Fugitive Emissions Management Guideline

VERSION 1.4: June 2025

About the Regulator

The British Columbia Energy Regulator (Regulator) oversees the full life cycle of energy resource activities in B.C., from site planning to restoration. The Regulator ensures activities are undertaken in a manner that protects public safety and the environment, supports reconciliation with Indigenous peoples, conserves energy resources and fosters a sound economy and social well-being. We work collaboratively across government and industry sharing policy and technical expertise in support of B.C.'s transition to low-carbon energy and helping meet future global energy needs.

Vision, Mission and Values

Vision

A resilient energy future where B.C.'s energy resource activities are safe, environmentally leading and socially responsible.

Mission

We regulate the life cycle of energy resource activities in B.C., from site planning to restoration, ensuring activities are undertaken in a manner that:

- Protects public safety and the environment
- Supports reconciliation with Indigenous peoples and the transition to low-carbon energy
- Conserves energy resources
- Fosters a sound economy and social well-being

Values

Respect is our commitment to listen, accept and value diverse perspectives.

Integrity is our commitment to the principles of fairness, trust and accountability.

Transparency is our commitment to be open and provide clear information on decisions, operations and actions.

Innovation is our commitment to learn, adapt, act and grow.

Responsiveness is our commitment to listening and timely and meaningful action.

Additional Guidance

As with all Regulator documents, this document does not take the place of applicable legislation. Readers are encouraged to become familiar with the acts and regulations and seek direction from Regulator staff for clarification.

The Regulator publishes both application and operations manuals and guides. The application manual provides guidance to applicants in preparing and applying for permits and the regulatory requirements in the planning and application stages. The operation manual details the reporting, compliance and regulatory obligations of the permit holder. Regulator manuals focus on requirements and processes associated with the Regulator's legislative authorities. Some activities may require additional requirements and approvals from other regulators or create obligations under other statutes. It is the applicant and permit holder's responsibility to know and uphold all legal obligations and responsibilities. For example, Federal Fisheries Act, Transportation Act, Highway Act, Workers Compensation Act and Wildlife Act.

Throughout the document there are references to guides, forms, tables and definitions to assist in creating and submitting all required information. Additional resources include:

- Glossary and acronym listing on the Regulator website.
- Documentation and guidelines on the Regulator website.
- Frequently asked questions on the Regulator website.
- Advisories, bulletins, reports and directives on the Regulator website.
- Regulations and Acts listed on the Regulator website.

In addition, this document may reference some application types and forms to be submitted outside of the Application Management System but made available on the Regulator's website. Application types and forms include:

- Heritage Conservation Act, Section 12
- Road use permits
- Water licences
- Master licence to cut
- Certificate of restoration
- Waste discharge permit
- Experimental scheme application
- Permit extension application

Table of Contents

Manual Revisions

The Regulator is committed to the continuous improvement of its documentation. Revisions to the documentation are highlighted in this section and are posted to the Documentation Section of the Regulator's website. Stakeholders are invited to provide input or feedback on Regulator documentation to ServiceDesk@bc-er.ca or submit feedback using the feedback form.

Version Number	Posted Date	Effective Date	Chapter Section	Summary of Revision(s)
1.0	July 18, 2019	January 1, 2020	Various	This is a new document. Users are encouraged to review in full. For more information, refer to INDB 2019-18 on the Regulator's website.
1.1	Dec.21, 2023	Dec.21, 2023	Various	Replace BCOGC with BCER; OGAA with ERAA; new logos, references and associations.
1.2	Mar.18, 2024	Mar.18, 2024	Ch.6	Add Chapter 6 – Alternative LDAR Programs.
1.3	May 17, 2024	June 1, 2024	Various	Various edits were completed to this document. Users are encouraged to review in full.
1.4	June 10, 2025	June 10, 2025	Various	Various edits were made throughout to ensure consistency with amendments to the Drilling and Production Regulation that took effect January 1 2025.

Chapter 1: Preface

This Fugitive Emissions Management Guideline provides regulatory requirements and guidance for fugitive emissions management in British Columbia. The guideline applies to fugitive emissions at wellsites and facilities regulated under the Energy Resource Activities Act (ERAA). It does not apply to liquefied natural gas (LNG) facilities.

1.1 Scope

This guideline focuses exclusively on requirements and processes associated with the BC Energy Regulator's (Regulator or BCER) legislative authorities and does not provide information on legal responsibilities that the BCER does not regulate. It is the responsibility of the applicant or permit holder to know and uphold its other legal responsibilities.

1.2 How to Use This Guideline

BCER requirements and recommended practices are included within each section and subsection throughout the guideline. "Must" indicates a requirement for which compliance is expected and may be subject to BCER enforcement, while "recommends" or "should" indicates a best practice that should be used by the applicable party.

