



METHANE
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Reducing Methane Emissions: Best Practice Guide Continual Improvement

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Disclaimer

This document has been developed by the Methane Guiding Principles partnership. The Guide provides a summary of current known mitigations, costs, and available technologies as at the date of publication, but these may change or improve over time. The information included is accurate to the best of the authors' knowledge, but does not necessarily reflect the views or positions of all Signatories to or Supporting Organisations of the Methane Guiding Principles partnership, and readers will need to make their own evaluation of the information provided. No warranty is given to readers concerning the completeness or accuracy of the information included in this Guide by SLR International Corporation and its contractors, the Methane Guiding Principles partnership or its Signatories or Supporting Organisations.

This Guide describes actions that an organisation can take to help manage methane emissions. Any actions or recommendations are not mandatory; they are simply one effective way to help manage methane emissions. Other approaches might be as effective, or more effective in a particular situation. What readers choose to do will often depend on the circumstances, the specific risks under management and the applicable legal regime.

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Summary



Continual improvement is an ongoing effort to improve products, services or processes. Methane management and reduction of emissions are important for the oil and gas industry. As methane emissions performance for the oil and gas industry improves; company goals, policies and practices must evolve to drive continual improvement and meet increasing regulatory, public and business expectations. For natural gas to continue to be accepted as a low-carbon option for fuel, the methane emissions associated with its extraction, processing and transmission need to be minimized.

Low methane emissions, referred to in this guide as 'methane excellence', can be achieved by setting and meeting strong targets for reducing emissions while systematically improving methane management. This involves improving efforts to measure emissions, adopting mitigation techniques, improving how emissions are reported, and embedding methane management as part of the company's culture.

Methane management requires commitment from both senior management and asset management, who should emphasize the importance of methane management and the expectation that all employees (and contractors) will adhere to company policies and practices relating to methane.

Best practice for continual improvement of methane management

- ✓ Use a management process such as the 'plan-do-check-act' cycle (the PDCA cycle)
- ✓ Improve methane leak detection and practices to prevent and repair leaks
- ✓ Apply methane mitigation strategies at the project engineering and design stage
- ✓ Learn from methane-emissions data, patterns and trends
- ✓ Set strong methane-reduction targets
- ✓ Report the results of mitigation activities.
- ✓ Build methane management into company culture

Introduction

Methods to reduce methane emissions (mitigation) drive discrete reductions, but continual improvement of methane management is needed to maintain a company-wide culture of methane excellence. Continual improvement of methane management can lead to recognition for methane excellence and help improve the reputation and long-term acceptance of the asset, the organization and the oil and gas industry as a whole.

The most important factor to achieving methane excellence is commitment from everyone – ranging from senior leadership to frontline employees. Commitment to methane excellence is a long-term effort to identify, fund and implement new strategies and operations.

Everyone in a company has a role in achieving methane excellence, but the role of the asset manager is particularly important. The asset manager is the communication link between senior management and employees regarding company policy and procedures, as well as the communication link between asset operations and management in relation to the results and impacts of policies and procedures.

This guidance can help asset managers achieve and maintain methane excellence.

Systematically improving methane management

Transforming a company from one that does the minimum required by law to one that achieves methane excellence is a complex journey that involves technical, organizational and leadership skills. Such an undertaking requires a systematic approach. Management-system structures, such as ISO 14001 and ISO 14080, provide specific tools to help.

Companies that use environmental-management systems, such as those certified to an ISO standard, need to have a risk register, which can be used as a basis for efforts to reduce methane emissions. Methane emissions can be added to the risk register of the Environmental Management System (EMS) as a potential environmental hazard, creating a process for:

- taking action to measure and reduce methane emissions;
- setting environmental objectives associated with methane emissions; and
- having changes in methane risk reviewed by management.

The risk statement, a term used in management system development, can be reported as failing to meet an internal or external key performance indicator for reducing methane emissions.

