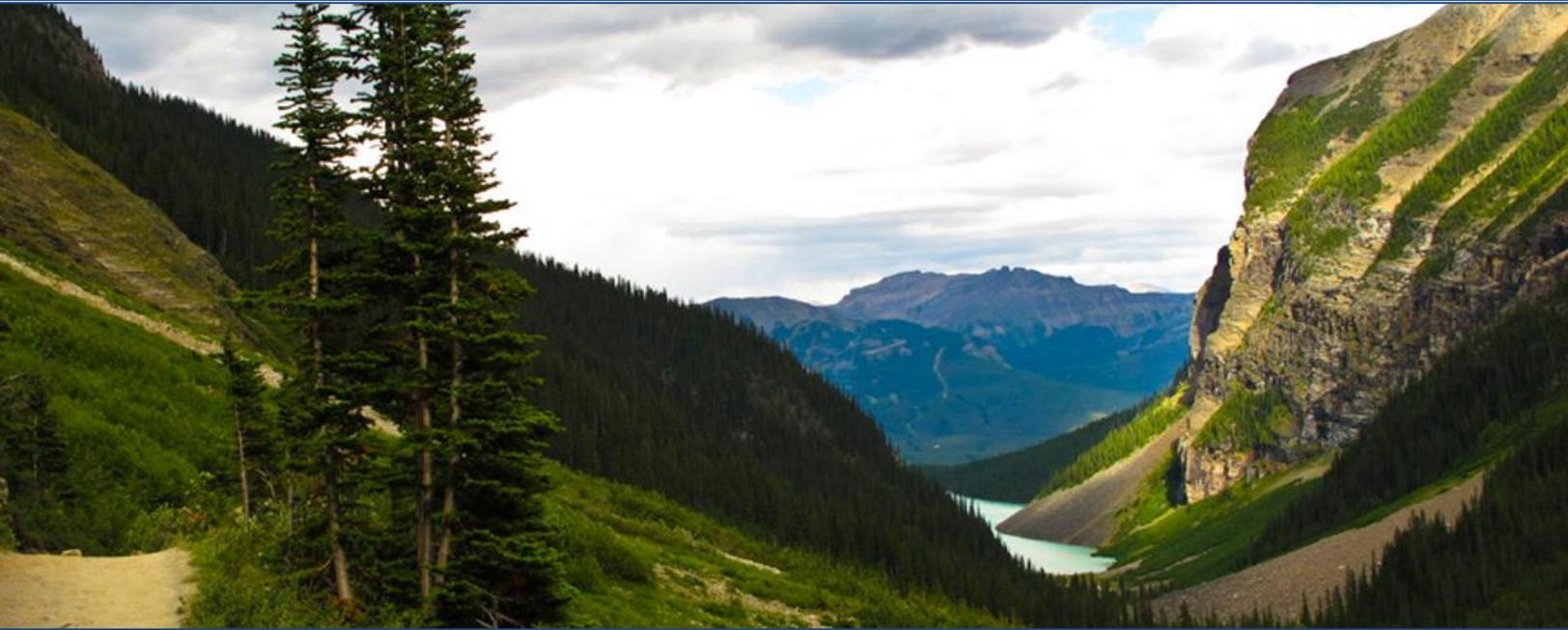


# Climate Change Legal Roadmap: Methane Reduction under the Climate Change Leadership Plan



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**August 8, 2017**



Environmental  
Law Centre

Library and Archives Canada Cataloguing in Publication

Title: Climate change legal roadmap : methane reduction under the climate change leadership plan / prepared by Brenda Heelan Powell (Staff Counsel, Environmental Law Centre (Alberta))

Names: Powell, Brenda Heelan, 1971- author. | Environmental Law Centre (Alta.), publisher.

Description: Includes bibliographical references.

Identifiers: Canadiana 20190088850 | ISBN 9780995304574 (PDF)

Subjects: LCSH: Climatic changes—Law and legislation—Alberta. | LCSH: Atmospheric methane—Alberta—

Prevention.

Classification: LCC KEA420 .P69 2019 | LCC KF3775.ZA3 P69 2019 kfmod | DDC 344.712304/6—dc23

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**Charitable Registration #11890 0679 RR0001**

## Acknowledgements

The Environmental Law Centre thanks the Alberta Law Foundation for its financial support of our climate change program which includes the **Climate Change Legal Roadmap** series of papers and the companion **Climate Change Law Blog Series**.



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## Introduction

In late 2015, the Alberta Government released its *Climate Leadership Plan* (the “ACLPL”) which is a policy document based upon the recommendations made in the *Climate Change Advisory Panel Report* (the “Advisory Panel Report”)<sup>1</sup> The ACLPL focuses on four key areas for further development:

- implementing a new carbon price on greenhouse gas (GHG) pollution,
- phasing out coal-generated electricity and developing more renewable energy,
- legislating an oil-sands emissions limit, and
- employing a new methane emission reduction plan.

While the ACLPL sets policy guidance for climate change legislative action in Alberta, it is a very high-level document. There is not a great amount of detail on the tools and mechanisms that will be used to achieve the policy goals set in the ACLPL.

In response to this dearth of policy detail, the ELC is publishing a series of reports – the **Climate Change Legal Roadmap** – outlining climate change actions taken in other jurisdictions and making recommendations for Alberta. The ELC has published three reports in this series: *A Snapshot of Alberta’s Climate Change Law & Policy*, *Carbon Pricing Recommendations for Alberta: Lessons from the Latest Developments in WCI*

*Jurisdictions* and *Oil Sands Emissions Limit under the Climate Change Leadership Plan*. This particular report looks at methane emissions reductions as proposed by the ACLPL.

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<sup>1</sup> The Alberta Climate Leadership Panel was established in mid-2015 for the purposes of providing advice to the Government of Alberta to inform the development of a comprehensive climate change strategy. The Panel engaged with Albertans, reviewed existing climate change policies, and provided advice to the Minister of Environment and Parks. The *Advisory Panel Report* is available at <https://www.alberta.ca/documents/climate/climate-leadership-report-to-minister.pdf>.

### The ELC’s Climate Change Legal Roadmap

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The ELC has published three reports in this series:

*A Snapshot of Alberta’s Climate Change Law & Policy*

*Carbon Pricing Recommendations for Alberta: Lessons from the Latest Developments in WCI Jurisdictions*

*Oil Sands Emissions Limit under the Climate Change Leadership Plan*

## Methane Emissions Reductions

A recent report by the Environmental Defense Canada concluded that methane emissions can be “cost-effectively reduced and eliminated by 2030”.<sup>2</sup> The two main issues related to methane emissions are oil and gas facilities that vent methane as part of normal operations and inadvertent methane leaks.

