Greenhouse Gas Emissions Management

Need a reporting solution geared towards greenhouse gas emissions?

The regulatory environment for oil and gas firms in Canada and the US is changing. More pressing federal and provincial/state regulations governing the identification, management, control, and reporting of emissions sources and data are on the horizon. Organizations must position themselves to be prepared for the new emissions controls. Getting an early start is essential in order to achieve reduction targets by 2025.

Emerson provides an emissions reporting solution offering that is geared towards helping companies track, manage, and report greenhouse gas emissions across the plethora of equipment and assets in the enterprise. Accurate tracking and reporting of emissions data is a requisite first step in achieving the mandated reductions.

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What Emerson Can Do For You?

LDAR proposes a 6-step program structure in which identifying and monitoring key components comes before any reparative actions are taken. In order to properly achieve emissions reduction targets organizations must consolidate the sources of emissions information from across the enterprise and consolidate it in a coherent manner. The Data Management practice has built a tracking and reporting solution that can be used to do exactly this. Presenting a hierarchy of assets across geographies, the solution tracks, manages, and reports total emissions broken down into operational and fugitive sources, as well as target numbers across the enterprise

Methane And The Oil And Gas Industry

According to the United States Environmental Protection Agency (EPA), methane is the second most prevalent greenhouse gas emitted in the US from human activities (Overview of Greenhouse Gases, 2016). Globally, over 60% of total methane emissions come from human activities such as industry, agriculture, and waste management. Pound for pound, the comparative impact of methane on climate change is more than 25 times greater than carbon dioxide over a 100-year period (Overview of Greenhouse Gases, 2016). This makes methane one of the most potent greenhouse gases, and a large contributor towards global climate change. Methane is the primary component of natural gas, and is emitted to the atmosphere during the production, processing, storage, transmission, and distribution of natural gas and crude oil. The oil and gas sector is a key source of methane emissions in Canada, the US, and around the world. Methane emissions in 2014 from Alberta's oil and gas sector accounted for 70% of provincial methane emissions. 48% of these methane emissions came from venting, 46% came from fugitives, and the remaining 6% were from flaring or other sources (Reducing methane emissions, 2016).

Regulatory Changes Methane As An Opportunity

To combat climate change caused by greenhouse gases, regulatory bodies at all levels are advocating emissions control and reduction. Due to the potency of methane as a greenhouse gas, reducing methane emissions is a key opportunity to make sizeable greenhouse gas reductions cost-effectively. At the historic Paris Agreement in December 2015, the International Energy Agency identified minimizing methane releases from upstream oil and gas production as one of the five key opportunities to keep the global temperature rise to below two degrees Celsius (Canada-US Joint Action to Reduce Methane Emissions, 2016).

Federal Regulations

In March 2016, The United States and Canada announced a joint commitment to reducing emissions. Canada has committed to reduce methane emissions from the oil and gas sector by 40-45% below 2012 levels by 2025. To implement this commitment, the federal government will introduce regulations to reduce methane emissions and require organizations to report on all potential sources of methane across the business including both venting and fugitive emissions.

The regulations would apply to oil and gas facilities that are responsible for the extraction, production and processing, and transportation of crude oil and natural gas. These include oil and gas wells and batteries, natural gas processing plants, compressor stations, and supporting pipelines. Environment and Climate Change Canada (ECCC) will be drafting regulatory requirements designed to cover key methane emissions from the following sources:

- Venting from wells and batteries (including associated gas at oil facilities)
- Storage tanks
- Pneumatic devices
- Well completions
- Compressors
- Fugitive equipment leaks

The proposed regulations will be published by early 2017 and finalized by end of 2017. ECCC will be phasing in requirements starting with leak detection and repair (LDAR), and well completions in 2018 for new and existing facilities. Subsequently, other requirements will be added through to 2020 (Reducing methane emissions from Canada's oil and gas industry, 2016).