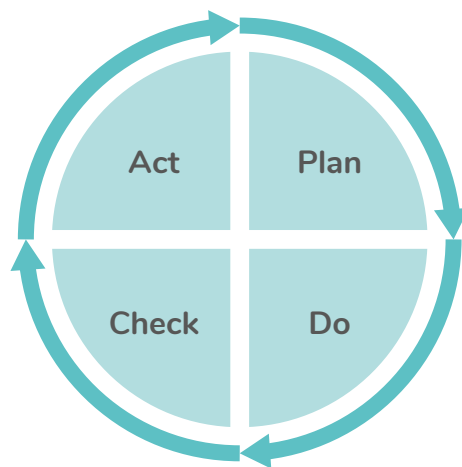
If a formal management-system structure is not available, a company can adopt the PDCA cycle, referenced in the Six Sigma system¹, to implement continual improvement and manage quality during the journey to methane excellence. Using this cycle allows a project to be broken down into small, manageable steps and allows for gradual improvement over time. The PDCA cycle requires the following.

- Map the desired change (plan)
- Make the change (do)
- Check to determine if the change had the desired effect (check)

- When the change is complete, make the changed process part of the relevant process (act).

The PDCA cycle then starts again so the changed process is continually improved.²

Figure 1: Illustration of the plan-do-act-check cycle



Continual improvement in methane management requires a management process like the PDCA cycle to be applied to the following elements of reducing methane emissions.

- Improving detection of emissions
- Improving emissions mitigation capabilities
- Setting strong methane-reduction targets
- Achieving transparency through reporting the results of mitigation activities
- Building methane reduction into the company's culture

Improve methane mitigation capabilities

1. Improve methane leak detection and response practices to prevent, detect and repair leaks

The more frequently an asset seeks out and detects methane emissions, the quicker

leaks will be found and repaired, and the more effectively emissions will be reduced. Formal monitoring/leak detection events provide an opportunity to understand the root causes of methane emissions and consider effective mitigation options. However, there could be an 'emission-to-cost' optimal point after which extra monitoring/leak detection events would bring reduced returns. For information on the range of monitoring program/leak detection options available, see the Equipment Leaks Best Practice Guide.

2. Learn from existing operations to reduce methane through engineering and design

Some sources of methane emissions can be eliminated by design or engineering when an asset is being modified. This may include using welds instead of threaded connection and flanges, redesigning a facility to eliminate storage tanks, and replacing pneumatic devices driven by natural gas with electric or mechanical devices, or ones driven by compressed air. The modification could include wider operational changes or be made exclusively to reduce emissions.

An even better option is to take advantage of the opportunity to eliminate potential emissions sources when designing new projects and to use information from current operations to justify increasing methane-reduction elements. For a review of the wide range of activities available to design into a new project, see the Best Practice Guide relating to Engineering Design and Construction.

3. Create an end-to-end process for reducing emissions

Typically, an oil and gas production facility will progress through three major phases on the path to methane excellence.

a Start with a comprehensive inventory of methane emissions

Assess current inventories and identify opportunities to improve accuracy and coverage of methane source identification. A comprehensive inventory will help to identify the largest contributors to emissions at the asset, as well as target specific sources for improvement.

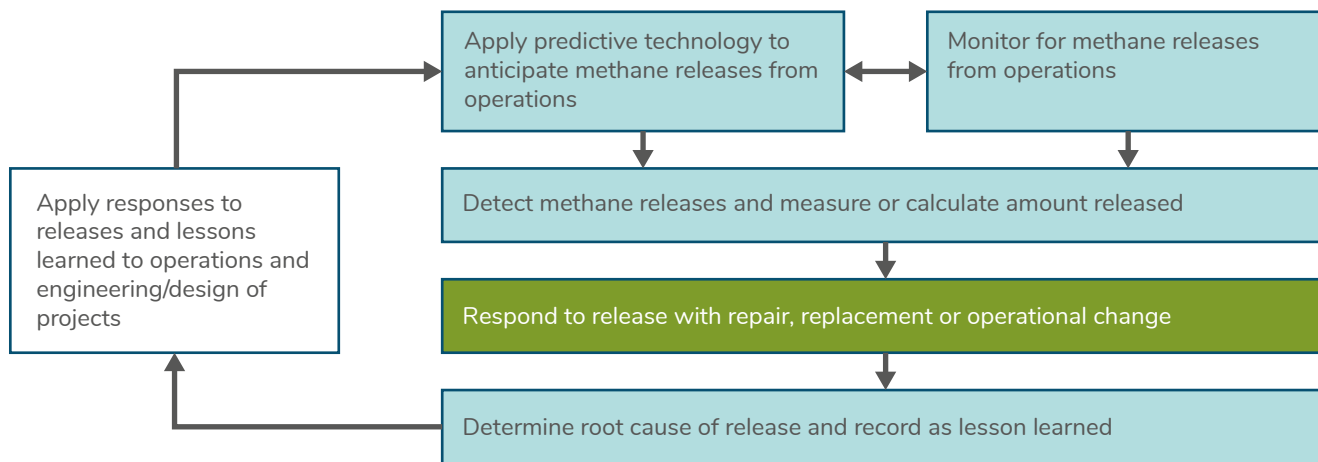
b Follow the mitigation strategies set out in the Methane Guiding Principles Best Practice Guides, prioritizing those that apply to the largest sources of emissions

