

GAS FLARING AND VENTING IN ALBERTA

Report and Recommendations for the Upstream Petroleum Industry
by the Flaring and Venting Project Team

Prepared for the
Clean Air Strategic Alliance
Board of Directors



September 2004

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About CASA

The Clean Air Strategic Alliance (CASA) is a non-profit association composed of stakeholders from three sectors – government, industry and non-government organizations such as health and environmental groups. All CASA groups and teams, including the board of directors, make decisions and recommendations by consensus. These recommendations are likely to be more innovative and longer lasting than those reached through traditional negotiation processes. CASA's vision is that the air will be odourless, tasteless, look clear and have no measurable short- or long-term adverse effects on people, animals or the environment.

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Executive Summary

The Flaring and Venting Project Team (FVPT) is a Clean Air Strategic Alliance (CASA) multi-stakeholder project team with representatives from industry, government, and non-government organizations. The FVPT had three main tasks:¹

- 1) Review the results of the implementation by CASA stakeholders of the 1998 Flaring Project Team recommendations, including the solution gas management framework.²
- 2) Evaluate and recommend ways to similarly reduce the venting of natural gas.
- 3) Review and if necessary make recommendations on reducing natural gas flaring at facilities and during well testing.

Flaring data available from 1999 through to 2002 confirms that the use of the solution gas management framework has been successful. Industry has surpassed the recommended target for solution gas flaring of a 50 percent reduction in flared volumes below 1996 levels by the end of 2002. In fact, the actual volume of gas flared in 2003 was reduced by 70 percent compared to the baseline year of 1996. In addition, use of the venting framework has resulted in a reduction in venting of 38% compared to the base year of 2000.

The FVPT has determined that the new volume limits will translate into a 78 percent reduction for flaring when compared to the baseline year of 1996 and over 70 percent reduction for venting, when compared to the baseline years of 2000.

These achievements, along with the success of the consensus-based decision making process utilized by CASA, have been recognized by the World Bank. The World Bank's Global Gas Flaring Reduction (GGFR) Partnership seeks to reduce flaring and venting of associated gas worldwide. In their referencing of best practices around the world, the GGFR has identified the successes of CASA and the FVPT, and has employed many similar concepts in their Global Venting and Flaring Voluntary Reduction Standard. http://www.worldbank.org/ogmc/global_gas.htm

At the time of writing this report the province of Alberta, the federal government, and industry are engaged in negotiations over GHG emission reduction requirements for the upstream oil and gas industry. Indications received by the team indicate that the federal government will view flaring and venting as a process emission and therefore emission reductions from these sources will count towards the Large Final Emitters target for the industry. It is likely that there will be significant emission reductions accruing to the oil and gas sector as a result of the reductions already made as well as those to come.

The use of the decision tree analysis, which requires companies to examine their flared solution gas and conserve it when determined to be economic, has given companies and government agencies a better understanding of the economics of conserving solution gas and has improved the available data. The FVPT hired a consultant to analyze the solution gas flaring and venting data for 2001 and 2002 submitted under ID 2002-02 EUB Requirements for Submission of Data for Solution Gas Flaring and Venting

¹ See Appendix 5: Terms of Reference for the CASA Flaring/Venting Project Team

² Management of Routine Solution Gas Flaring in Alberta: Report and Recommendations, CASA Flaring Project Team, 1998

Evaluations (<http://www.eub.gov.ab.ca/BBS/requirements/ils/ids/id2002-02.htm>), which required companies to provide the results of the decision tree analysis to the EUB. A breakdown of the different sizes, current conservation practices, and further conservation prospects was prepared. This analysis is discussed in Section three of this report.

Based on the evaluation of 2002 reduction targets and its analysis of the ID 2002-02 data, the FVPT believes it is now appropriate to set volume thresholds on flaring and venting. This will reduce the administrative work for both government and industry associated with doing the decision tree economic analysis. The FVPT is recommending conservation at all sites that flare or vent a combined volume of over 900 m³/day of solution gas per site by January 1, 2006. Some exemptions may be permitted under an economic hardship clause. Flaring and venting sites that release less than 900 m³/day would be encouraged but not required to conserve.

A source of concern in some areas is flaring or venting sites in close proximity to residences. It is proposed that all sites that potentially flare more than 900 m³/day and are closer than 500 meters from a residence would have to conserve, while sites that vent more than 900 m³/day and are closer than 500 meters from a residence would have consultation requirements with those residents. However, the team still believes that any unconserved gas should be burned whenever it is capable of supporting combustion.

The FVPT also examined the potential to reduce flaring and venting during well testing. When gas and oil wells are first drilled and are being readied for commercial production, there are requirements for information on the volume and content of the reservoir that require gas to be drawn off the well. In some cases, it has been the practice to vent or flare this gas rather than conserve it. This report addresses the length of time allowed for this well test flaring and makes recommendations for gathering information that will inform future recommendations on well test flaring.

The team examined the potential for reductions in fugitive emissions. Fugitive emissions are unplanned and often untracked emissions from leaks around valves, fittings, compressors, and other pieces of equipment. The technology required to locate and repair these leaks is developing, as is the willingness on the part of operators to spend the funds needed to do this work. The experience of some companies has been that the reduced losses result from a Leak Detection and Repair (LDAR) program more than repay the required outlay of funds. This report strongly recommends that this work be done and recommends that the Canadian Association of Petroleum Producers (CAPP) and the Small Explorers and Producers Association of Canada (SEPAC) develop a best practices document which recommends the procedures to be followed to reduce fugitive emissions.

The team examined a number of research efforts which are looking into the factors that affect the performance of flares, particularly the efficiency of combustion – how much of the flared material burns rather than escapes in its raw form. While a number of factors have been identified, such as exit velocity of the fuel, wind velocity, and flare tip design, there is not yet sufficient data on actual flares to be able to make recommendations on flare design or efficiency standards. The FVPT is recommending that research be monitored and recommendations made at a future time when the science allows for it.

The EUB currently has a temporary (less than 21 day) pipeline process that does not require pipeline application, only field office consent. (This form can be found in Guide 56, Section 6.9.10, Appendix 5). Turnaround time on these approvals is typically 1 to 3 days, depending on field staff availability. Use of this process to permit temporary tie-ins for testing will provide additional testing in-line, thereby reducing flaring and venting during well tests.

This report contains the following recommendations for the consideration of the CASA board of directors:

Solution Gas Flaring:

The Flaring and Venting Project Team recommends that

- 1) Recommendations 2 through 13 come into effect on January 1, 2006. These requirements will apply to both existing and new wells/facilities. For the interim period, the decision tree analysis will still be required. Where gas is being conserved it is expected that conservation will continue.
- 2) Licensees must conserve solution gas at all sites³ flaring or venting combined volumes greater than 900 m³/day per site⁴ if the EUB Guide 60 decision tree economic model results in a Net Present Value (NPV) of greater than negative \$50,000.
- 3) Licensees must conserve solution gas at all sites⁵ flaring volumes greater than 900 m³/day per site⁶ if the flare is within 500 meters of an existing residence. Licensees must consult with new residents (constructed or re-located after January 1, 2006) that are within 500 meters when the new residents move in.
- 4) Licensees are encouraged to conserve solution gas at all sites flaring or venting combined volumes less than 900 m³/day per site. The EUB may still require an economic evaluation for these sites.
- 5) Licensees of production facilities that are operating within 3 kilometres of each other or other appropriate oil and gas facilities (including pipelines) are required to jointly consider “clustering” when evaluating solution gas conservation economics.
- 6) Licensees of multi-well heavy oil or bitumen lease sites must prebuild solution gas conservation lines to one common point on the lease as part of initial construction.
- 7) In cases where conservation is determined by the company to be uneconomic but a third-party organization is able to conserve the gas, licensees are expected to either conserve the gas or make the gas available at the lease boundary at no charge within 3 months of a request.
- 8) Conserving facilities shall be designed for 95% conservation with a minimum operating level of 90%. The FVPT encourages conservation to as high a level as possible, noting that current conservation rates industry-wide are approximately 95%.
- 9) For conventional oil sites, where conservation is required, the well(s) would be shut in after completion of the test period (as per recommendation 30) until conservation is implemented.
- 10) For heavy oil and bitumen sites, solution gas conservation should be implemented as soon as possible to minimize flaring and venting. As soon as flow rates show that gas flaring could likely exceed 900 m³/day for a 3 month period, tie in should occur as quickly as possible. The period of flow rate determination is not to exceed 6 months. Tie in must also occur within a

³ A site is defined as a single surface lease (pads counted as one lease) where gas is flared or vented.

⁴ Volumes will be calculated based on a three month rolling average for conventional oil production and a six month rolling average for heavy oil and bitumen.

⁵ See footnote 3

⁶ See footnote 4

maximum of 6 months after flow rate determination. Shorter tie in times should be pursued wherever possible.