Provincial Regulations

The Alberta government has also committed to reducing methane emissions from oil and gas operations by 45% from 2012 levels by 2025. Alberta's reduction target and timeline match the commitments announced by Canadian and American federal governments, to maintain consistency with Alberta's approach of protecting economic competitiveness through alignment with North American environmental standards. According to the government of Alberta, methane reductions will be achieved using the following approaches:

- Applying new emissions design standards to new facilities
- Improving measurement and reporting of methane emissions, as well as LDAR requirements
- Developing a joint initiative on methane reduction and verification for existing facilities. The initiative will be backstopped by regulated standards in 2020 to ensure that the 2025 target is met.

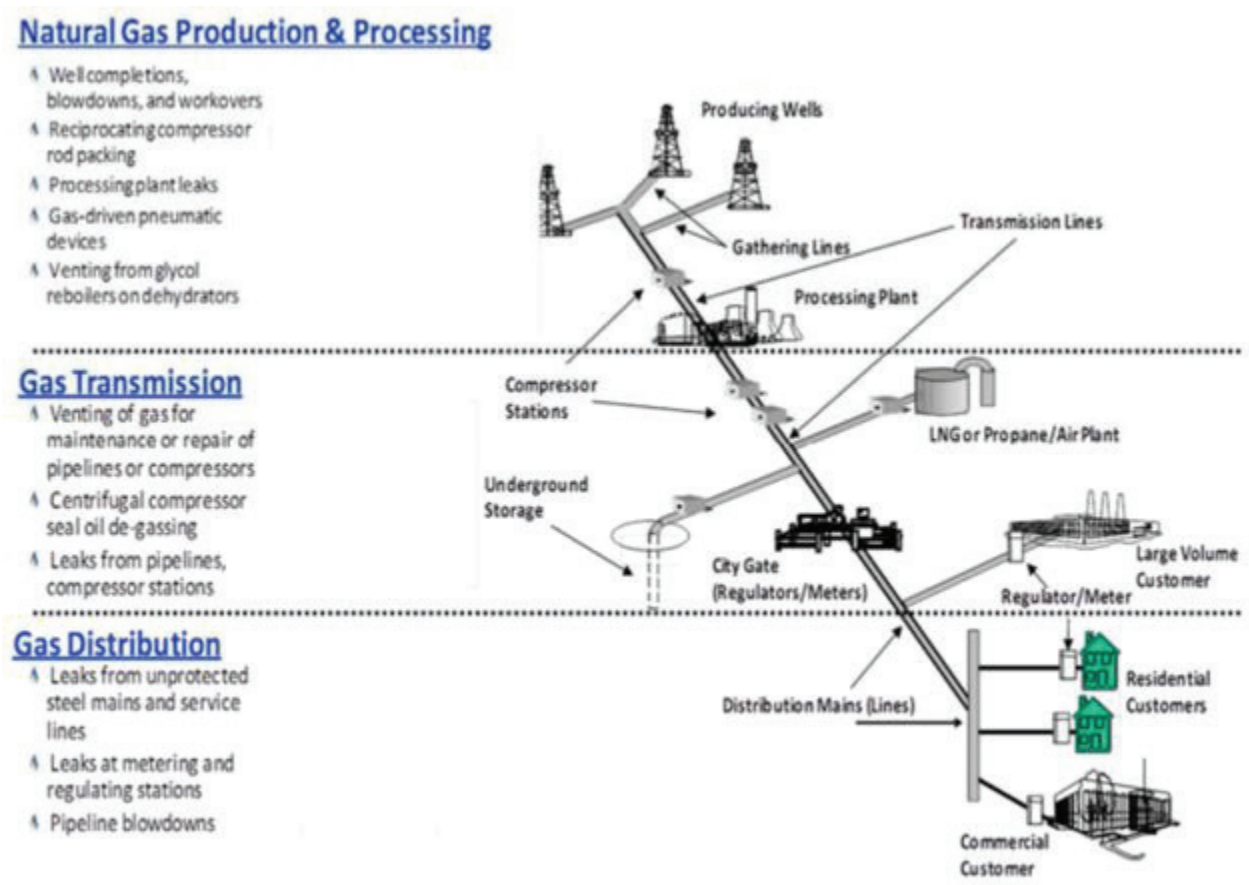
Implementation of the new oil and gas methane standards will be led by the Alberta Energy Regulator, in collaboration with Alberta Energy and the Alberta Climate Change Office (Reducing methane emissions, 2016).