Reviewing possible mitigation activities for each area of an asset and assessing available mitigation options against environmental impact, cost and feasibility, will identify the best possible mitigation strategies for the asset. The cost-effectiveness of each mitigation option can be assessed by using the Methane Cost Model in the Methane Guiding Principles Toolkit. Inventories of emissions should be reviewed regularly as they will change as a result of methane management.

c Continual improvement of methane leak detection and mitigation

Track advances in monitoring/leak detection, information management and technology for reducing emissions as there are regular advances in efficiency, cost and accuracy. For example, upgrading methane monitoring systems/leak detection and using digital solutions can automate tasks that were previously performed manually, increase the accuracy of measurements and potentially reduce costs. Applying advanced analytics and artificial intelligence can build a predictive maintenance process that identifies potential methane leaks before they happen.

Figure 2: The methane management cycle



Learn from methane-emissions data, patterns and trends

An asset with a growing methane-management program will have information from methane monitoring/leak detection, leak repairs, engineering changes and operational changes made to reduce methane emissions. With this information, an asset can start to assess trends and patterns and find out the effect of efforts that have been made to reduce emissions. It is necessary to make a causal link between efforts to reduce methane emissions with the change in emission levels in order to identify the next suitable opportunity for action to be taken.

One approach to analyzing trends and patterns is to apply a structured root-cause analysis program such as the '5 Whys' framework. The 5 Whys framework is a tool provided by Six Sigma³ where the user provides a statement of the issue to be analyzed and then considers the response to related 'why' questions until the root cause is discovered. It is particularly appropriate for team settings, making it an ideal way to assess methane management in operational meetings on facilities.

An example of a root-cause analysis for methane management follows.

- **Question 1:** Why does the asset have high methane emissions from flaring?
Answer: The pipeline the asset is connected to is often unavailable.
- **Question 2:** Why is the pipeline often unavailable to receive gas from the asset?
Answer: The pipeline has more customers than it can manage, so assets with individual contracts for services have priority.
- **Question 3:** Why do the assets with contracts have priority?
Answer: They pay a fee to use the pipeline. To cover the fee, they are paid a reduced rate for their gas, which can sometimes result in a loss.
- **Question 4:** Why doesn't the asset have a contract for using the pipeline?
Answer: When the relationship between the asset and pipeline developed, the asset did not want to risk a financial loss in exchange for a reduction of methane emissions as reducing emissions was not a priority at the time.

- **Solution:** The asset has high emissions from flaring because transporting the gas in a pipeline runs the risk of financial loss. A new cost-benefit analysis based on the asset's and company's current methane-reduction priorities needs to be performed.

Set strong methane-reduction targets

Having a methane-reduction target is a vital part of methane management as it drives continual improvement and demonstrates to stakeholders the company's intended level of methane reduction.

Current best practice in methane targets includes setting intensity targets for operated assets. For example, the Oil and Gas Climate Initiative announced a target for member companies to reduce by 2025 the collective average methane intensity of aggregated upstream gas and oil operations to below 0.25%, with the ambition to achieve 0.20%.⁴ Many companies have announced individual targets with similar ambitions.

Future recommended best practice in target setting could increase ambition and widen the scope of methane management. Going forward, companies developing new or improving existing methane reduction targets should consider several components:

1. Include methane emissions from both gas and oil production.

The International Energy Agency (IEA) estimates that more than half of methane emissions from the oil and gas supply chain come from oil production⁵, so a target should consider all methane emissions from both oil and gas production, including stranded and marketed associated gas.

2. Address emissions from both operated and non-operated assets.

Joint ventures are common across the oil and gas industry. For some companies, large portions of their portfolios may be non-operated⁶. As a result, including objectives for influencing the reduction of methane emissions at non-operated assets is also important. Some companies, like Chevron⁷, have already announced targets that apply to both operated and non-operated assets.

