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Flaring in Canada: Overview and Strategic Considerations

Part 1

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Flaring in Canada: Overview and Strategic Considerations

Part 1: Overview

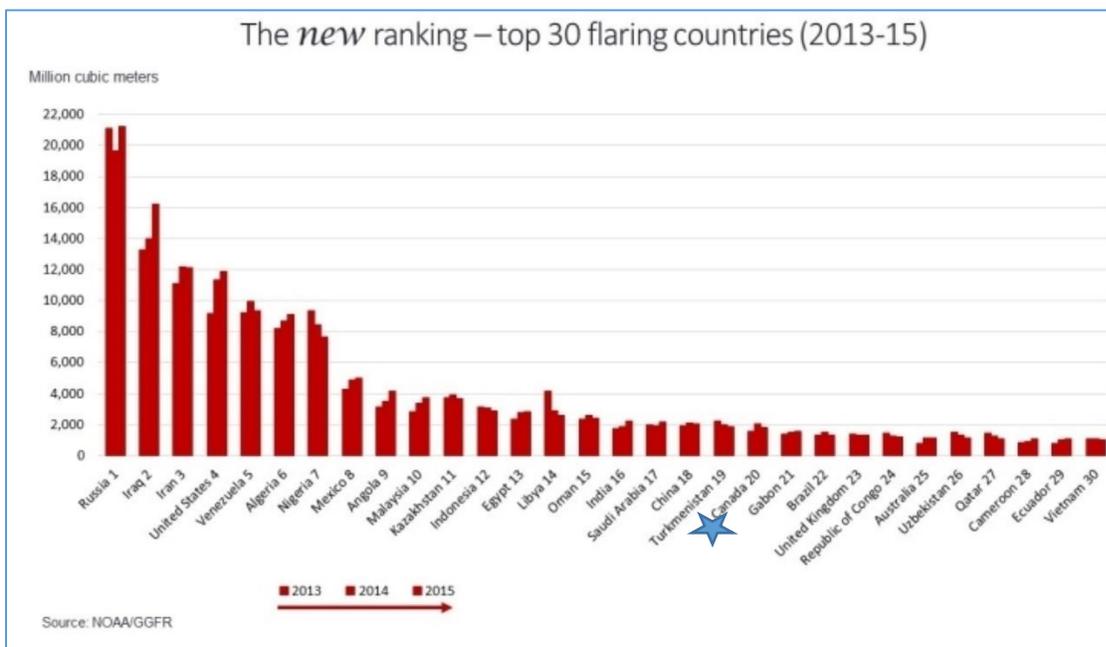
Description of Project Background

This report is Part 1 of a two-part project that aims to understand flaring regulations for the oil and gas industry across Canada. Part 1 will provide a brief description of Cap-Op Energy’s understanding of the technical requirements of the Zero Routine Flaring Initiative (ZRF) and a detailed assessment of the policy instruments for reducing flaring in individual jurisdictions across Canada. Part 2 will provide recommendations for a Canadian approach to eliminating routine flaring from oil and gas production before 2030.

Flaring occurs in many industries, under many different conditions. This report provides a focus on flaring associated with oil production, especially as it relates to the World Bank - Global Gas Flaring Reduction Partnership (GGFR) and the Zero Routine Flaring by 2030 initiative.

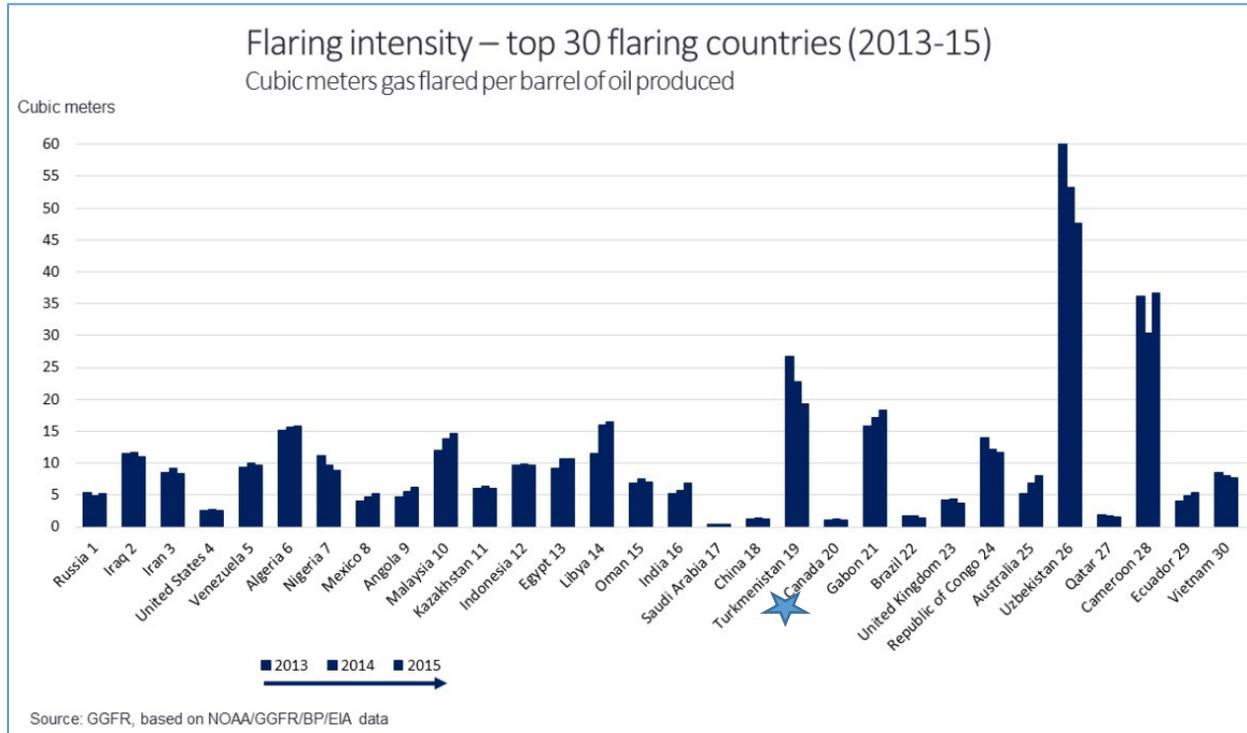
Internationally, Canada is ranked 20th in the world’s list of greatest volume of gas flared per year, as illustrated in the figure below. However, when compared on an intensity basis, among the same 30 highest flaring nations, Canada is listed in the bottom three per barrel of oil produced, see Figure 2.

Figure 1: Top Flaring Countries by Volume¹



¹ <http://www.worldbank.org/en/programs/gasflaringreduction#7>

Figure 2: Top Flaring Countries by Intensity²



In 2002, the World Bank launched the Global Gas Flaring Reduction partnership (GGFR), bringing to the table governments of oil-producing countries, state-owned companies and major international oil companies to share global best practices and implement country-specific programs to reduce flaring.³

On April 2015, the World Bank Group President Jim Yong Kim and the United Nations Secretary-General Ban Ki-moon jointly launched the “Zero Routine Flaring (ZRF) by 2030” initiative. Endorsers of the initiative would commit to develop new oil fields without routine flaring and pledge to eliminate ongoing routine flaring as soon as possible, and by no later than 2030. Endorsing countries, companies and development institutions further commit to reporting their progress annually.

On March 10, 2016 Prime Minister Trudeau, in a joint announcement with President Obama, endorsed the World Bank’s initiative to end routine gas flaring by 2030, as part of the two nations’ commitment to combatting climate change.

To fulfil this commitment, Environment and Climate Change Canada (ECCC) is conducting a baseline assessment of existing domestic policy initiatives and policy instruments related to flaring in Canada. The assessment will be used to inform consultation and engagement with provincial and territorial partners, working toward a national Canadian approach to the elimination of routine flaring.

The ZRF initiative intends to conserve the flared gas. Conservation is defined as the recovery of to use as fuel for production facilities, to sell, to inject for enhanced recovery from oil or condensate pools, or to

² <http://www.worldbank.org/en/programs/gasflaringreduction#7>

³ <http://www.albertaoilmagazine.com/2007/04/world-bank-adopts-eub-strategy-for-reducing-greenhouse-gas/>

generate power, among other uses. Though not a form of conservation, incineration often provides a more complete combustion of gas than flaring and can reduce environmental impacts.

National Regulations

Regulations on oil and gas activities in Canada are governed at both the national and provincial levels. Currently the major Canada-wide regulations for oil and gas operations are from the Canada Oil and Gas Operations Act⁴. Specifically, the Canada Oil and Gas Drilling and Production Regulation suggests that no operator shall flare or vent gas unless it receives special approval to do so, or if it is otherwise necessary to do so because of an emergency⁵. The regulation further places a duty on operators to ensure flow rates and volumes are consistently recorded and reported.

Overview of Provincial and Territorial Policies

Alberta, Saskatchewan, and British Columbia have the greatest concentration of oil and gas facilities in Canada and also have the most comprehensive rules and regulations for flaring, venting and incineration. Similar rules are applied in all three jurisdictions, for reporting and reducing venting and flaring activities, and standard procedures for facility operations. These regulations are applied to well testing, batteries, dehydrators, gas plants, compressor stations and pipelines and include provisions for temporary venting and flaring approvals. The regulations in Alberta particularly provide a high level of detail in flaring and venting reduction guidelines which date back to 1996. To guide regulation development and to facilitate clustering⁶ the Province compiles collected emission data into an annual Upstream Petroleum Industry Flaring and Venting Report⁷. BC and Saskatchewan originally developed their policies to align with those of Alberta.

In the Atlantic Provinces, including Newfoundland and Labrador and Nova Scotia, the regulation is focused on flaring and venting from offshore operations. Guidelines are provided to reduce flaring and venting activities. Quebec and Ontario don't have robust oil and gas activity, and as a result have no regulations for reducing flaring or venting. Appendix C - Oil Production and Well Count in Canada, provides a summary of oil production and the number of operational oil wells in each province. However, flaring emissions from other industries are covered under the Provinces' Cap and Trade Program and there are strict measurement and reporting guidelines. The Provinces covered in this report are listed in order of the comprehensiveness of the regulations and include relevant subsections based on the level of details provided in the Guidelines:

- Brief overview of the overall Provincial regulations,
- List of definitions - relevant and recurring terms that may be Province-specific,
- Description of policy instruments – what are the different policies, what facilities do they cover and what is required of operators
- Description of administrative/reporting requirements - what to report, who to report to, in what format and how frequently.

⁴ <http://laws-lois.justice.gc.ca/eng/acts/O-7/>

⁵ <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/page-6.html#h-52>

⁶ Clustering is the grouping of solution gas production from 2 or more neighboring facilities

⁷ <https://www.aer.ca/documents/sts/ST60B-2015.pdf>

- Affected capital and operating procedures – What operations are impacted, and what capital costs are required to comply
- Exemptions and requirements for exemptions – What are the exceptions to the policy (if any) and what is the process to take advantage of them
- Level of compliance and enforcement – How are the regulations or guidelines enforced, what is the implementation timeline, what are the policing methods

Alberta

Overview

Policy: Directive 60 - Upstream Petroleum Industry Flaring, Incinerating, and Venting (March 22, 2016)⁸

Alberta has been identified internationally as a leader for efforts in the overall reduction of flaring associated with oil production. The Energy Utility Board's (EUB's) (predecessor to the AER) flaring and venting reduction strategy has been utilized by the World Bank to encourage countries to reduce wasteful flaring of solution gas in their own jurisdictions.⁹

Directive 60 applies to all aspects of energy production - well testing, crude oil / bitumen battery, gas plant/battery, dehydrator, pipeline, line heater and compressor station and is enforced by the Alberta Energy Regulator (AER). While there are strict guidelines for the disposal of waste gases, flaring, incineration or venting is permitted under specific conditions. The AER also outlines detailed reporting requirements, which the agency compiles, publishes, and studies for future policy amendments. Much of Directive 60 has been developed through consultation with Clean Air Strategic Alliance (CASA) to ascertain the public safety and environmental impacts before flaring is initiated.

Through Directive 60, the AER's objective is to eliminate or reduce flaring, venting and incinerating in order to ensure the Alberta Ambient Air Quality Objectives (AAAQOs) are met and meet health and safety and other objectives. Flared volumes greater than 100 m³/month are required to be reported via Petrinex (Canada's Petroleum Information Network). Flared volumes exceeding 500 m³/day volumes (not including purge, pilot or dilution gas) and all acid and sour gas flaring, are to be metered. Engineering estimates, in lieu of metering, are permitted under certain conditions.

Flared gas is required to have a lower heating value (LHV) of 20 megajoules per cubic metre (MJ/ m³) or more, and may be mixed with fuel gas to achieve this threshold. The AER recognizes and accepts that short-duration emergency flaring with gas of a lower heating value may occasionally occur, this should be indicated in the required reporting. The elimination of flare pits as a best management practice (BMP) was introduced in 1996, with all pre-existing flare pits to be decommissioned by December 2014. This was supplemented by the introduction of Directive 60 - Upstream Petroleum Industry Flaring, Incinerating, and Venting, introduced in July 1999.

Gas containing more than 5 parts per million (ppm) H₂S (0.0005%) must not be released to the atmosphere without the approval of the AER unless it meets specified destruction requirements.