According to an economic analysis prepared for the Pembina Institute and the Environmental Defense Fund (the *IDF Economic Analysis*),<sup>3</sup> the oil and gas sector is the largest anthropogenic source of methane in Canada comprised of methane from fugitive emissions (leaks), vented emissions (due to equipment design or operational procedures), and incomplete combustion. The *IDF Economic Analysis* concluded that a 45% reduction in methane emissions is possible with existing technology. The largest abatement opportunities in the oil and gas sector come from addressing:<sup>4</sup>

- stranded gas venting from oil wells by installing flares (reduce emissions by 78%);
- fugitives from gathering and boosting stations by implementing leak detection and repair (reduce emissions by 60%);
- chemical injection pumps by replacing gas-driven pumps with non-natural gas driven pumps (reduce emissions by 60%);
- reciprocating compressor rod packing seals by replacing rod packing at a higher frequency (reduce emissions by 22%); and
- fugitives from centrifugal compressors by implementing leak detection and repair (reduce emissions by 60%).

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<sup>2</sup> Environmental Defense Canada, *Canada’s Methane Problem; Why strong regulations can reduce pollution, protect health, and save money* (April 2017) available at [methaneproblems.org](http://methaneproblems.org) at 1.

<sup>3</sup> ICF International, *Economic Analysis of Methane Emission Reduction Opportunities in the Canadian Oil and Natural Gas Industries*, prepared for Environmental Defense Fund and Pembina Institute (October 2015).

<sup>4</sup>*Ibid.*

Another (albeit dated) report identified several options for the reduction of methane emissions in the oil and gas sectors.<sup>5</sup> A variety of mitigation options are suggested depending upon the source:

- exploration - emissions from well testing and cleaning;
- unused associated gas - if not used for power generation or exported for sale, this gas is vented or flared at the point of oil production;
- process vents - vented gas released from the production process;
- process flares - emissions resulting from incompletely burnt flared gas released from the production process;
- maintenance - releases during routine maintenance in production and distribution processes, caused by the need to isolate and depressurize a part of the system;
- power generation - exhaust gas releases from the use of natural gas in power generation for the production and distribution process;
- compressors - releases from seal losses, passing valve emissions, start-up and shut-down of machinery, and indirectly through compressor energy requirements;
- pneumatic devices - some valves are natural gas operated and can therefore cause methane emissions;
- system upsets - system upsets may be caused by pipe breakage or pressure surges leading to losses at pressure release valves; and
- fugitive emissions - these occur predominantly in the transmission and distribution system from ageing pipe networks.

*The Alberta Climate Leadership Panel sets the goal of reducing methane emissions from oil and gas operations by 45% by 2025.*

The following approaches are proposed:

- applying new emissions design standards to new Alberta facilities;
- improving measurement and reporting of methane emissions, as well as leak detection and repair requirements; and
- developing a joint initiative (with Alberta industry, environmental groups and Indigenous communities) on methane reduction and verification for existing facilities, and backstopping this with regulated standards that take effect in 2020.

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<sup>5</sup> AEAT-3773: Issue 3, *Options to Reduce Methane Emissions (Final Report)* prepared for DGXI (November 1998) at 113-114, available at [http://ec.europa.eu/environment/enveco/climate\\_change/pdf/methane\\_emissions.pdf](http://ec.europa.eu/environment/enveco/climate_change/pdf/methane_emissions.pdf).

It should be noted that fugitive emissions from reciprocating compressors, compressor stations (transmission, storage and gathering), wells, and LDC metering and regulator equipment are one of the largest combined methane emission categories identified in the *IDF Economic Analysis*.<sup>6</sup>

The ACLP sets the goal of reducing methane emissions from oil and gas operations by 45% by 2025.<sup>7</sup> The following approaches are proposed:

- applying new emissions design standards to new Alberta facilities;
- improving measurement and reporting of methane emissions, as well as leak detection and repair requirements; and
- developing a joint initiative (with Alberta industry, environmental groups and Indigenous communities) on methane reduction and verification for existing facilities, and backstopping this with regulated standards that take effect in 2020.

The ACLP indicates that implementation of the new oil and gas methane standards will be led by the Alberta Energy Regulator (the “AER”), in collaboration with Alberta Energy and the Alberta Climate Change Office.

### **Methane Regulation in Alberta**

In Alberta, oil and gas activity is regulated by the AER. Currently, the AER does have requirements relating to emissions from oil and gas activities in a variety of directives and informational letters.<sup>8</sup> These include technical requirements for measuring and reporting

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<sup>6</sup> *Supra*. note 3 at 3-11. Also see *supra*. note 5 which noted that fugitive emissions account for the majority of methane emissions in the oil and gas sector.

<sup>7</sup> See <https://www.alberta.ca/climate-methane-emissions.aspx>.

<sup>8</sup> AER directives are available at <https://www.aer.ca/rules-and-regulations/directives>. See *Directive 007: Volumetric and Infrastructure Requirements*; *Directive 017: Measurement Requirements for Oil and Gas Operations*; *Directive 039: Revised Program to Reduce Benzene Emissions from Glycol Dehydrators*; *Directive 0056: Energy Development Applications and Schedules*; *Directive 60: Upstream Petroleum Industry Flaring, Incinerating, and Venting*; *Directive 84: Requirements for Hydrocarbon Emission Controls and Gas Conservation in the Peace River Area*; *ID 2003-01: 1) Isolation Packer Testing, Reporting, and Repair Requirements 2) Surface Casing Vent Flow/Gas Migration Testing, Reporting, and Repair Requirements*; *IL-98-01: A Memorandum of Understanding Between Alberta Environmental Protection and the Alberta Energy and Utilities Board Regarding Coordination of Release Notification Requirements and Subsequent Regulatory Response*; and *Manual 11: How to Submit Volumetric Data to the AER*.

emissions associated with wells, pipelines and facilities. Most relevant to our discussion is *Directive 60: Upstream Petroleum Industry Flaring, Incinerating, and Venting* (“*Directive 60*”).<sup>9</sup>

*Directive 60* contains the requirements for flaring, incinerating, and venting in Alberta at all upstream petroleum industry wells and facilities. These requirements also apply to pipeline installations that convey gas licensed by the AER in accordance with the *Pipeline Act*.<sup>10</sup> According to *Directive 60*, its requirements were developed to eliminate or reduce the potential and observed impacts of such activities and to ensure that public safety concerns and environmental impacts are addressed. As well, the requirements set by *Directive 60* are designed to ensure compliance with Alberta Environment and Parks’ *Alberta Ambient Air Quality Objectives and Guidelines*.

Under *Directive 60*, in accordance with an objective hierarchy, the following three options must be evaluated in the course of oil and gas operations:

- can flaring, incineration, and venting be eliminated?
- can flaring, incineration, and venting be reduced?
- will flaring, incineration, and venting meet performance standards?

with the ultimate goal of eliminating flaring, incineration and venting. *Directive 60* also sets the following industry-wide limit:<sup>11</sup>

- 1) The Alberta solution gas flaring limit is 670 million cubic metres ( $10^6 \text{ m}^3$ ) per year (50 per cent of the revised 1996 baseline of  $1340 \times 10^6 \text{ m}^3/\text{year}$ ).
- 2) If solution gas flaring exceeds the  $670 \times 10^6 \text{ m}^3$  limit in any year, the AER will impose reductions that will stipulate maximum solution gas flaring limits for individual operating sites based on analysis of the most current annual data so as to reduce flaring to less than  $670 \times 10^6 \text{ m}^3/\text{year}$ . For example, solution gas flaring could be limited to a maximum of 500 thousand ( $10^3$ )  $\text{m}^3/\text{year}$  at any one site.