1.3 Acknowledgement

The BCER would like to acknowledge the Alberta Energy Regulator (AER) for their input into this guideline through allowing the Regulator to use material from Manual 16 throughout this guideline. Contributions from industry, environmental non-governmental organizations, academia, service providers and government are also gratefully acknowledged.

Chapter 2: Developing a Fugitive Emissions Management Plan

Fugitive Emissions Management Plans (FEMP) detail how a permit holder's fugitive emissions will be systematically detected, managed and reported.

Permit holders should develop a written FEMP. FEMPs and associated data should be reviewed annually and continuous improvements to the plan should be made as appropriate.

2.1 Accountability

The FEMP should clearly identify which individual is accountable (permit holder representative) along with their title and contact information. This individual should be a senior officer as defined in the Greenhouse Gas Emission Reporting Regulation.

2.2 Roles and Responsibilities

The FEMP should document internal (e.g., individual staff, groups, departments) and external (e.g., contractors) resources allocated to develop, implement, maintain and update the FEMP, with their specific responsibilities identified. Table 2.1 provides an example of how a permit holder might allocate and document FEMP resources and responsibilities.

Table 2.1. Example of how resources might be allocated and documented in a FEMP

Resource	Responsibility
Corporate management	• Maintain corporate commitment to the FEMP. • Approve annual FEMP budget. • Review and sign annual certification statement.
FEMP management team	• Develop and maintain FEMP review schedule. • Create comprehensive survey and screening survey schedule. • Oversee data management system. • Submit reports to the Regulator. • Assess the FEMP's effectiveness and opportunities for continuous improvement. • Provide updates, develop annual reports, and make recommendations.
Fugitive emissions surveyors	• Maintain and calibrate test equipment. • Perform comprehensive surveys. • Perform screening surveys. • Generate individual facility/wellsite reports. • Generate summary reports. • Identify components that require repair, replacement, or retrofit. • Determine leak severity, and measure or estimate emissions rate. • Maintain electronic system to capture and retain data. • Maintain monitoring schedules. • Confirm integrity of repairs.
Field operators	• Provide guidance on comprehensive survey and screening survey schedules. • Supervise surveyors and provide them with information about facility performance and operation during comprehensive surveys and screening surveys. • Review facility /wellsite reports and develop work plans (work orders) to address recommendations.
Maintenance team	• Repair leaks or modify facilities / wellsites (e.g., install test ports, re-pipe vent lines). • Close out work orders and record repair details.

2.3 Preventive Maintenance

A FEMP should indicate what preventive maintenance practices the permit holder is using to reduce or prevent fugitive emissions. This might include checklists used by field operators during routine inspections, regularly scheduled maintenance programs, and maintenance programs or standard operating procedures that incorporate preventive maintenance practices.

The following preventive maintenance practices could be incorporated into operations and maintenance practices to reduce fugitive emissions:

- Tighten loose connections (especially in a vibrating service).
- Plug or eliminate open-ended lines.
- Inspect and confirm positive isolation capability of separator and scrubber dump valves.
- Inspect and maintain pressurized pneumatic devices and pumps (e.g., controller case seals).
- Fix or replace pressurized pneumatic devices and pumps that are not operating within manufacturer written specifications.
- Inspect and maintain thief hatches.
- Inspect and maintain pressure relief valves (PRVs) and pressure vent relief valves (PVRVs).
- Close thief hatches if found open on tanks with vent gas control.
- Ensure combustion systems remain lit when facility or wellsite is pressurized and active.
- Ensure control equipment (such as vapour recovery unit) is operational (except when it is down for maintenance) and is operating and maintained as designed.
- Look for and correct abnormal process events.

2.4 Continuous Improvement

The FEMP should describe how data will be used to evaluate performance and inform continuous improvement.

The following are indicators that could be used to evaluate the performance of a FEMP and to determine if any changes are needed:

- Quantified emissions reductions over time (e.g., by corporate or operating area, or by facility type or equipment).
- Cost of detection (e.g., $/kg methane detected).
- Volume of gas conserved by managing fugitive emissions.
- Number of leaking components over time (e.g., by corporate or operating area or by facility type or equipment).
- Specific components within facilities that are more prone to leaks.
- Time between leak detection and repair.

- The FEMP should indicate methods used to review data, how often data are reviewed, and how changes will be made to the FEMP following these reviews.

2.5 Non-Operated Sites

Permit holders are responsible for ensuring that leak detection surveys are completed and submitted for their non-operated sites. Permit holders should ensure that all requirements including completion of surveys, leak repair and reporting are addressed in their contract operating agreements.

Chapter 3: Leak Detection Surveys

This chapter provides technical guidance to permit holders on leak sources, detection and measurement technology and methods, as well as leak detection survey timing and frequency.