Directive 60 applies to flares and incinerators in all upstream oil and gas industry systems for burning sweet, sour, and acid gas, including portable equipment used for temporary operations such as well completion, servicing, and testing and pipeline installations that release gas (e.g. compressor stations, line

⁸ <https://www.aer.ca/rules-and-regulations/directives/directive-060>

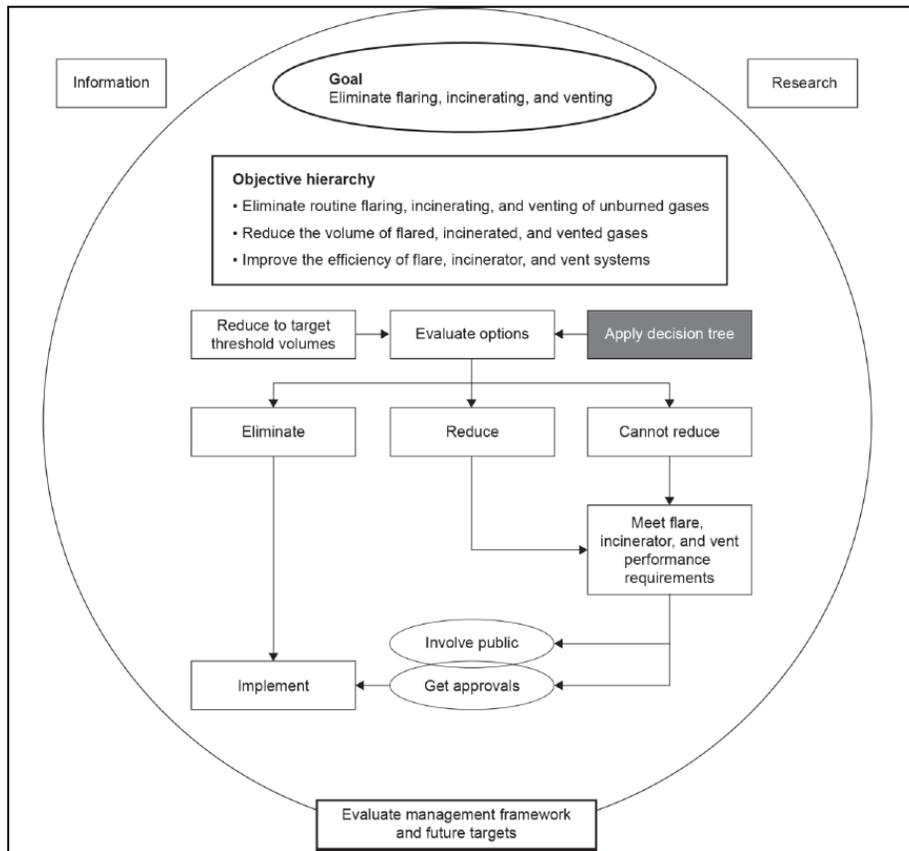
⁹ World Bank adopts EUB strategy for reducing greenhouse gas
<http://www.albertaoilmagazine.com/2007/04/world-bank-adopts-eub-strategy-for-reducing-greenhouse-gas/>

heaters). Flare and incinerator systems include associated separation equipment, piping, and controls. For the purposes of this directive, the terms flare and incinerator are used interchangeably except in combustion conversion efficiency and in stack design conditions.

The Directive recognizes that significant volumes of fuel gas may be used in order to sustain pilots for emergency flares at producing facilities. Continuous pilots may be necessary where gas is flared on a constant or routine basis or where sour gas can potentially be released from pressure safety valves (PSVs) or emergency shutdown valves (ESDVs). In situations where gas is not continuously or routinely flared, where ESDVs are not configured to depressurize facilities to flare, and where maximum foreseeable operating pressures are well below PSV release pressures, the potential exists to safely conserve natural gas by extinguishing the flare pilots. When considering a request to extinguish flare pilots as a form of conservation, the AER field centre considers both local conditions and the operating history of the facility.

Alberta Energy Regulatory (AER) adopts the Clean Air Strategic Alliance (CASA¹⁰) solution gas decision model to evaluate reduction opportunities for flaring, incineration, and venting. Under this management framework, projects which could lead to the conservation or destruction of these gases are evaluated for their economic feasibility and against AER volumetric thresholds.

Figure 3: Casa Decision Tree to Reduce Flaring, Incineration and Venting



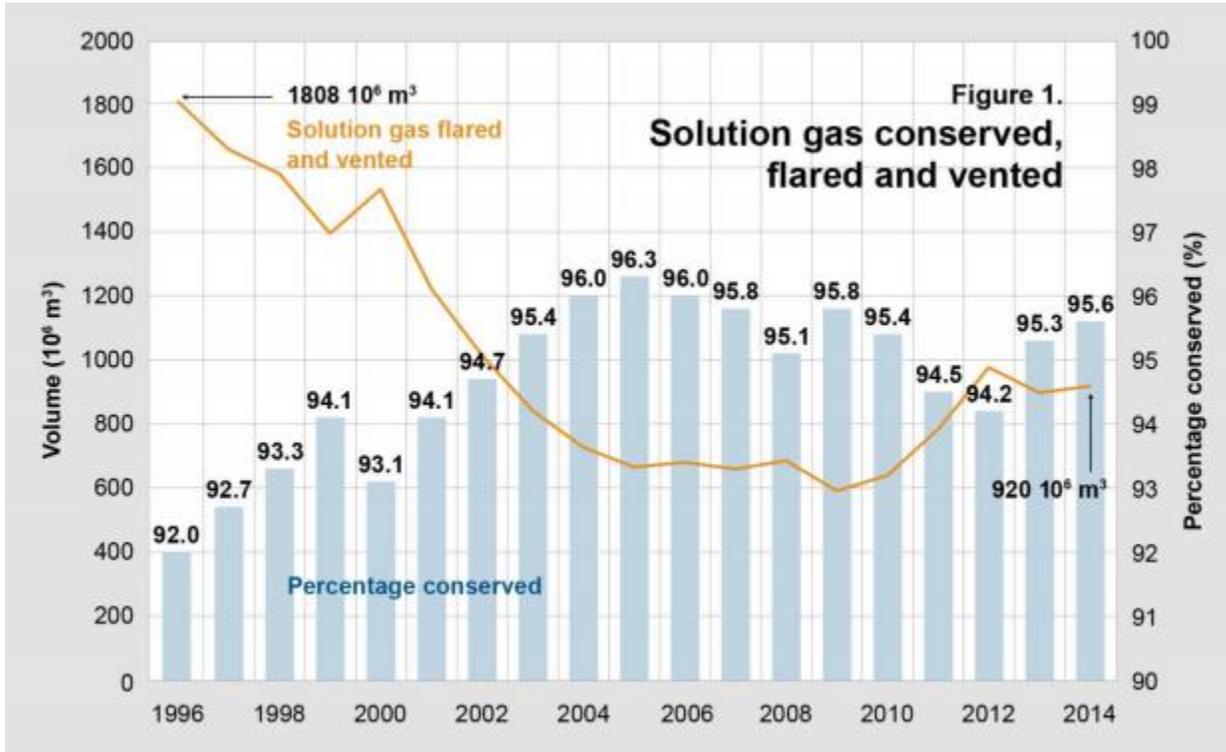
Alberta has made significant progress towards the reduction of flaring, venting and incineration. Alberta’s solution gas flaring and venting has dropped from 1808 million cubic metres (10⁶ m³)/ year in 1996 to 920

¹⁰ www.casahome.org

10⁶ m³/year in 2014 (49% reduction). The industry has achieved a 95.6 per cent solution gas conservation rate in 2014, an increase from the year before¹¹. See the figure below for historical figures.

The AER makes flaring, incineration, and venting information available to licensees, operators, and approval holders in order to facilitate solution gas conservation and clustering opportunities.

Figure 4: Alberta Report of Solution Gas Conserved, Flared and Vented¹²



Definitions of Flaring Under Consideration¹³

- Conservation: The recovery of solution gas for use as fuel for production facilities, other useful purposes (e.g., power generation), sale, or beneficial injection into an oil or gas pool.
- Clustering: The practice of gathering the solution gas from several flares or vents at a common point for conservation.
- Emergency Flaring: Occurs when safety controls within the facility are enacted to depressurize equipment to avoid possible injury or property loss resulting from explosion, fire or catastrophic equipment failure. Examples of upset flaring include: PSV overpressure; and emergency shut down.
- Gas Battery: A system or arrangement of tanks and other surface equipment (including interconnecting piping) that receives the effluent from one or more wells that might provide measurement and separation, compression, dehydration, dew point control, H₂S scavenging

¹¹ ST60B-2015: Upstream Petroleum Industry Flaring and Venting Report Industry Performance for Year Ending December 31, 2014. Dated February 2016. <https://www.aer.ca/documents/sts/ST60B-2015.pdf> , page 9

¹² <https://www.aer.ca/documents/sts/ST60B-2015.pdf>

¹³ Directive 60, <https://www.aer.ca/rules-and-regulations/directives/directive-060>

where <0.1 tonne/day of sulphur is being treated, line heating, or other gas handling functions prior to the delivery to market or other disposition.

- Gas Processing Plant: A system or arrangement of equipment used for the extraction of H₂S, helium, ethane, natural gas liquids, or other substances from raw gas; does not include a wellhead separator, treater, dehydrator, or production facility that recovers less than 2 m³/day of hydrocarbon liquids without using a liquid extraction process (e.g., refrigerant, desiccant).
- Non-associated Gas: Gas produced from a gas pool (i.e., not associated with oil or bitumen reservoirs or with production).
- Non-routine Flaring, Venting, Incineration: Applies to intermittent and infrequent events. There are two types of nonroutine flaring: planned flaring and unplanned flaring.
- Planned Flaring: Events where the operator has control over when flaring will occur, how long it will occur and the flow rates. Planned flaring results from the intentional de-pressurization of processing equipment or piping systems. Examples of planned flaring include pipeline blowdowns, equipment depressurization, start-ups, facility turnarounds, and well tests.
- Oil Battery: A system or arrangement of tanks or other surface equipment or devices receiving the effluent of one or more wells for separation and measurement prior to market delivery or other disposition.
- Routine Flaring, Venting, Incineration: Applies to continuous or intermittent flaring, venting, and incineration that occurs on a regular basis due to normal operation. Examples of routine flaring include: glycol dehydrator reboiler still vapour flaring; storage tank vapour flaring; flash tank vapour flaring; and solution gas flaring.
- Site: A single surface lease (pads counted as one lease) where gas is flared or vented
- Solution Gas: All gas that is separated from condensate, oil, or bitumen production.
- Sour Gas: Natural Gas, including solution gas, containing H₂S
- Unplanning Flaring: Emergency or upset operational activities closely associated with facility health and safety. Flare events where the operator has no control of when flaring will occur. There are two types of unplanned flaring: upset flaring and emergency flaring.

Description of Policy Instrument and Compliance Requirements

Directive 60 identifies five unique sources or locations of flaring;

- Solution Gas Management (Crude Oil / Bitumen Battery Flaring)
- Temporary and Well Test Flaring and Incinerating
- Gas Battery, Dehydrator, and Compressor Station Flaring, including equipment depressurization for maintenance; process upsets; and emergency depressurizing for safety reasons
- Gas Plant Flaring and
- Pipeline Flaring

The basis of Directive 60 is to evaluate each of these sources or locations based on three questions built into decision tree models:

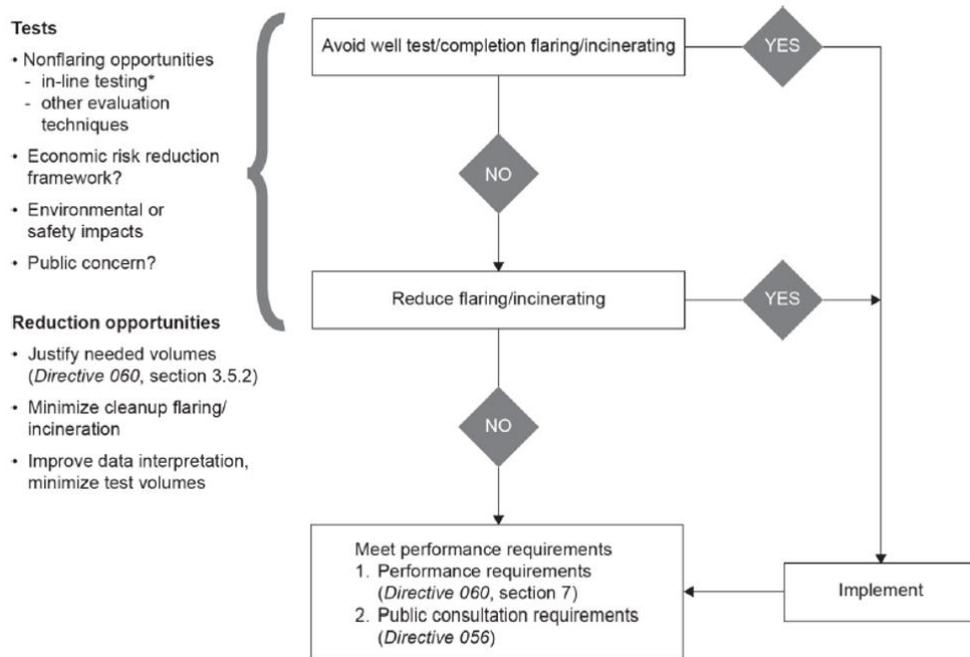
- Can flaring, venting, incineration be eliminated?
- Can flaring, venting, incineration be reduced?
- Can flaring, venting, incineration meet performance standards?

Evaluations are based on:

- Public concern
- Safety concern
- Environmental impact/benefit and
- Economic alternatives and risk assessment.

Licensed facilities that generate more than 900 m³/day of solution gas and are able to sustain a stable flame, or have a gas release of a specified volume or duration, are required to apply a decision tree analysis with the goal of eliminating flaring, incineration and venting. Below is the ‘Temporary flaring and incineration decision tree model’ as an example of a typical decision tree applied for each of the sources or locations of flaring identified in Directive 60.

Figure 5: Example of Directive 60 Decision Tree for Temporary Flaring



For solution gas; in June 1999 the Minister of Energy issued Information Letter (IL) 99-19; Otherwise Flared Solution Gas Royalty Waiver Program¹⁴ The IL provides a producer with financial incentive to use solution gas in a form previously using royalty gas. The intent of the program is to reduce solution gas flaring. The applicant would, among other requirements, provide evidence of the sub-economic status for the solution gas at the battery level. The royalty waiver would last for ten years.

Description of Administrative/reporting Requirements

All monthly flared, incinerated, and vented volumes must be reported separately on Petrinex (Canada’s Petroleum Information Network).