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<sup>9</sup> AER, *Directive 60: Upstream Petroleum Industry Flaring, Incinerating, and Venting*.

<sup>10</sup> *Pipeline Act*, R.S.A. 2000, c. P-15.

<sup>11</sup> *Supra*. note 9 at s.2.1.

*Directive 60* focuses on sources such as solution gas, well testing, dehydrators and compressors as specific sources of emissions. However, it does not impose prescriptive requirements for emissions reductions<sup>12</sup> and does not include specific methane standards. As stated in the *IDF Economic Analysis*, the “regulations are performance based, allowing operators to identify sources that meet the requirements of the directive”.<sup>13</sup>

Another key piece in addressing methane emissions from oil and gas activities is regulation of leaks from suspended, abandoned and orphan facilities (a.k.a. legacy sites).<sup>14</sup> These terms refer to facilities that are inactive but have not yet been reclaimed as required by the *Environmental Protection and Enhancement Act*:<sup>15</sup>

- suspension means “the temporary cessation of operations at a well or facility in the manner prescribed by the regulations and includes any measures required to ensure that the well or facility is left in a safe and secure condition”<sup>16</sup>
- abandonment means “the permanent dismantlement of a well or facility in the manner prescribed by the regulations and includes any measures required to ensure that the well or facility is left in a permanently safe and secure condition”<sup>17</sup>
- an orphan facility is “a well, pipeline, facility or associated site which has been investigated and confirmed as not having any legally responsible and/or financially able party to deal with its abandonment and reclamation responsibilities”.<sup>18</sup>

According to its *Regulatory Change Report*, the AER is currently working on a Climate Policy Assurance Program to develop a regulatory framework to implement the outcome of a 45% reduction in methane emissions from oil and gas operations by 2025. The first regulatory requirements to be developed will address the measurement, monitoring, and reporting of methane emissions; and fugitive emissions. Standards for new and existing facilities will be subsequently developed.

<sup>12</sup> *Supra.* note 3 at 2-9.

<sup>13</sup> *Ibid.*

<sup>14</sup> See for example, a news article about legacy wells leaking methane in Medicine Hat, Alberta: Collin Gallant, “City safe despite methane leaks: officials” (June 29, 2017) Medicine Hat News available at <http://medicinehatnews.com/news/local-news/2017/06/29/city-safe-despite-methane-leaks-officials/>.

<sup>15</sup> *Environmental Protection and Enhancement Act*, R.S.A. 2000, c. E – 12. For more information, see Jason Unger, *Reclaiming Tomorrow Today: Regulatory timing for abandonment and reclamation of well sites in Alberta* (Edmonton: 2013, Environmental Law Centre) available at [http://elc.ab.ca/media/8918/Reclaiming\\_Tomorrow\\_Today.pdf](http://elc.ab.ca/media/8918/Reclaiming_Tomorrow_Today.pdf).

<sup>16</sup> *Oil and Gas Conservation Act*, R.S.A. 2000, c. O-6 at s. 1(1)(xx).

<sup>17</sup> *Ibid.* at s. 1(1)(a).

In this regard, the AER's *Directive 13: Suspension Requirements for Wells*,<sup>19</sup> *Directive 20: Well Abandonment*<sup>20</sup> and *Directive 29: Surface Development in Proximity to Abandoned Wells*<sup>21</sup> are relevant. A suspended well is required to be inspected for leaks in accordance with *Directive 13*. The frequency of inspection is based upon the risk profile of each well. Critically sour wells must be inspected annually; other wells must be inspected every 3 or 5 years depending upon the test method chosen.<sup>22</sup> There is no specific mention of methane in *Directive 13* (or any particular GHG or VOCs for that matter).

The procedure and requirements for abandoning a well are set out in *Directive 20*. While there are requirements to test for leakages during the abandonment process and prior to surface abandonment (a.k.a. well capping), there are no requirements for leak monitoring post-abandonment set by *Directive 20*.

However, *Directive 29* and complementary provisions in the *Subdivision and Development Regulation*<sup>23</sup> create setback requirements for surface developments near abandoned wells (i.e. any building must be a specified distance from an abandoned well). As well, *Directive 29* sets out requirements for testing and monitoring of abandoned wells near surface developments. Monitoring frequency is based upon the risk profile of each well (low risk: every 5 years, medium risk: every 3 years, high risk: annually) and the monitoring parameters specifically include methane.

According to its *Regulatory Change Report*,<sup>24</sup> the AER is currently working on a Climate Policy Assurance Program to develop a regulatory framework to implement the outcome of a 45% reduction in methane emissions from oil and gas operations by 2025. The first regulatory requirements to be developed will address the measurement, monitoring, and reporting of methane emissions; and fugitive emissions. Standards for new and existing facilities will be

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<sup>18</sup> See the Orphan Well Association website at [http://www.orphanwell.ca/pg\\_faq.html](http://www.orphanwell.ca/pg_faq.html).

<sup>19</sup> AER, *Directive 13: Suspension Requirements for Wells*.

<sup>20</sup> AER, *Directive 20: Well Abandonment*.

<sup>21</sup> AER, *Directive 29: Surface Development in Proximity to Abandoned Wells*.

<sup>22</sup> *Supra*. note 19 at Table 1.

<sup>23</sup> *Subdivision and Development Regulation*, Alta. Reg. 43/2002 at ss. 10-11.3. This regulation is made pursuant to the *Municipal Government Act*, R.S.A. 2000, c. M-26.

<sup>24</sup> This is updated weekly and available on the AER website at <https://www.aer.ca/rules-and-regulations/regulatory-change-report>.

subsequently developed. According to media reports,<sup>25</sup> draft regulations for measurement, monitoring and reporting should be available in mid-2017 and implemented in 2018. A new facility standards directive should be published in mid-2018.

