



Shell's Rocky Mountain House asset in Canada

SHELL ONSHORE OPERATING PRINCIPLES IN ACTION IN NORTH AMERICA: METHANE FACT SHEET

Shales continue to play an important role in meeting global energy demand. Shell's shales business uses advanced technologies, including hydraulic fracturing, to unlock these resources safely and responsibly.

Today, our operations in North America are focused on six projects. We uphold five global principles, the [Onshore Operating Principles](#), which govern the onshore shale (oil and gas) activities where we operate and where hydraulic fracturing is used. The principles cover safety, air quality, water protection and usage, land use and engagement with local communities. We review our Onshore Operating Principles annually and update them as new technologies, challenges and regulatory requirements emerge. In 2016, we updated the Principles to include how we manage any potential induced seismic events from our wastewater injection or hydraulic fracturing activities. We are transparent in our activities and actively engage with communities, industry participants and other stakeholders to bring about improvements in the sector.



Operator conducting leak detection and repair survey with an optical gas imaging (OGI) camera on one of our Appalachia sites in the USA.

Methane

Emissions

Using US Environmental Protection Agency (EPA) methane emission estimates from 2015 and US Energy Information Administration (EIA) natural gas production values, the methane emission rate is around 1.1% in the natural gas sector in the USA, with the production segment making up approximately 0.7% of the total¹. Our estimated methane emission rate for our North American shale operations is less than 0.25% of methane emitted per the volume of natural gas we produced and based on 2016 corporate reporting, which includes methane emissions from operated facilities supporting natural gas production². Our business strategy specifically states a strategic ambition to reduce our carbon intensity as part of the energy transition. We continue to apply work practices and technologies to keep our emission rates under the EPA's Methane Challenge³.

Voluntary initiatives

We have a range of voluntary initiatives in place to reduce our emissions to enhance the overall climate benefit of natural gas for power generation and other industrial and commercial uses. The initiatives include:

- **Programmes to detect and repair methane leaks.** Fugitive emissions from equipment, such as compressor seals, pump seals, valves and connectors, continue to be addressed.
- **Energy-efficiency measures.**
- **Programmes to reduce flaring and venting.**

¹ EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2015*, EPA 430-P-17-001, April 13, 2017. <https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks>

² Shell estimates methane emission based on a combination of emission factors, engineering estimates, mass balance and direct measurements.

³ EPA has two voluntary program options in the oil and gas space: the Natural Gas STAR program and the Natural Gas STAR Methane Challenge. Shell has been a partner in the Natural Gas STAR program since 1995, but is not participating in the Methane Challenge.



Operator carrying out routine on site inspections in our Jumping Pound Complex in Canada.

LDAR

Shell's shales business falls under corporate standards to implement a voluntary Leak Detection and Repair (LDAR) programme for all major installations. Many of our shales sites implemented LDAR programmes before these standards were developed and helped shape them. In accordance with our Onshore Operating Principles, we monitor both new and existing production facilities, gathering lines, and compressor stations. The scope of our LDAR programme extends beyond regulatory compliance and is based on a belief that a fit-for-purpose program delivers many benefits, including product conservation, operational efficiency, asset safety, emission reduction and environmental improvement. The programme is a work practice, coupled with optical gas imaging technology, designed to identify and repair sources of fugitive emissions. The programme has six phases, which are systematically followed across our USA shales sites: planning and initiation, monitoring, repair, review, reporting, and auditing and quality assurance. LDAR surveys complement routine onsite inspections and maintenance.

AIR

Shell conducts its operations in a manner that protects air quality and controls fugitive emissions as reasonably practicable.