- 11) After December 31, 2005, for any sites flaring or venting combined volumes greater than 900 m³/day and not conserving, a review of conservation economics will be required every year. This information is to be kept on file by the licensee and can be audited by the EUB at any time.
- 12) Operators will be required to consult with residents (e.g. per the existing Guide 56 consultation requirements) at the time of licensing if the proposed site may flare natural gas.
- 13) Residents that are within 500 metres of a solution gas flare must be consulted annually and their concerns addressed. Residents may inform licensees if they wish to be exempt from consultation in subsequent years or if they wish to be consulted on an annual or bi-annual basis. Licensees must recommence annual consultations when new owners move into the existing residence.
- 14) A royalty waiver under the Otherwise Flared Solution Gas program should continue to be available to producers that have used the EUB Guide 60 decision tree economic analysis to demonstrate that the solution gas conservation is uneconomic. This waiver should be extended to apply to bitumen sites.

Solution Gas Venting:

The Flaring and Venting Project Team recommends that

- 15) Recommendations 16 through 26 will come into effect on January 1, 2006. These requirements will apply to both existing and new wells/facilities. For the interim period, the decision tree analysis will still be required. Where gas is being conserved it is expected that conservation will continue.
- 16) Licensees must conserve gas at all sites⁷ flaring or venting combined solution gas volumes greater than 900 m³/day per site if the EUB Guide 60 decision tree economic evaluation results in a Net Present Value (NPV) of greater than a negative \$50,000.
- 17) Licensees are encouraged to conserve solution gas at all sites flaring and venting combined volumes less than 900 m³/day per site⁸. The EUB may still require an economic evaluation for these sites.
- 18) Licensees of production facilities that are operating within 3 kilometres of each other or other appropriate oil and gas facilities (including pipelines) are required to jointly consider “clustering” when evaluating solution gas conservation economics.
- 19) Licensees of multi-well heavy oil or bitumen lease sites should prebuild solution gas conservation lines as part of initial construction.
- 20) In cases where conservation is determined by the company to be uneconomic but a third-party organization is able to conserve the gas, licensees are expected to either conserve the gas or make the gas available at the lease boundary at no charge within 3 months of a request.

⁷ See footnote 3

⁸ See footnote 3

- 21) Conserving facilities shall be designed for 95% conservation with a minimum operating level of 90%. The FVPT encourages conservation to as high a level as possible, noting that current conservation rates industry-wide are approximately 95%.
- 22) For conventional oil sites, where conservation is required, the well(s) would be shut in after completion of the test period (as per recommendation 30) until conservation is implemented.
- 23) For heavy oil and bitumen sites, solution gas conservation should be implemented as soon as possible to minimize flaring and venting. As soon as flow rates show that gas venting could likely exceed 900 m³/day for a 3-month period, tie in should occur as quickly as possible. The period of flow rate determination is not to exceed 6 months. Tie in must also occur within a maximum of 6 months. Shorter tie in times should be pursued wherever possible.
- 24) After December 31, 2005, for any sites flaring or venting combined volumes greater than 900 m³/day and not conserving, a review of conservation economics will be required every year. This information is to be kept on file by the licensee and can be audited by the EUB at any time.
- 25) Operators will be required to consult with residents (e.g. per the existing Guide 56 consultation requirements) at the time of licensing if the proposed site may vent natural gas. Residents may inform licensees if they wish to be consulted on an annual or bi-annual basis.
- 26) CAPP and SEPAC will develop a best practice code for venting close to residences by December 31, 2005.
- 27) A royalty waiver under the Otherwise Flared Solution Gas program should continue to be available to producers that have used the EUB Guide 60 decision tree economic analysis to demonstrate that the solution gas conservation is uneconomic. This waiver should be extended to apply to bitumen sites.

Well Test Flaring:

The Flaring and Venting Project Team recommends that:

- 28) The EUB, in partnership with CAPP and SEPAC, set up a program to collect data for a period of well testing across the province, as to the length of tests, volumes of gas flared, and provide reasons if the tests take longer than 72 hours. The Flaring and Venting Project Team be reconvened in the second quarter of 2005 to review the data and develop recommendations regarding the time period for well testing, for implementation January 1, 2006.
- 29) Until January 1, 2006, well testing (including clean up and testing) would be limited to a total period of 120 hours (not necessarily consecutive, i.e. excluding shut in time) per zone tested unless an exemption has been specifically granted.
 - a) Exemptions may be granted:
 - To clean up well bore in unique situations;
 - Where stabilized flow has not been reached; or
 - Where there have been mechanical problems with the well.
 - b) If additional time for well test flaring is needed the EUB should be contacted as soon as possible with the reasons for extension, but not later than the end of the 120 hour period.
- 30) After the well test, if a conventional oil well is expected to flare or vent greater than 900 m³ per day and has an NPV greater than negative \$50,000, the well must be shut in until conservation is implemented.

- 31) The Third Tier Exploratory Well Royalty Exemption program should provide recognition for the time period required for well test flaring.
- 32) The EUB grant a one-month extension to the NOWPP where a well has flared gas for less than 120 hours in the first month of NOWPP and, awaiting tie-in to conserve, has subsequently shut in the well for the remainder of the month. Such requests should only be made after the well has been tied in and gas is being conserved.
- 33) Existing flaring permit thresholds continue to apply as outlined in Guide 60 Updates and Clarifications⁹. This includes a permit threshold of 5% H₂S for sour wells and a threshold for sweet and sour volumes of 200 x 10³m³ for wells which are already tied in, 400 x 10³m³ for development wells, and 600 x 10³m³ for wells such as New Wildcat, Deeper Pool Test or Outpost wells.
- 34) The EUB develop a proposal to ensure that the rights of the public to be heard are protected in circumstances where a company has committed in its initial application to not flare and subsequently is faced with a change in circumstances that would require flaring. The EUB will bring their proposal to the CASA Flaring and Venting Project Team when it reconvenes in the second quarter of 2005.
- 35) CAPP and SEPAC should develop best management practices guidelines for well test flaring by December 31, 2005.
- 36) Once a commingled pool has been established, well testing need only be done on a commingled pool basis, thereby eliminating one or more tests on individual pools, and reducing flaring.

Flare Performance Standards:

The Flaring and Venting Project Team recommends that:

- 37) Government and Industry should support further flaring research on understanding the relationship between gas composition and combustion efficiency, including the effects of hydrogen sulphide (H₂S) content.
- 38) Government and Industry should support further research on understanding the effects of flare stack design, including appurtenances (flare tips) on combustion efficiency.
- 39) CAPP and SEPAC should develop best management practices for maintaining flare equipment in acceptable condition to ensure good combustion performance.
- 40) The EUB and AENV should take the lead on gathering latest flaring research and in consultation with stakeholders, update flare performance requirements and combustion efficiency related guidelines.
- 41) The EUB, AENV, CAPP and SEPAC should continue to review the results of any field-testing of combustion efficiency monitoring methodologies that are occurring.
- 42) The EUB should review the ignition requirements found in American Petroleum Institute Standard 537 and modify their requirements as appropriate.

⁹ Existing permit thresholds continue to apply for volumes for 200, 400, 600 10³m³ or 5 % H₂S, as currently specified in Guide 60.

Fugitive Emissions:

The Flaring and Venting Project Team recommends that:

- 43) CAPP and SEPAC develop a best management practices document by December 31, 2005 to assist the upstream oil and gas industry in managing fugitive emissions and targeting sources that are most likely to have larger volume emissions and which would be more cost effective to address. CAPP and SEPAC will incorporate improvement to emission factors into the best management practices document as they become available.
- 44) Once a best management practices document has been developed by CAPP and SEPAC, the EUB should require licensees to develop and implement leak detection and repair programs to minimize fugitive emissions from upstream petroleum industry facilities.
- 45) In 2007, the Flaring and Venting Project Team should review the best practices for leak detection and repair, and its use.

Other Research Needs:

The Flaring and Venting Project Team recommends that:

- 46) The Air Research Planning Committee (ARPC) , through its research activities, consider examining whether there are any emissions related to the combustion of compounds used in well stimulation, treatment chemicals used downhole, including drilling and subsequent activity.
- 47) The Air Research Planning Committee (ARPC), through its research activities, consider examining whether there are any emissions of heavy metals in flare stack emissions.

Review and Further Work:

The Flaring and Venting Project Team recommends that:

- 48) The Flaring and Venting Project Team be reconvened to review the framework in the first quarter of 2007.

1. Background

About CASA

The Clean Air Strategic Alliance (CASA) was established in March 1994 to manage air quality issues in Alberta. CASA is a nonprofit association composed of diverse stakeholders from three sectors: government, industry, and non-government organizations such as health and environment groups. Senior representatives from each sector are committed to developing and applying a comprehensive air quality management system for Alberta through a collaborative, consensus-based process. All CASA groups use the consensus-based process to make decisions and recommendations. As well, all participants work toward a shared vision that, “The air will be odourless, tasteless, look clear and have no measurable short- or long-term adverse effects on people, animals or the environment.”

About the CASA Flaring and Venting Project Team

The CASA Flaring and Venting Project Team was established in September 2000 to assess the performance and make recommendations regarding the Alberta solution gas flaring and venting management framework. The team provided a report in June 2002 with detailed timing and recommendations. The team reconvened in 2003 to continue its work on flaring and venting reductions. A history of the team’s work can be found in Section 2.1 of this report.