## **Federal Methane Regulation**

Federally, the most relevant piece of legislation is the *Canadian Environmental Protection Act, 1999 (CEPA)*<sup>26</sup> which has pollution prevention as its primary objective. It is under *CEPA* that authority to establish the National Pollutant Release Inventory (NPRI) is found. The NPRI requires emissions reporting of a variety of designated substances (although methane is not one of them).<sup>27</sup>

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*Two draft regulations were introduced in late May 2017 and are anticipated to come into force on January 1, 2020 (with some provisions coming into force on January 1, 2023). The upstream oil and gas industry will be covered by the proposed Regulations Respecting Reduction in the Release of Methane and Certain Volatile Organic Compounds (Upstream Oil and Gas Sector). The proposed Regulations Respecting Reduction in the Release of Volatile Organic Compounds (Petroleum Sector) will apply to the petroleum and petrochemical sector.*

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The *CEPA* also plays a key role in the Canada-wide Air Quality Management System (AQMS) which is a result of federal and provincial collaboration to develop a comprehensive approach to reducing air pollution in Canada. Arising from the AQMS are the Canadian Ambient Air Quality Standards (CAAQS) which have been established as objectives under *CEPA*. Standards

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<sup>25</sup> Potential AER timeline found in Laura Chutny, “Air emissions regulations in Western Canada - a primer” (January 30, 2017) JWN Energy available at <http://www.jwnenergy.com/article/2017/1/air-emissions-regulations-western-canada-primer/>.

<sup>26</sup> *Canadian Environmental Protection Act, 1999*, S.C. 1999, c. 33.

<sup>27</sup> The legal basis for the NPRI is the *Notice with respect to substances in the National Pollutant Release Inventory* for 2016 and 2017 published in the Canada Gazette, Part I pursuant to section 46(1) of *CEPA*. The NPRI list can be found at <http://www.ec.gc.ca/inrp-npri/default.asp?lang=En&n=9617CEC8-1>. For further information, see the *Guide for Reporting to the NPRI* available at <https://www.ec.gc.ca/inrp-npri/28C24172-53CB-4307-8720-CB91EE2A6069/2016-17%20Guide%20for%20Reporting%20-%20EN.pdf>.

have been developed for Sulphur dioxide, fine particulate matter and ozone (and are in development for nitrogen dioxide). As well, the AQMA has established Base-level Industrial Emissions Requirements (BLIERs) established to address nitrogen oxides, sulphur dioxide, volatile organic compounds and particulate matter. The Province of Alberta has agreed to the AQMS and, accordingly, is taking steps to implement CAAQS and BLIERs in Alberta.

As can be seen, the AQMS does not have a direct focus on methane. However, the federal government (similarly to the Alberta government) has committed to reduce methane emissions in the oil and gas sector by 40-45% below 2012 levels by 2025. This will be done via regulations under *CEPA* that will address methane emissions from the upstream oil and gas industry, and from the petroleum and petrochemical sector.

Two draft regulations were introduced in late May 2017 and are anticipated to come into force on January 1, 2020 (with some provisions coming into force on January 1, 2023). The upstream oil and gas industry will be covered by the proposed *Regulations Respecting Reduction in the Release of Methane and Certain Volatile Organic Compounds (Upstream Oil and Gas Sector)*.<sup>28</sup> The proposed *Regulations Respecting Reduction in the Release of Volatile Organic Compounds (Petroleum Sector)*<sup>29</sup> will apply to the petroleum and petrochemical sector.

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

Under the proposed regulations, upstream oil and gas facilities are defined as those that extract hydrocarbons from an underground geological deposit or reservoir, primary processing of those hydrocarbons, or transportation of hydrocarbons (including storage) other than for local distribution.

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<sup>28</sup> *Regulations Respecting Reduction in the Release of Methane and Certain Volatile Organic Compounds (Upstream Oil and Gas Sector)* available at <https://www.ec.gc.ca/lcpe-cepa/eng/regulations/detailReg.cfm?intReg=243>.

<sup>29</sup> *Regulations Respecting Reduction in the Release of Volatile Organic Compounds (Petroleum Sector)* available at <https://www.ec.gc.ca/lcpe-cepa/eng/regulations/detailReg.cfm?intReg=244>.

The regulations propose to impose general requirements on all upstream oil and gas facilities.

These include:

- Hydrocarbon gas conservation equipment must be operated such that at least 95% of the gas routed to the equipment is captured and conserved, and must be operating continuously (other than servicing and repairs).<sup>30</sup>
- Any gas destruction equipment (in Alberta) must meet the requirements set out in the AER's *Directive 60*.<sup>31</sup>
- If a well undergoes hydraulic fracturing and has a gas to oil ratio of at least 53:1, then it must not vent gas during flowback (this requirement does not apply in BC or Alberta due to existing provincial requirements).<sup>32</sup>
- If a compressor is installed after January 1, 2020, then gas must be captured and routed to gas conservation equipment.<sup>33</sup> However, if a compressor predates January 1, 2020, the gas may be conserved, incinerated or vented (in the case of venting, the flow rate must be measured and cannot exceed a prescribed limit).<sup>34</sup>

The proposed regulations also will require all upstream oil and gas facilities to register and keep records to demonstrate compliance with the regulatory requirements.

Under the proposed regulations, additional requirements apply specifically to facilities that produce or receive at least 60,000m<sup>3</sup> of hydrogen gas in a year.<sup>35</sup> These requirements pertain to venting limits, leak detection and repair (LDAR) programs, pneumatic pumps and controllers, and other equipment:

- There is a venting limit of 250 m<sup>3</sup> per month.<sup>36</sup> This limit does not apply to emergency venting. As well, a month is excluded if, for 12 consecutive months prior, the combined total of gas vented or destroyed was less than 40,000 m<sup>3</sup>.

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<sup>30</sup> *Supra.* note 28 at s.4.

<sup>31</sup> *Supra.* note 28 at s.6.

<sup>32</sup> *Supra.* note 28 at ss. 8-10.

<sup>33</sup> *Supra.* note 28 at s. 11.

<sup>34</sup> *Supra.* note 28 at ss. 11-13.

<sup>35</sup> *Supra.* note 28 at ss. 15 and 19-33.

<sup>36</sup> *Supra.* note 28 at s. 19.

- With the exception of single wellheads with gathering pipelines connected to it, each facility must implement a LDAR program which inspects for leaks every 4 months.<sup>37</sup> The regulations set standards for leak detection equipment, defines what is and is not a leak if a leak is detected, and sets timelines for repairs.<sup>38</sup>
- Facilities with a total compressor power rating of at least 745 kW are not allowed to use gas operated pneumatic controllers.<sup>39</sup> Other facilities must use low bleed pneumatic controllers.
- Where a facility pumps liquids exceeding 20L per day, electric pumps or pumps equipped with emissions control devices must be used.<sup>40</sup>
- The regulations require that the open ends of pipes or hatches must be closed (other than during operations that require these to be open).<sup>41</sup>

The regulatory requirements are anticipated to come into force at different dates. The requirements relating to well completion by hydraulic fracturing, LDAR programs and compressor limits will come into effect in January 2020. The requirements for production venting requirements and emission limits for pneumatic controllers and pumps will come into effect in January 2023.

### **Regulations Respecting Reduction in the Release of Volatile Organic Compounds (VOCs) (Petroleum Sector)**

The proposed regulations will apply to facilities that produce liquid petroleum products by means of processing, using distillation, of: crude oil or bitumen; mixtures of crude oil or bitumen or other hydrocarbon compounds; or partially refined feedstock derived from crude oil or bitumen. It is anticipated that these regulations will impact 26 facilities in Canada.<sup>42</sup>

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<sup>37</sup> *Supra.* note 28 at s. 21.

