detectable concentration areas, and then proceed towards higher concentrations.
16.	**Requirement**	**Personnel conducting activities associated with gas testing shall meet the training and competency requirements that apply to their roles, in accordance with the Training and Competency SHEERS Standard.**
	Guidance:	JO may choose to expand the roles and responsibilities established in Appendix B and in the Training and Competency SHEERS Standard as well as define various levels of competency within a defined role. For example, personnel may be trained and authorized to only observe and record gas test readings at a defined frequency after initial monitoring has been performed.

17.	**Requirement:**	**Documentation associated with portable gas testing shall adhere to the record retention requirements detailed in the Control of Work SHEERS Process.**

CoW Standards Specific Requirements

Confined Space Entry Requirements

18.	**Requirement:**	**Confined Space gas testing requirements include but are not limited to:** **a. To identify atmospheric hazards in a confined space, mechanical ventilation, if in place, shall be stopped to establish a static atmosphere prior to performing the initial gas testing. This will allow potentially hazardous gases to stratify and concentrate for better detection and classification of the space.** **b. Initial gas testing shall be performed from outside the confined space utilizing manways, open valves, flanges, piping, and ports to gas test inside the space.** **i. Gas testing shall be performed using remote sampling techniques (e.g., extension wand, tubing, etc.) where feasible to prevent breaking the entry plane while sampling the interior of the space.** **ii. If a representative sample from the section/region of a confined space cannot be gas tested from outside the confined space, then a QGT shall enter the space to conduct further sampling to obtain a representative sampling of the atmosphere. Supplied air shall be used by the QGT entering the space in areas with an unknown/untested atmosphere.** **iii. If feasible, continuous gas testing shall be used for Permit Required Confined Space entry.** • **If continuous gas testing is not feasible, the QGT shall determine frequency of monitoring, with a minimum of every 2 hours.**
	Guidance	The type of work that may not allow for continuous monitoring includes, but is not limited to, water washing a tank, grit blasting inside a vessel, etc.). The QGT should consider the size and internal / external configuration of the confined space to allow adequate time after stopping ventilation to allow the space to reach a static atmosphere (typically 10-30 mins).

Hot Work Requirements

19.	**Requirement:**	**Hot Work gas testing requirements in Hazardous (Classified) areas shall include but are not limited to:** **a. Continuous gas testing shall be performed.** **i. When performing Open Flame Hot Work continuous gas monitoring equipment shall be attended/observed by persons who meet requirements of the Training and Competency SHEERS Standard.** **ii. Jo shall determine the Non-Open Flame Hot Work activities (e.g., equipment with an operating temperature at or above the auto-ignition temperature of the process medium) that require attended/observed continuous gas testing.** **b. Gas testing shall be performed in the area surrounding the hot work activity, above and below grade, surveying at least 10 meters (35 feet) radius from the point of the activity, including testing of flanges, valves, bleeders, drains, sewers, manholes, vent pipes and other potential leak sources or areas of poor ventilation where gases may accumulate.** **i. Initial gas testing shall be performed after the work site and equipment have been prepared per applicable requirements.**

Excavation Requirements

20.	**Requirement:**	**Gas testing in an excavation site shall be performed prior to entering the space in the following circumstances:** **a. Odors noticed (e.g., exhaust fumes, H2S, etc.).** **b. Discovery of leaks, releases, seeps or discharges of vapors or liquids (including water).** **c. When hazardous atmospheric conditions exist or may reasonably be expected to develop (e.g., near pipelines, valves, tanks, landfills, underground hazardous plumes, or exhaust fumes from running equipment, etc.).**

Isolation of Hazardous Energy Requirements

21.	**Requirement:**	**a. Gas testing shall be performed when opening process equipment that contains or contained a process medium/fluid with the potential risk of a hazardous atmosphere.** **i. Continuous gas monitoring shall be performed when working on opened, isolated equipment that still contains process medium (e.g., removing a pump between upstream and downstream double block and bleed valves) to confirm that the isolation is holding.**

	ii. **The QGT shall determine the frequency for evaluating and documenting the results of the continuous gas testing.** b. **Work shall stop, zero-energy state verified, and gas testing shall be revalidated upon detection of:** i. **Unexpected leaks, releases, seeps or discharges of vapors or liquids** ii. **Unexpected odors (e.g., exhaust fumes, H2S, etc.)**
Guidance:	First Line Break Procedure shall be followed when there is a potential hazard from exposure into any piping system, piece of equipment, process, product or hazard.