The tasks set before the Flaring and Venting Project Team by the CASA Board in September 2000 include the following:

- Determine whether the solution gas flaring reduction targets for 2000 and 2001 have been met.
- Determine, based on improved information, firm future reduction targets, timelines and threshold volumes for solution gas flaring.
- Evaluate the royalty treatment of flared and vented gas cost sharing programs and their implication for achieving future reduction targets.
- Evaluate the approval process and determine if fixed-term approvals are required.
- Review performance requirements and efficiency standards, and determine the feasibility of combustion efficiency standards for all flares.
- Assess research findings and their implication for management of flaring and venting.
- Review information on gas venting and mitigation approaches and recommend a venting management framework, including short-term actions and long-term strategies.
- Review and develop recommendations with regard to EUB Guide 60, and Guide 60: Updates and Clarifications Documents.
- Develop recommendations for a strategy to respond to the issues associated with flaring and venting.

About Flaring and Venting in the Upstream Petroleum Industry

What Is Flaring?

Flaring is the act of burning natural gas, including solution gas (gas produced in conjunction with oil production) that cannot be used, processed or sold due to technical or economic factors, as part of well testing, and in emergencies due to safety concern.

What Is Venting?

Venting is the direct release of natural gas into the atmosphere. Venting has typically been used to manage small quantities of waste natural gas that cannot be used economically. The EUB requires that gas that cannot be used on site be conserved, be burned (flared or incinerated), rather than vented, if it is able to support stable combustion.

What is Conservation?

Gas conservation refers to the recovery of natural gas, including solution gas, for useful purposes, as opposed to disposing of the gas by flaring or venting. Examples of gas conservation include gas delivered to a pipeline for sale, gas used as fuel for production facilities and equipment, or alternative uses such as power generation or injection into an oil or gas pool.

What is a conserving site?

For the purposes of this report conserving sites are sites designed to recover a minimum of 95% of the produced gas, and are operated so that on a monthly basis they capture no less than 90% of the gas which would otherwise be flared or vented.

What are Fugitive Emissions?

Fugitive emissions are small unintentional emissions from equipment such as valves, fittings, compressors, joints, storage tanks, etc. Companies can reduce fugitive emissions by performing Leak Detection and Repair (LDAR) programs, in which they physically locate the leaks within a facility and may tighten, re-seal or replace the equipment that is leaking.

Public Concern

There is public concern about potential adverse health effects and environmental impacts of flaring and venting. Historically, some residents in proximity to energy facilities that flare or vent have complained about odour, smoke, noise, and impacts on livestock and humans, as well as aesthetic impacts.

2. Flaring and Venting Project Team Work

2.1 Previous Work on Flaring and Venting

Albertans are concerned over the flaring and venting of solution gas. Studies have raised questions about the combustion efficiency of solution gas flaring, the nature of the by-products of incomplete combustion, and the potential of emissions from flares and vents to cause health effects in humans and animals. They are also concerned about the greenhouse gas effects of emissions from flaring and venting.

The Canadian Association of Petroleum Producers (CAPP) brought the solution gas flaring issue to the CASA board of directors in November 1996. In response, CASA established the Flaring Project Team (FPT) in February 1997 to develop recommendations to address potential and observed impacts associated with solution gas flaring. In its final report,¹⁰ presented to the CASA Board in June 1998, the Flaring Project Team recommended a framework for the management of solution gas flaring and actions to achieve the overall goal of the eventual elimination of routine flaring of solution gas.

http://www.casahome.org/uploads/FPT_final_report.pdf

The report was implemented by the Alberta Energy and Utilities Board (EUB), which initiated new requirements for upstream flaring. These requirements are detailed in Guide 60: Upstream Petroleum Industry Flaring Guide¹¹ and Guide 60: Updates and Clarifications,¹² both available on the EUB Web site <http://www.eub.gov.ab.ca>. In September 2000, CASA established a project team to study the further management of solution gas flaring, as well as solution gas venting. The Flaring and Venting Project Team (FVPT) released a [report](#)¹³ in June 2002 detailing their findings and recommendations. The results of this team's work is reflected in Draft Guide 60 (Dec. 2002).

In its 2002 report the FVPT identified a significant data gap with respect to vented gas volumes and the economics of further reductions in solution gas flaring and venting. One of its recommendations was that data be collected by industry and reported to the EUB during 2002 and analyzed in early 2003. The team reconvened in 2003 and continued its work, starting with analysis of the data that had been collected and analyzed. The team also addressed a number of items that had been deferred in its 2002 report. This report is the result of that work.

¹⁰ Management of Routine Solution Gas Flaring in Alberta: Report and Recommendations of the Flaring Project Team, CASA, 1998.

¹¹ Guide 60: Upstream Petroleum Industry Flaring Guide, EUB, 1999.

¹² Guide 60: Updates and Clarifications, EUB, 1999 and 2001.

¹³ <http://www.casahome.org/uploads/FVPTRptANDRecsFinalVersionJUN-21-2002.pdf>

2.2 Achievement of 2002 Reduction Targets and Current Status of Solution Gas Flaring and Venting

The work of industry and other stakeholders has resulted in significant reductions in the volume of gas flared in Alberta. The EUB flaring data for 2002¹⁴ confirms that since the first CASA FPT recommendations were implemented in 1999, solution gas flaring volumes have been reduced by 62% (based on the 1996 revised baseline of $1340 \times 10^6 \text{ m}^3/\text{year}$) versus a 2002 target of 50% reduction. Solution gas venting was reduced by 29% from the 2000 baseline.

The table below shows the flare reduction targets and corresponding actual reduction percentages from 1999 to 2003.

Table 1: Solution Gas Flare Reduction
(Based on the 1996 Revised Baseline $1340 \times 10^6 \text{ m}^3/\text{year}$)

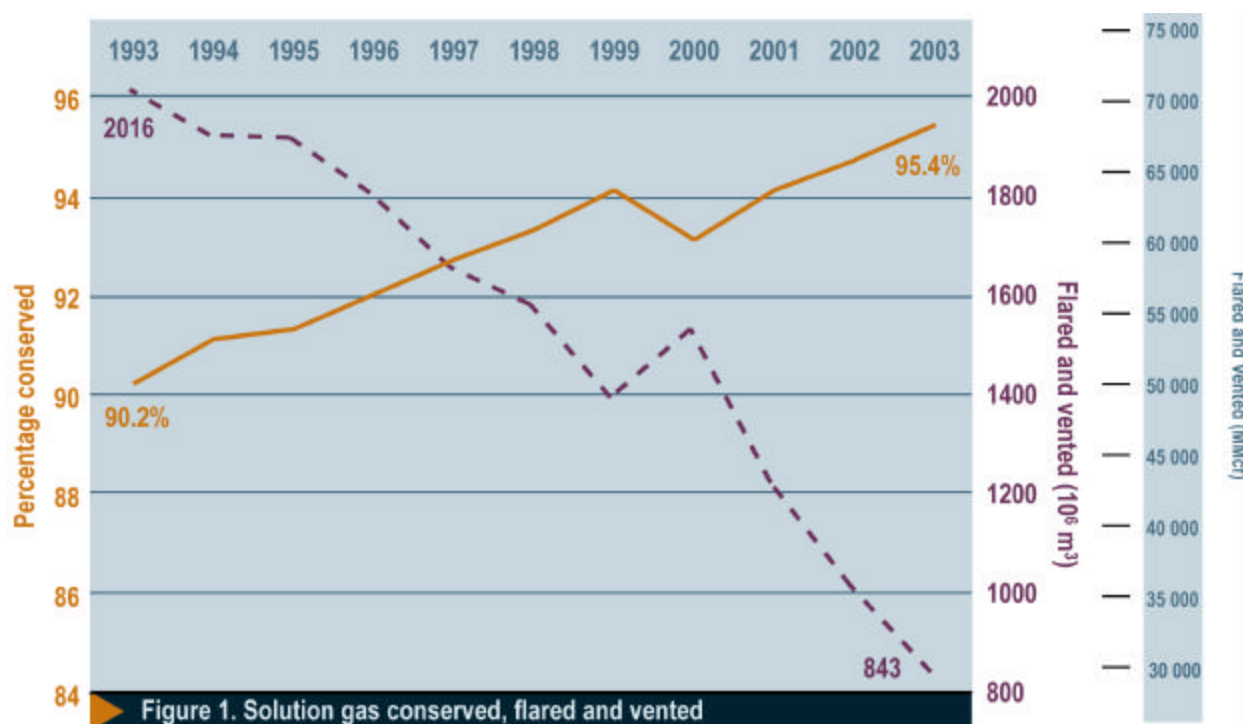
Year	Firm Target Reduction (%)	Actual Reduction (%)
1999	None established	30
2000	15	38
2001	25	50
2002	50	62
2003	None established	70

Table 2: Solution Gas Venting reduction
Solution gas venting reduction (compared to 2000 baseline)

Year	Reduction (%)
2001	15
2002	29
2003	38

The EUB's data for 2003 shows that 95.4% of solution gas was conserved or used in some manner. The remaining 4.6% was flared or vented. (Figure 2).