<sup>38</sup> If the repair can be done while the equipment is operating, a detected leak must be repaired within 30 days. Otherwise, the repair must be done by the end of the next planned shutdown. If the facility is offshore, the repair must be made within 365 days (unless it can be done while the equipment is operating).

<sup>39</sup> *Supra.* note 28 at s. 26.

<sup>40</sup> *Supra.* note 28 at s. 28.

<sup>41</sup> *Supra.* note 28 at s. 31.

<sup>42</sup> Regulatory Impact Analysis Statement (2017-05-27) Canada Gazette Part 1, Vol. 151, No. 21 at p. 2161. The affected facilities include 18 petroleum refineries, 6 upgraders and 2 petrochemical facilities.

The proposed regulations require each facility to implement an LDAR program, monitor VOCs at the facility perimeter, put in place preventative equipment, and undertake record-keeping and reporting activities.

Subject to limited exceptions, the LDAR program requirements applies to all equipment components at a facility.<sup>43</sup> The exceptions are those components that are designated as unsafe to inspect and pumps with dual mechanical seal systems that meet specified requirements. The LDAR program must provide for three inspections per year with pumps being visually inspected on a weekly basis. The regulations specify which equipment and methodology must be used for inspections.

Repairs of significant leaks must occur within 15 days (a leak is presumed to be significant unless it meets conditions described in the regulations). If a leak cannot be repaired within 15 days, it must be flagged for repair within 60 days or before the end of the next shutdown (if the repair requires a full or partial shutdown). If a piece of equipment has 3 significant leaks within a consecutive 24 month period, it must be replaced.

A fence-line monitoring program - which consists of collection and analysis of samples to measure benzene and 1,3-butadiene as well as the total concentration of all retainable VOCs - must be established.<sup>44</sup> The “fence-line” may be the property boundary or an internal monitoring perimeter. There must be at least 12 sampling locations along the fence-line and samples must be collected every 14 days from April to December. The regulations establish standard equipment and procedures for sampling and analysis.

The proposed regulations set several technical requirements for equipment components at a facility including:<sup>45</sup>

- open-ended lines must be closed;

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<sup>43</sup> *Supra.* note 29 at ss. 3-10.

<sup>44</sup> *Supra.* note 29 at ss. 17-25.

<sup>45</sup> *Supra.* note 29 at ss. 11-15.

- sampling systems must be designed and used in a manner that minimizes release of VOCs into the environment;
- pressure relief devices must be designed and used in a manner that minimizes release of VOCs into the environment; and
- compressors must have a mechanical seal system with barrier fluid system or a closed-vent system to capture leakage.

Different aspects of the regulations are proposed to come into force at different times. The fence-line monitoring programs must be established no later than July 1, 2018. The LDAR requirements come into force July 1, 2019 (only 1 inspection is required in 2019 and full implementation is required by 2020). The equipment requirements come into force on July 1, 2019. Generally, the record keeping and reporting obligations that accompany each of the regulatory requirements come into force at the same time.<sup>46</sup>

Concurrently with both regulations (the upstream oil and gas sector and the petroleum sector), the *Regulations Designating Regulatory Provisions for the Purposes of Enforcement (Canadian Environmental Protection Act)* will be amended to include provisions from these proposed regulations for purposes of an increased fine regime for offences involving harm or risk of harm to the environment, or obstruction of authority.

## **Methane Regulation in the United States**

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*In 2012, the EPA implemented New Source Performance Standards (NSPS) to address the release of volatile organic compounds in the oil and gas industry (subpart OOOO). In 2016, the NSPS was augmented to specifically address methane emissions (subpart OOOOa).*

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<sup>46</sup> *Supra.* note 29 at ss. 16 and 26-39.

Under the previous administration (President Obama), there was a clearly expressed strategy for the reduction of methane emissions in the US.<sup>47</sup> This strategy is designed to cut methane from a variety of sources including oil and gas systems. Proposed approaches include:

- the introduction of Environmental Protection Agency (EPA) regulations;
- the Bureau Land Management (BLM) will propose updated standards to reduce venting and flaring from oil and gas activities from oil and gas production on public lands;
- the Administration will identify additional downstream methane reduction opportunities as part of the Quadrennial Energy Review; and
- expansion of voluntary efforts to reduce methane emissions through Natural Gas STAR program.

Although both EPA regulations and BLM standards for methane are now in place, with the inauguration of President Trump and the accompanying political shift in early 2017, the status of the methane reduction strategy (and GHG reduction in general) is unclear.<sup>48</sup>

In 2012, the EPA implemented New Source Performance Standards (NSPS) to address the release of volatile organic compounds in the oil and gas industry (subpart OOOO).<sup>49</sup> In 2016, the NSPS was augmented to specifically address methane emissions (subpart OOOOa).<sup>50</sup> In contrast with the results oriented approach taken in Alberta, the NSPS regulates specific sources such as wet seal compressors.<sup>51</sup>

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<sup>47</sup> US Climate Action Plan, Strategy to Cut Methane Emissions (March 28, 2014) available at <https://obamawhitehouse.archives.gov/blog/2014/03/28/strategy-cut-methane-emissions>.

<sup>48</sup> On April 18, 2017, the EPA announced that it will be reconsidering the fugitive emissions requirements in the NSPS, see [https://www.epa.gov/sites/production/files/2017-04/documents/oil\\_and\\_gas\\_fugitive\\_emissions\\_monitoring\\_reconsideration\\_4\\_18\\_2017.pdf](https://www.epa.gov/sites/production/files/2017-04/documents/oil_and_gas_fugitive_emissions_monitoring_reconsideration_4_18_2017.pdf). As well, the Information Collection Request to gather information to help the EPA determine how best to reduce emissions from existing sources has been withdrawn, see <https://www.federalregister.gov/documents/2017/03/07/2017-04458/notice-regarding-withdrawal-of-obligation-to-submit-information>.

<sup>49</sup> *Emission Standards for New, Reconstructed and Modified Sources*, 40 CFR Part 60, subpart OOOO.

<sup>50</sup> *Emission Standards for New, Reconstructed and Modified Sources*, 40 CFR Part 60, subpart OOOOa.

<sup>51</sup> *Supra.* note 3 at 2-9.