The AER makes the collected flaring, incineration, and venting information available to licensees, operators, and approval holders in order to facilitate solution gas conservation and clustering opportunities (flaring or conservation opportunities through collaboration). The AER also annually

¹⁴ <http://www.energy.alberta.ca/NaturalGas/1139.asp>

publishes The Upstream Petroleum Industry Flaring and Venting Report providing details of the industry performance. The most recent report for year ending December 31, 2014, is dated February 2016¹⁵.

For Temporary and well testing flaring, incineration, and venting; All well test reports must be submitted within three months of completing fieldwork. For well tests that require permits, a sour gas flaring data summary report must be submitted to the AER Authorizations Branch within three weeks of the completion of the flaring event.

Licensees requesting well testing or temporary permits must evaluate conservation opportunities such as using existing gas gathering systems before beginning temporary maintenance, well cleanup, or testing operations (i.e., “in-line testing”). In-line testing must be done when economic and feasible to do so. If in-line testing is not possible, licensees must design completions and well testing programs to minimize emissions while ensuring technically sound well completion and acquisition of sufficient reservoir and productivity information for future development decisions.

Flaring is allowed by the AER when done in accordance with Directive 60. However, parties may agree to zero flaring, as set out in a zero flaring agreement. Once filed, the zero flaring agreement becomes a condition of the well licence. Should the licensee, operator, or approval holder fail to adhere to this agreement, operations at the well may be suspended. This agreement, including the condition, expires when production begins.

The economic evaluation criteria must be completed as follows:

- Evaluations completed on a before-tax basis, and must exclude contingency and overhead costs
- Conservation economics must be evaluated on a royalties-in basis (paying royalties) for incremental gas and gas by-products that would otherwise be flared or vented. If the economic evaluation results in an NPV less than –\$55 000, the licensee or operator must re-evaluate the gas conservation project on a royalties-out basis (not paying royalties). If the evaluation results in an NPV –\$55 000 or more, the licensee or operator must proceed with the conservation project and may then apply to Alberta Energy for an “otherwise flared solution gas” royalty waiver
- Price forecasts used in the evaluation of solution gas conservation projects (gas gathered, processed, and sold to market) must use the most recent version of commodity price forecast from GLJ Petroleum Consultants Limited. Gas prices must be obtained from the “Natural Gas and Sulphur Price Forecast Table” in the “ARP” column (\$Cdn/MMBtu). Condensate prices must be obtained from the “Crude Oil and Natural Gas Liquids Table” in the “Alberta Natural Gas Liquids Section – Edmonton Pentanes Plus” column (\$Cdn/bbl)
- Price forecasts for power generation projects are to use the Alberta Electric System Operator (AESO) price forecast
- Detailed breakdown of capital costs including equipment, material, installation, and engineering costs must be included
- Incremental annual operating costs for conservation project assumed to be 10% of initial capital cost of installing the conservation facilities
- The most recent inflation rate must be based on the current economic trends report published quarterly on the Government of Alberta, Treasury Board and Finance, Economy and Statistics website. <http://www.finance.alberta.ca/aboutalberta/index.html>
- Discount rate equal to the prime lending rate plus 3%

¹⁵ <https://www.aer.ca/documents/sts/ST60B-2015.pdf>

- Solution gas conservation project is considered economic if the NPV is equal to or greater than \$50,000(Cdn) pre tax
- Solution gas project economics recalculated every 12 months if project is uneconomic

Affected Capital Equipment or Operating Procedures

The following facilities and procedures are covered under Directive 60:

- Solution Gas Management (Crude Oil / Bitumen Battery Flaring, Incineration, and Venting)
 - All upstream petroleum industry wells and facilities and pipeline installations that convey gas
 - With the exception of oil sands mining schemes and operations, Directive 60 applies to all schemes and operations approved under section 10 of the Oil Sands Conservation Act (OSCA). Directive 60 does not apply to any processing plants approved under section 11 of the OSCA
 - For multiwell bitumen sites, solution gas conservation lines must be built to a common point on the lease as part of initial construction
- Temporary and Well Test Flaring and Incinerating
 - Upstream oil and gas (UOG) facilities impacted by activities such as well testing, well cleanup, well servicing, sour gas pipeline blowdown, coalbed methane well testing, underbalanced drilling, maintenance blowdowns, and emergency blowdowns
- Gas Battery, Dehydrator, and Compressor Station Flaring, Incinerating, and Venting
 - Production and processing facilities such as gas battery, dehydrator, and compressor stations
- Gas Plant Flaring, Incinerating, and Venting
 - Sources include; routine flaring, incineration, and venting of low-pressure flash-gas and other gas streams, and nonroutine flaring, incineration, and venting for equipment depressurizing for maintenance process upsets, and emergency depressurizing for safety reasons
- Pipeline Flaring, Incinerating, and Venting
 - All gas gathering and transmission lines and related facilities such as compressor stations

Exemptions and Requirements for Exemptions

Under the directive there are provisions for exemptions, along with the conditions to be met if an exemption is being applied for. For example, if a licensee or operator is operating a conservation program, they may request to discontinue conservation under several conditions, including when annual operating expenses exceed annual revenues.

For solution gas; If gas volume is less than 900 m³/day or if a stable flame can not be maintained, and upon meeting other conditions, venting as an alternative to flaring will be considered acceptable. The AER may investigate the potential to conserve solution gas through power generation for flared or vented solution gas volumes as low as 500 m³/day if it appears that gas volumes are stable. Exempt are oil sands mining schemes, operations and any processing plants approved under section 11 of the OSCA.

For temporary and well testing; Intermittent and small volumes are exempt and so may be vented, assuming public concerns, safety concerns and environmental concerns are properly addressed.

For gas battery, dehydrator, and compressor station; exempt are intermittent small sources, less than 100 m³per month, such as pig trap depressurizing.

For gas plants reporting requirements, the fuel gas used for pilots or flare system purge, and acid gas volumes from gas sweetening (which are normally continuously flared) are excluded from required reporting calculations. This gas, which is flared, incinerated, or vented, for example as flare pilot gas, header purge gas, or as storage tank blanket gas, is reported as fuel gas. Exempt are intermittent small sources (less than 100 m³per month) such as pig trap depressurizing. These evaluations must be updated annually or when there are material changes in plant equipment or operation.

For pipelines; during the depressurizing of sweet natural gas transmission lines, the conservation, the flaring or the incineration of gas may not be practical when the impact on system customers, producers and/or the environment are considered. In such situations, the appropriate AER field centre may allow the venting of gas to reduce the duration of system outages and related impacts. Exempt are intermittent small sources (less than 100 m³per month) such as pig trap depressurizing. These evaluations must be updated before any planned flaring, incinerating, or venting activities.

Level of Compliance, Enforcement Measures and Timing

The Alberta Energy Regulator (AER) is responsible for approving permits related to venting and/or flaring. Oil and gas companies are also required to contact the Ministry in cases of non-routine flaring and emergencies. The Directive provides guidelines for nonroutine flaring or venting, violation of which could result in suspension of site operations. More research will need to be conducted along with an interview of the Alberta Energy Regulator to further understand disciplinary actions for violations of flaring regulations.

References and Further Information

- Directive 60 - Upstream Petroleum Industry Flaring, Incinerating, and Venting, release date March 22, 2016.
 - <https://www.aer.ca/rules-and-regulations/directives/directive-060>
- Upstream Petroleum Industry Flaring and Venting Report Industry Performance for Year Ending December 31, 2014. Dated February 2016
 - <https://www.aer.ca/documents/sts/ST60B-2015.pdf>
- Information Letter (IL) 99-19; Otherwise Flared Solution Gas Royalty Waiver Program
 - <http://www.energy.alberta.ca/NaturalGas/1139.asp>
- EnerFAQs – 6; Flaring and Incineration
 - https://www.aer.ca/documents/enerfaqs/AER_EnerFAQs06_FlaringIncineration.pdf
- Non-Routine Flaring Management: Modeling Guidance, April 17, 2014
 - <http://aep.alberta.ca/air/modelling/documents/NonRoutineFlaringModelling-May09-2014A.pdf>
- Transferring Alberta's Gas Flaring Reduction Regulatory Framework to Nigeria: Potentials and Limitations", dated 2007
 - <https://www.albertalawreview.com/index.php/ALR/article/download/374/371>
- [Alberta Oil Magazine, April 10, 2007, World Bank adopts EUB strategy for reducing greenhouse gas](#)
 - <http://www.albertaoilmagazine.com/2007/04/world-bank-adopts-eub-strategy-for-reducing-greenhouse-gas/>

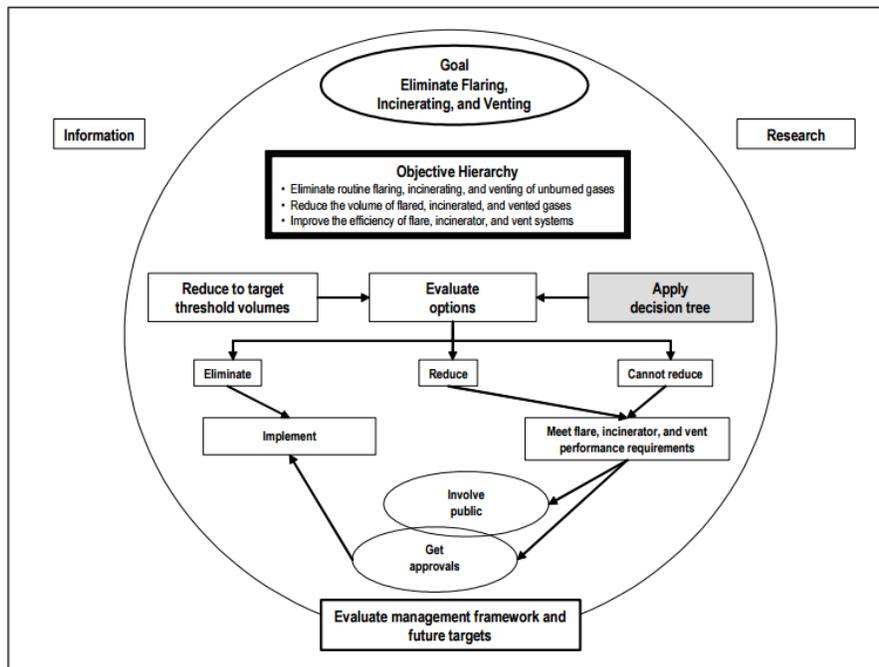
- Mar 20, 2015 Alberta Government Media Release, Alberta renews GHG emissions reduction partnership with World Bank.
 - <https://www.alberta.ca/release.cfm?xID=3790735840F95-AD95-3EA3-4CEF5BD2D624BEE8>

British Columbia

Overview

British Columbia has some of the most comprehensive and stringent environmental regulations for energy producers in Canada and mirrors the regulations in Alberta. The Flaring and Venting Reduction Guideline¹⁶ (effective October 4, 2010) provides regulatory requirements and guidance for flaring, incineration and venting of natural gas at wellsites, oil and gas facilities and pipelines in the province. The BC Oil and Gas Commission (Commission) is responsible for administering and enforcing these regulations. The Guideline provides procedural information for flare approval requests, dispersion modelling and the measuring and reporting of flared, incinerated and vented gas regulated under the Oil and Gas Activities Act (OGAA)¹⁷. These initiatives were a result of the BC Energy Plan (published in 2007) that set out to eliminate all routine flaring at oil and gas producing wells and production facilities by 2016 with an interim goal to reduce flaring by 50% by 2011¹⁸. The Plan further set a goal to reduce natural gas flaring and venting at test sites and pipelines and encourage operators to implement compressor station efficiency projects. The chart below summarizes the Management Framework for flaring reduction initiatives under the Guideline¹⁹:

Figure 6: Management Framework for Flaring Reduction Initiatives Under the BC Flaring Guideline



¹⁶ <http://www.bcogc.ca/node/5916/download>

¹⁷ http://www.bclaws.ca/civix/document/id/complete/statreg/274_2010

¹⁸ http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/electricity-alternative-energy/bc_energy_plan_2007.pdf - page 30

¹⁹ The Guideline – Page 9

Similar to Alberta, operators in British Columbia are required to evaluate three options:

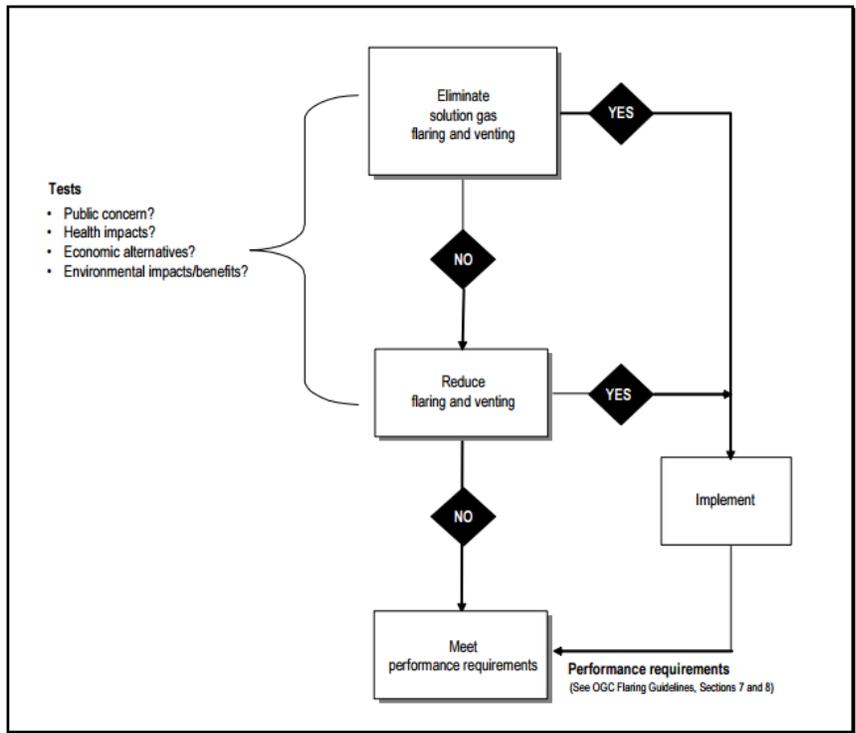
- Can flaring and venting be eliminated?
- Can flaring and venting be reduced?
- Will flaring and venting meet performance standards?