¹⁴ Source: ST-60B: Upstream Petroleum Industry Flaring Report, EUB, 2004.
<http://www.eub.gov.ab.ca/bbs/products/STs/st60b-2004.pdf>

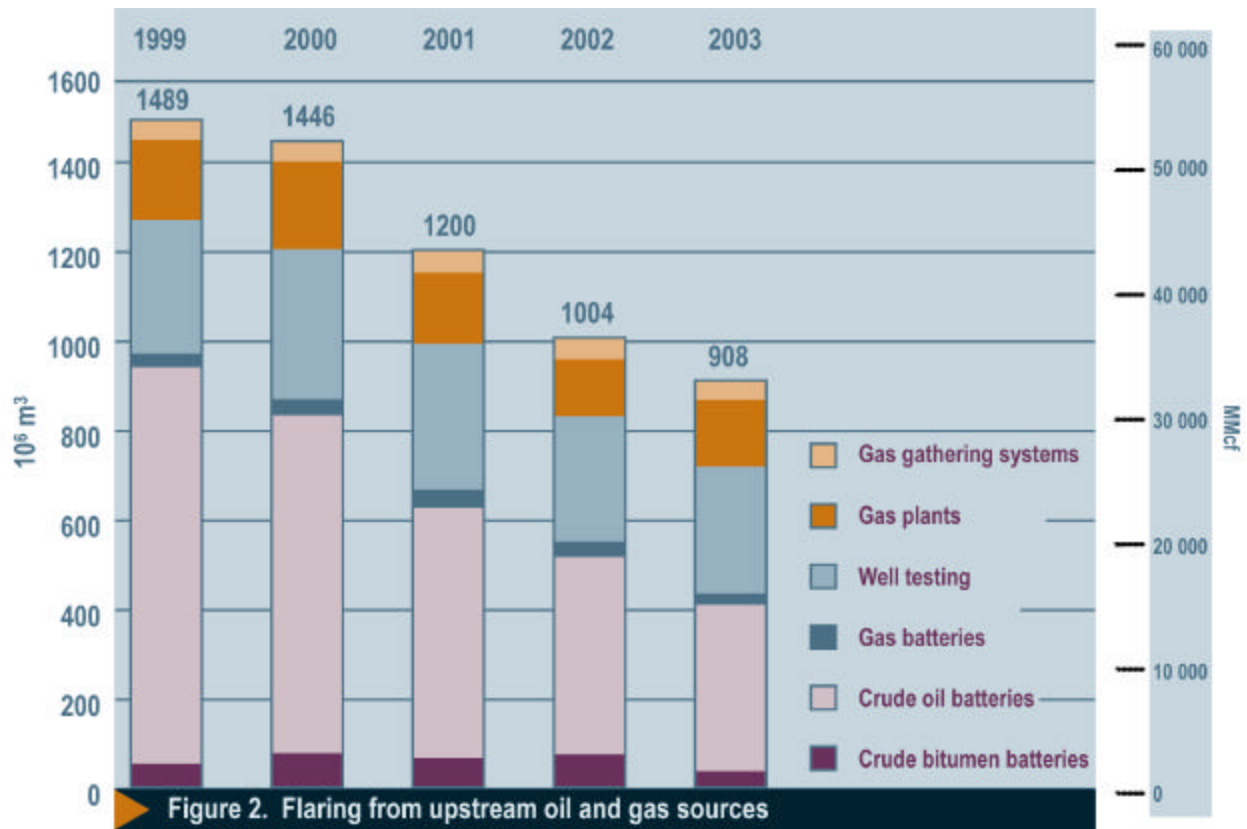
Figure 1: Solution Gas Conserved, and Flared and Vented (1993-2003)

Source: ST-60B: Upstream Petroleum Industry Flaring Report, EUB, 2004.

The significant reductions in flaring and venting that industry achieved were first initiated by the 1998 CASA Flaring Project Team report. This was also aided by several contributing factors including:

- Concerted efforts of industry and the CASA stakeholders
- Publication of the annual flaring and venting report (EUB ST 60-B) and monthly publication of solution gas flaring and venting data (ST60).
- High commodity prices
- The development and enforcement of EUB Guide 60: Upstream Petroleum Industry Flaring Guide. (This includes restricting flare volumes at conserving facilities for turnarounds and emergency, restrictions on flared volumes under the New Oil Well Production Period (NOWPP) program, and minimizing flaring on new development wells in conserving pools.)

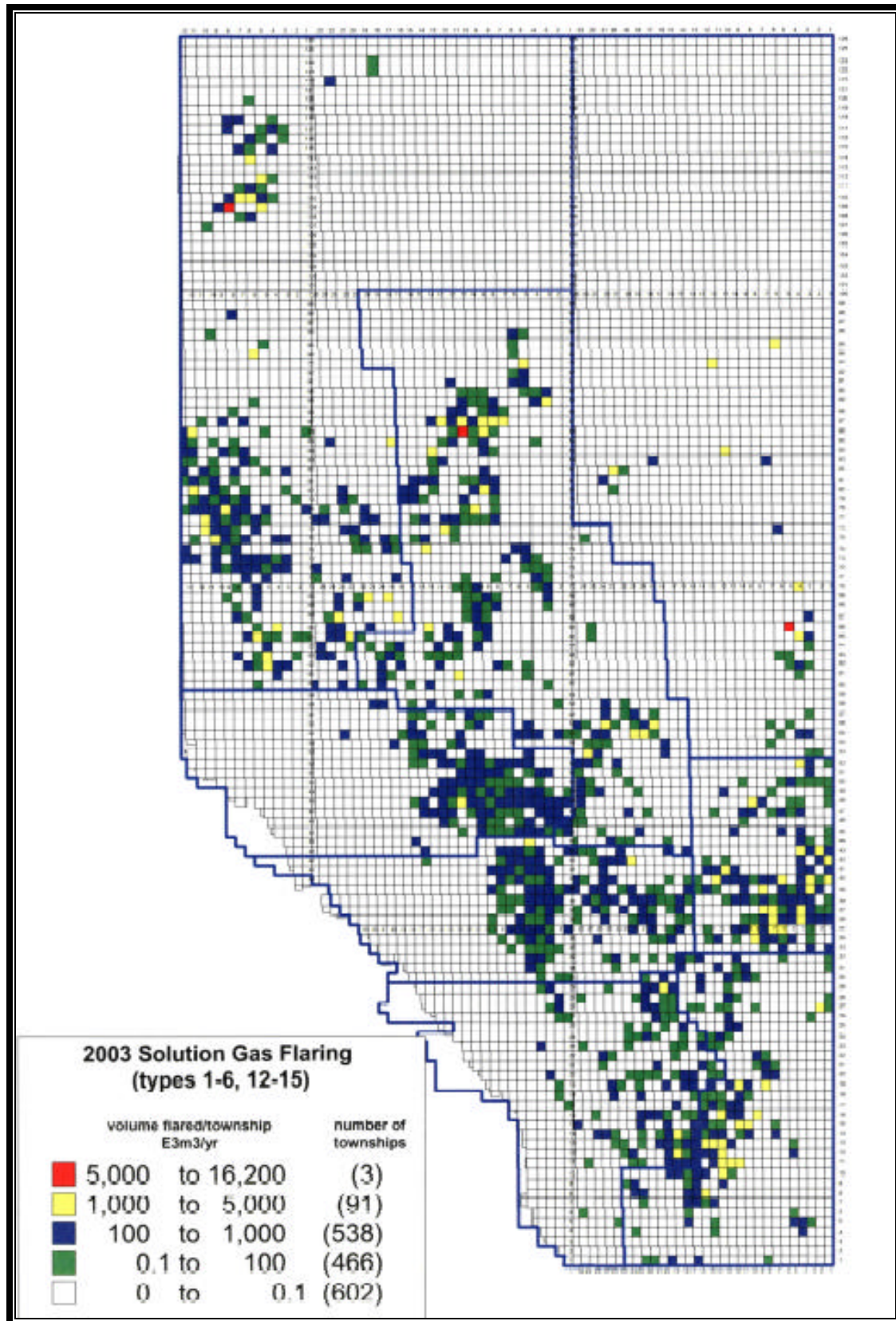
By the end of 2002, industry operators were required to have evaluated all routine solution gas flares, as required by EUB Guide 60, using the decision tree (Figure 6:), and to implement conservation at all sites where the analysis indicates that it is economic to do so. Similarly, all new flares or vents occurring since that time must also be evaluated using the Decision Tree. The achievements by industry so far represent a significant accomplishment and demonstrate the effectiveness of implementing the solution gas management framework and decision tree. Figure 3 shows the decline in flaring from the upstream oil and gas industry from 1999-2003.

Figure 2: Flaring from Upstream Oil and Gas Sources

Source: ST-60B: Upstream Petroleum Industry Flaring Report, EUB, 2004.

