FUGITIVE EMISSIONS SUMMIT AMERICAS

2022

# Methane Measurement Technologies – Current Industry Practices

SPONSORED BY: Bray EMERSON MRC Global TEADIT ZWICK

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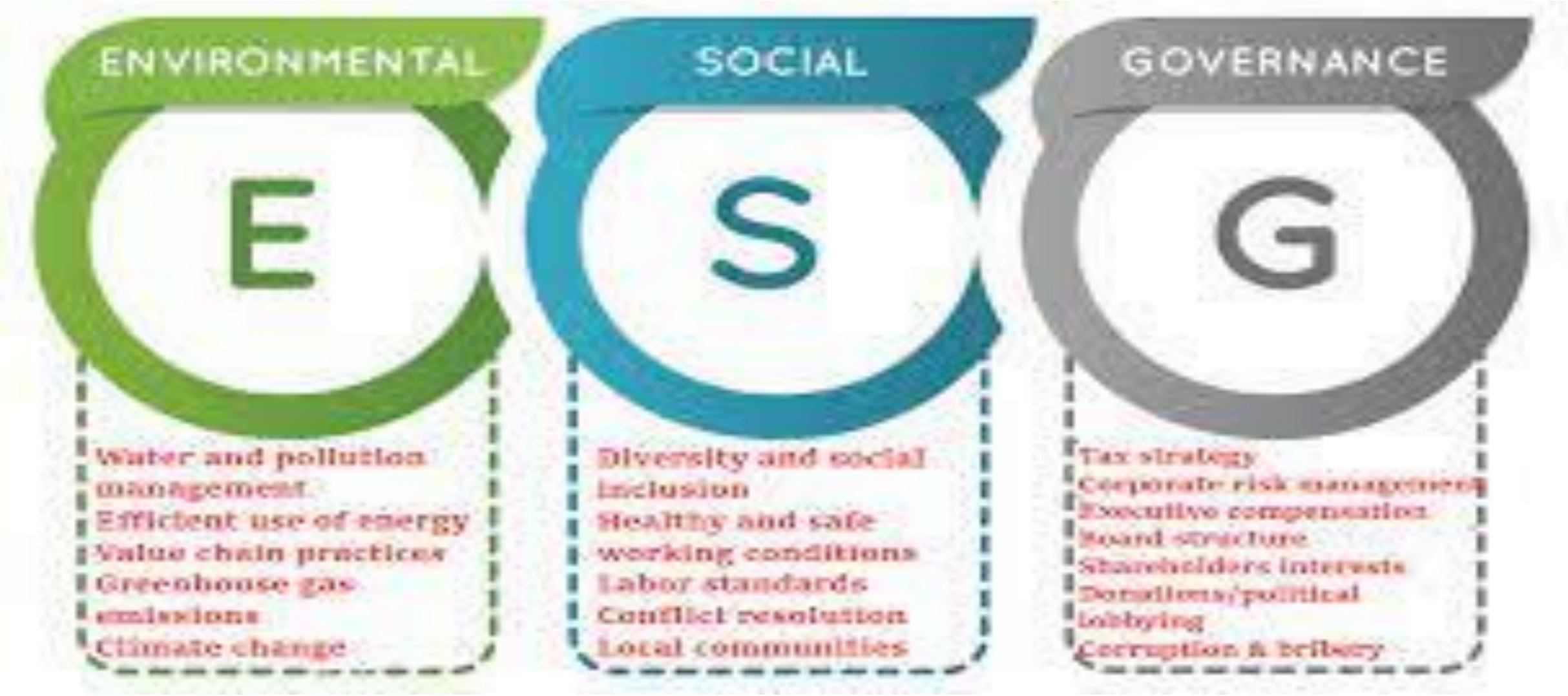
# Introduction

Natural gas consists primarily of methane, i.e., greenhouse gas(approximately 95% of gas flowing in a natural gas pipeline is methane)