3. Include both an absolute target and an intensity target for methane.

Most companies currently target a methane intensity (total methane emissions from oil and gas production divided by total natural-gas production). These intensity targets are informative and can provide certainty on emissions levels even if production rises. EDF recommends an intensity target of up to 0.20%⁸.

Absolute targets are also important as they provide certainty about environmental outcomes. These targets include the total percentage of methane emissions the company plans to reduce relative to a baseline year. IEA notes that 75% of methane emissions from oil and gas operations can be reduced using existing technology, and 50% of these emissions at no net cost.⁹

4. Rigorous emissions measurements and analysis inform targets and validate reduction levels.

Field measurements at both the site and basin levels are necessary to accurately assess progress towards targets. Public reporting of data and methods makes targets more credible, and validation from a third party provides further support.

Systematically improving methane management

Companies using a formal management system may already have a mechanism to support and drive methane reduction targets. Environmental and emissions management systems such as ISO 14001 (environmental) and ISO 50001 (energy/emissions) need targets for the company's environmental impacts or emissions, which include methane emissions. Consistently applying a management process like the PDCA cycle can help with meeting methane reduction targets.

An ambitious but achievable methane reduction target requires high-quality accurate information from the asset. Asset managers can drive the methane reduction targets set by their companies by supplying information about their assets, including the following.

- The potential for current practices to reduce emissions
- The potential for proposed practices to reduce emissions
- The potential for methane emissions to increase due to production increasing or the asset expanding
- The potential for methane emissions to reduce due to production reducing or the asset shrinking

Accurate information from the asset supports continual improvement by helping the company become confident in setting increasingly ambitious methane-reduction targets over time.

Report mitigation strategies used and the results

Transparent reporting of methane emissions and reduction targets, as well as the information these are based on, is critical to building internal and

external stakeholder confidence in a company's efforts to reduce methane emissions. Not reporting can be misinterpreted as a failure to act. Globally, and increasingly in line with the Taskforce on Climate-related Financial Disclosures (TCFD) guidance, investors are starting to ask more questions about a company's management of climate change issues. Transparency regarding efforts to reduce emissions (whether voluntary or required by law or regulation) and the results of those efforts helps establish a company's or asset's position and achievements in the field.

Current best practice in external reporting of methane includes:

- Reporting an overall group level methane number (Mte) and a methane intensity (%)
- Reporting methane emissions in carbon dioxide equivalents (CO₂e) and methane (CH₄) to communicate methane's impact on global warming, the economic value (methane is lost product) and align with regulatory reporting on greenhouse gas.

Future recommended best practice in external reporting includes increasing the ambition on external reporting by broadening the scope to include asset level reporting. The following is a set of reporting considerations that are particularly relevant at the asset level.

- External reporting of asset level methane emissions drives senior management to look critically at the parts of their portfolio that underperform. Asset-level reporting drives continual reporting by expanding the scope of reporting and reinforces the importance of mitigation strategies in an asset culture.
- Use of emission factors in estimating methane emissions introduces uncertainty. Non-region-specific emission factors are not likely to be

representative. Moving towards regional emission factors and the use of direct detection and measurement technologies at the asset level will enhance future external reporting.

- Having information validated by a third party adds to the expertise of company scientists, engineers, and statisticians who collect, analyze and report information on methane emissions. Third parties can help identify problems and opportunities for continual improvement. Although validation from a third party is most commonly part of well-established methane management systems, evolving methane management systems can also benefit from third-party validation by learning and improving more rapidly.

Integrate mitigation strategies into company culture

An oil and gas company can promote a culture that supports methane excellence by continually raising awareness of methane reduction across the business until it is embedded in the company's culture. At this point, methane reduction is not an extra task, but part of an employee's role, much like a behavior-based safety program.¹⁰

Asset managers should be able to communicate new processes and procedures, as well as strategic and cultural changes associated with methane reduction, to their employees. The following is a set of recommendations for asset managers to use. Communications materials may be developed centrally (for use by Asset managers) or locally dependent upon the scope and content.

1. Integrate methane reduction efforts into existing business and operational procedures

To make methane reduction part of employee normal behavior and work habits, it needs to

be built into as many existing procedures and trainings as possible.