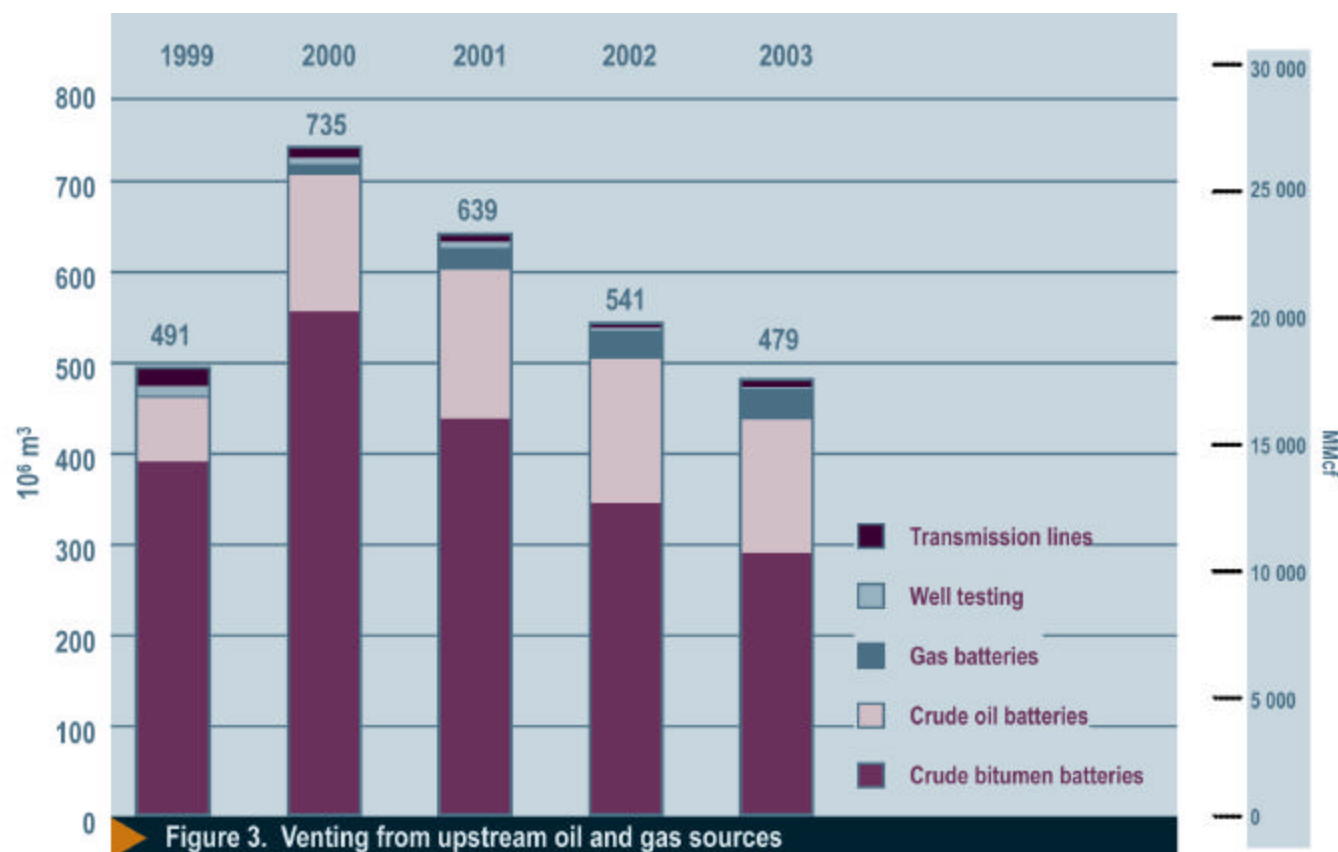
The map in Figure 3 shows solution gas flare volumes by township for Alberta based on 2003 data.

Figure 3: 2002 Solution Gas Flaring (types 1-6, 12-15)



As a result of the 1998 CASA recommendations and the implementation of Guide 60, there has been considerable improvement in flare and vent gas measurement and reporting. These improvements, along with increased industry activity, have resulted in an increase in the amount of reported vent gas between 1999 and 2003, as shown in Figure 5. EUB data for 2003 indicate that solution gas venting has been reduced by 38% from the 2000 baseline. Total vented volumes represent many small, individual sources.

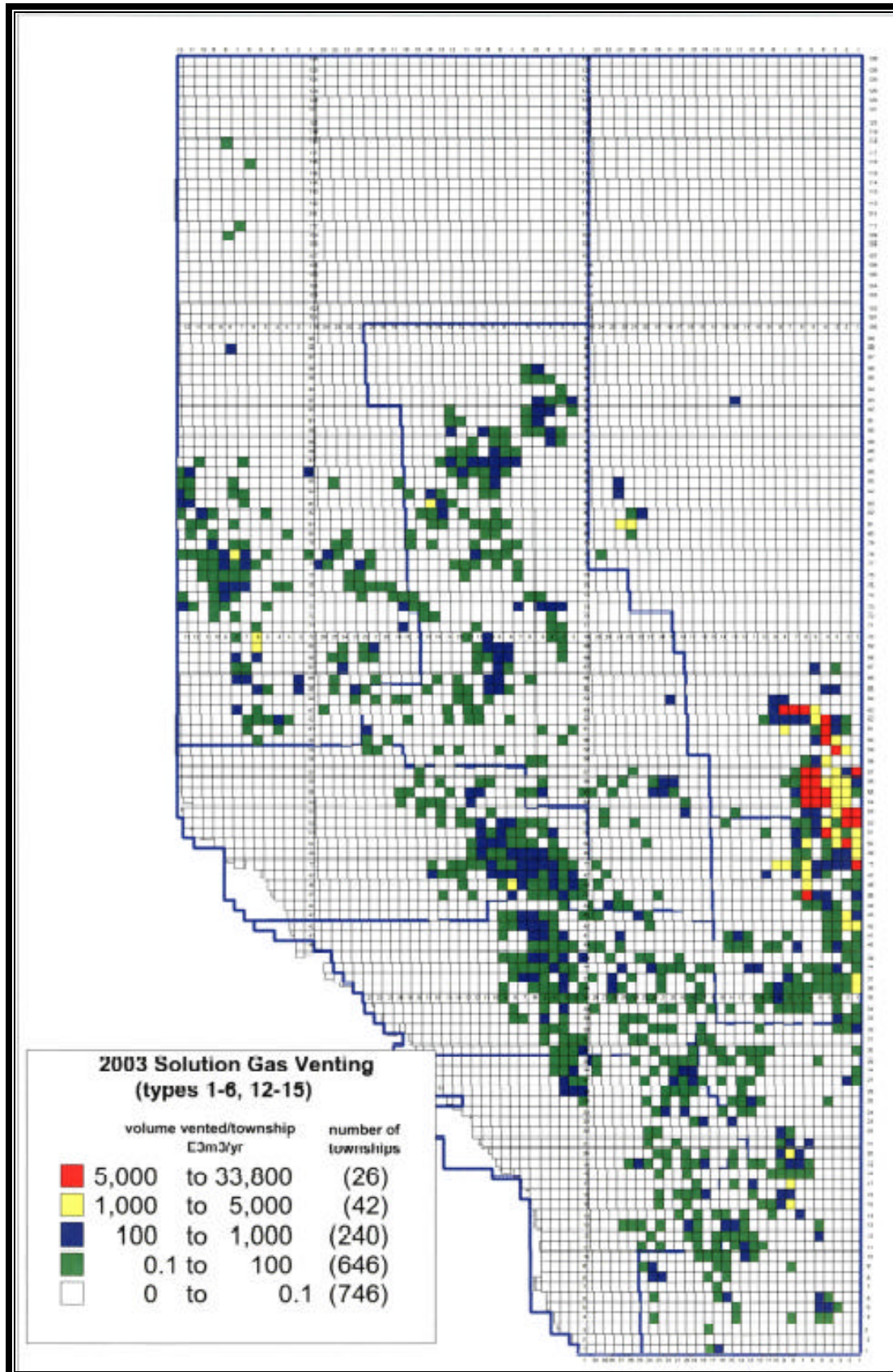
Figure 4: Venting from Upstream Oil and Gas Sources



Source: ST-60B: Upstream Petroleum Industry Flaring Report, EUB, 2003.

The map in Figure 6 displays solution gas vent volumes per township for Alberta based on 2002 data.

Figure 5: 2002 Solution Gas Venting (types 1-6, 12-15)



2.3 2003/2004 Flaring and Venting Project Team Work

The FVPT reconvened from February 2003, to June 2004. One of the team's main objectives was to assess the solution gas flaring and venting data gathered by the EUB in response to the 2002 recommendation. A consultant was hired by the FVPT to compile and analyze the data that had been received. The consultant provided a report (see Section 3) that presented the costs and volumes associated with potential flaring and venting reductions. The FVPT reviewed the report, along with additional data compiled by industry and the EUB, and discussed the appropriateness of further reduction targets for solution gas flaring, as well as reduction targets for solution gas venting. The team brought forward proposals for volume thresholds for solution gas flaring and venting (see Sections 4 and 5). After discussion, the team members agreed upon one proposed threshold for both solution gas flaring and venting.

The FVPT also reviewed data on the number of well tests conducted in Alberta and the associated volumes of gas flared and vented. Some members of the team met with EUB field staff to discuss possible approaches including duration limits for well testing. The FVPT's proposal for well testing is explained in Section 6.