Image Courtesy: Wikepedia and National Geographic

# Methane Emissions

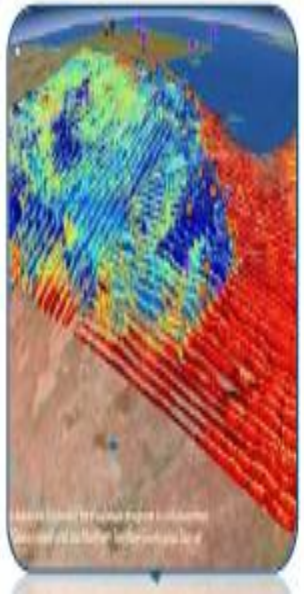



While there is a growing ESG requirements in order to to demonstrate low emissions through voluntary disclosure.

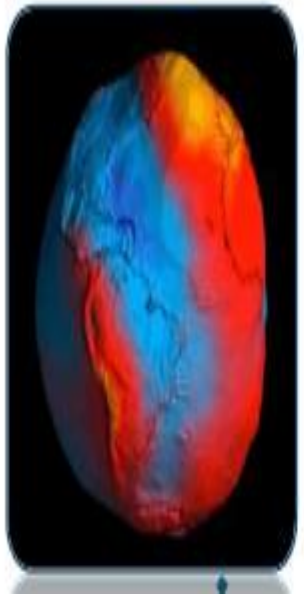
# How to measure methane emissions

## Like doing a CT, MRI & Ultrasound → All at once

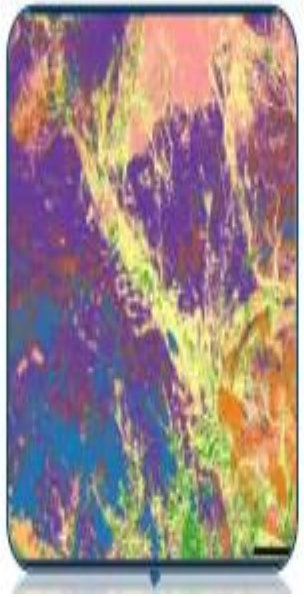
Magnetics



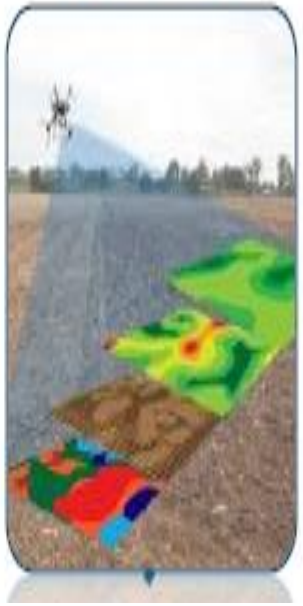
Gravitation



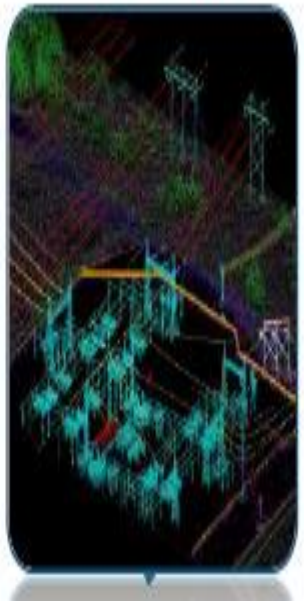
Light



Radar



LiDAR



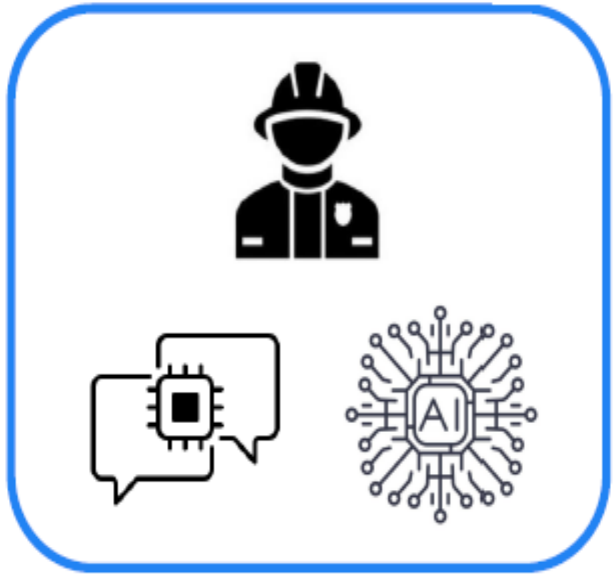
Seismic

# Automation in methane emissions

DroneDeploy helps the Energy industry to **automate remote** processes, **reduce cost**, and improve **safety and reliability**

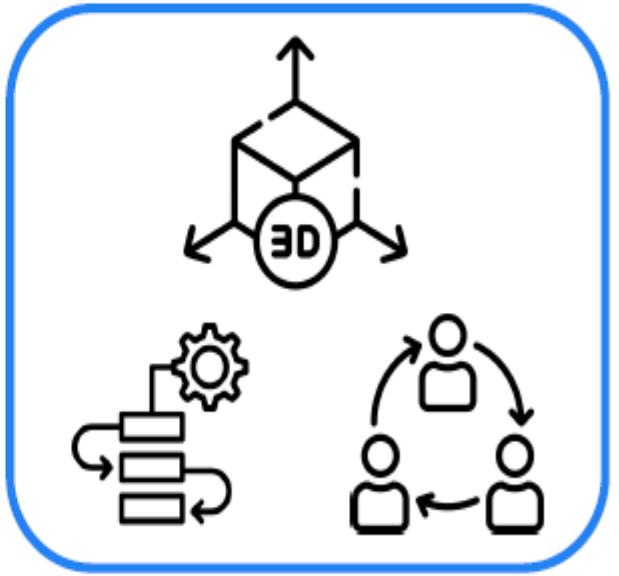
Manual or Autonomous data capture

Image processing. Maps, 3D models, 360 walkthrough




Data analysis & AI


Native integration or open API




Actionable data & collaboration

# Current Industry Practices, Codes, Regulations Applicable

- Continuous Emission Monitoring System (originally written in 1998, rev 2021)
- Air Monitoring Directive (originally written in 1989, rev 2016)
- Code of Practice for Energy Recovery, Waste Control Regulation (AR192/96)
- Alberta Air Emission Standards and Guidelines for Electricity Generation
- Natural Resources Conservation Board
- Emission Guidelines for Oxides of Nitrogen (Nox) for New Boilers, Heaters and Turbines Using Gaseous Fuels Based on a Review of Best Available Technology Economically Achievable (BATEA)