3.1 Survey Frequency

The definitions of comprehensive and screening surveys are listed in DRP Section 41.1(1). The FEMP should have documented procedures and plans for meeting the required frequency of fugitive emissions comprehensive surveys and screening surveys detailed in Tables 3.1 to 3.3 including tracking for:

- Number of comprehensive surveys or screening surveys required and completed at each facility or wellsite (Drilling and Production Regulation (DPR) Section 41.1 (2) to (5)).
- Results of comprehensive surveys and screening surveys and the status of all repairs (DPR Section 41.1(15)(16)).

Fugitive emissions comprehensive survey requirements apply only to facilities and wellsites with active (e.g. pressurized in part or in whole) equipment that process or handle natural gas. Required comprehensive survey frequencies vary according to facility and wellsite type. Comprehensive survey frequencies for regulatory compliance are detailed in Table 3.1.

Screening surveys must be done a minimum of annually at any active conventional wellsite (wellsite producing from a zone not listed in Schedule 2 of the DPR) that does not have a production tank (DPR Section 41.1(5)). Screening surveys must also be done a minimum of annually at all inactive wells. Surveys are not required for water source, water injection or water disposal wells. In addition, screening surveys are not required for inactive wells with a status of cased, abandoned or zonally abandoned. Screening survey frequencies for regulatory compliance are detailed in Table 3.1.

The FEMP should indicate how companies track when comprehensive or screening surveys are required and the procedures used to ensure that all applicable components and natural gas driven pressurized pneumatic devices are surveyed at each site.

Table 3.1: Required Comprehensive Survey Frequencies

Well or Facility Type	Maximum Number of Comprehensive Surveys Required Per Year
Gas Processing Plant Compressor Station Compressor Dehydrator Battery (Single-well, Multi-well and Processing) Natural Gas Liquids Fractionation Facility	4
Tank Terminal (that process or uses natural gas) Injection/Disposal Facility (that process or uses natural gas) Pump Station (that process or uses natural gas) Satellite Battery Gas Dehydrator Facility Wellsite with Unconventional Production Wellsite with Conventional Production that Includes a Production Tank	1

Table 3.2: Required Screening Survey Frequencies

Well Type	Maximum Number of Screening Surveys Required Per Year
Conventional Production without a Production Tank Inactive Well (excluding cased, abandoned, zonally abandoned)	1
Water Source Water Injection Water Disposal Inactive Well with a Status of Cased, Abandoned, Zonally Abandoned	0

All co-located wellsites and facilities must undergo leak detection surveys whenever any of them is surveyed. For example, if a wellsite is co-located with a multi-well battery, each time the multi-well battery is surveyed, the co-located wellsite would also be surveyed.

Data on assigned facility type is available BCER website under Data and Reports, Data Centre, Facility Inventory report. Permit holders should review their inventory of facilities to ensure that the facility type and facility description are current. Inactive facilities must be suspended within 12 months of ceasing operation (DPR Section 79).

Facility status may be changed by submitting a facility notice of intent as outlined in Chapter 12 of the Oil and Gas Activity Operations Manual. To change facility type, contact the BCER via Pipelines.Facilities@bc-er.ca.

3.1.1 Proration of Required Survey Frequency

The number of comprehensive surveys undertaken per calendar year at a facility may be adjusted as indicated in Table 3.3. Minimum comprehensive survey interval requirements are not affected by the adjustments.

Table 3.3: Proration of Three Comprehensive Surveys per Year

Days Active (Pressurized) per Calendar Year	Number of Comprehensive Surveys Required per Calendar Year
0-30	0
31 - 90	1
91 - 181	2
182 - 272	3
273 or more	4

The number of comprehensive or screening surveys undertaken per calendar year at a facility or wellsite may be adjusted as indicated in Table 3.4. Minimum survey interval requirements are not affected by the adjustments.

Table 3.4: Proration of One Survey (Comprehensive or Screening) per Year

Days Active (Pressurized) Per Calendar Year	Number of Surveys (Comprehensive or Screening) Required Per Calendar Year
0-90	0
91-365	1

If proration of survey frequencies is used, records of facility operating days must be submitted to the Regulator through eSubmission by no later than March 31 of the year after which the proration was used.

3.1.2 General Comprehensive Survey Spacing Requirement

At facilities where more than one comprehensive survey is required per calendar year each comprehensive survey must be conducted at least 60 days from the last comprehensive survey conducted as per Section 41.1(6)(a) of the DPR.

Facility Turnarounds

Comprehensive surveys should be conducted within 14 days after the completion of a facility turnaround. The end of the turnaround is determined by the resumption of operations (full or partial).

Comprehensive surveys conducted after a facility turnaround apply towards the number of comprehensive surveys required at a facility each calendar year provided they also meet the general comprehensive survey interval requirement.

Post Construction

Leak detection surveys should be conducted within 30 days after the completion of construction activities. This includes the construction of new facilities (greenfield), as well as any modifications of existing (brownfield) facilities.