Definitions Under Consideration²⁰

- Flaring: Combustion of gas in a flare stack or an incinerator unless otherwise specified²¹
- Routine flaring: Continuous flaring of gas that is not required for safety or environmental purposes and is otherwise economical to conserve
- Non-routine' or 'un-planned' flaring: The depressurizing of equipment and pipelines due to process upsets or emergencies
- Conservation: Recovery of solution gas for sale, for use as fuel for production facilities, for power generation or for beneficial injection into an oil or gas pool (pneumatics, oil recovery)
- Fugitive emissions: Unintentional releases of gas resulting from production, processing, transmission, storage and delivery

Description of Policy Instrument and Compliance Requirements

Figure 7: Decision Tree for Flaring Reduction Activities at Solution Gas and Oil Batteries



Venting should be considered the last approach for the management of solution gas and oil batteries. In cases where facilities must release gas, 100% of the gas should be flared. Sites are required to conserve if venting volumes are greater than 900 m³ per day per site, with a net present value of conservation economics greater than C\$50,000 or if venting are volumes greater than 900 m³ per day per site and are located within 500 m of an existing residence. The following decision tree should be used as a guide to identify opportunities for flaring reduction. All sites with flaring volumes greater than 900m³

per day, must update conservation economics every 12 months. Facilities with gas to oil ratio (GOR) greater than 3000 m³/m³ must be shut-in until the gas is conserved. Conserving facilities must be designed for 95% conservation with a minimum operating level of 90%. Conservation must strictly be implemented

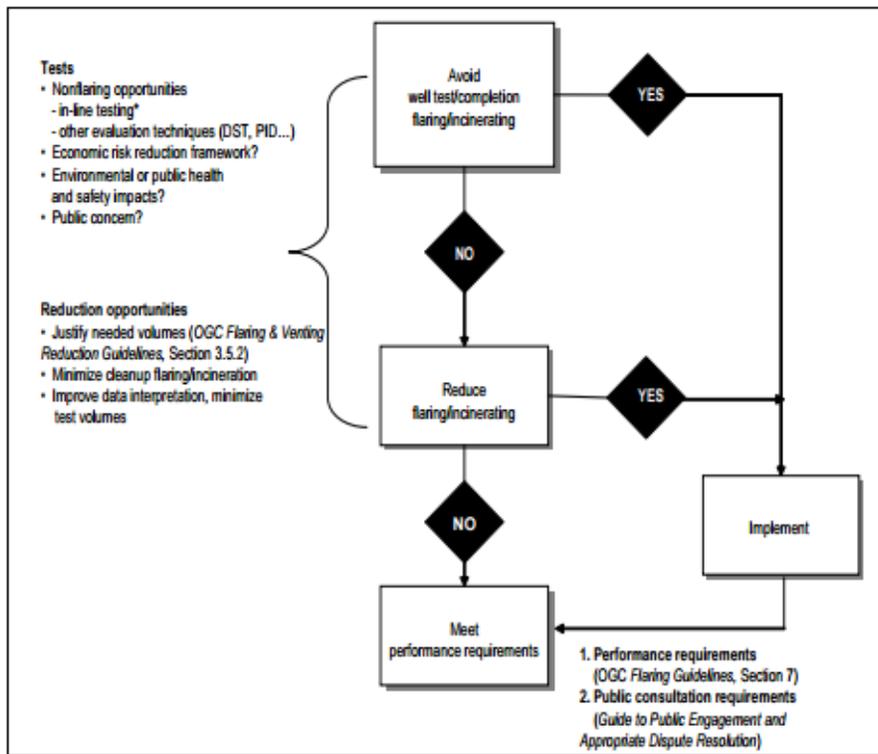
²⁰ The Guideline – page 67

²¹ The Guideline – page 5

at all new gas batteries, exceptions will be considered on a case-by-case basis where it is uneconomical to do so. In cases where annual operating expenses exceed revenues, or the NPV before tax is less than \$50,000, facilities can apply to discontinue conservation by submitting an economic report to the Commission with the following guidelines:

- Use before-tax basis numbers for economic identification
- For price forecasts, use Sproule Associates and Limited natural gas price forecasts²²
- Include all capital costs of equipment and installation
- Incremental annual operating costs for projects assumed to be maximum 10% of capital costs, if there is H₂S, then maximum 20%
- For discount rate use the prime lending rate in Canada
- Detailed capital and operating cost schedule; production forecast for oil/gas streams, reserve calculations,
- Documentation of alternatives considered to reduce venting and/or flaring

Figure 8: Decision Tree for Flaring Reduction Activities at Well Sites



Activities related to well flaring include well testing, cleanup and well maintenance/servicing. The following decision tree should be used as a guide to identify opportunities for flaring reduction. In-line testing is mandatory for all wells on private land, wells on crown land within 1.25 km of a residence or within 3 km of a suitable pipeline. Further, wells drilled and facilities constructed after September 1, 2010 must not release gas containing more than 20 ppm hydrogen sulphide (more information in the Affected Capital section below). Depending on the type of well, flaring and venting time limits

apply as follow:

- 72 hours for crude oil wells/sites/gas,
- 120 hours for dry coalbed methane development wells
- 336 hours for dry coalbed methane non-development wells

²² <http://www.sroule.com/forecasts>

- 120 hours for shale gas development wells
- 336 hours for share gas non-development wells

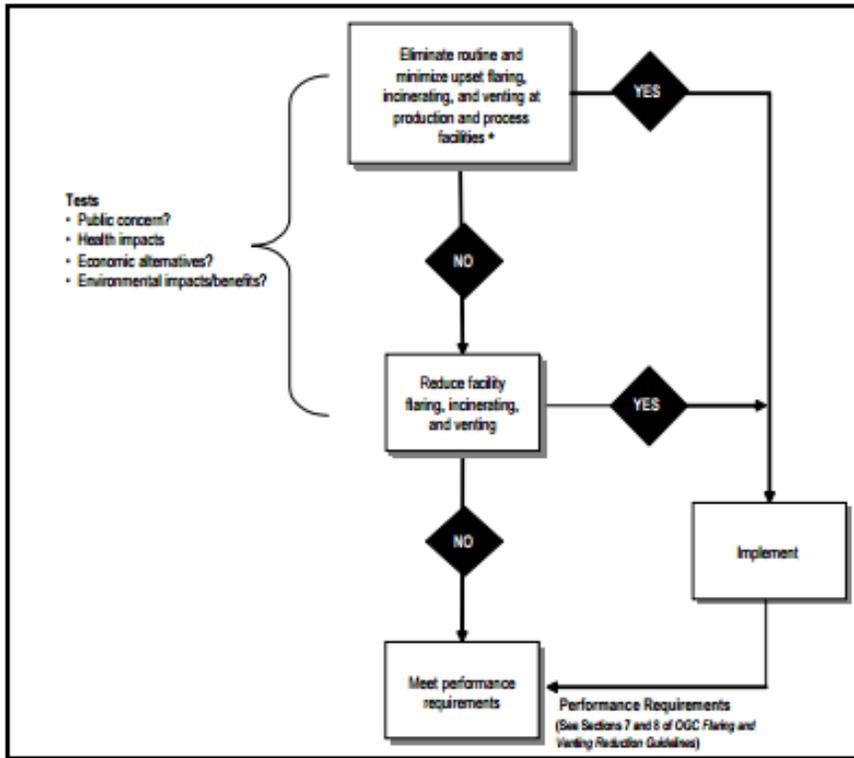
Time extensions are granted in cases where the clean-up of a wellbore is not complete or where there have been mechanical problems with the well. Temporary flaring approvals are also granted in the following situations:

- Flaring related to drilling operations
- Flaring necessary for emergency purposes
- Well workover or maintenance does not exceed 50,000 m³ in one year
- Flaring is in accordance with well permit (must be granted at time of permit application)

Approvals for flaring requests will not be granted for multiple tests of wells at the same location that are completed in the same zone, or for flaring due to delay of a tie-in unless that well is required to enable start-up of a facility. Otherwise, organizations must provide specific engineering, economic and operational information, to gain approval if the flared volumes exceed the following thresholds:

- 600 10³ m³ for wells that have not been tied in and have an exploratory classification
- 400 10³ m³ for wells that have not been tied in and have a development classification
- 200 10³ m³ for wells that have been tied into existing facilities
- 200 10³ m³ for each additional segregated zone in the well

Figure 9: Decision Tree for Flaring Reduction Activities at Natural Gas Facilities



Flaring at natural gas facilities includes processing plants, compressor stations and dehydrator facilities. The following decision tree is provided in the regulation as a guide to identify flaring reduction opportunities, unless volumes are from intermittent small sources (less than 100 m³ per month). Natural gas facilities are required to measure and report flaring activities as per the reporting procedures mentioned below, and don't require specific approvals for non-routine flaring related to maintenance and emergencies. Non-routine flaring for any other reason must be approved in the

facility permit. For new facilities, the use of incineration must be considered during the permit application process for flares other than purge and pilot gases. Frequent non-routine flaring events are limited to a maximum of 6 in a 6-month period. Details and reporting procedures of this can be found below in the

Affected Capital Equipment section. Regarding dehydrators, effective June 30, 2007, any new dehydrators must not emit more than 1 tonne/yr of benzene emissions, and the cumulative emissions must not exceed the limit of the oldest dehydrator on site as per the chart below:

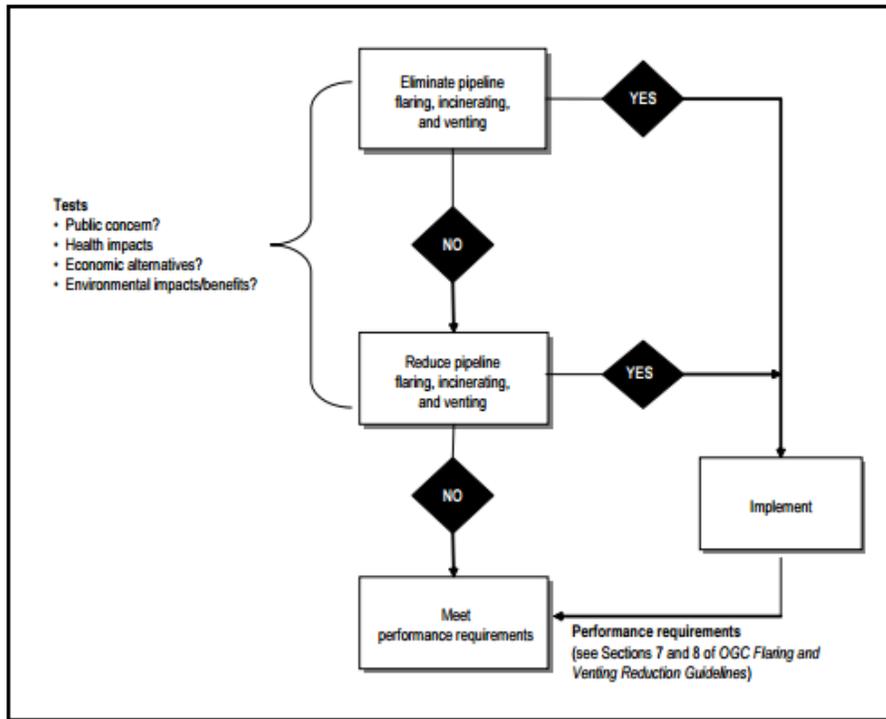
Table 1: Benzene Emission Limits for Dehydrators

Date of Installation or Relocation	Benzene Emissions Limit
Prior to January 1, 1999	
a) Greater than 750 m to the nearest permanent resident or public facility	5 tonnes / yr
b) Less than 750 m to the nearest permanent resident or public facility	3 tonnes / yr
January 1, 1999 to June 30, 2007	3 tonnes / yr
After June 30, 2007	1 tonne / yr

Pipeline Flaring and Venting

Pipeline flaring and venting includes the disposal of gases from gas gathering systems and transmission lines through depressurizing for maintenance, process upsets, or emergency depressurizing for safety reasons. The following decision tree should be used as a guide to identify flaring reduction opportunities.

Figure 10: Decision Tree for Flaring Reduction Activities at Pipelines



General Flaring Information

Under the Guideline, operators are required to phase out existing flare pits for continuous gas flaring and new flare pits are no longer approved. In cases where disposal of gas is required, section 47 of the Drilling and Production Regulation mandates that flares, incinerators and enclosed gas burners must be located at least 80 m from any public road, public utility, building, or public concourse. Flares stacks and incinerators should also comply with the noise limits established in the British Columbia Noise Control Best Practices Guideline²³. Gas combustion systems including flare stacks and incinerators should be designed so they don't result in off-lease odours, or result in adverse impacts to public health and safety, or injury to vegetation. Heating values of these systems should not be less than 20 megajoules per cubic meter, however for existing stacks with an established history of compliance with the BC Air Quality Objectives/Standards, operators can maintain heating value of minimum 12 MJ/m³.

Description of Administrative/reporting Requirements

There are different reporting requirements based on the size of the production and processing facilities. Organizations that flare, incinerate or vent more than 0.1 10³ m³ per month must report volumes monthly to the Ministry of Finance using the BC-19 (gas processing plants) and/or BC-S2 (all other facilities, compressors, pipelines, and gas gathering systems) forms²⁴. These reports must demonstrate that volumes of gas are determined in an accurate and reliable manner, with documentation detailing the methodology used to determine flared, incinerated and vented volumes for each facility. Flaring associated with well drilling, completions and maintenance must be reported through the online Well Deliverability Test Report²⁵.

In addition to the monthly reporting required above, all oil and gas facilities must maintain a log related to all non-routine flaring and venting events and how public complaints (if any) were investigated and addressed. The logs must contain the following minimum information:

- Each non-routine flaring and venting incident & reason that it occurred
- Date/Time & duration (in hours) & gas source or type
- Volume for each incident and how the volume was determined
- Complaint name and contact information
- Company representative assigned to investigate
- Commission representative contacted
- Any changes implemented to prevent future non-routine event of a similar nature from occurring

In regards to benzene emissions from glycol dehydrators in gas plants, organizations must complete the Dehydrator Engineering and Operations Sheet (located in Appendix B of the Benzene Control BMP)²⁶ and submit an annual Dehydrator Benzene Inventory List by email in accordance with Section 12 of the Benzene Control BMP.