- Guidance on Air Emissions and Monitoring Requirements during Combustion of Non-Gaseous Fuels
- Guidelines for the Location of Stationary Bulk Ammonia Storage Facilities

# …contd

- Activities Designation Regulation, Provincial and Federal-Environmental Impact Assessment
- Emissions Trading Regulation
- Mercury Emission from Coal Fired Power Plants
- Ozone Depleting Substance and Halocarbons Regulation
- Release Reporting Regulation
- Substance Release Regulation
- Alberta Stack Sampling Code 1995
- Carbon and Greenhouse Gas Legislation in Alberta
- Directive 60: Upstream Petroleum Industry Flaring, Incinerating and Venting
- Directive 17: Measurement Requirements for Oil and Gas Operations
- Alternative Fugitive Emissions Management Program and Check List

# …contd

- AB Regulation 244/2018 Methane Emission Reduction Regulation
- CASA (Clean Air Strategic Alliance) Good Practices Guide for Odour Management In Alberta from Prevention and Mitigation to Assessment and Complaints.
- Environmental Protection and Enhancement Act RSA2000, cE-12, Code of Practice for Compressor and Pumping Stations and Sweet Gas Processing Plant.
- Regulatory framework of Air Emissions.
- SOR/2018-66 Regulations Respecting Reduction in the Release of Methane and Certain Volatile Organic Compounds (Upstream Oil and Gas Sector)
- Canadian Environmental Protection Act, 1999-C-15.31
- Indian Oil and Gas Canada
- The Explorers and Producers Association of Canada
- Petrinex, Canada's Petroleum Information Network