Methane

Monitoring

Shell is committed to evidence-based leak detection, which we perform at a frequency at or above regulatory requirements. We carry out systematic and prioritised LDAR surveys as part of the start-up and commissioning of major installations, as well as during existing operations. The majority of operating sites with surface equipment are monitored on an annual basis. We also conduct on-going auditory, visual and olfactory (AVO) checks across all sites during routine on-site inspections. As we gain more experience and new technology is deployed, the LDAR programme will be continuously improved through rigorous expert analysis of the data. Our monitoring programme covers facilities subject to regulatory requirements, such as USEPA 40 CFR 60 Subpart OOOOa, as well as sites not included in any regulatory programme. Surveys are conducted based on a component estimate and equipment inventory, following industry guidelines and internal best practices. They can be conducted by either internal Shell staff or external contractors depending on the location. We provide guidance and minimum requirements for consistent implementation of the LDAR programme.

Technology

We primarily use optical gas imaging (OGI) – also known as infrared – cameras for leak monitoring/detections and complement the cameras with the three senses; auditory, visual and olfactory. We are looking at next generation detection technologies. [In June 2017, we launched a methane detector pilot in our Rocky Mountain House asset in Canada.](#) The pilot is part of the [Methane Detectors Challenge \(MDC\)](#), which was launched in 2014 and is a collaboration between Environmental Defense Fund (EDF), oil and gas companies, US-based technology developers and other experts. The Challenge aims to bring to market technologies that can better detect sources of fugitive emissions in real time, while improving the speed and cutting costs associated with methane detection and monitoring. The Rocky Mountain House pilot tests the Quanta3 sensing system, which unlike handheld OGI cameras has the potential to continuously monitor methane emissions in our shales sites. If next generation detection technologies are proven to be technically feasible and cost effective, they could be used to complement or substitute OGI cameras and other monitoring tools.



Operators reviewing Quanta3 sensing system in our Rocky Mountain House site in Canada.

Repair

After identifying, assessing and documenting a source of fugitive emissions, we aim to conduct repairs as quickly as reasonably practicable. Repairs are conducted during the initial survey or, if an immediate fix is not possible, within 60 days. Sometimes it is necessary to delay repairs due to technical and safety reasons, until a replacement part becomes available or to coincide with the next scheduled shutdown. We conduct follow-up monitoring after repairs or replacement of components to ensure the repairs have been successful.

Training

We roll out training and assess competences to assure our LDAR personnel are educated in the program's purpose and deployment. The training provides technical understanding to implement the written LDAR programme and instructs members of the LDAR team on their individual responsibilities. Training programmes vary according to the level of involvement and degree of responsibility of LDAR personnel. We provide initial training and refresher training covering monitoring practices, changes in technologies and advances in programme improvements. We ensure that our contractors are trained to conduct surveys and effectively operate monitoring equipment.

Methane

Maintenance and prevention

We perform a wide range of routine, on-going and scheduled preventative maintenance to minimise emissions. Information from operator surveillance, inspections and surveys are reviewed and analysed regularly to identify emission sources and reduction opportunities. For example, we staff liquids unloading activities, use plunger lifts where applicable, and seek technology solutions. Our [GameChanger](#) program is investigating technologies for monitoring and reducing emissions, such as devices to replace the use of natural gas as a motive force in pneumatic controls. This has the potential to eliminate associated vented methane emissions where electricity is present.

Reporting

We catalogue and report emissions annually as required by our corporate standards and applicable regulations. Internally, we estimate methane emissions based on a combination of emission factors, engineering estimates, mass balance and direct measurements. This approach is designed to increase the accuracy of data. In the USA, we report emissions in accordance with the US EPA 40 CFR Subpart W Greenhouse Gas Report, which is publicly available. The Subpart W Report provides detailed reporting requirements. We meet similar reporting requirements in Canada. We go a step beyond regulatory allowable exclusions and include a more comprehensive set of methane sources in our annual sustainability report using primarily EPA and API measurement-based emission factors and to a lesser extent actual measurements. We work with the EPA and others to improve these factors annually using field measurement data and focused studies.

Shared learnings

Shell believes in collaboration aimed at improving methane emission management. We participate in several external initiatives (see list) and contribute to a range of internal and external studies, covering quantification, leak prioritisation, advanced leak detection (e.g. stationary, drone, and vehicle-based systems) and leak reduction technologies. We have several initiatives, such as iShale™, which facilitate technology development and deployment, contributing to reduced environmental impact and emissions.