For facilities where the annual average of total flared, incinerated and vented volumes per facility exceeds 0.5 10³ m³ per day, meters designed for expected flow conditions and range are required. Further details regarding calibration and proving of measurement devices can be found in Chapter 2 of the Measurement Requirements for Upstream Oil and Gas Operations Manual. In cases where monthly volume cannot be

²³ <https://www.bcogc.ca/node/11095/download>

²⁴ <http://www2.gov.bc.ca/gov/content/taxes/natural-resource-taxes/oil-natural-gas/forms-publications/forms>

²⁵ <http://www.bcogc.ca/node/5699/download>

²⁶ <http://www.capp.ca/publications-and-statistics/publications/279307>

determined solely from meters (solution gas from non-point sources, acid gas flared continuously or in emergencies), then the following table of uncertainty requirements applies.

Table 2: Uncertainty Maximums for Measurement and Reporting

Stream	Max Uncertainty of Monthly Volume	Single Point Measurement Uncertainty
Fuel gas > 500 m ³ /d	5%	3%
Fuel gas < 500 m ³ /d	20%	10%
Flare, incinerator, or vent gas	20%	5%
Acid gas	10%	10%

Estimates of flared, incinerated and vented gas may also be used if reporting procedures are well defined, validated, and based on engineering calculations that meet the uncertainty requirements mentioned in the above table. The CAPP's Guide for Estimation of Flaring and Venting Volumes from Upstream Oil and Gas Facilities, 2002 contains acceptable practices for estimation²⁷.

Affected Capital Equipment or Operating Procedures

The Flaring and Vent Reduction Guideline of BC includes facilities such as well sites, oil batteries, compressor stations, gas processing plants and pipelines, and flaring/venting from the following activities:

- Oil/gas well drilling/completion/testing
- Oil production/solution gas
- Gas production
- Planned non-routine depressurizing of processing equipment/gas pipelines for maintenance
- Unplanned/non-routine depressurizing of process equipment and gas pipelines due to process upsets/emergencies
- Pilot, purge, blanket, and process gas

Note: Fugitive emissions are not reported as flared or vented because they are considered shrinkage.

Notifications

In situations where flaring, incineration or venting occurs, organizations are responsible for notifying the Commission, residents and administrators of incorporated centres located within a notification radius noted in the table below:

Table 3: Notification Distances for Flaring Gas Containing Hydrogen Sulphide

H ₂ S Content	Flaring Event Duration or Volume	Notification Radius
Any	<4 hr and < 10 e ³ m ³	None
<1%	>4 hrs or > 10e ³ m ³	1.0 km
1% - 5%		1.5 km
>5%		3.0 km

²⁷ <http://www.capp.ca/publications-and-statistics/publications/38234>

Notification must be given a minimum of 24 hours prior to commencement of unplanned (non-routine) and planned flaring events to both the Commission and other stakeholders. It should be in writing and include minimum information about company name/contact persons/telephone, location of flaring, duration of event, expected volume and rate, type of well, and the H₂S content of flare.

Limited Number of Flaring Events

Under the guideline, gas processing plants must not exceed six major non-routine flaring events in any consecutive six-month period. Major flaring events are described in the table below:

Table 4: Definition of Major Flaring Events and Approved Capacity

Approved inlet capacity	Major flaring event definition*
>500 10 ³ m ³ /d	100 10 ³ m ³ or more
150 – 500 10 ³ m ³ /d	20% of design daily inlet or more
< 150 10 ³ m ³ /d	30 10 ³ m ³ or more
*The definition of a flaring event includes situations where: 1) Volumes greater than or equal to those specified in the table are flared in any single day; each day that specified flared volumes are exceeded is considered to be a separate, individual event, or 2) Volumes greater than or equal to those specified in the table are flared in one contiguous period spanning more than one day (for example, flaring for 4 days at a continuous rate of 25 10 ³ m ³ /d is considered one event)	

In the event of any major flaring event, the gas plant must submit an exceedance report to the Commission Pipelines and Facilities Department within 30 days of the occurrence. The report must provide details of all flaring events (volume and duration), propose a plan for corrective action and provide corresponding timeline for implementing of such actions

Organizations are required to evaluate impacts on air quality if burn gas contains greater than or equal to 1 mole percentage of H₂S. For gas containing more or equal to 1 mole percent and less than 5 mole percent H₂S, information on dispersion assessments must be collected. For any gas with more than 5 mole percent H₂S, the dispersion modelling must be submitted to the Commission.

Exemptions and Requirements for Exemption

The Drilling and Production Regulation²⁸ under the Oil and Gas Activities Act authorizes flaring at wells under the following circumstances:

- If the flaring is related to drilling operations
- If the flaring is necessary for emergency purposes
- If the flaring is for well workover or maintenance operations, and cumulative quantity of flared gas does not exceed 50 000 m³ in one year
- If it is in accordance with the well permit (approvals granted during well permit application)

²⁸ http://www.bclaws.ca/civix/document/id/loo97/loo97/282_2010

Level of Compliance, Enforcement Measures and Timing

The BC Commission is responsible for approving site testing, and activities related to venting and/or flaring. Oil and gas companies are also required to notify the Commission in cases of non-routine flaring and emergencies. More research will need to be conducted along with an interview of the BC Commission to further understand disciplinary actions for violations of flaring regulations.

Saskatchewan

Overview

The Saskatchewan Oil and Gas Conservation Act came into effect in 1979, and under it the Oil and Gas Conservation Regulation (2012) ²⁹. Furthermore, Directive S-10 (Saskatchewan Upstream Petroleum Industry Associated Gas Conservation Directive³⁰) and Directive S-20 (Saskatchewan Upstream Flaring and Incineration Requirements³¹) are the two major policy levers for managing emissions related to venting, flaring, and incineration. Directive S-10 focuses primarily on associated gas at licensed oil wells and oil facilities, while Directive S-20 provides guidelines for flaring and incineration system design. The regulations cover all facilities in Saskatchewan where the combined venting and flaring volumes are greater than 900 m³/day and meet an economic criterion (conservation economics generate an NPV greater than \$50,000). The Ministry of the Economy (ECON)'s Saskatchewan Upstream Oil and Gas Industry Flaring and Venting Emission Reduction Committee is responsible for administration. Again the policies in Saskatchewan are very similar to those enacted in Alberta and BC.

Definitions of Flaring Under Consideration

- Conservation: Recovery of associated gas for sale, use as fuel in production facilities, beneficial injection into an oil or gas pool, and for other useful purposes (power generation, etc).
- Associated gas: Gas produced from oil or heavy oil reservoirs, includes gas caps
- Non-associated gas: Gas produced from a gas pool (not associated with oil or bitumen reservoirs)
- Fugitive emissions: Unintentional releases of gas resulting from production, processing, transmission, storage, and delivery
- Routine flaring, venting, incineration: Continuous release of gas
- Non-routine flaring, venting, incineration: Intermittent and infrequent events such as planned maintenance, process upsets, and emergencies
-

Description of Policy Instrument and Compliance Requirements

Directive S-10

The Basis of S-10 is to evaluate projects the basis of three questions:

- Can flaring, venting, incineration be eliminated?
- Can flaring, venting, incineration be reduced?
- Can flaring, venting, incineration be meet performance standards?

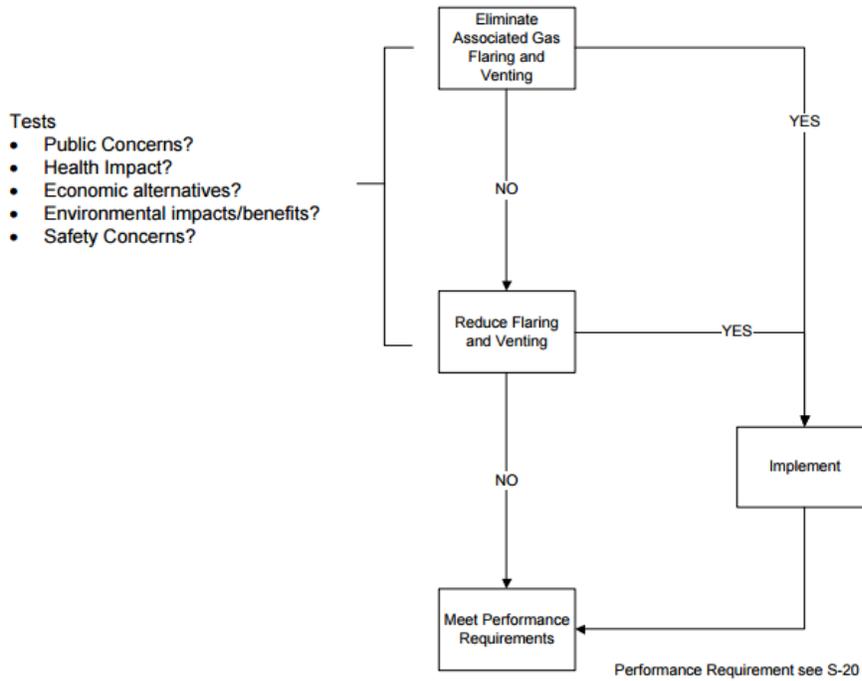
²⁹ <http://www.qp.gov.sk.ca/documents/English/Regulations/Regulations/O2R6.pdf>

³⁰ <http://publications.gov.sk.ca/documents/310/85153-Directive%20S-10%20Saskatchewan%20Upstream%20Petroleum%20Industry%20Associated%20Gas%20Conservation%20Directive.pdf>

³¹ <http://publications.gov.sk.ca/documents/310/85154-Directive%20S-20%20%20Saskatchewan%20Upstream%20Flaring%20and%20Incineration%20Requirements.pdf>

Under the regulation, a licensed facility must not flare, incinerate or vent associated gas over 900m³/day. The effective date for S-10 was July 2012 (date of inception) for all new oil wells and facilities, and July 2015 for existing facilities. Between the three years allotted for compliance by existing facilities, ECON could order specific facilities for immediate compliance. The following decision tree should be applied to the conservation of all vented and flared associated gas:

Figure 11: Decision Tree for Flaring Reduction Activities of Associated Gas



Venting or flaring is not permitted at all (including temporary flaring) within 500 m of a residence. If a new residence is relocated within 500 m of an existing associated gas flare or vent, the operator must provide information to the new residents about site operations.

Venting is deemed a suitable option when the waste gas is non-combustible (such as N₂) or is an inert gas mixture and meets the following circumstances:

- Gas or vapour does not contain hydrogen sulphide in concentrations greater than 10,000 ppm at the source, unless it's an emergency and a reasonable level of precautions taken to protect human health, public safety, property and the environment
- Vented substances don't contain odorous compounds such as mercaptan, VOCs, or ammonia
- Vented gas does not exceed Ministry of Saskatchewan's Ambient Air Quality Standard

Non-routine flaring is allowed for no longer than 7 days at a time unless otherwise approved by ECON. Temporary venting is allowed at wells for no longer than 24 hours, where no more than 2,000 m³ of gas is released. Reasons for non-routine flaring events can include emergency, plant turn-around, drilling, well servicing, and routine maintenance, and where a reasonable level of precaution has been taken to protect human health, public safety, property and the environment. In cases of non-routine flaring, operators are encouraged to notify residents within 500 metres of the site and must notify the nearest ECON Field Office by phone, email or letter within 48 hours prior to the activity.

Directive S-20

The standards outlined in Directive S-20 apply to all wells and facilities licenced or approved under The Oil and Gas Conservation Act and/or the Oil and Gas Conservation Regulations from 1985 that are installed after July 2012. Existing flare stacks and incinerators installed prior to July 2012 are subject to the Saskatchewan Upstream Petroleum Industry Storage Standards S-01 (2002)³². Organizations will also be expected to meet Directive S-20 standards in cases where there is an upgrade or major maintenance of flaring or incineration system, facility expansion, or a facility transformation (battery to gas plant). Exceptions may be granted by ECON provided a technical rationale.

Under the Directive, all organizations must register their businesses and obtain a licence for reporting and complying with emissions regulations. License holders must install a vapour recovery unit to prevent emissions of volatile gasses from storage devices and associated processing equipment at facility or well sites when H₂S is equal/greater than 10 mol/kilomol at source of emission or 0.01 mil/kilmol as measured at edge of the lease. ECON may also specify a limit for concentrations of VOCs or other air contaminants where or when it is in the opinion of the Ministry to protect the environment, property or public safety. Other methods to control sour gas emissions at a licensed facility or well site may be individually approved.

Additionally, license holders shouldn't operate an upstream facility in a manner that results in air pollution emissions that exceed ambient air quality standards under Saskatchewan Ministry of Environment. In cases where there is persistent or significant odour complaints received at a licensed facility or a well, the facility may be required to implement one or more mitigative measures:

- Air quality investigation / air quality monitoring equipment
- Attempt to eliminate air contaminants at the source
- Develop & implement public consultation program
- Seal and leak proof storage vessels and equipment
- Install vapour recovery unit on storage or process equipment
- Direct recovered vapour to properly operating flares
- Recover associated gas that may be vented or flared
-

Description of Administrative/reporting Requirements

Since the regulations in Saskatchewan effectively mirror those in Alberta, all flared and vented gas must be reported as per the requirements of Petrinex. This does not apply to acid gas streams at gas plants that are flared/incinerated as part of normal operations. A log must also be kept for all non-routine flaring, incinerating and venting events along with responses to public complaints. Logs must include information on the complaints, how complaints were investigated and addressed, describe each gas release incident, include date, time, duration, gas source, and be kept for a minimum of 12 months.

Reporting of all associated gas flaring and venting is the same as Alberta and is to be submitted in Petrinex. In cases where estimates are used, volume estimates must be based on measurement and/or engineering calculations and expressed to the nearest 0.1 10³ m³/month. A formal system for consistently estimating and reporting volumes must be in place where flare meters are not used. ECON may require that meters be installed where there are failures to demonstrate adequate flare or vent gas estimation systems.