Methane RegsTechnical Factsheet.pdf

# …contd

- SK Safety Board/Saskatchewan Ministry of Environment
- BC Oil and Gas /BC Ministry of Environment
- AB Energy Regulator/Alberta Environmental Parks
- Canada Energy Regulator
- Canadian Association of Petroleum Producers
- Clean Air Strategic Alliance
- Carbon Connect International, for Implementation and offsets.
- Emission Reduction Alberta
- Environment and Climate Change Canada
- Petroleum Technology Alliance Canada
- American Society of Mechanical Engineers
- American National Standards Institute
- American Petroleum Institute
- Pipeline Research Community International
- National Authority of Corrosion Engineers

# Current Industry Codes

What is driving the CHANGES?

API Standards

1. API 622 Packing Qualification
2. API 624 Linear Valve Test Standard
3. API RP621  Maintenance
4. API 641 Quarter Turn Valve Test Standard
5. API 600 Gate Valves (4” and above)
6. API 602 Gate, Globe and Check Valves (below 4”)
7. API 603 Stainless Steel and Alloy Valves
8. API 623 Globe Valves
9. API 608 Ball Valves
10. API 609 Butterfly Valves
11. API 599 Plug Valves
12. API 598 Testing Standard
13. API 607 Fire Test Standard
14. API 6D Pipeline Valves
15. API 589 Older Version of Fire Test Standard

# …contd

- Pipeline Act
- Pipeline Rules
- Directive 77 Pipelines – Requirements and Reference tools
- Canadian Standards Association CSA Z662-19, CSA Z620.1-2016, Z620.2-2021 and Z620.3-2022
- Pipeline Performance Report
- CSA ISO 14064-1:20 Green house gases- Part 1 Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removal (adopted ISO14064-1-2018, second edition, 2018-12)
- Compliance and Standards

# Example of PTAC

**Advanced Methane Detection, Analytics and Mitigation Project**

- Demonstrates the scalability and ability to be deployed in real world situations of various novel remote sensing sensors, software, solar electric system solutions sensor and related technologies for methane detection, measurement, and mitigation in the Canadian upstream oil and gas (UOG) sector.
- Focus on testing technologies on major sources, namely cold light/medium and heavy oil production, natural gas production, and surface casing vent flows from major sources in AB and SK, support Canadian government's overall goal of methane emission reductions by 40 to 45% below 2012 levels by 2025

# Examples of Canadian Association of Petroleum Products

## Collaboration on Methane Research and Innovation

- Natural Resources Canada, Emissions Reduction AB and several universities working together to develop ground, aerial and satellite-based methane detection network. Industry has also partnered with PTAC on variety of projects, including use of truck-based sensors for area methane detection.

- Through various partnerships and programs, industry working to develop innovative solutions to improve environmental performance. The Advanced Methane Detection, Analytics and Mitigation Project demonstrates use of remote sensing sensors, software, solar electric system solutions sensor and related technologies for methane detection, measurement, and mitigation.

# AB Methane Field Challenge

- Launched through PTAC's Alberta Upstream Petroleum Research Fund (AUPRF)
- Collaborative platform between the Government of AB, the AB Energy Regulator, and industry.
- Technical team providing oversight to project includes producers, the AB Energy Regulator, BC Oil and Gas Commission, Harrisburg University/University of Calgary, Cap-Op Energy, and DXD Consulting
- Cost-effective approach to reduce methane emissions