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*The preamble to NSPS (subpart OOOOa) indicates that methane emissions occur throughout the natural gas industry through normal operations, routine maintenance, fugitive leaks and system upsets. In the petroleum industry, methane emissions result primarily from field production operations, such as venting of associated gas from oil wells, oil storage tanks, and production-related equipment (such as gas dehydrators, pig traps, and pneumatic devices).*

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Subpart OOOOa of the NSPS applies to crude oil and natural gas facilities that are new, reconstructed and modified sources after September 18, 2015.<sup>52</sup> The NSPS specifies which particular facility types are subject to the requirements (paraphrased):<sup>53</sup>

- single well that conducts a well completion after hydraulic fracturing or refracturing (subject to some limited exceptions);
- single centrifugal compressor using wet seals (but not a compressor that is located at a well site, or adjacent to a well site and is servicing more than 1 well site);
- single reciprocating compressor (but not a compressor that is located at a well site, or adjacent to a well site and is servicing more than 1 well site);
- several categories of pneumatic controllers;
- group of all equipment within a process unit (onshore only);
- sweetening units located at onshore natural gas processing plants that process natural gas produced from either onshore or offshore wells;
- certain pneumatic pump facilities; and
- collection of fugitive emissions components at a well site or at a compressor station.

The preamble to NSPS (subpart OOOOa) indicates that methane emissions occur throughout the natural gas industry through normal operations, routine maintenance, fugitive leaks and system upsets. In the petroleum industry, methane emissions result primarily from field production

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<sup>52</sup> *Supra.* note 50 at s. 60.5360a.

<sup>53</sup> *Supra.* note 50 at s. 60.5364a.

operations, such as venting of associated gas from oil wells, oil storage tanks, and production-related equipment (such as gas dehydrators, pig traps, and pneumatic devices).

Accordingly, the NSPS (subpart OOOOa) sets requirements for methane emissions reductions for each type of affected facility. Further, there are requirements for fugitive emissions monitoring and repair. The NSPS (subpart OOOOa) requires record-keeping and reporting. Overall, the requirements set out in NSPS (subpart OOOOa) are very technical in nature and incorporate by reference several standards for measurement and assessment of gases.

Briefly the requirements set by the NSPS are:<sup>54</sup>

- reduced emission completion and completion combustion requirements for a subset of newly completed oil wells that are hydraulically fractured or refractured;
- fugitive emissions survey and repair programs to be performed semiannually at the affected newly drilled or refractured oil and natural gas wellsites, quarterly at new or modified gathering and boosting stations & new or modified transmission and storage compressor stations; and
- reductions from centrifugal compressors, reciprocating compressors, and pneumatic controllers and pumps.

For those interested in precise detail, the EPA has issued a series of summaries of its Air Rules for the Oil & Natural Gas Industry.<sup>55</sup>

It should be noted that on May 31, 2017, the EPA placed a 90 day stay on the NSPS (subpart OOOOa).<sup>56</sup> However, the EPA's authority to issue the stay was not upheld by the court and the EPA has been ordered to implement NSPS (subpart OOOOa).<sup>57</sup>

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<sup>54</sup> U.S. Environmental Protection Agency, *Regulatory Impact Analysis of the Final Oil and Natural Gas Sector: Emission Standards for New, Reconstructed, and Modified Sources*.

<sup>55</sup> Available at <https://www.epa.gov/stationary-sources-air-pollution/epas-actions-reduce-methane-and-volatile-organic-compound-voc>.

<sup>56</sup> See <http://www.reuters.com/article/us-usa-climatechange-methane-idUSKBN18R2VZ>.

<sup>57</sup> See <http://www.dw.com/en/blow-to-trumps-epa-as-us-court-upholds-obama-methane-rule/a-39535033> and <http://www.cbc.ca/news/business/epa-court-methane-1.4189200>.

As mentioned, the BLM has recently put rules in place to reduce waste from venting, flaring and leaks during oil and gas activities on onshore Federal and Indian leases.<sup>58</sup> The rule focuses on several processes in the course of oil and gas production:

- venting and flaring of associated gas from development oil wells;
- gas leaks from equipment at the well site or elsewhere on the lease;
- operation of high-bleed pneumatic controllers and certain pneumatic pumps;
- gas emissions from storage vessels;
- downhole well maintenance and liquids unloading; and
- well drilling and completions.

While this rule came into effect on January 17, 2017, it has been subject to challenges. There was an unsuccessful attempt to overturn this rule by a Joint Resolution of Disapproval under the *Congressional Review Act*.<sup>59</sup> In addition, a lawsuit has been filed by some states challenging the BLM rule.<sup>60</sup>

In addition to federal action, several states have taken steps to reduce methane emissions. For example, the California Environmental Protection Agency has proposed a Short-Lived Climate Pollutant Reduction Strategy which addresses methane emissions.

In addition to federal action, several states have taken steps to reduce methane emissions. For example, the California Environmental Protection Agency has proposed a Short-Lived Climate Pollutant Reduction Strategy which addresses methane emissions (among other emissions)<sup>61</sup> and

<sup>58</sup> *Waste Prevention, Production Subject to Royalties, and Resource Conservation*, 43 CFR Parts 3100, 3160 and 3170.

<sup>59</sup> *H.J. Res 36: Methane Rule* which passed through the House but did not pass through the Senate, see status at <https://www.congress.gov/bill/115th-congress/house-joint-resolution/36/all-actions?overview=closed#tabs>. See also Modrall Sperling, “The BLM’s New Venting and Flaring Rule: Potential Future Developments” (January 13, 2017) Lexology available at <http://www.lexology.com/library/detail.aspx?g=fd162fde-0c53-48bc-93cf-a34994af9346> and Valerie Volcovici, “Bid to revoke Obama methane rule fails in surprise U.S. Senate vote” (May 10, 2017) Reuters available at <http://www.reuters.com/article/us-usa-congress-idUSKBN18620F>.

<sup>60</sup> An application for an initial injunction against the rule was denied: see *Wyoming and Montana vs. United States Department of the Interior*, unreported (D. Wyo, 2017) available at [https://cdn.westernenergyalliance.org/sites/default/files/VentingFlaringPIOrder\\_011617.pdf](https://cdn.westernenergyalliance.org/sites/default/files/VentingFlaringPIOrder_011617.pdf).

<sup>61</sup> US, California Environmental Protection Agency, Air Resources Board, *Proposed Short-Lived Climate Pollutant Reduction Strategy* (April 2016).

which has been described as the country's strictest methane rule.<sup>62</sup> The State's framework on oil and gas methane emissions includes the following:<sup>63</sup>

- Adopt and implement a greenhouse gas emission standard for crude oil and natural gas facilities regulation. This is still being developed and may include leak detection and repair, vapour collection, use of dry seals (vs. wet seals) in compressors, no bleed pneumatic devices and pumps, and monitoring at underground natural gas storage facilities.
- Improve monitoring and standards to detect and minimize emissions for storage facilities.
- Reduce emissions from pipelines.

The State of Colorado adopted the NSPS standards and extended them to apply to methane from oil and gas activities in 2014 (i.e. prior to the development of the EPA's NSPS (subpart OOOOa) dealing with methane).<sup>64</sup> The requirements set by Colorado's rule include:

- open-ended valves or lines must either be sealed or become subject to leak detection and repair requirements;
- centrifugal compressors must reduce hydrocarbon emissions by 95%; and
- reciprocating compressors at natural gas compressor stations must replace rod packing every 26,000 hours of operation or every 36 months.