We are working with:

[US Environmental Protection Agency \(EPA\) \(Natural Gas STAR Program\);](#)

[American Petroleum Institute \(API\);](#)

[Stanford Natural Gas Institute \(NGI\);](#)

[Centre for Responsible Shale Development \(CRSD\);](#)

[Climate and Clean Air Coalition \(CCAC\);](#)

[Oil and Gas Climate Initiative \(OGCI\);](#)

[Petroleum Environmental Research Forum \(PERF\);](#) and

[The World Bank.](#)

Energy-efficiency

Shell has greenhouse gas and energy management plans in place for key installations. These plans identify major GHG sources and reduction opportunities. They are reviewed and updated annually. Meanwhile, we continue to invest in research and development (R&D) to improve the efficiency of our facilities, processes and operations, and to develop new technology solutions.

High-bleed controllers⁴

The majority of our natural gas pneumatically operated controllers are low-emission. We have engineering standards in place for new equipment to use low-emission or zero emission options. We are consistently reducing the number of high-bleed pneumatic controllers across our shales assets in the USA and Canada. We have a small remaining inventory of high-bleed controllers, many of which we have inherited as a result of mergers and acquisitions. We are committed to upgrading all the remaining high-bleed controllers on our shales sites with low-emission alternatives within the next five years, excluding controllers designed for safety purposes.

⁴ EPA's Natural Gas STAR defines high-bleed controller as any pneumatic device that bleeds in excess of 6 standard cubic feet per hour (scfh) (over 50 Mcf per year). See link: https://www.epa.gov/sites/production/files/2016-06/documents/ll_pneumatics.pdf

Methane

Flaring and venting

We operate our assets with the goal of eliminating continuous flaring and venting of hydrocarbons as a means of disposal and to minimize necessary flaring for safety or emergency purposes. In line with our corporate standards, sites are advised to provide equipment/facilities to export, re-inject or use the produced associated gas to eliminate continuous flaring. While some flaring could still occur for safety or emergency purposes and due to lack of pipeline capacity, corporate standards advise installations to establish, maintain and implement a flaring and venting management action plan when such activities are material. We are part of World Bank's Global Gas Flaring Reduction Partnership (GGFR), a public-private initiative, which seeks to remove technical and regulatory barriers to flaring reduction. As part of the partnership, the [World Bank](#) has developed the "Zero Routine Flaring by 2030" initiative, which Shell signed up to in 2015. This encourages governments, companies and development organisations to work together to end the disposal of gas by flaring. The initiative aims to identify ways to use gas from oil production – for example, to generate electricity for local communities.

Compensation

In 2016, sustainable development continued to account for 20% of our corporate scorecard, which helps determine the annual bonus levels of all our employees, including members of the Shell Executive Committee (20% also in 2017). The Executive Committee's sustainable development measures were split evenly between our safety and environmental performance. The Remuneration Committee has focused the environmental component on GHG emissions in three specific business areas: refining, chemical plants and flaring in upstream assets. This goes beyond carbon dioxide to include other GHGs such as methane.

Additional Resources

- Shell Global/Sustainability/Climate change and energy transitions
<http://www.shell.com/sustainability/environment/climate-change.html>
- Shell Sustainability Report 2016
<https://reports.shell.com/sustainability-report/2016/servicepages/download-centre.html>
- Shell Global/Shell's principles for producing tight/shale oil and gas
<http://www.shell.com/energy-and-innovation/natural-gas/tight-and-shale-gas/shells-principles-for-producing-tight-shale-oil-and-gas.html>
- Rational Middle/The Methane Question: Fugitive Emissions
<http://rationalmiddle.com/movie/the-methane-question-fugitive-emissions/>
- Houston Energy Dialogues; Energy Dialogues Summary Report (June 2017)
https://www.bakerinstitute.org/media/files/research_document/20c6e148/CES-pub-EnergyDialogues-062917.pdf