# Regulation

- Designed to reduce methane and VOC emissions from the upstream oil & gas sector.
- Apply to upstream oil & gas facilities that extract, process, and/or transport hydrocarbon gas.
- Facilities that:
  - produce and/or receive more than 60 000 $m^3$ of hydrocarbon gas per year
  - compress natural gas
  - undertake hydraulic fracturing during well completions outside of AB and BC with gas-to-oil ratios of 53:1
- When high potential to emit, introduce operating and maintenance requirements to inspect and repair equipment, ensure control intentional/unintentional emissions.
- Measures focus on:
  - inspection program that requires industry to scan their systems and components 3 times each year
  - compressor maintenance check-up once a year to prevent significant deterioration of sealing system
  - requirements to control venting at general facility level and at equipment/process level

Courtesy: https://www.canada.ca/en/environment-climate-change/services/canadian-environmental-protection-act-registry/factsheet-technical-information-regulations-reduction-methane.html

# Timeline for Implementation and Registration

- B**efore April 30, 2020,** or within 120 days of when the facility begins to be covered by any of the requirements.
- Provisions to retain information for record-keeping, inspection purposes, and for on-demand reporting to Environment and Climate Change Canada.
- Regulatory requirements for fugitive equipment leaks, venting from well completions, and compressors, on January 1, 2020.
- Regulatory requirements for facility production venting restrictions and venting limits for pneumatic equipment, on January 1, 2023

# …contd

**2020**

**JANUARY 1**

Overall vent gas limit ***(8.3)***
Fuel, flare, and vent gas definition changes for Petrinex reporting ***(appendix 2)***
Flaring, venting, and incineration definition changes for Petrinex reporting ***(appendix 2)***
Methane reduction retrofit compliance plan ***(8.1)***
Methane emissions record keeping ***(8.11)***
Fugitive emissions management program ***(8.10.1 & appendix 12)***
Fugitive emissions surveys & screenings ***(8.10.2.1 & 8.10.3.1)***
Compressor seal testing ***(8.6.2.1)***

**JUNE 1**

Annual methane report due for the 2019 calendar year ***(8.2)***

**2022**

**JANUARY 1**

Defined vent gas limit ***(8.4)***
Vent gas limit for crude bitumen batteries ***(8.5)***
Vent gas limits for pneumatic devices installed on or after January 1, 2022 ***(8.6.1)***
Vent gas limits for compressor seals and glycol dehydrators ***(8.6.2 & 8.6.3)***

**2023**

**JANUARY 1**

Minimum 72-hour test duration for gas production at crude bitumen wells ***(Directive 017)***
Overall vent gas limit exemptions for pneumatic devices, compressor seals, and glycol dehydrators expire ***(8.3.1)***
Vent gas limits for pneumatic devices installed before January 1, 2022 ***(8.6.1)***

# Key requirements of Regulations

| Emission source | Requirements |
| --- | --- |
| **Fugitive (leaks)**<br><br>For facilities that produce and/or receive more than 60 000 $m^3$ of hydrocarbon gas per year | 1. implementation of a leak detection and repair (LDAR) program to identify and minimize hydrocarbon gas leaks<br>2. inspections for leaks three times per year<br>3. an alternative LDAR program is possible (alternate leak detection methods may be used if it is demonstrated that the emission reductions are equivalent to the reductions that would be achieved with the required inspection program)<br>4. corrective action when leaks ≥ 500 ppm are found<br>5. coming into force date: January 1, 2020 |
| **Venting from compressors** | 1. for compressors with a rated brake power ≥ 75 kW and operated at least 5% of the time over the last 3 years<br>2. vent gas from seals or rod packings and distance pieces must be either captured (to be conserved or destroyed) or vented and measured annually/continuously<br>3. corrective action when emissions are higher than the applicable limit<br>4. coming into force date: January 1, 2020 |