## **Methane Regulation in UK**

The *UK Climate Change Act 2008*<sup>65</sup> includes methane as a targeted greenhouse gas.<sup>66</sup> Among other things, this Act:

- sets target for reductions by 2050;

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<sup>62</sup> See Tom James, "California Board Adopts Strictest U.S. Methane Rules" (March 27, 2017) Reuters available at <https://www.usnews.com/news/us/articles/2017-03-23/california-regulator-to-vote-on-united-states-strictest-methane-rule>.

<sup>63</sup> *Supra*. note 61 at 77-80.

<sup>64</sup> US, *Colorado: Revisions to Colorado Air Quality Control Commission's Regulation Numbers 3, 6, and 7 Fact Sheet* available at [https://www.colorado.gov/pacific/sites/default/files/AP\\_Regulation-3-6-7-FactSheet.pdf](https://www.colorado.gov/pacific/sites/default/files/AP_Regulation-3-6-7-FactSheet.pdf).

<sup>65</sup> *UK Climate Change Act 2008*, (UK) 2008, c. 27.

<sup>66</sup> *Ibid.* at ss. 24(1)(b) and 92.

- establish committee on climate change;
- confers powers to establish an emissions trading system; and
- allows action for adaptation to climate change.

Since it is a targeted greenhouse gas under the Act, methane could be included in an UK emissions trading scheme. The viability of doing so is considered in *MethaneUK*,<sup>67</sup> a publication of the University of Oxford Environmental Change Institute:<sup>68</sup>

Although methane trading is at first sight a highly attractive option for mitigating methane emissions, in practice most methane generating sectors are excluded due to other policy instruments (no additionality), other economic drivers (more attractive), small players (reduces liquidity) and poor quantification of emissions (introduction of hot air). Only coal mine methane and emissions from oil and gas rigs are currently viable sectors for exploiting the methane trading opportunity and this is dependent on incorporation into the European Emissions Trading Scheme in 2008.

It should be noted that, to date, the European Emissions Trading Scheme does not include methane (it applies to carbon dioxide, nitrous oxide and perfluorocarbons).<sup>69</sup>

The Oil & Gas Authority provides regulatory oversight of the oil and gas industry in the UK.<sup>70</sup> Rules regarding venting and flaring are found in the *Energy Act 1976* and the *Petroleum Act 1998*.<sup>71</sup> Generally, venting and flaring must be kept to the minimum that is technically and economically justified. Further, permission for venting and flaring is required.<sup>72</sup>

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<sup>67</sup> Christine N. Jardine, Brenda Boardman, Ayub Osman, Julia Vowles and Jane Palmer, *methaneuk* (University of Oxford: 2009, Environmental Change Institute).

<sup>68</sup> *Ibid.* at 77.

<sup>69</sup> See European Union website at [https://ec.europa.eu/clima/policies/ets\\_en](https://ec.europa.eu/clima/policies/ets_en).

<sup>70</sup> *Energy Act 2016*, (UK) 2016, c. 20.

<sup>71</sup> *Energy Act 1976*, (UK) 1976, c. 76 and *Petroleum Act 1998*, (UK) 1998, c.17. See also the Oil & Gas Authority website at <https://www.ogauthority.co.uk/licensing-consents/consents/flaring-and-venting/>.

<sup>72</sup> *Energy Act 1976*, *ibid.* at ss. 12, 12A and 12B, and *Petroleum Act 1998*, *ibid.*

According to the *European Commission Global Methane Reduction Actions* summary document.<sup>73</sup>

...the key sources of coal, oil and gas mining exploration are not covered by any specific EU legislation for methane emissions. Where such mining occurs, national legislation is often be {sic} in place to reduce the fugitive methane losses.

At the level of the EU, action to reduce methane emissions has been focused on landfill waste. As yet, other methane sources have not been addressed. As suggested by at least one commentator, methane is “the next frontier for European climate leadership”.<sup>74</sup>

### **International Action on Methane**

Globally, oil and gas activities are one source of anthropogenic methane emissions comprising about 20% of total methane emissions.<sup>75</sup> There is a fair amount of data outlining methane emissions by country.<sup>76</sup> For example, the Oxford Institute for Energy Studies provides the following chart:<sup>77</sup>

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<sup>73</sup> Global Methane Initiative, *European Commission Global Methane Reduction Actions*, Ref. Ares (2013) 2843722 - 06/08/2013.

<sup>74</sup> Mark Brownstein, “Methane: The Next Frontier for European Climate Leadership” (November 4, 2016) Environmental Defense Fund, Energy Exchange available at <http://blogs.edf.org/energyexchange/2016/11/04/methane-the-next-frontier-for-european-climate-leadership/>.

<sup>75</sup> Other sources include agriculture, landfills, wastewater, coal mines. See for example, <https://icp.giss.nasa.gov/education/methane/intro/cycle.html> and <http://www.globalmethane.org/about/methane.aspx>.

<sup>76</sup> See <http://data.worldbank.org/indicator/EN.ATM.METH.KT.CE>.

<sup>77</sup> Chris Le Fevre, *Methane Emissions: from blind spot to spotlight*, OIES Paper: NG 122 (Oxford, England: 2017, Oxford Institute for Energy Studies) available at <https://www.oxfordenergy.org/wpcms/wp-content/uploads/2017/07/Methane-Emissions-from-blind-spot-to-spotlight-NG-122.pdf>.

**Table 3: Methane emissions from the energy sector for selected Annex 1 countries in 2015 (Thousand tonnes of methane)**

	<b>Oil</b>	<b>Gas</b>	<b>Venting or Flaring</b>	<b>Solid fuels</b>	<b>Total</b>
Australia*	5	290	-	1,212	1,510
Canada	295	483	944	46	1,768
France	2	44	1	1	48
Germany	9	193	0	124	326
Italy	12	182	3	2	199
Netherlands	1	13	12	-	26
Poland	4	35	50	676	765
Romania	99	185	92	40	416
Russia	13,304	5,376	6,608	2,450	27,738
Spain		26	2	6	34
Turkey	11	80	19	49	159
Ukraine*	5	1,141	-	943	2,090
UK	7	154	41	55	257
USA	1,595	6,497	IE	2,692	10,784

Source: UNFCCC [http://di.unfccc.int/detailed\\_data\\_by\\_party](http://di.unfccc.int/detailed_data_by_party)

Note: \* 2012 numbers, IE included elsewhere

On an international front, Canada has made commitments to address methane emissions (and not just from oil and gas sources). In March 2016, the US and Canada published a *Joint Statement on Climate, Energy, and Arctic Leadership*.<sup>78</sup> Both countries expressed an intention to play a "leadership role internationally in the low carbon global economy". A key element of this statement was the agreement to take action to reduce methane emissions from the oil and gas sector by 40-45% below 2012 levels by 2025. Because this commitment was made prior to the inauguration of President Trump and the accompanying political shift in early 2017, the status of the methane reduction strategy in the US is unclear.