Appendix A: Terms and definitions

Term	Definition
Alarm Set Point	Fixed or adjustable setting on gas testing equipment that will automatically trigger an indication, alarm, or other output function if the atmospheric concentration reaches the set level.
Bump Test/Functional Test	A test that verifies calibration by exposing the instrument to a known concentration of test gas (or known concentrations of gas mixtures). The instrument reading is compared to the actual quantity of gas present (as specified on the testing material or certificate). Calibration is verified if the instrument's response is within an acceptable tolerance range (specified by the manufacturer of the testing material) of the actual concentration.
Calibration (of Portable Gas Equipment)	The process of exposing the instrument to a known concentration of gas to determine the accuracy of its response, readings, and alarm set points. The instrument's response may be adjusted if needed. A two-point calibration (zero gas and a known concentration) may be used to perform a full calibration.
Continuous Gas Test	A process whereby gases which may be present, or which may be generated during work are continuously monitored in real time. Continuous gas testing is normally required where there is a high likelihood of changing gas concentrations and/or there is a high risk to workers if the gas concentration changes unexpectedly. There are two primary types of continuous air monitoring programs: • Attended—The air monitoring instrument is observed at all times. • Non-attended—Air monitors are strategically positioned in or near the work area, run at all times, and periodically checked.
Explosive Atmosphere	A mixture of flammable gases, vapors, liquids, or dusts with air. There is a potential for explosive atmospheres to develop from improper cleaning or preparation of tanks, vessels, pipes, or equipment that previously contained such materials or from the accumulation of combustible dusts.
Follow-Up Gas Testing	Testing at intervals, performed after the initial testing, sufficient to ensure that the atmosphere remains safe for the work being performed.
Gas / Atmospheric Testing	Analysis of atmospheres using equipment of sufficient sensitivity and specificity to identify and evaluate potential hazards (i.e., oxygen deficiency/enrichment, combustible gases, toxic substances, dusts, fumes, vapors) that may exist or have the potential to arise and the verification of the resulting values against acceptable concentrations.
Gas Testing – Active	Gas testing involving the use of an aspirated pump that draws air to the instrument sensors.
Gas Testing – Passive	Gas testing that does not utilize a pump. Diffusion of ambient air across the sensors is the means of detecting hazardous atmospheres.
Hazardous Atmosphere	An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue, injury, or acute illness from the following: • Flammable gas, vapor or mist in excess of 10% of the lower flammable limit.

Term	Definition
	• Airborne combustible dust at concentrations that meet or exceed its lower flammable limit. • Atmospheric oxygen concentrations less than 19.5% or greater than 23.5%. • Atmospheric concentrations of any substance in excess of the permissible limit. • Atmospheric conditions immediately dangerous to life or health.
Immediately Dangerous to Life and Health (IDLH) Atmosphere	An atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life or would interfere with an individual's ability to escape unaided from a dangerous atmosphere.
Inert Atmosphere	An atmosphere that contains less than 5% oxygen. Nitrogen is often used to create an inert atmosphere in order to reduce the risk of ignition, minimize oxidation, purge containers, or other purposes.
Initial Gas Test	Gas test, or tests that are conducted prior to beginning work and that are designed to determine if acceptable atmospheric conditions exist, or if controls need to be put in place prior to beginning work.
Lower Explosive Limit (LEL)	Lowest concentration (percentage (%)) of a gas or vapor in air capable of producing a flash of fire in the presence of an ignition source (arc, flame, heat). Also called lower flammable limit (LFL).
Occupational Exposure Limit (OEL)	The concentration of an atmospheric contaminant that workers may be exposed to without the likelihood of experiencing adverse health effects. OELs are set by industry recognized organizations/authorities.
Parts Per Million (ppm)	The number of contaminant parts in a million parts of air.
Personal Gas Detector (Wearable)	A wearable device, usually battery operated, which senses the presence of gases including oxygen, toxic and or combustible gases.
Portable Gas Detector	A spot-reading or continuous-duty gas detection apparatus that has been designed to be readily carried from place to place and to be used while it is being carried. A portable device that is battery operated and includes but is not limited to: • A hand-held apparatus, suitable for single-handed operations. • Personal monitors, similar in size and mass to the hand-held apparatus, are continuously operating while they are attached to the user. • A larger apparatus that can be operated by the user while it is suspended by hand or shoulder strap or by a carrying harness; it may or may not have a hand-directed probe.
Stratified Atmosphere	The density of gases and vapors can result in a stratified or layered atmosphere, particularly in confined spaces. For example: • Some gases are heavier than air and settle to the bottom of a space (e.g., hydrogen sulfide), • Some gases are lighter than air and concentrate at the top of a space (e.g., methane),

Term	Definition
	• Some gases are the same density as air and accumulate in the center of a space (e.g., carbon monoxide).
Toxic Atmosphere	Any atmosphere that contains a concentration of hydrogen sulfide (H2S), carbon monoxide (CO), benzene, or any other recognized contaminants in concentrations exceeding applicable recognized Occupational Exposure Limits (SHEERSL) or concentrations that may result in adverse health effects.