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| | |
|---|---|
| **Venting from well completions involving hydraulic fracturing** | 1. for facilities located outside of British Columbia and Alberta with a gas-to-oil ratios of at least 53:1<br>2. no venting<br>3. conservation of hydrocarbon gas for re-use on site or for sale, or flaring / clean incineration of hydrocarbon gas<br>4. coming into force date: January 1, 2020 |
| **General facility production venting**<br><br>For facilities that produce and/or receive more than 60 000 $m^3$ of hydrocarbon gas per year | 1. for facilities where the combined venting, destroyed and delivered hydrocarbon gas volume exceeds 40 000 $m^3$<br>2. venting limit of 15 000 $m^3$ of hydrocarbon gas per year<br>3. conservation of hydrocarbon gas for re-use on site or for sale, or flaring / clean incineration of hydrocarbon gas<br>4. coming into force date: January 1, 2023 |

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| | |
|---|---|
| **Venting from pneumatic devices**<br><br>For facilities that produce and/or receive more than 60 000 $m^3$ of hydrocarbon gas per year | 1. for pneumatic controllers and pneumatic pumps (if the combined volume of hydrocarbon gas pumped by all pumps is greater than 20 L per day)<br>2. venting limit of 0.17 $m^3$ of hydrocarbon gas per hour for pneumatic controllers<br>3. conservation of hydrocarbon gas for re-use on site or for sale, replacement with non-emitting or low-bleed for pneumatic controllers, or operate using a gas other than hydrocarbon gas for pneumatic pumps<br>4. coming into force date: January 1, 2023 |
| **Other equipment**<br><br>For facilities that produce and/or receive more than 60 000 $m^3$ of hydrocarbon gas per year | 1. minimize emissions from pipes, hatches that are not required to be open and sampling systems or pressure relief devices at the facility<br>2. coming into force date: January 1, 2020 |

# Implementation and Registration

- Form Schedule 1, 2 & 3
- Alternative Leak Detection and repair program notification
- Factsheet, general and technical information
- Order declaring provisions of regulations respecting reduction in release of methane and certain VOC
- Canada's methane regulations for upstream oil & gas
- Pollution and waste management
- Managing substances in environment

Environment and Climate Change Canada | Environnement et Changement climatique Canada

***Regulations Respecting Reduction in the Release of Methane and Certain Volatile Organic Compounds (Upstream Oil and Gas Sector)***

**Schedule 1 (Subsections 2(1) and 33(2))**
**Information for Extension of Period for Repair of Equipment Component**

**Pursuant to subsection 33 of the *Regulations Respecting Reduction in the Release of Methane and Certain Volatile Organic Compounds (Upstream Oil and Gas Sector)***
(1) An operator for an upstream oil and gas facility that must repair an equipment component on or before the end of a period referred to in paragraph 32(1)(b) may, not later than 45 days before the end of the period, apply to the Minister to extend the period for up to six months.
(2) The Minister must grant the application and extend the period for up to six months if the application contains the information set out in Schedule 1 and (a) documents that establish that, as of the making of the application, there are reasonable grounds to conclude that it is not technically feasible to complete the repair of the equipment component before the end of the next planned shutdown; (b) documents that establish that the applicant has a plan to repair the equipment component that sets out (i) the expected date for the completion of the repair, (ii) the steps to be taken to ensure completion of the repair on or before that date, (iii) a justification, with supporting documents, for the belief that that date is the earliest feasible date to complete the repair, and (iv) measures to be taken to minimize, if not eliminate, any harmful effect on the environment or human health from the emission of hydrocarbon gas before the completion of the repair; and (c) a statement that the implementation of the plan is to begin within 30 days after the day on which the extension is granted.
(3) The period granted under subsection (2) may be further extended by application made under subsection (1). At most two applications for a further extension may be made.
(4) The Minister must refuse the application if the Minister has reasonable grounds to believe that the applicant has provided false or misleading information in the application.