Pre-commissioning inspections are considered by the Regulator to be a suitable alternative to post construction surveys.

For facilities and wellsites, the start of the 30 day time period is the first day of startup.

Comprehensive surveys conducted after facility construction apply towards the number of comprehensive surveys required at a facility each calendar year provided they also meet the general comprehensive survey spacing requirement.

Reactivation of Inactive Wells and Facilities

Leak detection surveys should be conducted within 14 days after the reactivation of a facility or well. Reactivation is achieved the first day of production (wellsite) or receipts to a facility.

Surveys conducted after the reactivation of a facility or well apply towards the number of surveys required at a facility or well each calendar year provided they also meet the general survey interval requirements.

Some inactive wells and facilities maintain an active status. These wells and facilities must be changed to inactive status in accordance with the requirements and timelines specified in Sections 25 and 79 of the Drilling and Production Regulation. Information on current well and facility status can be obtained from the BCER Data Center.

For facilities that have a status of active, but do not have enough pressurized days to require a survey to be completed (see Tables 3.2 and 3.3), permit holders must submit a survey record showing the number of pressurized days (Section 41.1(4) DPR). A similar report is not required for wells.

3.2 Survey Scope

Leak detection surveys must include all equipment and components at a facility or wellsite that could be a source of fugitive emissions, including pressurized pneumatic devices unless the components are unsafe to survey, difficult to survey or inaccessible to survey. Unsafe, difficult or inaccessible components do not need to be included until it becomes feasible to do so. Documentation stating why the component is unsafe, difficult or inaccessible to include in the survey must be detailed in each survey report.

Difficult to survey components are those that cannot be surveyed without elevating the surveyor more than two (2) metres above a supported surface or are unable to be reached via a wheeled scissor-lift or hydraulic type scaffold that allows access to components up to 7.6 metres above the ground.

Unsafe to survey components are those that cannot be surveyed without exposing surveyor to an immediate danger as a consequence of completing the survey. This is dependent on the survey method used.

Inaccessible to survey components are those that are buried, insulated, or obstructed by equipment or piping that prevents access to the components by surveyor.

Survey technicians must use survey techniques that allow them to safely and effectively detect leaks at storage tank components. When the survey method used includes optical gas imaging, if there is a reasonable line of sight to a component, it must be surveyed.

The permit holder must survey the following:

- Pressurized equipment components with hydrocarbon throughput.
- Natural gas–driven pressurized pneumatic devices.
- Tank-top equipment, including thief hatches and gauge-board assemblies and pressure relief devices.
- Pressure relief valves.
- Equipment used to combust vent gas, including burners, flare ignitors, pilots.
- Combustors.
- Equipment used to conserve vent gas, including vapour recovery units and vent gas capture systems.

It is recommended that, should liquid loading/unloading activities take place while a comprehensive survey using an optical gas imaging camera is being conducted, that the liquid loading/unloading activities be included within the scope of the survey.

All leaks must be quantified by either measurement, engineering estimate, or emission factor (DPR Section 41.1(10)).

Leak rates and corresponding quantification methods must be submitted to the Regulator using eSubmission.

When leak rates are quantified by engineering estimate or emission factor a methodology that is in accordance with the Greenhouse Gas Emission Reporting Regulation must be used. The estimation of leaks by empirical experience is not acceptable.

3.3 Sources of Fugitive Emissions

Standard Equipment Components

Fugitive emissions from standard equipment components are the result of components wearing out or failing over time, being improperly installed, or loosening due to vibration. These fugitive emissions can often be easily detected during a fugitive emissions comprehensive survey or screening survey, and the component can often be immediately refitted, repaired, or replaced.

The following components are common sources of fugitive emissions:

- Connections (especially threaded connections) and fittings.
- Instruments and valves (e.g., pressure relief valves and control valves).
- Seals and housings (e.g., pressurized pneumatic controller case seals and tank thief hatch seals).

Abnormal Processes

Fugitive emissions from abnormal processes typically result from equipment malfunctioning or becoming inoperative, or from processes functioning abnormally. These types of emissions may be more difficult to detect because they can be more intermittent and may require a detailed investigation before the source can be identified and repaired.

The following abnormal processes are common sources of fugitive emissions:

- Unlit flares (ignitors and pilots).
- Malfunctioning pressurized pneumatic devices.
- Conservation units (e.g., vapour recovery units) that have quit operating.
- Equipment components emitting vent gas upstream of equipment actively controlling vent gas.

Hydrocarbon storage tanks can also be sources of fugitive emissions from abnormal processes when:

- Thief hatches are open outside the time required for pressure relief.
- Leaking process gas or volatile product moves past the seats of drains or blowdown valves.
- Gas and liquids are separated inefficiently allowing gas to carry through.
- Production changes result in high vapour carry through.
- Pigging operations displace large volumes of gas to the tank.