The economic evaluation criteria must be completed as follow:

- Evaluations completed on a before-tax basis

³² <http://publications.gov.sk.ca/documents/310/85269-Directive%20S-01%20Saskatchewan%20Upstream%20Petroleum%20Industry%20Storage%20Standards.pdf>

- Price forecasts using the most recent GLJ Petroleum Consultant's Product Price and Market forecasts for the Canadian Oil and Gas Industry³³
- Price forecasts using the Alberta Electric System Operator
- Detailed breakdown of capital costs including equipment, material, installation, engineering costs
- Incremental annual operating costs for conservation project assumed to be 10% of initial capital cost of installing the conservation facilities
- Discount rate equal to the prime lending rate plus 3%
- Conservation project considered economic if the NPV is equal to or greater than \$50,000(Cdn) pre-tax
- Project economics resubmitted every 12 months if project is uneconomic

Affected Capital Equipment or Operating Procedures

The following facilities are covered under Directive S-10:

- Oil wells, single oil well batteries
- Multiple oil well batteries
- Associated gas processing plants
- Any wells/facilities that vent, flare, incinerate associated gas

Directive S-20 outlines several performance requirements for flaring and incineration equipment for burning sweet, sour and acid gas, including portable equipment used for temporary operations:

- Use of flare pits and earthen pits as storage receptacles in the production operation of wells and facilities prohibited after 2002
- Flares, incinerators and other combustion systems must be designed, maintained and operated so that emissions do not exceed the Ambient Air Quality Standards prescribed by the ENV
- The combined or lower heating value of gas must not be less than 20 mega joules per cubic metre unless the existing stacks already comply with the Ambient Air Quality Standards under the ENV
- The operating limits and procedures must be provided to ECON immediately upon request
- Incinerators must provide a minimum residence time of 0.5 seconds at maximum flow rate or greater as required for complete combustion of heavier gases
- Incinerators must operate with a minimum exit temperature of 600 degrees Celsius
 - Facilities that don't meet the minimum exit temperatures or residence times above must submit 3rd-party verified conversion efficiency test results to ECON for approval
- License holders using incinerators must be able to provide details about the conversion efficiency of the equipment
- Routine gas combustion must not result in continuous or repeat black smoke emissions over a consecutive period of six minutes, any smoke that results in public concern should be immediately reported to the nearest ECON Field Office
- Flares and incinerators must meet the following stack designs
 - Radiant heat intensity at ground level must not exceed 4.73 kilowatts per sq metre
 - Stacks located within a distance of 5x the height of neighboring buildings must have a height of at least 2.5x the height of the highest building

³³ <http://www.gljpc.com/pdfs/pricing.pdf>

- Stacks with more than 10 mil/kmol of H₂S must have a minimum height of 12 m above ground level
- Proper gas-liquid separation facilities adequate to protect the pipeline system or gas combustion system must be used
- Licenses must take precaution to prevent blackflash (check valves are not acceptable form)
- Flares and incinerators must have adequate spacing from areas frequented by workers and from other sources of combustible gases including water disposal wells, storage tanks, oil and gas processing equipment, and occupied residences (spacing must comply with The Prairie and Forest Fire Act)

Exemptions and Requirements for Exemptions

Directive S-10 does not apply to licensed gas well or facilities that solely produce, handle, transmit, process, measure, test, inject, incinerate, flare, or vent non-associated gas. Stand-alone gas processing plants are also exempt from the requirements, in special cases where an allowable flaring or incineration volume is allotted by ECON, contingent the flaring event does not cause public complaints or compromise public safety. These allotments can only be given during the time licence is issued or renewed.

Regarding specifications for flare stacks and incinerators under Directive S-20, ECON accepts written requests for exemptions for new installations when provided acceptable technical rationale. Additionally, portable incinerator or fire stacks used during drilling, servicing, turn around or tests and located and used on site for less than one year are exempt from the requirements.

Level of Compliance, Enforcement Measures and Timing

The ECON is responsible for approving site testing, and activities related to venting and/or flaring. Oil and gas companies are also required to notify the Ministry in cases of non-routine flaring and emergencies. More research will need to be conducted along with an interview of ECON to further understand disciplinary actions for violations of flaring regulations.

Manitoba

Overview

Oil and Gas activities in Manitoba are regulated under the National Oil and Gas Act³⁴, and flaring is mentioned in The Drilling and Production Regulations 111/94 (1994)³⁵. The Act mentions, in section 115 that the Minister may require gas conservation in cases where the Minister is of the opinion that the escape or flaring of gas at a well, battery or gas plant constitutes waste. Under the Regulation, gas batteries are required to report an estimate volume of gas flared, and acquire a permit to continue flaring or venting after June 30, 2000. Operators are required to flare whenever possible and provide reasons for venting in situations where they must vent. Otherwise there are no regulations in Manitoba in regards to reporting flaring events, reducing, or eliminating routine and/or non-routine flaring.

³⁴ <http://web2.gov.mb.ca/laws/statutes/ccsm/o034e.php>

³⁵ <http://www.gov.mb.ca/iem/petroleum/actsregs/dap4.html>

Nova Scotia

Overview

The oil and gas regulations in Nova Scotia focus on offshore production, and are covered under the Nova Scotia Offshore Petroleum Resources Accord Implementation Act, which came into effect in 1988³⁶. Under the Act, the Nova Scotia Offshore Petroleum Drilling and Production Regulation (November 2009) is administered by the Nova Scotia Offshore Petroleum Board (CNSOPB). The Regulation dictates that no operator is allowed to flare or vent gas unless permitted approval under subsection 52(4) is obtained or unless there's an emergency where flaring and venting is necessary³⁷. In such a situation, the Board should be notified through the daily drilling report, the daily production report or in some other written or electronic form daily during which the flaring event occurs.

Section 52(4) indicates that the Board shall approve a formation flow test if the operator demonstrates that the test will be conducted safely, without pollution and in accordance with good oilfield practices, that enable³⁸:

- Data collection on the deliverability or productivity of the well
- Establish reservoir characteristics
- Obtain representative samples of the formation fluids

Newfoundland and Labrador

Overview

Similar to Nova Scotia, the regulations in Newfoundland and Labrador focus on offshore production. They are covered under the Newfoundland and Labrador Atlantic Accord Implementation Act that came into effect in 1987³⁹. The Accord outlines all rules and regulations related to offshore petroleum resource management and revenue sharing. Under the Accord are several Regulations that individually touch on flaring, venting and incineration.

Description of Policy Instruments and Compliance Requirements

Regulation 20/97 – Offshore Petroleum Installations (2001)⁴⁰

Under this Regulation, flaring and venting is considered acceptable for the purposes of ensuring safety of an installation. As such, all process vessels and equipment that release ignitable vapour may be vented into the atmosphere. In cases where point source emissions from storage tanks are channeled to flare stacks and flare pits, flame arresters or an equivalent safety device must be installed.

Section 17 clarifies regulations related to gas release systems for new offshore petroleum installations. The Regulation suggests that every gas release system should be designed and installed in accordance with the American Petroleum Institute Standards, primarily APIS 2000 (Venting Atmospheric and Low-Pressure Storage Tanks)⁴¹ and APIS RP 521 (Guide for Pressure-Relieving and Depressuring Systems)⁴².

³⁶ <http://laws-lois.justice.gc.ca/eng/acts/c-7.8/>

³⁷ <http://www.laws-lois.justice.gc.ca/eng/regulations/SOR-2009-317/page-6.html#h-52>

³⁸ <http://www.laws-lois.justice.gc.ca/eng/regulations/SOR-2009-317/page-5.html#docCont>

³⁹ <http://laws-lois.justice.gc.ca/eng/acts/c-7.5/>

⁴⁰ <http://www.assembly.nl.ca/legislation/sr/regulations/rc970020.htm>

⁴¹ <https://law.resource.org/pub/us/cfr/ibr/002/api.2000.1998.pdf>

⁴² <http://www.api.org/~media/Files/Publications/Whats%20New/521%20e6%20PA.pdf>

Additionally, flare booms and associated equipment should be designed with the following considerations:

- A continuous flame using an automatic igniter system,
- Withstand radiated heat at the maximum venting rate,
- Prevent flashbacks, and
- Withstand all loads to which they may be subjected.

Operators are encouraged wherever practical to measure the quantities of gas vented from installations, but these are not strictly required or enforced. The uncertainties likely to be achievable in flare gas metering systems will be in the order of +/-5% for high pressure flare systems and +/-10% for low pressure flare systems.

Regulation 1150/96 – Petroleum Drilling Regulations (2006)⁴³

The Petroleum Drilling Regulation provides mechanical guidelines for the set-up of flare pits and flare lines. Under section 60 of the Act, the following applies:

- For every well, there shall be a flare pit or a flare tank at the drill site located not less than 40 m from the well-bore
- Flare pit/tank must have a rear firewall of sufficient height to contain the flame
- The flare line should be designed to prevent the accumulation of fluid within the line
- If more than 1% of hydrogen sulphide gas is expected to be produced, the flare stack should be at least 10 m in height and be equipped with a pilot flame to ensure continuous ignition of vented gas

Regulation 120/09 – Offshore Petroleum Drilling and Production Guidelines (2009)⁴⁴

The Newfoundland and Labrador Offshore Petroleum Drilling and Production Regulation is administered and mandated by the Canada-Newfoundland and Labrador Offshore Petroleum Board (CNLOPB). Like Nova Scotia, the Regulation dictates that no operator is allowed to flare or vent gas unless granted approval under subsection 53 (4) or unless there's an emergency where flaring and venting is necessary. In such a situation, the Board should be notified through the daily drilling report, the daily production report or in some other written or electronic form daily during which the flaring event occurs. Operators are also required to measure and record any produced fluid that enters and leaves their facilities, including fuel that is flared, vented burned or otherwise disposed.

Section 52(4) indicates that the Board shall approve a formation flow test if the operator demonstrates that the test will be conducted safely, without pollution and in accordance with good oilfield practices, that enable:

- Data collection on the deliverability or productivity of the well
- Establish reservoir characteristics
- Obtain representative samples of the formation fluids

⁴³ <http://www.assembly.nl.ca/Legislation/sr/regulations/rc961150.htm>

⁴⁴ <http://www.assembly.nl.ca/legislation/sr/regulations/rc090120.htm>

Definitions Under Consideration

- Gas Release System: A system for releasing gas and combustible liquid from an installation, and includes a flare system, a pressure relief system, a depressurizing system and a cold vent system⁴⁵.

Ontario

Overview

The number of oil and gas facilities in Ontario are marginal compared to those in the Western provinces and as such there is very little regulation for flaring, venting and incineration in the province. The major guidelines and regulations that apply to flaring or venting in Ontario are included in the measurement and reporting requirements as part of the Cap and Trade Program.

In addition, Regulation 347 under the Environmental Protection Agency (amended June 2008) applies to new, expanding and operating landfills larger than 1.5 million cubic meters⁴⁶. This regulation does not apply to closed landfills, coal ash landfills or forest product operations. Regulation ON.350 under the Climate Change Mitigation and Low-carbon Economy Act of 2016 provides guidelines for quantification, reporting and verification of GHG emissions and applies to the operation of equipment from Natural Gas facilities including flare stacks⁴⁷.

Regulation ON.300 applies to flaring from petrochemical production and Regulation ON.200 applies to flaring from Petroleum refining. Petroleum companies affected are required to monitor the carbon content or high heat value of the flare gas on a quarterly basis. The calculation of CO₂, CH₄, and N₂O can be found in the appendix: Appendix B - Ontario Emissions Calculation and Reporting Formula.

A more detailed breakdown of the equation can be found on page 165 under Section ON.353 7A in the Ontario Guideline for Greenhouse Gas Emissions Reporting⁴⁸.

Definitions of Major Terms

- Flaring: combusting waste gas without energy recovery (part of Regulation ON.350)
- Fuel Gas Systems: system to compressors, piping, knock-out pots, mix drums, sulphur removing systems units and flaring units that collect fuel gas (ON.350)

Quebec

Overview

Similar to Ontario, the number of oil and gas facilities in Quebec are not as numerous as those in the Western provinces, which is reflected in the lack of comprehensive regulations related to flaring, venting and incineration. Under the Environment Quality Act, all relevant organizations are required to report emissions and contaminants released into the atmosphere, from flaring and venting related to pipelines, compressor stations, well testing and associated gas⁴⁹. The Act is administered by the Ministère du Développement durable de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC), which is also responsible for site development, management of residual materials, use of

⁴⁵ <http://www.assembly.nl.ca/legislation/sr/regulations/rc970020.htm> (Section 17)

⁴⁶ <https://www.ontario.ca/laws/regulation/900347>

⁴⁷ http://www.downloads.ene.gov.on.ca/envision/env_reg/er/documents/2016/012-6837_Guideline.pdf

⁴⁸ http://www.downloads.ene.gov.on.ca/envision/env_reg/er/documents/2016/012-6837_Guideline.pdf

⁴⁹ <http://legisquebec.gouv.qc.ca/en/ShowDoc/cr/Q-2,%20r.%2015>

flares, GHG emissions, environmental emergency measures and site restoration⁵⁰. Similar to Ontario, there is a comprehensive formula for calculating and reporting emissions from flaring activities⁵¹

In cases where a flare is equipped with a continuous gas flow monitoring and recording system, direct readings are preferred. Where a continuous gas flow meter is not present, the annual average of measured gas composition should be used (mole fraction of feed gas for de-methanizer, or mole fraction of output gas from de-methanizer).

Furthermore, the Cap & Trade regulation in Quebec (similar to the one implemented in Ontario) limits total emissions on manure storage facilities, and landfills with methane treatment and destruction.