Quantifying Methane Emissions

Methane emissions can be broadly classified into two categories – emissions caused by day to day operations and emissions caused by equipment fugitives (leaks). Understanding the various sources of emissions is a key first step in starting to track and report emissions. Recapping the items subject to regulations by the ECCC mentioned earlier, this section analyzes each item with respect to both operational and fugitive emissions. A few additional categories have been included, referenced from the EPA's information collection request that resulted from the US government's commitment to address emissions reduction in March 2016 (The Oil and Natural Gas Industry: Information Collection Request, 2016).

Operational Emissions

Source	Device Usage	Typical Emissions
Pneumatic Devices and Controllers	A Pneumatic Controller is a mechanical device designed to measure temperature or pressure and transmit a corrective air signal to the final control element (What is a Pneumatic Controller?, 2001).	As part of normal operation, pneumatic devices release or bleed natural gas to the atmosphere. (Options for Reducing Methane Emissions from Pneumatic Devices in The Natural Gas Industry, 2006).
Storage Tanks	Storage tanks are used for a variety of processes in the oil and gas industry.	Flash losses can occur when crude is transferred from a gas/oil separator at higher pressure to a storage tank at atmospheric pressure. Working losses occur when crude levels change or when the tank is agitated. Standing losses occur with daily and seasonal temperature and pressure changes. (Technology Transfer Workshop, 2006).
Liquids Unloading	In mature gas wells, the accumulation of liquids in the well can occur when the bottom well pressure approaches reservoir shut-in pressure. This accumulation of liquids can impede and often halt gas production, and removal of fluids (i.e., liquids unloading) is required in order to maintain production (US EPA Office of Air Quality Planning and Standards (OAQPS), 2014).	When liquid loading occurs, several strategies are typically used by operators to unload the liquids. One of the more common activities, known as well blowdowns, involves shutting in the well to allow bottom hole pressure to increase, then venting the well to the atmosphere (known as well blowdowns). This activity produces substantial emissions. (US EPA Office of Air Quality Planning and Standards (OAQPS), 2014).
Pumps	Pumps are used in several oil and gas processes to move fluids from one point to another.	Circulation pumps in glycol dehydration units and chemical transfer pumps are often powered by pressurized natural gas. As part of their normal operation, these devices will vent methane gas to the atmosphere. (Convert Gas-Driven Chemical Pumps to Instrument Air, 2004).
Reciprocating Compressors	A reciprocating compressor is a packing system that uses pistons driven by a crankshaft to deliver gases at high pressure (Reciprocating Compressor, 2016). They are used in oil refineries, gas pipelines, chemical plants, and natural gas processing plants.	Reciprocating compressors in the natural gas industry leak natural gas during normal operation. Areas of high leak frequency include flanges, valves, and fittings located on compressors. The highest volume of gas loss, however, is associated with piston rod packing systems (Reducing Methane Emissions from Compressor Rod Packing Systems, 2006).
Centrifugal Compressors	Centrifugal compressors achieve pressure by adding kinetic energy to a continuous flow of fluid through the rotor. They are used in a variety of applications including gas turbines, diesel engine chargers, pipeline compressor stations, and oil refineries, petrochemical and chemical plants. (Centrifugal Compressor, 2016).	The majority of methane emissions occur through seal oil degassing which is vented to the atmosphere (Reducing Methane Emissions from Centrifugal and Reciprocating Compressors, 2010).
Well Completion	Gas wells in tight formations and coal beds require hydraulic fracture It is necessary to clean out the well bore and formation. After well completion, operators produce to an open pit or tank to collect sand, cuttings, and fluids for disposal (Reducing Methane Emissions from Production Wells: Reduced Emission Completions, 2010).	The natural gas produced from the first start is flared as it contains impurities associated with the initial fracturing (sand, cuttings, etc.) (Reducing Methane Emissions from Production Wells: Reduced Emission Completions, 2010).