3.4 Survey Procedures

A FEMP should describe the methods and equipment used for comprehensive surveys and screening surveys including the make and model of the equipment used. It is not necessary to use the same type of equipment for all comprehensive surveys and screening surveys.

3.4.1 Comprehensive Surveys- Detection Methods

The two leak detection survey technologies that, when they meet the minimum specifications in this guideline and when used in accordance with the procedures in the guideline, are accepted as comprehensive survey methods under the Drilling and Production Regulation are organic vapour analyzers (US EPA Method 21[1]) and optical gas imaging (OGI) cameras.

[1] ***EPA Method 21*** means the method of the Environmental Protection Agency of the United States entitled *Method 21 — Determination of Volatile Organic Compound Leaks*, set out in Appendix A-7 to Part 60 of Title 40, chapter I of the *Code of Federal Regulations* of the United States.

OGI cameras must be capable under laboratory conditions of detecting 1 gram per hour of pure methane emitted at:

- A distance of 3 metres between the camera and the emission.
- A difference between air temperature and background temperature of no greater than 10 degrees Celsius.

Before using any survey equipment, the surveyor must make sure that it can be safely operated in the area and take any necessary precautions. Before starting the survey, the surveyor should identify a scanning path to ensure all areas of the facility are surveyed. It is usually best to follow the path of the product from inlet to outlet. The surveyor might also conduct the survey by individual process units and then check off each unit as it is surveyed.

Meteorological conditions, such as rain and wind, can make it more difficult to detect fugitive emissions. For example, higher winds can disperse plumes more quickly, making them harder to detect. Comprehensive surveys conducted during meteorological conditions that substantially compromise their effectiveness should be avoided, where practicable (surveys done at wind speeds greater than 4 m/s, during moderate to heavy precipitation events, at ambient temperatures below -20 degrees Celsius).

Organic Vapour Analyzer

Organic vapour analyzers, sometimes called toxic vapour analyzers, are portable analyzers typically equipped with photoionization detectors (PIDs) or flame ionization devices (FIDs). Other types of sensors include catalytic oxidation or infrared absorption sensors.

When completing surveys using an organic vapour analyzer:

- Manufacturer written recommendations for the specific type of equipment used must be followed.
- The tip of the analyzer's probe must be traced along the leak interface as close as possible to the component's surface.
- Surveyors must ensure that the analyzer reaches its full meter reading by keeping the analyzer's probe in place until the reading levels out or peaks.
- To prevent falls when surveying elevated components, surveyors may use an extension probe on the analyzer rather than a ladder.
- When multiple components are close together, it can be difficult to identify the location of a leak. Surveyors must take the time to ensure that the correct source is identified and may use soap testing to help confirm the leak location.
- Surveys must be conducted at a pace that is appropriate for the size of the component and its configuration. Larger components will take more time to survey if a uniform probe speed is used. As a general rule, a speed of 3 cm per second should be used, moving more slowly when inspecting areas with higher potential for leaks.

Gas Imaging Cameras

Gas imaging cameras, often referred to as optical gas imaging cameras, are a tool for detecting fugitive emission sources. These cameras provide images and video recordings of leaks that are invisible to the human eye. In addition, they can be used when it is not practical to use an organic vapour analyzer (e.g., when the component is hard to reach or is difficult to access with the analyzer's probe) and can be used to detect fugitive emissions from a distance.

The ability of an OGI camera to detect fugitive emissions depends on several factors, such as distance from source, atmospheric conditions, thermal gradient, and surveyor competency.

When completing comprehensive surveys using an OGI camera:

- Manufacturer written recommendations for the specific type of equipment used must be followed.
- Surveyors should stand 1.5 to 3 metres from the equipment being surveyed (for detection purposes), depending on the size and accessibility of the equipment. (For quantification by quantitative OGI, standing further back may be sometimes be appropriate.)
- Surveyors should divide the field of view in the camera view finder into quadrants and scan each quadrant to look for gas movement from each component. Gas movement might be visible only when the gas moves from the component to the background. If contrast is low or movement is difficult to observe, the high-sensitivity mode of the camera might help with detection.
- Each piece or group of equipment should be scanned from a wide angle in order to identify any apparent emissions. After a wide-angle scan, detailed scans should be done to identify the specific fugitive emissions source and to detect any lower-rate fugitive emissions not visible in the wide-angle scan. Each piece of equipment should also be scanned from at least two separate viewpoints to increase the probability of emissions detection.
- If the temperature of the leaking gas is similar to the surrounding area, surveyors should adjust the temperature span on the camera to compensate for low thermal contrast to improve their ability to identify a leak (e.g., when the component being surveyed is close to a heater or boiler).
- Surveyors must consider, to the extent practicable, whether there are any factors such as ambient weather conditions or surrounding physical structures that could affect the ability to detect the fugitive emissions and take these into account when conducting a survey. Surveys should not be conducted during weather conditions that undermine quality when it can be avoided (moderate and heavy precipitation, wind speeds> 4m/s, ambient temperatures below -20 degrees Celsius).
- It is difficult to see gas movement when the camera is in motion, so the camera is to be held still on one scene for a few seconds before moving on to the next.
- It can be challenging to distinguish between hydrocarbon gas and other hot gases, such as steam. When viewed through a camera, steam will dissipate quickly as it cools, but a hydrocarbon gas plume often remains visible for longer.