⁵⁰ <http://www.nrcan.gc.ca/energy/sources/shale-tight-resources/17714>

⁵¹ http://legisquebec.gouv.qc.ca/en/resource/cr/Q-2R15_EN_145_001.pdf?langCont=en&digest=D1A1C3F055AAACB8C283108A0D851678

Appendix A - Provincial Regulations Summary

Alberta

- Environmental Protection and Enhancement Act (EPEA)
 - Directive 039 (Revised Program to Reduce Benzene Emissions from Glycol Dehydrators)
 - Directive 060 (Upstream Petroleum Industry Flaring, Incineration, Venting)
 - Information Letter (IL) 99-19 (Otherwise Flared Solution Gas Royalty Waiver Program)

British Columbia

- Oil and Gas Activities Act
 - The Flaring and Venting Reduction Guideline
- Petroleum and Natural Gas and Pipeline Act of British Columbia

Saskatchewan

- The Oil and Gas Conservation Act
 - The Oil and Gas Conservation Regulation
 - Directive S-10 (Saskatchewan Upstream Petroleum Industry Associated Gas Conservation Directive)
 - Directive S-20 (Saskatchewan Upstream Flaring and Incineration Requirements)

Newfoundland & Labrador

- Newfoundland and Labrador Atlantic Accord Implementation Act
 - Regulation 20/97 – Offshore Petroleum Installations
 - Regulation 1150/96 – Petroleum Drilling Regulations
 - Regulation 120/09 – Offshore Petroleum Drilling and Production Guidelines

Nova Scotia

- Nova Scotia Offshore Petroleum Resources Accord Implementation Act
 - Nova Scotia Offshore Petroleum Drilling and Production Regulation

Manitoba

- Oil and Gas Act
 - The Drilling and Production Regulations 111/94

Ontario

- Environmental Protection Agency
 - Regulation 347
 - Regulation ON.300
 - Regulation ON.200
- Cap & Trade

Quebec

- Environment Quality Act
 - Cap & Trade

Appendix B - Ontario Emissions Calculation and Reporting Formula

$$E_{s,CH_4}(\text{noncombusted}) = Q_s \times (1 - \eta) \times Y_{CH_4} \quad \text{Equation 350-12}$$

$$E_{s,CO_2}(\text{noncombusted}) = Q_s \times Y_{CO_2} \quad \text{Equation 350-13}$$

$$E_{s,CO_2}(\text{combusted}) = \sum_i \eta \times Q_s \times Y_i \times n_i \quad \text{Equation 350-14}$$

$$E_{s,CO_2}(\text{total}) = E_{s,CO_2}(\text{combusted}) + E_{s,CO_2}(\text{noncombusted}) \quad \text{Equation 350-15}$$

Where:

$E_{s,CH_4}(\text{noncombusted})$ = Contribution of annual noncombusted volumetric CH₄ emissions from flare stack (Sm³).

$E_{s,CO_2}(\text{noncombusted})$ = Contribution of annual volumetric CO₂ emissions from CO₂ in the inlet gas passing through the flare noncombusted (Sm³).

$E_{s,CO_2}(\text{combusted})$ = Contribution of annual volumetric CO₂ emissions from combustion from flare stack (Sm³).

Q_s = Volume of natural gas sent to flare during the year (Sm³).

η = Fraction of natural gas combusted by flare (default combustion efficiency is 0.98). For gas sent to an unlit flare, η is zero.

Y_{CH_4} = Mole fraction of CH₄ in gas to the flare.

Y_{CO_2} = Mole fraction of CO₂ in gas to the flare.

Y_i = Mole fraction of hydrocarbon constituents i (i.e., methane, ethane, propane, butane, pentanes, hexane, and pentane plus) in natural gas to the flare.

n_i = Number of carbon atoms in the hydrocarbon constituent i , (e.g., 1 for methane, 2 for ethane, 3 for propane, 4 for butane, 5 for pentanes, 6 for hexanes and 7 for pentanes plus) in natural gas to the flare.

$$E_{N_2O} = Q_s \times HHV \times EF \times 0.001 \quad \text{Equation 350-16}$$

Where:

E_{N_2O} = Annual N₂O mass emissions from flaring (tonnes/y).

Q_s = Volume of gas combusted by the flare in the reporting period (Sm³/y).

HHV = High heat value of the flared gas from paragraph (7)(ii)

EF = N₂O emission factor. Use 9.52×10^{-5} kg N₂O/GJ.

0,001 = Conversion factor from kilograms to tonnes.

Appendix C - Oil Production and Well Count in Canada

Alberta, Saskatchewan and British Columbia have the greatest concentration of oil and gas facilities in Canada and also have the most comprehensive rules and regulations for flaring, venting and incineration. The following tables provide a summary of oil production and number of operational oil wells in each province.

NED 2016 ESTIMATED PRODUCTION OF CANADIAN CRUDE OIL AND EQUIVALENT (bbi)⁵²

CONV. LIGHT CRUDE OIL/ PÉTROLE BRUT LÉGER CLASS. (Barrels)

AB	330,644
BC	23,238
SK	167,829
MB	41,028
NWT/NT	9,506
NF/NL	195,655
ON	582

AB UPGRADED BITUMEN/ BITUME VALORISÉ-AB1 (Barrels)

SUB TOTAL/SOUS-TOTAL	918,309
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HEAVY CRUDE OIL/ PÉTROLE BRUT LOURD (Barrels)

AB CONV./CLASS.-AB	117,777
AB NON-UPGRADED BITUMEN / BITUME NON VALORISÉ-AB3	1,479,118
AB SUB TOTAL/SOUS-TOTAL -AB	1,596,895
SK CONV./CLASS.-SK	280,780

CAPP Statistical Handbook (2015 Data)Number of Operating/Producing Oil Wells at Year-End⁵³

BC	1,129
AB - Conventional	32,643
AB - Bitumen	11,015
SK	29,222
MB	4,204

⁵² NEB 2016 Estimated Production of Canadian Crude Oil and Equivalent, updated October 2016, <http://www.neb-one.gc.ca/nrg/sttstc/crdlndptrlmpdct/stt/stmtdprdctn-eng.html>

⁵³ **CAPP Statistical Handbook (2015 Data)**, <http://www.capp.ca/publications-and-statistics/publications/275430>

Appendix D - Provincial Summary Tables

The following provincial summary tables were developed to quickly compare across various jurisdictions the key features of flaring regulations.

Each table addresses the following attributes;

- Overview - High level summary of policy, describing conditions covered
- Description of policy instrument and requirements - Summary of policy requirements
- Description of enforcement measures - Summary of the consequences of violation.
- Description of administrative requirements - Summary of application requirements
- Description of reporting requirements - Summary of reporting requirements such as content, frequency, and timing
- Affected capital equipment or operating procedures - Identify facilities covered under policy/specific operating procedures required
- Expected actions required to comply – Actions required outside of reporting for compliance
- Exemptions and requirements for exemption - What exemptions are there and how can they be acquired
- Level of compliance / Timeline – Description of compliance conditions

Appendix D.1 – Alberta Summary

Alberta Summary Directive 60	Solution Gas Management (Crude Oil / Bitumen Battery Flaring)	Temporary and Well Test Flaring and Incinerating	Gas Battery, Dehydrator, and Compressor Station Flaring	Gas Plant Flaring	Pipeline Flaring
Overview	<p>Applies to Conventional and Crude Oil, Bitumen Battery. Objective is to have UOG industry reduce solution gas routine flaring. Methods of conservation include pipeline to sales, fuel, power generation, pressure maintenance, or any other method that may become available.</p> <p>Through the Information Letter (IL) 99-19: Otherwise Flared Solution Gas Royalty Waiver Program, the Alberta Department of Energy has developed criteria to provide incentive to conserve solution gas that would otherwise be flared.</p>	<p>Applies to temporary flaring and incineration activities. These activities include well testing, well cleanup, well servicing, sour gas pipeline blowdown, coalbed methane well testing, underbalanced drilling, maintenance blowdowns, and emergency blowdowns through temporary or permanent flare or incinerator equipment. Objective is to have UOG industry avoid flaring, incineration or venting at well testing and completions.</p>	<p>The AER addresses gas battery, dehydrator, and compressor station flaring, incinerating, and venting and includes; routine flaring and incineration, and nonroutine flaring, incineration, and venting for equipment depressurization for maintenance; process upsets; and emergency depressurizing for safety reasons. Applies to all volumes except for intermittent small (less than 100 m³/month) volumes. Objective is to have UOG industry eliminate routine and minimize upset flaring, incineration and venting at production and processing facilities.</p>	<p>The AER limits the total annual volume of gas disposed of by flaring, incineration, and venting at gas processing plants based on factors such as process volume of the gas plant.</p>	<p>The AER addresses disposal of gas from gas gathering and transmission lines by flaring, incineration, and venting. This includes the routine flaring, incineration, and venting of low-pressure flash-gas and other gas streams at pipeline system compressor and dehydration facilities, and nonroutine flaring, incineration, and venting for pipeline depressurizing for maintenance, process upsets, or for emergency situations.</p> <p>Objective is to eliminate pipeline flaring, incineration, and venting.</p>
Description of policy instrument and requirements	<p>Applies to all sites where the combined flaring and venting volume is greater than 900 m³/day and the net present value (NPV) is greater than –Cdn\$55 000. Conservation economics must be completed and reviewed every 12 months. Licensees or operators of active production facilities operating within three kilometres (km) of each other or other appropriate oil and gas facilities (including pipelines) must evaluate clustering when evaluating solution gas conservation economics. If gas volumes are sufficient to sustain stable combustion, the gas must not be vented, but must be burned or conserved.</p>	<p>For sour gas, exceeding certain thresholds including H₂S content, duration and volume, the licensee or operator is required to flare. For oil or gas well testing a temporary flaring permit is required; time limits are set which would allow flaring. Exceeding the time limit requires additional permits.</p>	<p>All gas battery, dehydrator, and compressor stations must report flaring, incinerating, and venting activities.</p>	<p>Applies to gas disposal at gas processing plants by flaring, incineration, and venting. This includes routine flaring, incineration and venting of low-pressure gas streams and nonroutine flaring, incineration and venting of equipment depressurizing under maintenance, upset and emergency conditions.</p> <p>To have UOG industry eliminate routine and minimize upset flaring, incineration and venting at production and processing facilities, except for emergency situations.</p>	<p>No information collected.</p>

Alberta Summary Directive 60	Solution Gas Management (Crude Oil / Bitumen Battery Flaring)	Temporary and Well Test Flaring and Incinerating	Gas Battery, Dehydrator, and Compressor Station Flaring	Gas Plant Flaring	Pipeline Flaring
<p>Description of enforcement measures</p>	<p>At site level: Upon request licensee or operator must provide evidence supporting the implemented solution gas management program including conservation economics at each site. At province level: If Alberta wide solution gas flaring exceeds 670 million cubic metres (106 m³) per year (50 per cent of the revised 1996 baseline of 1340 106 m³/year) then the AER will impose site based limits to individual facilities in order to meet this target.</p>	<p>Must show evidence of reasonable effort to reduce volumes emitted where possible.</p>	<p>No defined enforcement measures</p>	<p>Frequent nonroutine flaring, incineration and/or venting, are identified by frequency and volume. Investigation of cause(s) and subsequent mitigation plan must be registered with AER.</p>	<p>No defined enforcement measures</p>
<p>Description of administrative requirements</p>	<p>Annually licensees or operators must update the conservation economics for any sites that are flaring or venting combined volumes of more than 900 m³/day. This information, with the responsible individual named and the document dated, is to be kept on file by the licensee or operator and must be provided to the AER upon request. Conservation economics must be evaluated on a royalties-in basis (paying royalties) for incremental gas and gas by-products that would otherwise be flared or vented. If the economic evaluation results in an NPV less than – Cdn\$55 000, the licensee or operator must re-evaluate the gas conservation project on a royalties-out basis (not paying royalties). If the evaluation results in an NPV – Cdn\$55 000 or more, the licensee or operator must proceed with the conservation project and may then apply to Alberta Energy for an “otherwise flared solution gas” royalty waiver.</p>	<p>Application to be made in writing, following a prescribed format and submitted electronically. Blanket Flaring Permits, a single permit to cover several flaring events at different sites in an area, are granted upon request. Licensees must avoid temporary flaring in situations where existing infrastructure can be reasonably used for in-line disposition of the gas, especially in populated areas. Licensees must limit the volumes for gas that they request, especially gas with high H₂S contents. Situations involving sulphur emissions of 50 tonnes or more are subject to closer scrutiny by the AER Authorizations Branch.</p>	<p>The licensee or operator must document alternatives that were considered, such as conservation options, in order to eliminate or reduce flaring, incineration, and venting, how they were evaluated, and the outcome of the evaluation.</p>	<p>Monthly reporting of flared and vented volumes. Licensees must document alternatives that were considered, such as conservation options, in order to eliminate or reduce flaring, incineration, or venting, how they were evaluated, and the outcome of the evaluation.</p>	<p>Licensees must document alternatives considered, such as conservation options, to eliminate or reduce flaring. Licensees must assess opportunities to eliminate or reduce flaring, incineration, and venting of gas due to frequent maintenance or facility outages. In particular, investigate and correct repeat events at gas pipelines and related facilities such as at compressor stations, to public concerns and to implement feasible measures to conserve gas from the depressurizing of pipeline systems.</p>
<p>Description of reporting requirements</p>	<p>Flared, incinerated, and vented solution gas must be reported monthly through Petrinex (Canada’s Petroleum Information Network).</p>	<p>All well test reports must be submitted within three months of completing the fieldwork. For all well tests that require permits, a sour gas flaring data summary report must be submitted to the AER Authorizations Branch within three weeks of the completion of flaring.</p>	<p>All monthly flared and vented volumes must be reported separately on Petrinex (Canada’s Petroleum Information Network).</p>	<p>Licensees must log and monitor nonroutine flaring events. All monthly flared and vented volumes must be reported separately on Petrinex (Canada’s Petroleum Information Network).</p>	<p>All monthly flared, incinerated, and vented volumes must be reported separately on Petrinex (Canada’s Petroleum Information Network).</p>