Appendix B: Roles and responsibilities

Role	Definition	Responsibilities
Qualified Gas Tester (QGT)	A person who has received training, has been tested, and verified competent in the identification of testing strategies needed based upon the operations and potential hazardous atmosphere, the use of portable gas-testing equipment and has successfully demonstrated the identification and use portable gas detection strategies and equipment in the field. This person must also be trained to recognize potential hazards for work requiring gas testing. Different levels of qualification/additional roles may be established based upon technical complexity of the atmospheric testing needed to support JO operations.	• May perform initial gas testing for permit clearance • Knowledgeable about acceptable atmospheric working conditions and gas testing order • Knowledgeable about gas testing techniques (e.g., vessel testing, stratified atmospheric testing, etc.) • Conducts and documents gas tests • Allow work crew (authorized entrants, hot work crews, etc.) to witness gas testing if requested • Determine the frequency of follow-up gas testing for tasks • Verify and validate field calibration checks of gas testing equipment • Calibrate and response test portable gas testing equipment • Understand the hazards inherent in hot work and confined space entry and the gases that may be present for relevant tasks where gas testing is required • Understand when to stop work

Appendix C: References

Internal References

Joint Operations Occupational Exposure Standard for Chemicals
Joint Operations Hydrogen Sulfide (H2S) Occupational Exposure Standard
Enterprise Occupational Exposure Standards: Benzene

External References

American Conference of Governmental Industrial Hygienists (ACGIH))

Guide to Occupational Exposure Values
TLVs (Threshold Limit Values) and BEIs (Biological Exposure Indices)
Air Sampling Instruments
Air Sampling Technologies – Principles and Applications
Modern Industrial Hygiene Vol 1 - 3

American Petroleum Institute (API)

Recommended Practice 68	Recommended Practice for Oil and Gas Well Servicing and Workover Operations Involving Hydrogen Sulfide
Recommended Practice 74	Occupational Safety for Onshore Oil and Gas Production Operation
Recommended Practice 75	Safety and Environmental Management System for Offshore Operations and Assets
Recommended Practice 76	Contractor Safety Management for Oil and Gas Drilling and Production Operations
Recommended Practice 500	Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Division 1 and Division 2
Recommended Practice 505	Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, and Zone 2
Recommended Practice 1646	Safe Work Practices for Contractors Working at Retail Petroleum/Convenience Facilities

American National Standards Institute (ANSI)

ANSI/ASSE Z117.1-2009	Safety Requirements for Confined Spaces

American Welding Society (AWS)

AWS F1.1M:2018	Methods for Sampling Fumes and Gases Generated by Welding and Allied Processes

British Standard Institute

BS EN 1127-1:2019	Explosive atmospheres – Explosion prevention and protection

California/OSHA (Cal/OSHA)

Title 8, Table AC-1	Permissible Exposure Limits for Chemical Contaminants

Compressed Gas Association (CGA)

CGA P-76—2018	Hazards of Oxygen-Deficient Atmospheres

International Association of Oil & Gas Producers (IOGP)

Report No. 459	Life-Saving Rules
Report No. 638	Process Safety Fundamentals

International Safety Equipment Association (ISEA)

	ISEA Statement on Validation of Operation For Direct Reading portable Gas Monitors

National Institute for Occupational Safety and Health (NIOSH)

	Recommended Exposure Limits (RELs)

National Fire Protection Association (NFPA)

NFPA 70	National Electric Code
NFPA 350	Guide for Safe Confined Space Entry and Work
NFPA 497	Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas

Occupational Safety & Health Administration (OSHA)

OSHA 1910 Subpart H	Hazardous Materials
OSHA 1910.146 App B	Procedures for Atmospheric Testing
OSHA 1910.252	Welding, Cutting, Brazing
OSHA 1910. Subpart Z	Toxic and Hazardous Substances
SHIB 09-30-2013	Safety and Health Information Bulletin - Calibrating and Testing Direct-Reading Portable Gas Monitors

Underwriters Laboratories (UL)

UL 121303	Standard For Safety Guide for Use of Detectors for Flammable Gases
UL 62990	Standard for Safety for Workplace Atmospheres – Part 1: Gas Detectors – Performance Requirements of Detectors for Toxic Gases

Appendix D: Gas Testing Safe Operating Limits

This table identifies the ranges or thresholds which are acceptable to work without additional controls (e.g., respiratory protection, shortened shifts, forced ventilation) or further assessment.

Target Vapor/Gases	**Safe to Work** No additional controls required
Oxygen	19.5 – 23.5%
LEL	0%
Hydrogen Sulfide (H2S)	5 ppm or less
Carbon Monoxide (CO)	25 ppm or less
Benzene	0.5 ppm or less
Sulfur Dioxide (SO2)	1 ppm or less
Ammonia (NH3)	12.5 ppm or less

Note:

This is not an exhaustive list of all target vapor/gases that shall be tested to verify that the work area is safe from a hazardous atmosphere prior to authorizing work to commence.

Consultation with Occupation Hygienist /HSE professionals may be needed to:

- verify the target compounds
- establish acceptable gas testing criteria
- identify testing strategy and equipment to evaluate the vapor and/or gases comprising the potentially hazardous atmosphere
- identify additional controls necessary based off of initial or further assessments

Additional Joint Operations, regulatory, legal and or industry occupational exposure limits may need to be implemented for the above listed and/or other target compounds.