When comprehensive surveys using optical gas imaging cameras are conducted at very cold temperatures (below approximately -20 Celsius) physical limitations with the camera may be experienced such as LCD screen freezing or a high battery discharge rate. Efforts to keep the camera warm such as minimizing the time spent outside and the use of heating pads and/or blankets may be used.

Acoustic Leak Detection

Leakage from level control valves on separators and scrubbers to tankage without operating vapour recovery or thermal control devices must be monitored as part of comprehensive surveys by using an acoustic leak detection device as per the Greenhouse Gas Emission Reporting Regulation. Any leakage found must be reported as a leak.

When completing comprehensive surveys using an acoustic leak detection device follow manufacturer written recommendations for the specific device used.

3.4.2 Comprehensive Surveys- Measurement Methods

BCER approved leak measurement devices for comprehensive surveys are as follows:

1. Quantitative optical gas imaging.
2. High flow sampler.
3. Full flow meter.
4. Calibrated bag.
5. Other measurement devices, approved in consultation with the Regulator.

Quantitative Optical Gas Imaging Camera

Quantitative Optical Gas Imaging (QOGI) is a technology that is designed to work with an optical gas imaging camera as an add-on module. The module uses image information (pixel intensity and number of pixels) and supplementary data (distance from camera to the plume and ambient air temperature) to calculate the mass rate of the release.

When measuring emissions using an optical gas imaging camera follow manufacturer written specifications for the specific device used.

When QOGI is being used for measurement purposes, a tripod should be used to steady the camera.

High Flow Sampler

A high flow sampler includes a sampling hose, an instrumentation box containing a blower and combustibles sensors, a battery pack, and a control pad/display. The high flow sampler draws a sample of the air around a leak and measures pressure differential across an orifice restrictor as well as methane concentration using sensors. This information is used to calculate the leak flowrate.

Full Flow Meter

Leak flow rate can be measured with a variety of instruments such as a diaphragm flow meter, rotary meter, orifice meters and ultrasonic flow meter.

When measuring emissions using a full flow meter written manufacturer specifications are to be followed.

Calibrated Bag

A calibrated bag is a bag for measuring the flow rate from a vent or open line. The bag has a known volume and a neck sized to fit over openings. The leak rate is determined as the volume of the calibrated bag divided by the fill time.

It is expected that leaks up to 408 m^3/hr can be measured using a calibrated bag.[2]

When measuring emissions using a calibrated bag follow written manufacturer recommendations for the specific bag used.

Equipment Calibration and Maintenance

The FEMP should describe the methods of calibrating and practices for maintaining the survey equipment. This should include how frequently any maintenance or calibration activities are conducted and any procedures or tracking systems used to ensure that these activities are carried out (DPR Section 41.1(1)).

Documentation to demonstrate that equipment is being maintained and calibrated to the manufacturer's written specifications must be maintained.

3.4.3 Screening Surveys

Screening survey methods include the use of a soap solution (bubble test) and using the senses of hearing, sight, and smell (also known as Audio, Visual, Olfactory (AVO)). A comprehensive survey may be completed in place of a screening survey.

Leak rates and the quantification methods must be submitted to the Regulator using eSubmission.

Meteorological conditions, such as rain and wind, can make it more difficult to detect fugitive emissions. Screening surveys conducted during under meteorological conditions that substantially compromise their

[2] Section 8.5.2.1 Update of Equipment, Component and Fugitive Emission Factors for Alberta Upstream Oil and Gas, Alberta Energy Regulator, June 10, 2018

effectiveness (moderate or heavy precipitation, wind speeds greater than 4 m/s, ambient temperature below -20 degrees Celsius) should be avoided, when practicable.

AVO Inspections

When carrying out AVO inspections, check for the following:

- Stains, wet areas, or dripping around thief hatches, pressure vacuum relief valves, and gauge board assemblies on storage tanks.
- Frosting or sweating of valves and pressure-relief devices connected to vent lines.
- Visible vapour or steam plumes from components.
- Normally closed valves connected to vents or open-ended lines that are not fully closed or plugged.
- Components that have been temporarily removed for inspection, maintenance, or other purposes and have not been put back in place.
- Unlit pilots and flares.
- Odours inside buildings and downwind of piping, process equipment, and storage tanks.
- Sounds indicative of a leak.
- Responses on hydrocarbon detection monitors (personal monitors).