Alberta Summary Directive 60	Solution Gas Management (Crude Oil / Bitumen Battery Flaring)	Temporary and Well Test Flaring and Incinerating	Gas Battery, Dehydrator, and Compressor Station Flaring	Gas Plant Flaring	Pipeline Flaring
<p>Affected equipment or operating procedures</p> <p>capital or</p>	<p>All upstream petroleum industry wells and facilities and to pipeline installations that convey gas (e.g., compressor stations, line heaters) licensed by the AER. With the exception of oil sands mining schemes and operations, Directive 60 applies to all schemes and operations approved under section 10 of the Oil Sands Conservation Act (OSCA). Directive 60 does not apply to any processing plants approved under section 11 of the OSCA.</p> <p>For multiwell bitumen sites, solution gas conservation lines must be built to a common point on the lease as part of initial construction.</p>	<p>Upstream oil and gas (UOG) facilities impacted by activities such as well testing, well cleanup, well servicing, sour gas pipeline blowdown, coalbed methane well testing, underbalanced drilling, maintenance blowdowns, and emergency blowdowns.</p>	<p>Production and processing facilities such as gas battery, dehydrator, and compressor stations.</p>	<p>Gas processing facilities.</p>	<p>All gas gathering and transmission lines and related facilities such as compressor stations.</p>
<p>Expected actions required to comply</p>	<p>If gas volume rate exceeds 900 m³/day a decision tree model is applied to promote conservation of the gas. The goal is to conserve solution gas, to reduce the volume of solution gas routinely flared, incinerated or vented, if economical.</p>	<p>The AER does not require the licensee, operator, or approval holder to obtain the consent of residents within the notification radius of a temporary flaring event. The approval holder must provide notice of flaring with all residents and schools in accordance with minimum distance, duration and volume requirements and the appropriate AER field centre via the DDS system at least 24 hours in advance. Licensees must evaluate conservation opportunities such as using existing gas gathering systems before beginning temporary maintenance, well cleanup, or testing operations (i.e., “in-line testing”). In-line testing must be done when economic and feasible to do so. To facilitate conservation efforts, a licensee may install temporary compression and piping facilities, following outlined application requirements.</p>	<p>The approval holder must provide notice of flaring with all residents and schools in accordance with minimum distance, duration and volume requirements and notify the appropriate AER field centre via the DDS system at least 24 hours in advance.</p>	<p>Licensees must assess opportunities to eliminate or reduce nonroutine flaring, incineration, and venting of gas due to frequent maintenance or facility reliability outage. Licensees must investigate and correct causes of repeat nonroutine flaring. Gas plants must not exceed six major (defined based on plant size) nonroutine flaring events in any consecutive six-month period. The approval holder must provide notice of flaring with all residents and schools in accordance with minimum distance, duration and volume requirements and notify the appropriate AER field centre via the DDS system at least 24 hours in advance.</p>	<p>The approval holder must provide notice of flaring with all residents and schools in accordance with minimum distance, duration and volume requirements and notify the appropriate AER field centre via the DDS system at least 24 hours in advance.</p>

Alberta Summary Directive 60	Solution Gas Management (Crude Oil / Bitumen Battery Flaring)	Temporary and Well Test Flaring and Incinerating	Gas Battery, Dehydrator, and Compressor Station Flaring	Gas Plant Flaring	Pipeline Flaring
<p>Exemptions requirements and for exemption</p>	<p>If economics does not support conservation, flaring will be considered acceptable. If gas volume is less than 900 m³/day or if a stable flame can not be maintained, and upon meeting other conditions, venting as an alternative to flaring, will be considered acceptable. A licensee or operator may request to discontinue conservation if a number of conditions are met, including showing annual operating expenses exceed annual revenue. The AER may investigate the potential to conserve solution gas through power generation for flared or vented volumes as low as 500 m³/day if it appears that gas is stable.</p>	<p>No information collected.</p>	<p>Intermittent small volumes are exempt.</p>	<p>Fuel gas used for pilots or flare system purge and acid gas volumes from gas sweetening (which are normally continuously flared) are excluded from the calculations to determine reported volumes. Fuel gas that is flared, incinerated, or vented (e.g., flare pilot gas, header purge gas, storage tank blanket gas) must be reported as fuel gas, not flared gas.</p>	<p>Conservation measures, flaring or incineration of gas from sweet natural gas transmission pipeline depressurizing may not be practical when impacts on system customers and producers are considered. In such situations, the appropriate AER field centre may allow the venting of gas to reduce the duration of system outages and related impacts.</p>
<p>Level of compliance / Timeline</p>	<p>Conservation is preferred over flaring and/or incineration. Flaring and/or incineration is preferred over venting. Venting will be considered if stable flame can not be maintained and other conditions are met.</p>				

Appendix D.2 – British Columbia Summary

British Columbia Summary (Flaring and Venting Reduction Guideline)	Solution Gas and Oil Batteries	Well Flaring	Natural Gas Facility	Pipeline Flaring
Overview	Applies to Conventional and Crude Oil, Bitumen Battery. To have UOG industry reduce solution gas routine flaring. Methods of conservation must include pipeline to sales, fuel, power generation, pressure maintenance, or any other method that may become available.	Applies to temporary flaring and incineration activities. These activities include well testing, well cleanup, well servicing, sour gas pipeline blowdown, coalbed methane well testing, underbalanced drilling, maintenance blowdowns, and emergency blowdowns through temporary or permanent flare or incinerator equipment. Time limits apply for cases where flaring or incineration is required - (detailed in the report)	Applies at processing plants, dehydrator, and compressor stations. NO special approval required for non-routine flaring related to maintenance or emergencies. Maximum allowed non-routine flaring events of 6 in a 6 month period. Applies to all volumes except for intermittent small (less than 100 m ³ /month) volumes. Dehydrators must not emit more than 1 tonne/yr of benzene emissions, the cumulative emissions must not exceed the limit of the oldest dehydrator on site	This includes the routine flaring, incineration, and venting of disposal of gases from gas gathering systems and transmission lines through depressurizing for maintenance, process upsets, or emergency depressurizing for safety reasons.
BC Energy Plan (2007) set to eliminate all routine flaring at oil and gas producing wells and production facilities by 2016 with an interim goal to reduce flaring by 50% by 2011				
Description of policy instrument and requirements	Applies to all sites where the combined flaring and venting volume is greater than 900 m ³ /day and the net present value (NPV) is greater than –Cdn\$50 000. Conservation economics must be completed and reviewed every 12 months. Licensees or operators of active production facilities operating within three kilometres (km) of each other or other appropriate oil and gas facilities (including pipelines) must evaluate clustering when evaluating solution gas conservation economics. Facilities with gas to oil ratio (GOR) greater than 3000 m ³ /m ³ must be shut-in until the gas is conserved.	For sour gas, exceeding certain thresholds such as H ₂ S content, duration and volume, the licensee or operator is required to flare. Based on classification given (exploratory, development zone classification), different volume thresholds apply. Temporary flaring approvals are also granted in the following situations: <ul style="list-style-type: none"> • Flaring related to drilling operations • Flaring necessary for emergency purposes • Well workover or maintenance does not exceed 50,000 m³ in one year • Flaring is in accordance with well permit (must be given at time of permit application) 	All gas battery, dehydrator, and compressor stations must report flaring, incinerating, and venting activities.	All gases flared, vented or incinerated must be reported and steps made to conserve these gases
Description of enforcement measures	At site level: Upon request licensee or operator must provide evidence supporting implemented solution gas management program including conservation economics at each site.	Must show evidence of reasonable effort to reduce volumes emitted where possible.	No defined enforcement measures	No defined enforcement measures

British Columbia Summary (Flaring and Venting Reduction Guideline)	Solution Gas and Oil Batteries	Well Flaring	Natural Gas Facility	Pipeline Flaring
Description of administrative requirements	Annually licensees or operators must update the conservation economics for any sites that are flaring or venting combined volumes of more than 900 m ³ /day. This information, with the responsible individual named and the document dated, is to be kept on file by the licensee or operator and must be provided upon request.	Application to be made in writing, following a prescribed format and submitted electronically. Licensees must limit the volumes for gas that they request, especially gas with high H ₂ S contents. Situations involving sulphur emissions of 50 tonnes or more are subject to closer scrutiny by the AER Authorizations Branch.	The licensee or operator must document alternatives that were considered, such as conservation options, in order to eliminate or reduce flaring, incineration, and venting, how they were evaluated, and the outcome of the evaluation.	Licensees must document alternatives considered, such as conservation options, to eliminate or reduce flaring. Licensees must assess opportunities to eliminate or reduce flaring, incineration, and venting of gas due to frequent maintenance or facility outages. In particular, investigate and correct repeat events at gas pipelines and related facilities such as at compressor stations, to public concerns and to implement feasible measures to conserve gas from the depressurizing of pipeline systems.
All oil and gas facilities must maintain a log related to all non-routine flaring and venting events and how public complaints (if any) were investigated and addressed. For facilities where the annual average of total flared, incinerated and vented volumes per facility exceeds 0.5 10 ³ m ³ per day, meters designed for expected flow conditions and range are required. Where flaring, incineration or venting occurs, organizations are responsible for notifying the Commission, residents and administrators of incorporated centres located within a notification radius.				
Description of reporting requirements	Organizations that flare, incinerate or vent more than 0.1 10 ³ m ³ per month must report volumes monthly to the Ministry of Finance using BC-S2	All well test reports must be submitted within three months of completing the fieldwork. For all well tests that require permits, a sour gas flaring data summary report must be submitted to the AER Authorizations Branch within three weeks of the completion of flaring.	Organizations that flare, incinerate or vent more than 0.1 10 ³ m ³ per month must report volumes monthly to the Ministry of Finance using the BC-19 for processing facilities, BC-S2 for all other facilities	Organizations that flare, incinerate or vent more than 0.1 10 ³ m ³ per month must report volumes monthly to the Ministry of Finance using BC-S2
Affected capital equipment or operating procedures	All upstream petroleum industry wells and facilities: - oil/gas well drilling, completion and testing - oil production/solution gas - gas production	Upstream oil and gas (UOG) facilities impacted by activities such as well testing, well cleanup, well servicing, sour gas pipeline blowdown, coalbed methane well testing, underbalanced drilling, maintenance blowdowns, and emergency blowdowns.	Production and processing facilities such as gas battery, dehydrator, and compressor stations.	All gas gathering and transmission lines and related facilities such as compressor stations.
Expected actions required to comply	If gas volume rate exceeds 900 m ³ /day a decision tree model is applied to promote conservation of the gas. Specific compliance regulations apply to: - notification of non-routine flaring events and total volume of gas flared - limitations to total number of non-routine flaring events and total volume of gas flared - limitations to the benzene, VOC or sulphur content of gas flared			

British Columbia Summary (Flaring and Venting Reduction Guideline)	Solution Gas and Oil Batteries	Well Flaring	Natural Gas Facility	Pipeline Flaring
Exemptions and requirements for exemption	The Drilling and Production Regulation under the Oil and Gas Activities Act authorizes flaring at wells under the following circumstances: • If the flaring is related to drilling operations • If the flaring is necessary for emergency purposes • If the flaring is for well workover or maintenance operations, and cumulative quantity of flared gas does not exceed 50 000 m ³ in one year • If it is in accordance with the well permit (approvals granted during well permit application)			
Level of compliance / Timeline	Conservation is preferred over flaring and/or incineration. Flaring and/or incineration is preferred over venting. Venting will be considered if stable flame can not be maintained and other conditions are met.			

Appendix D.3 – Saskatchewan Summary

Saskatchewan Summary (Directive S-10 and S-20)	Associated Gas Flaring
Overview	Applies to all oil and gas facilities: a licensed facility is not allowed to flare, incinerate or vent associated gas over m ³ /day.
Description of policy instrument and requirements	Venting or flaring is not permitted at all (including temporary flaring) within 500 m of a residence. If a new residence is relocated within 500 m of an existing associated gas flare or vent Venting is a suitable option in situations where the waste gas is non-combustible (such as N ₂) or an inert gas mixture if hydrogen sulphide concentrations are lower than 10,000 ppm, vented gas does not contain odorous compounds and there are no human/public/environmental health implications Non-routine flaring is allowed for no longer than 7 days at a time unless otherwise approved by ECON. Temporary venting is allowed at wells for no longer than 24 hours, where no more than 2,000 m ³ of gas is released.
Description of enforcement measures	At site level: Upon request licensee or operator must provide evidence supporting implemented solution gas management program including conservation economics at each site.
Description of administrative requirements	Under Directive S-20, organizations must register their business and obtain a licence for reporting and complying with emissions regulations. License holders should install a vapour recovery unit to prevent emissions of volatile gasses from storage devices and associated processing equipment at facility or well sites when H ₂ S is equal/greater than 10 mol/kilomol at source of emission or 0.01 mil/kilmol as measured at edge of the lease. ECON may also specify a limit for concentrations of VOCs or other air contaminants where or when it is in the opinion of the Ministry to protect the environment, property or public safety. Annually licensees or operators must update the conservation economics for any sites that are flaring or venting combined volumes of more than 900 m ³ /day. This information, with the responsible individual named and the document dated, is to be kept on file by the licensee or operator and must be provided upon request.
Description of reporting requirements	All flared and vented gas must be reported as per the Saskatchewan requirements of the Petroleum Registry of Alberta, and must be reporting in Petrinex A log must also be kept for all non-routine flaring, incinerating and venting events along with responses to public complaints.

Saskatchewan Summary (Directive S-10 and S-20)	Associated Gas Flaring
Affected capital equipment or operating procedures	Oil wells, single oil well, batteries multiple associated gas, oil gas processing, well, batteries plants any wells/facilities that vent, flare, or incinerate associated gas
Expected actions required to comply	In cases of non-routine flaring, operators are encouraged to notify residents within 500 metres of the site and must notify the nearest ECON Field Office by phone, email or letter within 48 hours prior to the activity.
Exemptions and requirements for exemption	Direction S-10 does not apply to licensed gas well or facilities that solely produce, handle, transmit, process, measure, test, inject, incinerate, flare, or vent non-associated gas. Stand-alone gas processing plants are also exempt from the requirements, in special cases where an allowable flaring or incineration volume is allotted by ECON, contingent the flaring event does not cause public complaints or compromise public safety. ECON accepts written requests for exemptions for new installations for Directive S-20 when provided acceptable technical rationale.
Level of compliance / Timeline	The ministry may inspect facilities and/or visit sites during emergencies and accidents or during complaints, however there are no disciplinary measures for violations provided