The FVPT revisited the topic of combustion efficiency, one of the original topics of concern for the first flaring team. The team contacted flaring researchers in order to obtain the most current information on factors affecting combustion efficiency. Although there is still not enough information to make specific, detailed recommendations on combustion efficiency or flare design, the FVPT made further recommendations relating to combustion efficiency (see Section 7).

Fugitive emissions were reviewed, as was the need for Leak Detection and Repair (LDAR) programs. Recommendations by the FVPT for fugitive emissions management can be found in Section 9.

Coal bed methane, or Natural Gas from Coal, is being reviewed through a Multi-stakeholder Advisory Committee (MAC) led by Alberta Energy and Sustainable Resource Development. After some discussion with the MAC, it was agreed that the CASA Flaring and Venting Project Team would develop recommendations to the CASA board for the flaring and venting issues related to coal bed methane development. It is expected that these recommendation will be presented to the CASA Board at the November 2004 meeting. In order to assist in this work stakeholders from the Canadian Society for Unconventional Gas have agreed to participate in this part of the team's work.

One of the deferred items from the work of the team in 2002 was facilities flaring. After examining, the team concluded, based on the low volumes associated with these facilities, (i.e. gas plants and gas gathering systems) and the proposed requirements in Draft Guide 60, that no further requirements are needed at this time.

3. Study of Solution Gas Conservation Trends and Costs

The EUB's Guide 60 required that by the end of 2002 licensees evaluate all routine solution gas flares. In 2002, the CASA Flaring and Venting Project Team recommended that data on flaring and venting in Alberta be collected and analyzed. The EUB's GB 2002-5 and ID 2002-2 required that this summary level economic evaluation data for sites that met set criteria be submitted by January 31, 2003 to help with the CASA FVPT evaluation. The set criteria was:

- Operators with fewer than 50 vent sources larger than 800 m³/day existing in 2001 were required to evaluate all of these larger vent sources by the end of 2002 and conserve any economic gas by the end of 2003.
- Operators with more than 50 vent sources larger than 800 m³/day had the option of evaluating those larger vent sources, or evaluating 50 % of the vented volumes reported from **all** of their solution gas sources by the end of 2002. In all cases, gas that could be economically conserved was to be conserved by the end of 2003.
- Summary level economic evaluation data for these vent sources was submitted to the EUB as required in ID 2002-2. This information is available at http://www.casahome.org/uploads/ID_2002-02_Data.xls
- Operators of all continuous solution gas flares where conservation was not implemented by December 31, 2001 had to supply economic evaluation data to the EUB, as required in ID 2002-2. This also applied to continuous solution gas flares evaluated in 2002.

3.1 Data Gathering and Analysis

Advanced NPD Inc, was hired by FVPT to analyze this data. A 152-page report was compiled, entitled **Solution Gas Flaring and Venting in Alberta: Volume Trends and Conservation Costs**, which was presented to the team's economic sub-committee for review. The report detailed recent flaring and venting conditions in Alberta, as well as an outlook for the period of 2003-2012. This report is available at: http://www.casahome.org/uploads/FV_Solution%20Gas%20FV%20in%20Alberta%20Report.pdf

Solution gas production was forecast using data from EUB's Alberta's Reserves 2002 and Supply/Demand Outlook 2003-2012, <http://www.eub.gov.ab.ca/bbs/products/STs/st98-2003.pdf>. Flaring and venting were then forecast by modeling the effect of Guide 60 regulations on the resulting solution gas forecast (based on the results of the analysis of the data submitted in accordance with EUB ID 2002-02). The findings of this report are discussed in Sections 4 and 5 as part of the development of reduction target proposals.

It is important to note that the report found for solution gas flaring, that roughly half the volume comes from sites that are already conserving 95% or more of solution gas produced. For solution gas venting, the report indicates that significant improvements in conservation should be seen in the future, as the volume vented from sites that can be economically conserved is approximately twice that of uneconomic sites. The report also cautioned, however, that solution gas venting volumes may increase initially due to an increase in bitumen production projects (2004 – 2008) before a decrease in vented volumes is achieved.

For existing flares, the report estimates that it would cost approximately \$60 million to reduce flaring at non-conserving facilities by an estimated 80 million m³ per year in 2003. For approximately \$10 million, existing solution gas venting could be reduced by roughly 50 million m³/year in 2003.

For new solution gas flares, the report estimates there is a 50% probability that the cost to conserve all solution gas from new flares between 2003 and 2012 would be less than \$76 million with a resultant loss in crude oil production of 530,000 m³. For new solution gas vents, there is a 50% probability that the cost to conserve all solution gas from new vents greater than 800 m³/day would be less than \$7 million. For new solution gas vents less than 800 m³/day it would cost less than \$97 million. The resulting losses would be 50,000 m³ of crude oil production and 460,000m³ of bitumen production.

4. Solution Gas Flaring Management

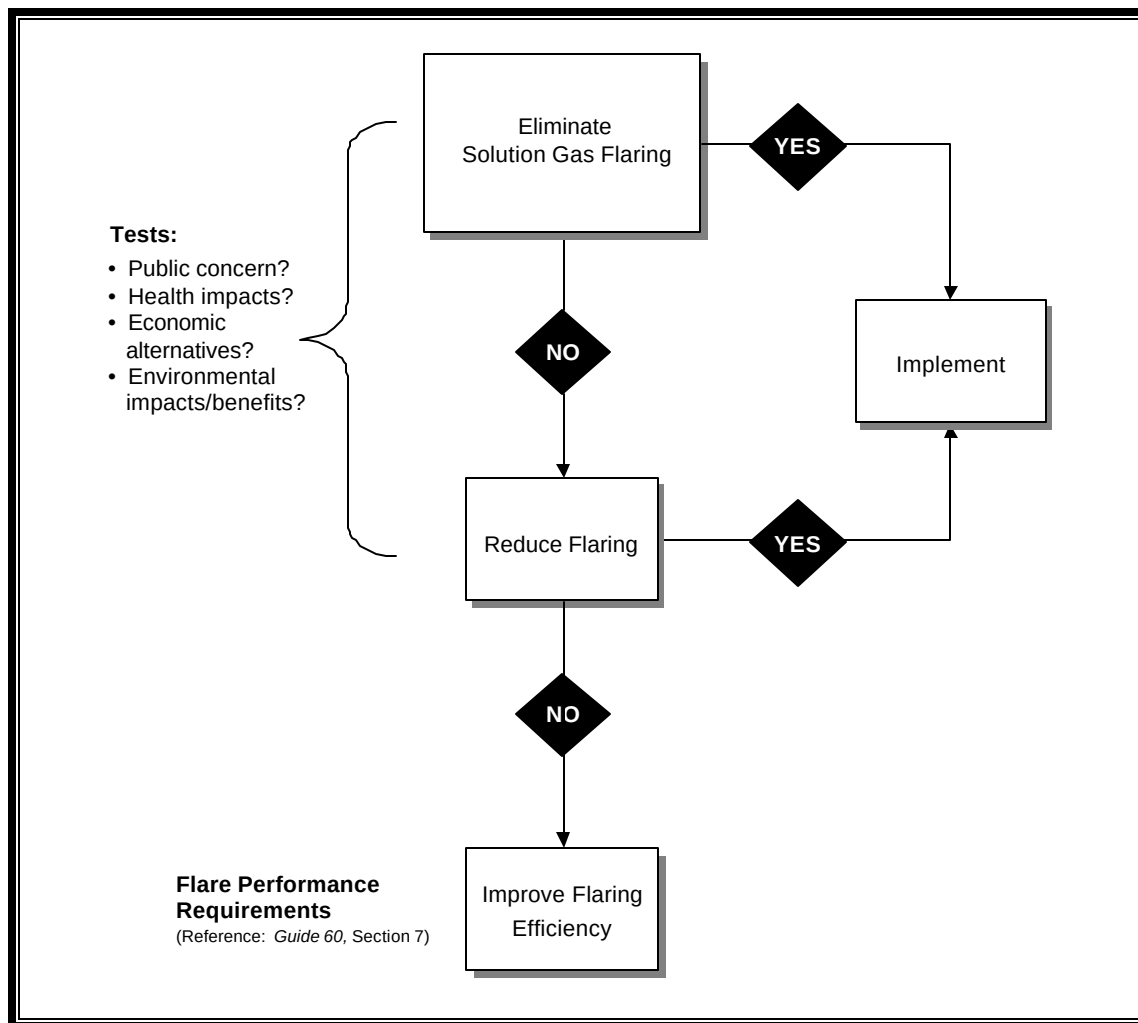
The FVPT evaluated progress on the solution gas flaring management recommendations made in the 2002 CASA report. The team found that solution gas flaring continues to be reduced substantially and that the EUB has clarified flaring requirements for industry through Guide 60 and the Guide 60 Updates and Clarifications. The EUB's solution gas flaring data for 2003 indicates that volumes flared were reduced 70 % from the 1996 baseline of $1340 \times 10^6 \text{ m}^3/\text{year}$.

The report commissioned by the FVPT found that solution gas flaring in Alberta is projected to steadily decline from 2003 to 2012 to a level roughly 76 % below 1996 levels, assuming no further policy changes are put in place.