Permit holders should make screening surveys part of their routine site visits.

Soap Testing

Soap or bubble testing can be an effective method to detect smaller leaks. A sprayer or squeeze bottle is used to apply a soapy solution to an area where a leak is suspected. If a leak is present, bubbling occurs at the location of a leak. Soap tests may not be effective in detecting leaks from equipment that is inaccessible, has continuously moving parts, or has a surface temperature greater than the boiling point or less than the freezing point of the soap solution.

3.4.4 Training and Competency

The FEMP should describe any internal and external surveyor training programs, including the topics covered and the duration of training, and relevant certifications. The FEMP must also describe the specific training for the types of equipment being used. The FEMP should also indicate how frequently the surveyors will be trained and how often they will be retrained or recertified (DPR Section 41.1(1)).

Training of individuals conducting fugitive emissions comprehensive surveys and screening surveys should include, at a minimum, the following:

- Principles of detecting emissions with the equipment or method.
- Operation and calibration of equipment.
- Sources of fugitive emissions.
- Factors that affect estimates of fugitive emissions (e.g., weather, temperature) and how to account for them.
- Interpretation of results.

Surveyors must also have experience detecting, measuring, recording, and reporting fugitive emissions. If they do not, such as in the case of a person that is being trained, the trainee must work under the direct supervision of a trained and experienced individual (DPR Section 41.1(1)).

Surveyors must have adequate training and experience with design and operation of pneumatic devices so that any natural gas driven malfunctioning (leaking) pneumatic devices and pumps will be detected during both comprehensive and screening surveys.

Chapter 4: Repairs

Permit holders must have procedures to track, manage, and verify the status of repairs and repair information must be submitted to the Regulator through eSubmission (DPR Section 41.1(147)).

The FEMP should describe the data management practices and systems used to ensure that comprehensive survey and screening survey results trigger required repairs and that the repairs are captured for reporting purposes. System details might include the names of software programs or applications used and the type of data managed by each system. When multiple systems are used, the FEMP should explain how data flows between systems (e.g., how data from surveys performed by third parties are integrated into the permit holder's internal systems to track repairs).

The first attempt to repair a leak should be made quickly after discovery, unless parts are unavailable, the equipment requires shutdown to complete repair, or other good cause exists.

Repairs can either be completed on site during or after comprehensive surveys or screening surveys. It is recommended that maintenance or operations staff who can perform repairs accompany surveyors to complete repairs that can be done immediately.

For leaks at facilities, if repair does not require an equipment shutdown, repairs must be completed within 30 days of detection. If repairs require an equipment shutdown, repairs must be completed as soon as practicable and no later than the next turnaround of the facility. If a repair is not completed within 30 days, the reasons for the repair timeline must be documented and maintained (DPR Section 41.1(12)).

For leaks at wells and well facilities, repairs must be completed within 30 days (DPR Section 41.1(13)).

If successful repairs cannot be completed within 30 days due to the need to order parts a permit holder may request an exemption. Requests must be in writing to methane@bc-er.ca.

If a leak meets the threshold of a reportable incident in accordance with the Emergency Management Regulation, it must be reported and managed as an incident. The integrity of all repairs made must be verified. Repairs may be verified using either a soap solution or an instrument based method such as optical gas imaging.

- All leaks identified during fugitive emissions surveys or by any other means must be repaired.

Information on each leak detected and repaired made must be submitted to the Regulator using the Regulator's eSubmission portal (DPR Section 41.1 (15)).

Tagging

Physical tagging (tag is affixed to a leaking component that cannot be immediately repaired), is the most common method of tagging. These tags should be hung either directly on the leaking component or in a position where it is easy to determine the location of the leaking component. Tags should be uniquely numbered, weather resistant, designed for high visibility, and securely hung using plastic zip ties or corrosion-resistant wire.

Alternative methods of tagging, such as geospatial identifiers, should identify fugitive emission sources and provide sufficient information to enable repair. This information should include the date the leak was detected.

Consideration should be given to leaving tags in place after repairs are made to monitor for recurrent leaks.

Chapter 5: Data Management

Data management systems allow permit holders to track, manage, and analyze fugitive emissions data. These systems should:

- Track completed comprehensive, and screening surveys and repairs (including work orders).
- Track scheduled comprehensive, and screening surveys and upcoming repairs (including tagging).
- Track facility /wellsite and component performance data over time.
- Enable data analysis to identify trends.
- Generate data summaries for use in regulatory reports.

Record Keeping

Detailed records of all surveys conducted, leaks detected, and repairs made are required to be reported to the Regulator. Appendix A identifies the information that permit holders are required to either keep a record of for audit purposes or submit to the Regulator through eSubmission.

Data for any survey that is required to meet regulatory requirements must be submitted. In addition, permit holders may submit data on voluntary surveys that are additional to mandatory surveys.