Sources of methane emissions in end to end oil and gas operation workflow. Source: (ICF International, 2015)

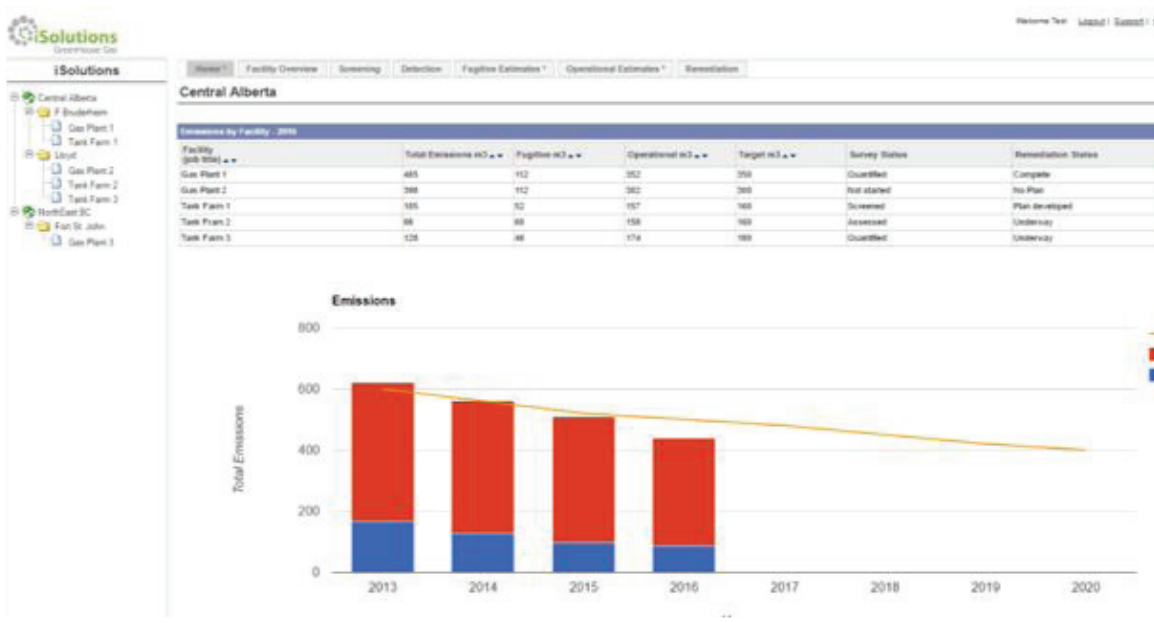
Fugitive Emissions

The LDAR best practices guide published by the EPA gives a further breakdown on identifying and classifying the types of fugitive emissions (Leak Detection and Repair: A Best Practices Guide, 2014).

Source	Device Usage	Typical Leak Scenario
Pumps	Used to move fluids from one point to another. Two types of pumps extensively used in petroleum refineries and chemical plants are centrifugal pumps and positive displacement, or reciprocating pumps.	Leaks from pumps typically occur at the seal.
Valves	Used to either restrict or allow the movement of fluids. Valves come in numerous varieties and with the exception of connectors, are the most common piece of process equipment in industry.	Leaks from valves usually occur at the stem or gland area of the valve body and are commonly caused by a failure of the valve packing or O-ring.
Connectors	Components such as flanges and fittings used to join piping and process equipment together. Gaskets and blinds are usually installed between flanges.	Leaks from connectors are commonly caused from gasket failure and improperly torqued bolts on flanges.
Sampling Connections	Sampling connections are utilized to obtain samples from within a process.	Leaks from sampling connections usually occur at the outlet of the sampling valve when the sampling line is purged to obtain the sample.
Compressors	Increase the pressure of a fluid and provide motive force. They can have rotary or reciprocating designs (detailed above).	Leaks from compressors most often occur from the seals.
Pressure Relief Devices	Safety devices designed to protect equipment from exceeding the maximum allowable working pressure. Pressure relief valves and rupture disks are examples of pressure relief devices.	Leaks from pressure relief valves can occur if the valve is not seated properly, operating too close to the set point, or if the seal is worn or damaged. Leaks from rupture disks can occur around the disk gasket if not properly installed.
Open Ended Lines	Pipes or hoses open to the atmosphere or surrounding environment.	Leaks from open-ended lines occur at the point of the line open to the atmosphere and are usually controlled by using caps, plugs, and flanges. Leaks can also be caused by the incorrect implementation of the block and bleed procedure.