4.1 Establishment of Solution Gas Flaring Limits

The management of solution gas flaring currently involves a decision tree (Figure 6:) that operators use to guide decisions related to routine solution gas flaring in Alberta. The decision tree and economic evaluation require industry to examine flaring and venting at their facilities. This has improved the accuracy of flaring and venting data and helped identify a number of sites previously thought to be uneconomic for gas conservation. This contributed to significant flaring reductions.

Figure 6: Solution Gas Flare Decision Tree



Conducting an economic evaluation of potential solution gas conservation requires a significant amount of time and administrative work. Aided by the economic analysis contained in the consultant's report (See Section 3), the FVPT was able to agree that all sites that flare more than 900 m³/day will be required to conserve by January 1, 2006, unless they receive an exemption as described below. It was further agreed that sites that flare less than 900 m³/day would not be required to routinely perform the Guide 60 economic analysis. By eliminating the economic evaluation requirement for most cases, the administrative burden will be significantly lessened. However, the FVPT recommends that the concepts of the decision tree (eliminate, reduce, meet performance requirements) still apply to all flaring.

The FVPT has determined that these volume limits will translate into a 78 percent reduction for flaring when compared to the baseline year of 1996.

For producing sites, conservation must be implemented as soon as possible once the determination that the site must conserve is made. Furthermore, if existing sites increase gas production such that the three-month average exceeds 900 m³/day, this should trigger the requirement for an evaluation. For existing non-conserving sites, licensees should also be aware of the approximate threshold production level at which conservation would become economic. This will allow for a quicker implementation of gas conservation, and less associated flaring or venting. If conservation is determined to be required, the site should be shut in until conservation is implemented. This implementation period is not to exceed three months. For new conventional oil sites, where conservation is required, the wells should be shut in after completion of testing until conservation is implemented. Clustering, in which several operators work together to implement conservation projects that would not be feasible if they acted on their own, will apply to all projects.

The FVPT recognizes that there will be cases in which industry should evaluate the economics of solution gas flaring, even if it is under the proposed 900 m³/day per site limit. The EUB may still require that operators perform the Guide 60 economic analysis upon request. Even at small volumes, companies should be encouraged, and sometimes required, to consider the cost benefits of clustering with other nearby sites.

The FVPT recognizes there will be cases where conservation is not economically feasible. Industry, however, recognizes the value in marginally uneconomic sites conserving solution gas. As such, all sites with a net present value greater than negative \$50,000 will be required to conserve. An exemption should be provided if licensees demonstrate that the net present value for a conservation project is less than negative \$50,000, based on the Guide 60 economic model. The operators of these exempted sites will be required to review their economic analysis annually, and to conserve if the analysis shows that they do not continue to qualify for exemption.

In order to accommodate variations in the production levels, the volume of solution gas for existing sites will be based on a three-month rolling average, while for new sites it will be based on production test information. Operators of sites will have an obligation to notify the EUB when the three-month rolling average exceeds or indicates that it could likely exceed 900 m³/day. A site is defined as a single surface lease (pads counted as one lease) where gas is flared or vented.

For heavy oil and bitumen sites, solution gas conservation should be implemented as soon as possible to minimize flaring and venting. As soon as flow rates show that gas production could likely exceed 900 m³/d for a 3 month period of time, tie in should occur as quickly as possible. The period of flow rate determination is not to exceed 6 months. Tie in must also occur within a maximum of 6 months after flow rate determination. Shorter tie in times should be pursued wherever possible (i.e. where complications or objections are not encountered).

For heavy oil and bitumen lease sites, the FVPT also sees value in requiring licensees to build solution gas conservation lines on the site as part of the initial construction. This will assist in conservation either by the licensee or by a third party as discussed below. Conservation lines should gather the gas to one common point on the lease. If an arrangement was then made for a third party to utilize the gas, the gas could then simply be routed to the lease boundary.

The Project Team supports making solution gas available to a third party for no charge at the lease boundary if the operator / licensee of a site does not want to conserve the gas. The team does not believe that this requirement should be put into regulation and at this time the team supports a voluntary approach. The intention is to further encourage alternative uses of solution gas and foster innovation that would make use of small volumes of gas that might otherwise be flared or vented.

The team suggests that in cases where conservation is determined by the company to be uneconomic but a third-party organization is able to conserve the gas within 3 months, licensees are expected to either conserve the gas or make the gas available to the third party at no charge at the lease boundary within 3 months of a request. It is expected that third parties will accept the gas under terms and conditions which are set out by the producer. Normally this would mean that the use of the gas would not impact the upstream facility in any way and is provided without compression or other treatment.

Flares that are within 500 meters of a residence and have a volume in excess of 900 m³/day would be required to conserve, with no exceptions. Smaller volume flares would not be required to conserve, but would be encouraged to do so. Residents living within 500 meters of a continuous solution gas flare must be consulted annually and their concerns addressed. Residents may inform licensees if they wish to be exempt from consultation in subsequent years. Licensees must recommence annual consultation when new owners move into the existing residence.

Therefore, the Flaring and Venting Project Team recommends that:

- 1) Recommendations 2 through 13 come into effect on Jan 1/2006. These requirements will apply to both existing and new wells/facilities. For the interim period, the decision tree analysis will still be required. Where gas is being conserved it is expected that conservation will continue.
- 2) Licensees must conserve solution gas at all sites¹⁵ flaring or venting combined volumes greater than 900 m³/day per site¹⁶ if the EUB Guide 60 decision tree economic evaluation results in a Net Present Value (NPV) of greater than negative \$50,000.
- 3) Licensees must conserve solution gas at all sites flaring volumes greater than 900 m³/day per site¹⁷ if the flare is within 500 meters of an existing residence. Licensees must consult with new residents (constructed or re-located after January 1, 2006) that are within 500 meters when the new residents move in.
- 4) Licensees are encouraged to conserve solution gas at all sites flaring or venting combined volumes less than 900 m³/day per site. The EUB may still require an economic evaluation for these sites.

¹⁵ A site is defined as a single surface lease (pads counted as one lease) where gas is flared or vented.

¹⁶ Volumes will be calculated based on a three month rolling average for conventional oil production and a six month rolling average for heavy oil and bitumen.

¹⁷ See footnote 16

- 5) Licensees of production facilities that are operating within 3 kilometres of each other or other appropriate oil and gas facilities(including pipelines) are required to jointly consider “clustering” when evaluating solution gas conservation economics.
- 6) Licensees of multi-well heavy oil or bitumen lease sites must prebuild solution gas conservation lines to one common point on the lease as part of initial construction.
- 7) In cases where conservation is determined by the company to be uneconomic but a third-party organization is able to conserve the gas, licensees are expected to either conserve the gas or make the gas available at the lease boundary at no charge within 3 months of a request.
- 8) Conserving facilities shall be designed for 95% conservation with a minimum operating level of 90%. The FVPT encourages conservation to as high a level as possible, noting that current conservation rates industry-wide are approximately 95%.
- 9) For conventional oil sites, where conservation is required, the well(s) would be shut in after completion of the test period (as per recommendation 30) until conservation is implemented.
- 10) For heavy oil and bitumen sites, solution gas conservation should be implemented as soon as possible to minimize flaring and venting. As soon as flow rates show that gas flaring could likely exceed 900 m³/day for a 3 month period, tie in should occur as quickly as possible. The period of flow rate determination is not to exceed 6 months. Tie in must also occur within a maximum of 6 months after flow rate determination. Shorter tie in times should be pursued wherever possible.
- 11) After December 31, 2005, for any sites flaring or venting combined volumes greater than 900 m³/day and not conserving, a review of conservation economics will be required every year. This information is to be kept on file by the licensee and can be audited by the EUB at any time.
- 12) Operators will be required to consult with residents (e.g. per the existing Guide 56 consultation requirements) at the time of licensing if the proposed site may flare natural gas.
- 13) Residents that are within 500 metres of a solution gas flare must be consulted annually and their concerns addressed. Residents may inform licensees if they wish to be exempt from consultation in subsequent years or if they wish to be consulted on an annual or bi-annual basis. Licensees must recommence annual consultations when new owners move into the existing residence.

4.2 Royalty Programs

Otherwise Flared Solution Gas Program

The Alberta Department of Energy introduced the Otherwise Flared Solution Gas (OFSG) program in January 1999. For wells approved under this program, royalties are waived on solution gas production that is otherwise uneconomic to conserve. The economic evaluation is based on parameters defined in Guide 60, Section 2. The FVPT reviewed Guide 60 economic parameters and recommended that some changes be made in its June 2002 report.

The FVPT recommended in June 2002 that annual operating costs be increased to 20 % of capital costs for sour solution gas evaluations. This is reflected in draft Guide 60 (December 2002). The FVPT also recommended that the OFSG program be extended to bitumen wells.

While recognizing that there is value in reducing the administrative burden of the decision tree analysis, the FVPT believes the economic evaluation is still a useful tool for companies that want a royalty rebate on uneconomic gas.