Data for each comprehensive survey and screening survey conducted must be submitted electronically to the Regulator through eSubmission by March 31 of each year for each survey conducted during the previous calendar year.

Data for each leak found and for repairs must be submitted electronically to the Regulator through eSubmission by March 31 of each year for each survey conducted during the previous calendar year.

Records related to leak detection, quantification, and repair must be retained for a period of not less than 7 years after the date that the leak detection, quantification, or repair was complete to meet the requirements of the Greenhouse Gas Emission Reporting Regulation.

Data must be certified by a permit holder representative. This individual should be a senior officer as defined in the Greenhouse Gas Emission Reporting Regulation.

Data Submission

For surveys completed in 2024 and following years, permit holders may submit a single survey for each site instead of submitting a survey for each active well or facility. The site survey should be submitted under the well authorization number or facility identification number for the well or facility that is most representative of the site.

For example, a multi-well pad containing unconventional gas wells, a well facility and a conventional well. The survey should be submitted as a well survey and associated to a well authorization number for one of the unconventional gas wells as most representative of the site.

For a facility site containing a gas processing facility, other facilities and a service well, the survey should be attached to the gas processing plant as most representative of the site.

Permit holders may still submit surveys by individual well authorization number or facility identification number if desired.

Chapter 6: Alternative Leak Detection and Repair Programs

Section 41.2 of the DPR allows the Regulator to approve alternative Leak Detection and Repair (LDAR) programs. Applications for alternative LDAR programs must be submitted to the Regulator for review and be approved by the Regulator prior to alternative LDAR program implementation. Applications must be submitted to the Regulator by existing oil and gas activity permit holders or their authorized representatives. Applications must be submitted to methane@bc-er.ca.

The checklist provided below is the minimum information needed by the Regulator to review applications. The Regulator may request additional information as needed to support the application review.

Approvals may be modified or cancelled if there is evidence of significant non-compliance or failure to achieve methane emissions reduction objectives.

The duration of alternative LDAR program approvals may be limited in consideration of future methane emission reduction targets and/or the need to collect verification data.

Approvals will be issued to the permit holder and published on the Regulator's website.

Checklist

General Alternative LDAR Program Details

☐	Cover Letter
☐	Submitter contact information
☐	Map showing the proposed alternative LDAR program area boundaries
☐	List of all facilities and wells included in the proposed alternative LDAR Program, along with associated Regulator facility identification numbers, facility types, well authorization numbers and well types (schedule 2, non-schedule 2)
☐	Indicate the proposed length of the program.

Technology Details

☐	List the technologies selected. Describe how they work. Describe their commercial availability and technical maturity, other applications or uses, minimum detection threshold, and list how often each technology will be used (i.e., daily, weekly, monthly, etc.).
☐	Summarize the laboratory, controlled, and field-level testing completed to date for each technology to be used. Include any available performance data, such as probability of detection curves.
☐	Describe any performance limitations of the selected technologies (e.g., detection limits, sensitivities to cloud cover, precipitation, snow cover, wind speed, extreme cold).
☐	Describe work practices or methods that will be used to mitigate any performance limitations.
☐	Describe quality assurance/quality control procedures.
☐	Describe data quality indicators for precision and bias.
☐	Describe instrument maintenance and calibration requirements.
☐	Describe how leaks will be detected, quantified and measured.
☐	Describe how individuals using the technologies are trained to ensure their competence.
☐	Indicate if the technologies or proposed program are currently in use by the applicant or have been applied for by the applicant in other North American jurisdictions. Provide copies of approvals and other application

	disposition responses received from other jurisdictions to the Regulator. **Optional:** Provide associated application packages reviewed by other North American jurisdictions for the same or similar program.

Performance Data

☐	Summarize the data that will be available if the proposed program is implemented. Submitters are to validate emissions reductions, operational viability, cost reductions, and technology performance.
☐	List data collection methodologies and tools that will be used.
☐	Describe how sources of fugitive emissions will be tracked for repair.
☐	Indicate what information is proposed to be submitted to the Regulator, how often, when, and in what format.

Emissions Reduction Estimate

☐	Provide an assessment that demonstrates that the proposed alternative LDAR program will achieve equivalent or more methane emission reductions to those expected if the LDAR requirements in the DPR and associated technical guidance are followed.

Appendix A: Data Collection

eSubmission

Refer to Chapter 16 of the eSubmission User Guide for data that must be collected and reported using the BCER's eSubmission system.

Keep a Record

The following information is to be submitted to the Regulator's upon request:

Survey Technician Data:

- Employer name.
- Employer business address.
- Training entity name.
- Training entity address.
- Name of trainer.
- Job title of trainer.
- Training date(s).
- Number of hours of training received.
- Description of training received.

Leak Survey Data:

- Survey report.

Repair Data:

- Documentation verifying repair of leak.
- Reason for repair timeline (if repair not completed within 30 days).