Emission Reporting Offering

LDAR proposes a 6-step program structure in which identifying and monitoring key components comes before any reparative actions are taken. In order to properly achieve emissions reduction targets organizations must consolidate the sources of emissions information from across the enterprise and consolidate it in a coherent manner. The Data Management practice has built a tracking and reporting solution that can be used to do exactly this. Presenting a hierarchy of assets across geographies, the solution tracks, manages, and reports total emissions broken down into operational and fugitive sources, as well as target numbers across the enterprise.



Overview screen, depicting overall emissions in comparison with targets, broken down by asset and geography

The solution enables customers to track progress and measure actual outputs compared to target outputs. Mindful of the vast array of emissions sources and scenarios mentioned above, our configurable solution intends to provide a complete GHG emissions picture for your enterprise. Environmental data for each operational and fugitive source are integrated into the comprehensive solution, capturing key asset details and such as vendor details, P&ID tagging, repair history, and leakage/ remediation history. Our solution offering simplifies integration of numerous data sources across your enterprise in order to form a single source of truth for greenhouse gas reporting. This includes sources such as but not limited to:

- Data historians
- Field data capture systems
- Databases and data warehouses
- ERP systems
- Manual data inputs

New sources of information can be easily added. Our solution synthesizes manual and process data in a unified information management and reporting system. As a holistic solution, our software can be used to track asset repairs, manage and report detected leaks, and output reports with foundational data required for regulatory environmental reporting.

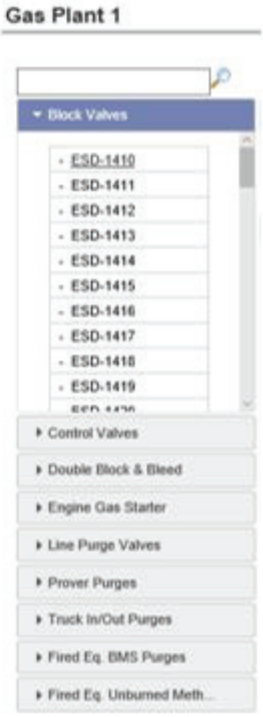
Current Year Status

Total Facility Operational Emissions	87 m3

Component Type	Count	Complete
Block Valve	2	1
Control Valve	6	0
Double Block & Bleed	3	0
Engine Gas Starter	2	2
Line Purge Valve	1	1