This form does not in any way supersede or modify the regulations, or offer any legal interpretation of those regulations. Where there are any inconsistencies between this form and the regulations, the regulations take precedent.
When using this form please save in Excel or comma-separated values (CSV) format and send by email to:
ec.methane-methane.ec@canada.ca

| | | |
|---|---|---|
| Date (dd/mm/yyyy) | | |
| **1.1 Operator information** | | |
| Name | | |
| *Civic address* | | |
| Civic address - street address (for example 1 Main street) | | |
| Civic address - city | | |
| Civic address - province or state | | |
| Civic address - country | | |
| Civic address - postal code (for example K1A 0H3) or zip code | | |
| **1.2 Authorized official information** | | |
| Name | | |
| Job title | | |
| Telephone (for example (XXX)XXX-XXXX + ext.) | | |
| Email address | | |
| *Civic address* | | |
| Civic address - street address (for example 1 Main street) | | |
| Civic address - city | | |
| Civic address - province or state | | |
| Civic address - country | | |
| Civic address - postal code (for example K1A 0H3) or zip code | | |
| *Postal address* | | |
| Postal address - street address (for example 1 Main street) | | |
| Postal address - city | | |
| Postal address - province or state | | |
| Postal address - country | | |
| Postal address - postal code (for example K1A 0H3) or zip code | | |
| **1.3 Contact person information** | | |
| *If different from the authorized official, provide contact person information* | | |
| Name | | |
| Job title | | |
| Telephone (for example (XXX)XXX-XXXX + ext.) | | |
| Email address | | |
| *Civic address* | | |
| Civic address - street address (for example 1 Main street) | | |
| Civic address - city | | |
| Civic address - province or state | | |
| Civic address - country | | |
| Civic address - postal code (for example K1A 0H3) or zip code | | |
| *Postal address* | | |

# Emissions Trading

1. Reduce emissions through improvements in facility operations and efficiency.
2. Fee of CA$15 per tonne of CO2e/year to AB's technology fund, CCEMC. For each payment, facility obtains 1 fund credit equal to 1 tonne reduction in CO2e. Pool of resources that enables additional investments in reducing emissions or adapting to climate change.
3. Purchase an emissions offset generated from non-covered facilities in AB. A 1 tonne reduction in CO2e from non-covered facility constitutes 1 emissions offset.
4. Purchase EPCs from covered facilities that have reduced their emissions intensity below their target and want to sell any extra reductions.

Net emissions intensity is calculated using the following equation:

- Net Emissions Intensity = Emissions Intensity of Covered Facility's Operations – (Fee + Offsets + Credits Production)

Courtesy: International Emissions Trading Association

# Emission Control to achieve targets

## Targets

### Existing facilities

- 6% improvement each year from 2007 to 2010, giving an enforceable 18% reduction from 2006 emission intensity, starting in 2010
- 2% annual improvement thereafter

### New facilities

- 3-year grace period
- Clean fuel standard
- 2% annual improvement

## Ways to comply
(in addition to in-house reductions)

### Climate change technology fund: *one fund/two components*

- Deployment & Infrastructure: access as % of total target over 2010-2017 period – 70%, 65%, 60%, 55%, 50%, 40%, 10%, 10%
- Research & Development: access over 2010-2017 period – 5 Mt annually
- Explore credit for certified project investments
- Contribution rate to funds ($/tonne over 2010-2017 period) – $15, $15, $15, $20, $20 escalating with GDP

### Trading

- Domestic trading
- Access to domestic offsets
- Access to Clean Development Mechanism at 10% of total target
- Actively explore linkages to a Canada-U.S, -U.S. regional or -state-level greenhouse gas emissions trading system