- Incorporate methane reduction activities and new operations practices into existing efficiency improvement programs, such as Six Sigma, to embed methane reduction into the company's core business and operational structure.
- Incorporate methane reduction activities into existing management system (ISO 14001 for environmental and ISO 50001 for energy and emissions) action plans to make improvements and monitor and report progress.
- Incorporate methane reduction activities into standard operating procedures (if a formal management system does not exist) and training programs when they are being amended for other purposes.

2. Establish new learning opportunities relating to reducing emissions

Include methane reduction awareness and climate change concepts in learning opportunities for non-technical as well as technical staff. The learning should include awareness of the savings to be made from recovering methane emissions that can then be used or sold, and benefits for the environment and the company's reputation.

- **Establish an 'internal learning hub'**
Best practices for reducing emissions, as well as related company procedures, should be centrally available, easily accessible and clearly identified in the form of an 'internal learning hub' that all employees have access to. Details of desired practices and projects to support continual improvement of methane management should be available in the hub, and comments should be welcomed.

- **Encourage experience sharing**

Increasing the level of engagement on methane reduction is known to drive continual improvement. Examples include:

- building methane reduction efforts into team-building activities at the asset-level; and
- encouraging asset employees to take part in forums that bring together oil and gas professionals with key roles in methane management, to share best practice.

3. Promote methane excellence and innovation

Getting involved with external initiatives such as the Methane Guiding Principles, and oil and gas industry groups and trade associations, provides access to information on best practices for reducing emissions. Company representatives who are involved are then able to share these best practices across their organizations.

Innovation requires a workforce that is eager and encouraged to innovate. An asset manager can develop a team culture of methane reduction innovation by creating a supportive environment and incentives for innovation. McKinsey & Company¹¹ recommends a progressive process to encourage innovation, combined here with the following specifics of making progress in methane reduction.

- **Communicate and connect**

Encourage teams by communicating personal and company support of methane reduction innovation and the desire for team involvement. Identify highly engaged team members to help with finding opportunities for innovation and driving efforts.

- **Set goals and boundaries**

Encourage creativity while maintaining discipline, and clearly express innovation goals and boundaries.

- **Support and govern the process**

Set metrics, targets and budgets to allow for openness about what success looks like, and what resources are available to achieve goals. Step in if boundaries are exceeded, particularly those of legal restrictions, safety restrictions and company policy.

- **Track and reward results**

Recognize and reward success not only in achieving a goal (such as increasing monitoring coverage by 20%) but also in driving innovation (for example, coming up with a way to streamline methods for collecting and storing monitoring/leak detection information). Just as innovation results range from minor to major, rewards can range from offering special recognition during a group meeting to a small (company-approved) gift. Methane reduction can also be built into the culture by making it a key performance indicator (KPI) for employees.

Checklist

The following checklist allows each company to assess their progress in establishing a continual-improvement process for their efforts to reduce methane emissions.

Items	Completed
✓ Asset has identified sources of methane and keeps an accurate inventory of them and their emissions.	
✓ Asset has methane goals and targets which are understood by employees, tracked and managed.	
✓ Methane reduction is promoted and integrated into employee KPIs or reward schemes as incentives.	
✓ Asset has arrangements in place to monitor, understand and comply with methane-management regulations that apply.	
✓ Asset has a methane action plan, monitors performance against it, and aims to improve efforts to further reduce methane emissions.	
✓ Asset has embedded methane-reduction best practice into appropriate operating procedures and has trained relevant staff in using the best practices.	
✓ Asset has a methane-awareness plan and a methane communication plan in place.	
✓ Asset has delegated accountability for methane management to appropriate roles.	
✓ Asset has arrangements in place to make sure adequate skills and budgets are in place for projects to reduce methane emissions.	
✓ Asset directly measures its methane emissions at agreed intervals.	
✓ Asset reports its methane emissions internally at agreed intervals.	
✓ Asset learns from its methane inventory, methane measurements and the sharing of best practice to further reduce methane emissions.	
✓ Asset independently verifies its methane emissions on a regular basis.	
✓ Asset tracks and embraces new technologies and best practice for measuring and reporting methane emissions.	
✓ Asset implements decisions and recommendations from external emission-reduction initiatives.	
✓ Where appropriate, the business understands methane emissions from non-operated facilities, has an influencing plan in place, and understands the basis of non-operated methane emissions and shares learnings.	

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