Top: sample summary of fugitive emissions grouped by type of equipment

Right: drill down for fugitive information of different assets by type



ESD-1410

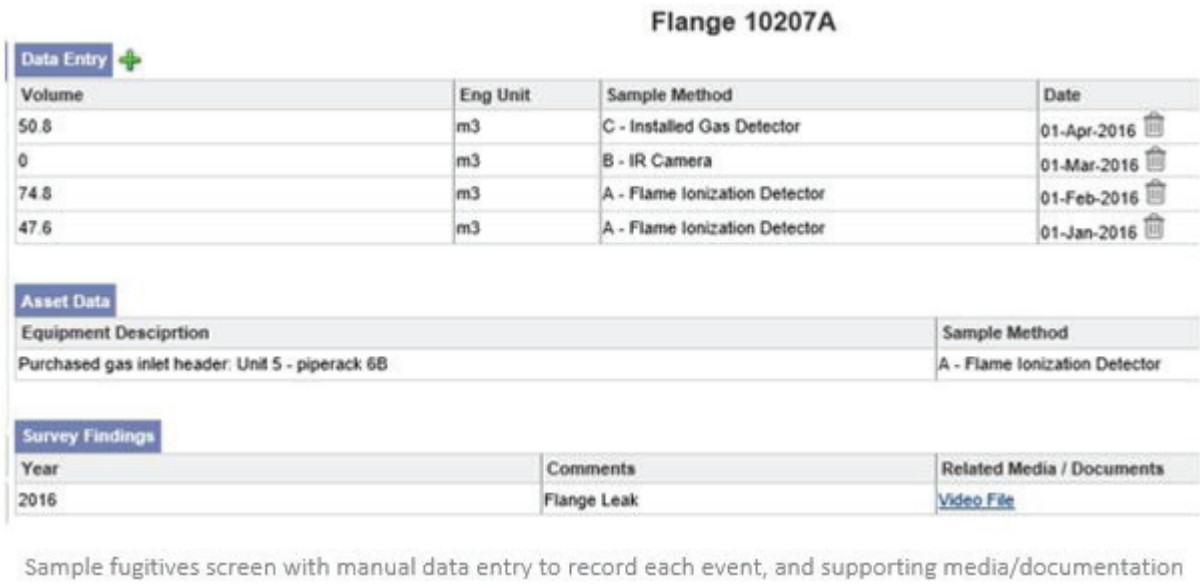
Data Entry

Estimated Strokes/Month	Mole Fraction	Estimated C2/Month (m3)	Year
5	0.98	0.0335	2016

Asset Detail

Attribute	Eng. Unit	Setting
Tag Number		ESD-1410
Class		Block Valves
Make & Model		Fisher V260
Size	Inches	8
Actuator Tag Number		
Actuator Make & Model		Fisher 3024C 45
Line Pressure	kPa	200
Line temp	degC	80
Gas Sample Date		22-Jan-2016
Volume per Stroke	cm3	2528

Sample operational estimates screen, detailing asset specifics and estimated operational emissions



Flange 10207A

Data Entry

Volume	Eng Unit	Sample Method	Date
50.8	m3	C - Installed Gas Detector	01-Apr-2016
0	m3	B - IR Camera	01-Mar-2016
74.8	m3	A - Flame Ionization Detector	01-Feb-2016
47.6	m3	A - Flame Ionization Detector	01-Jan-2016

Asset Data

Equipment Desciprtion	Sample Method
Purchased gas inlet header: Unit 5 - piperack 6B	A - Flame Ionization Detector

Survey Findings

Year	Comments	Related Media / Documents
2016	Flange Leak	Video File

Sample fugitives screen with manual data entry to record each event, and supporting media/documentation

Marry Operations And Environmental Data

In addition to our emissions management and reporting solution, there are other ways in which we can help your organization. Integrating operations and environment data into a single data source can result in several benefits for your organization. Oil and gas firms typically use historian systems for operational data, and leveraging the existing systems enhances the value gained from the existing investment. Additionally, less data scrubbing and transformation is required. Popular historian systems such as Capstone DataParc or OSIsoft PI provide a modeling / abstraction layer which helps produce an overarching view of your asset where data from multiple sources, event history, and manual and configuration data for an asset can be reported together. Modern tools also provide analytics packages which apply analytics consistently to assets, considering various operational characteristics. With our strong background with historian systems, we are more than capable of helping you realize these benefits and help you maximize your investment in existing systems.

Implement Leak Detection Systems

We have helped several clients implement leak detection systems using a variety of tools and methods and can help your organization through this process as well. A leak is detected whenever the measured concentration exceeds the threshold standard. Leak definitions vary by regulation, component type, service (e.g. light liquid, heavy liquid, gas/vapor) and monitoring interval. Many leak detection regulations also define a leak based on visual inspections and observations (such as fluids dripping, spraying, misting or cloud from or around components), sound (such as hissing) and smell (Leak Detection and Repair: A Best Practices Guide, 2014). We provide a flexible framework where data sources, thresholds and trigger characteristics may differ, but leaks are nevertheless defined and treated similarly. Our framework will allow your organization to implement descriptive, predictive, and prescriptive analytics on top of the organized data available. Emerson Operational Certainty Consulting also has a wealth of experience in implementing real-time notification systems and can configure this for your leak detection and management process as well.

Contact us today to learn more about our case examples and how we can help your organization.

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