### Credit for early action of 15 Mt

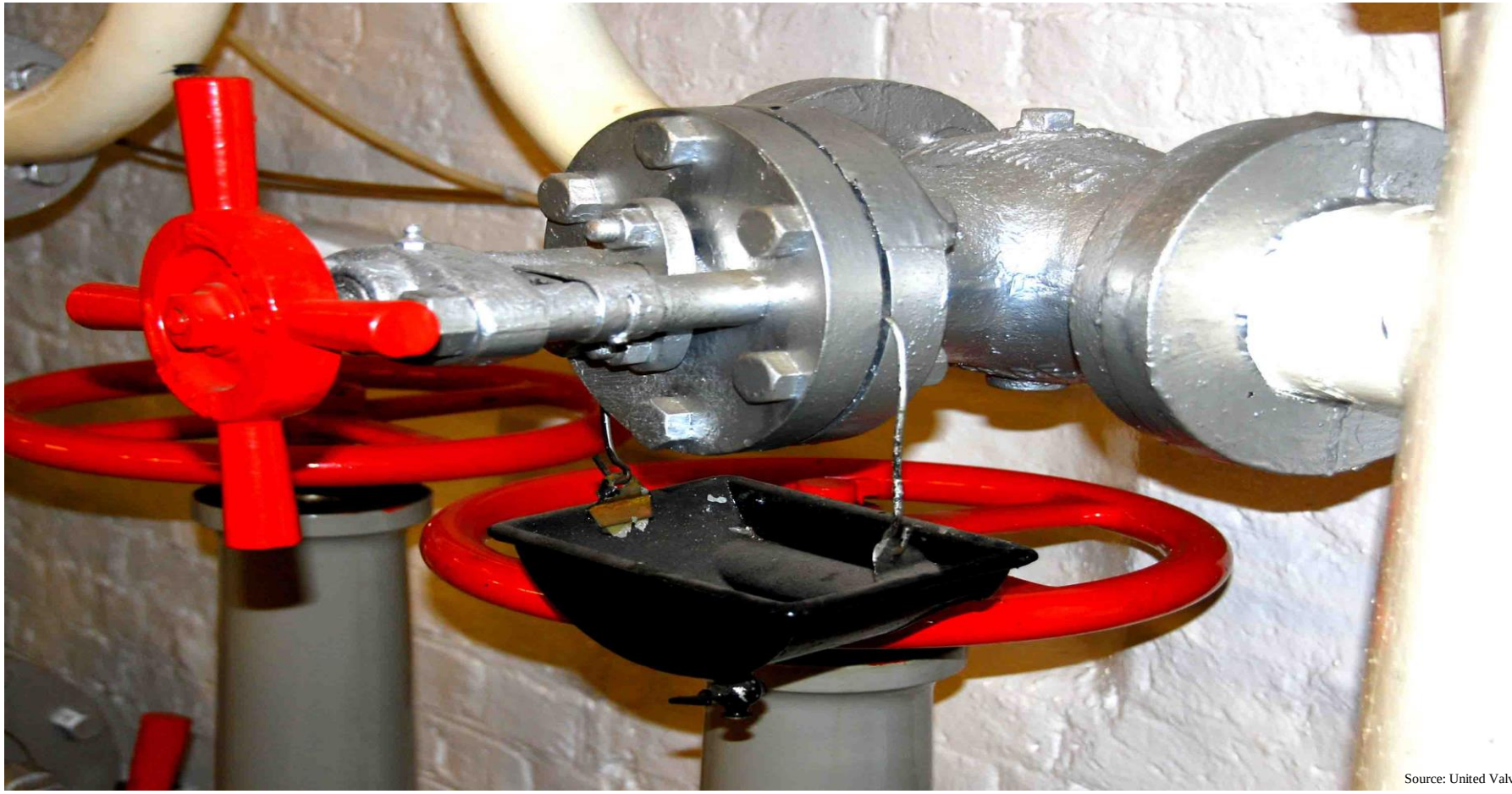
# …contd

In USA, METEC research program centers around research scientists, management and students focused on emissions from O&G infrastructure.

Major **categories** of research work:

1. Testing and experimental investigations i.e., leak detection & quantification, safety research and basic research.
2. Conducting field measurement campaigns i.e., optical gas imaging, OGI training, high volume sampler.
3. Developing emissions simulation software i.e., understanding performance of leak detection and quantification, compare with wide variety of modalities and performance, on wide range of facility types and develop methane emissions estimation tool, abatement simulation tool.

# The ultimate in leakage containment!
# Q&A



Source: United Valve, 2010