This commitment was echoed in a *Leaders' Statement on a North American Climate, Clean Energy, and Environment Partnership* (the Statement) issued by Prime Minister Trudeau, President Obama and President Peña Nieto in June 2016. The Statement represents a commitment by the countries to create an enduring partnership and action plan to set North America on a path to a more sustainable future.<sup>79</sup> One of the matters addressed in the Statement was driving down short-lived pollutants including methane. A concrete goal of reducing methane emissions from the oil and gas industry by 40 to 45% by 2025 was established.

All three countries agreed to develop national methane strategies and to implement federal regulations for existing and new sources of methane as soon as possible.

## *The Global Methane Initiative*

The GMI focuses on:

- the development of strategies and markets for the abatement, recovery, and use of methane through technology development, demonstration, deployment and diffusion;
- implementation of effective policy frameworks;
- identification of ways and means to support investment; and
- removal of barriers to collaborative project development and implementation.

<sup>78</sup> <http://pm.gc.ca/eng/news/2016/03/10/us-canada-joint-statement-climate-energy-and-arctic-leadership>.

<sup>79</sup> For more information on this statement see Brenda Heelan Powell, *Climate Change Blog Series: Highlights from the Leaders' Statement on a North American Climate, Clean Energy and Environment Partnership* (July 14, 2016) available at <http://elc.ab.ca/climate-change-blog-series-highlights-from-the-leaders-statement-on-a-north-american-climate-clean-energy-and-environment-partnership/>.

In addition to these commitments to take action on methane emissions, Canada has been a member of the Global Methane Initiative (GMI) since 2005.<sup>80</sup> Along with Canada, numerous other countries (including the US, UK and the EU) participate in this “US-led voluntary, multilateral partnership that aims to reduce global methane emissions and to advance the abatement, recovery and use of methane as a valuable clean energy source”.<sup>81</sup>

The GMI focuses on:<sup>82</sup>

- the development of strategies and markets for the abatement, recovery, and use of methane through technology development, demonstration, deployment and diffusion;
- implementation of effective policy frameworks;
- identification of ways and means to support investment; and
- removal of barriers to collaborative project development and implementation.

The GMI focuses on methane emissions from five sectors: agriculture, landfills, coal mines, wastewater, and oil and gas systems.

### **Recommendations for Methane Emissions Regulation in Alberta**

With the change of administration in the US, the status of pre-existing federal commitments to reducing methane (and other GHG) is uncertain. This has led some commentators to suggest that Canadian oil and gas producers may be at a competitive disadvantage if methane reduction requirements are imposed in Canada and not the US. Others have argued that this is not the case – pointing out that methane reduction is a cost effective means to address climate change and that there are already federal and state level regulations addressing methane emissions in place in the US.

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<sup>80</sup> Environment and Climate Change Canada, *Compendium of Canada's Engagement in International Environmental Agreement*, MV-CC-2/EN (Ottawa: Environment and Climate Change Canada, 2016) available at <https://www.ec.gc.ca/international/D61C3C48-7195-4BCC-8671-990838BD2A53/D4%202016%20IEA%20Factsheet%20GMI%20EN%20Final.pdf>.

<sup>81</sup> *Ibid.* The database for the GMI housed within US EPA at [www.globalmethane.org/tools-resources/index.aspx](http://www.globalmethane.org/tools-resources/index.aspx).

<sup>82</sup> *Supra.* note 73.

It is noteworthy that at least 12 states and numerous cities in the US have expressed their intention to meet the Paris Agreement goals and to increase efforts to decrease GHG emissions. It appears that, in spite of a lack of federal commitment, there will be concerted efforts to address US GHG emissions (including methane) at a subnational level.

In our view, both the federal and provincial governments should continue their steps to address the level of methane emissions from the oil and gas sector. The ELC recommends that the suite of legislation used to address these emissions include:

- There should be comprehensive LDAR requirements in place for the oil and gas sector. In this regard, the ELC supports legislated LDAR requirements.

However, assuming that the federal regulations under CEPA are implemented as proposed, the LDAR requirements will apply only to facilities that petroleum facilities and to upstream oil and gas facilities that produce or receive at least 60,000m<sup>3</sup> of hydrogen gas in a year.

The ELC recommends that the LDAR requirements be applicable to all upstream oil and gas facilities. Further, the ELC recommends that in the event a leak is detected and repaired, a follow-up inspection be required as soon as possible and no later than 30 days after the repair.

- The NSPS (subpart OOOOa) in the US sets specific requirements for various sources of methane. This contrasts with the performance based approach taken in Alberta under *Directive 60*. The proposed federal regulations do have specific requirements for pumps, controllers and open pipes; however, these requirements do not apply to all upstream oil and gas facilities. The ELC recommends that the specific requirements apply to all facilities in the upstream oil and gas sector.
- The solution gas flaring limit as it appears in *Directive 60* is currently set at 670 million cubic metres (10<sup>6</sup> m<sup>3</sup>) per year (50 per cent of the revised 1996 baseline of 1340 10<sup>6</sup> m<sup>3</sup>/year). The ELC recommends revisiting this limit to determine whether additional reductions in methane emissions are technological feasible thereby warranting a reduction in the solution gas flaring limit.
- Transparency and public access to information is a fundamental aspect of environmental regulation. In this regard, the ELC recommends that the data

arising from monitoring and reporting required under the proposed regulations be publicly available and easily accessible. The same recommendation applies to data collected under provincial requirements.

- With respect to the implementation of the proposed federal regulations, the ELC is disappointed that the originally proposed timelines have been delayed by three years (implementation by 2018-2020 is now 2020-2023). The ELC recommends that the original timelines be reinstated to reflect the urgency of responding to our international climate change commitments and methane's high global warming potential.
  
- Alberta currently has a system for the use of emission offsets and credits under the *Specified Gas Emitters Regulation*<sup>83</sup> (the "SGER") and includes methane. In the *Advisory Panel Report*, it is recommended that the SGER be replaced with a *Carbon Competitiveness Regulation* ("CCR") in which a carbon price is applied to industrial emissions based on performance by similar facilities. The CCR regime is still under development and is expected to be in place by 2018. If this change does occur, the ELC recommends that methane remain part of the new regime.
  
- Recognizing that there are significant issues with legacy wells in Alberta, efforts to reduce methane emissions (as well as other VOCs) need to be included in the actions designed to address legacy wells.<sup>84</sup>
  
- The ELC recommends that additional sources of methane, in addition to those in the oil and gas sector, be examined for potential regulation designed to reduce methane emissions.

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<sup>83</sup> Alta. Reg. 139/2007.

<sup>84</sup> This recommendation is also made in Environmental Defense Canada, *Canada's Methane Problem; Why strong regulations can reduce pollution, protect health, and save money* (April 2017) available at [methaneproblems.org](http://methaneproblems.org) at 10.