Therefore, the Flaring and Venting Project Team recommends:

- 14) A royalty waiver under the Otherwise Flared Solution Gas program should continue to be available to producers that have used the EUB Guide 60 decision tree economic analysis to demonstrate that the solution gas conservation is uneconomic. This waiver should be extended to apply to bitumen wells.

5. Solution Gas Venting Management

The FVPT evaluated progress on the solution gas venting management recommendations made in the 2002 CASA report. The team found that solution gas venting has been reduced and that the EUB has clarified venting requirements for industry through Guide 60 and its updated Draft Guide 60. A decision tree (Figure 3) similar to that for solution gas flaring can also be applied to venting. The EUB draft Guide 60 (Dec 2002) includes a venting decision tree as recommended by the FVPT in 2002.

EUB solution gas venting data for 2003 indicates that solution gas volumes vented were reduced 38 percent from the 2000 baseline of $704 \times 10^6 \text{ m}^3/\text{year}$. The consultant's economic report commissioned by the FVPT shows, while crude oil production is declining, crude bitumen production is increasing. The venting associated with increased crude bitumen production is expected to offset venting reductions associated with crude oil production. Solution gas venting is expected to stay at or above 2003 values until 2008, at which time it will begin to decline.

5.1 Establishment of Solution Gas Venting Limits

Solution gas venting data from 2001 and 2002 was analyzed for the FVPT. A breakdown of the different sizes, current conservation practices and further conservation prospects was prepared (for details please see the economic analysis report.) The report indicated that for solution gas venting, significant improvements in conservation should be seen in the future, as the volume from economic sites is approximately twice that of uneconomic sites. ID 2002-02 required that solution gas vents be evaluated and conservation implemented if the site is economic according to the Guide 60 analysis.

http://www.casahome.org/uploads/FV_Solution%20Gas%20FV%20in%20Alberta%20Report.pdf

As discussed in Section 4.2, conducting an economic evaluation of potential solution gas conservation requires a significant amount of time and administrative work. Based on the data provided in the economics report and from stakeholders, the FVPT concluded that sites venting less than $900 \text{ m}^3/\text{day}$ of solution gas are usually uneconomic to conserve and recommends that economic evaluations not be routinely required for these sites. Conversely, those sites venting more than $900 \text{ m}^3/\text{day}$ are usually economic. By eliminating the economic evaluation requirement for most cases, the administrative burden will be significantly lessened. However, the FVPT recommends the concepts of the decision tree (eliminate, reduce, meet performance requirements) still apply to all venting.

The FVPT is recommending that all sites flaring or venting combined volumes greater than $900 \text{ m}^3/\text{day}$, based on a three month rolling average, be required to conserve unless they are exempted as described below. Operators of sites will have an obligation to notify the EUB when the three-month rolling average either exceeds or indicates that it could likely exceed $900 \text{ m}^3/\text{day}$. For heavy oil and bitumen sites, solution gas conservation should be implemented as soon as possible to minimize flaring and venting. As soon as flow rates show that gas production could likely exceed $900 \text{ m}^3/\text{d}$ for a 3 month period of time, tie in should occur as quickly as possible. The period of flow rate determination is not to exceed 6 months. Tie in must also occur within a maximum of 6 months after a flow rate determination. Shorter tie in times should be pursued wherever possible (i.e. where complications or objections are not encountered).

For producing sites, conservation must be implemented as soon as possible once the determination that the site must conserve is made. Furthermore, if existing sites increase gas production such that the three-month average exceeds $900 \text{ m}^3/\text{day}$, this should trigger the requirement for an evaluation. For existing non-conserving sites, licensees should also be aware of the approximate threshold production level at which conservation would become economic. This will allow for a quicker implementation of gas conservation, and less associated flaring or venting. While implementing conservation for heavy oil or

bitumen sites, the well(s) should only be shut in if it will not result in damage. This implementation period is not to exceed six months.

For heavy oil and bitumen lease sites, the FVPT also sees value in requiring licensees to build solution gas conservation lines on the site as part of the initial construction. This will assist in conservation either by the licensee or by a third party as discussed below. Conservation lines should gather the gas to one common point on the lease. If an arrangement was then made for a third party to utilize the gas, the gas could then simply be routed to the lease boundary.

The FVPT supports making solution gas available to a third party for no charge at the lease boundary if the operator / licensee of a site does not want to conserve the gas. The team does not believe that this requirement should be put into regulation and at this time the team supports a voluntary approach. The intention is to further encourage alternative uses of solution gas and foster innovation that would make use of small volumes of gas that might otherwise be flared or vented.

The team suggests that in cases where conservation is determined by the company to be uneconomic but a third-party organization is able to conserve the gas within 3 months, licensees may either conserve the gas or make the gas available to the third party at no charge at the lease boundary within 3 months of a request. It is expected that third parties will accept the gas under appropriate terms and conditions which are set out by the producer. Normally this would mean that the use of the gas would not impact the upstream facility in any way and is provided without compression.

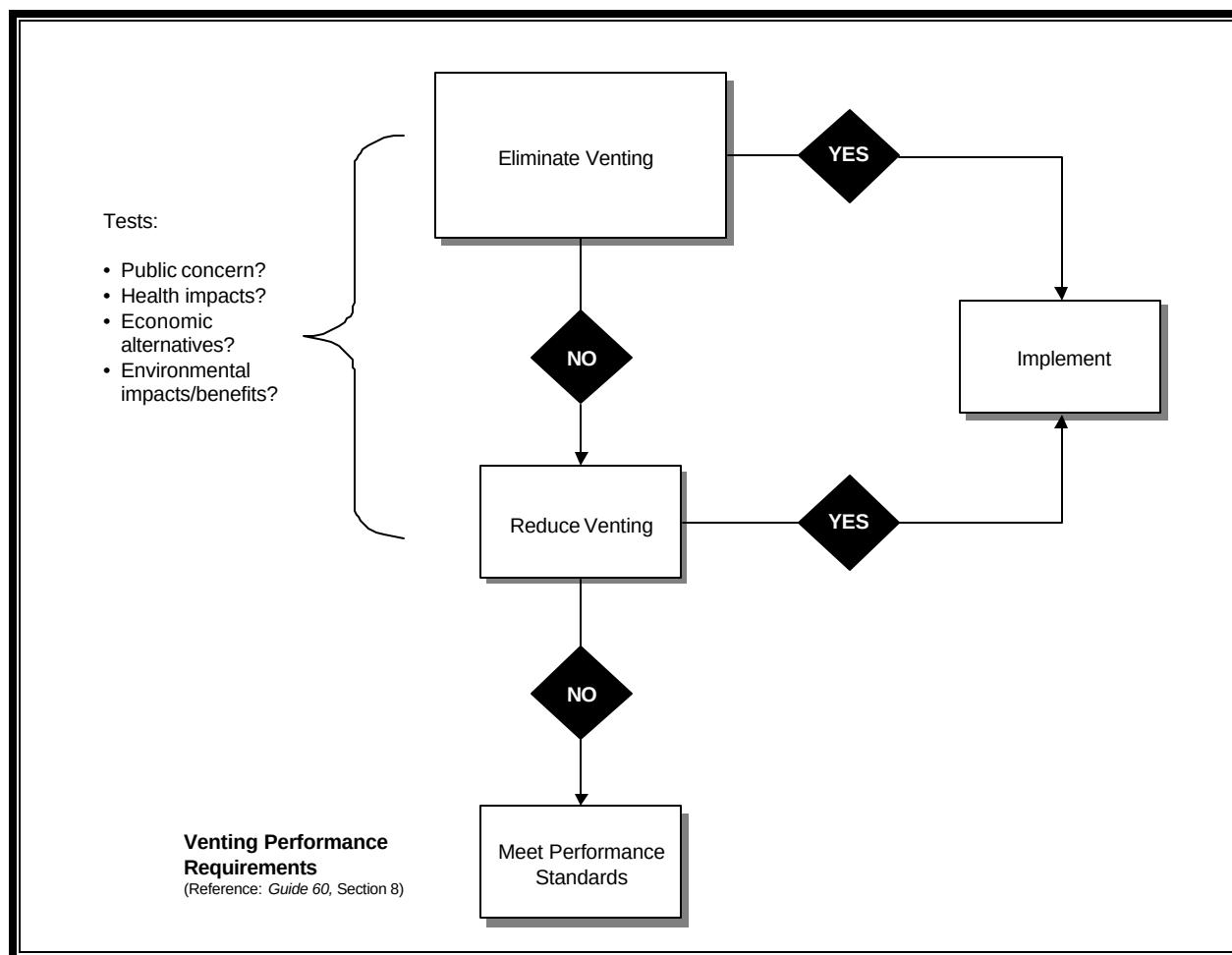
This translates into over 70 percent reduction, when compared to the baseline year of 2000.

The FVPT recognizes that there will be cases where industry should evaluate the economics of solution gas venting, even if it is under the proposed 900 m³/day limit. Even at small volumes, companies should be encouraged, and sometimes required, to consider the cost benefits of clustering with other nearby sites. To satisfy this concern, the EUB retains the right to require that operators perform the Guide 60 economic analysis upon request.

The FVPT also recognizes there will be cases where conservation is not economically feasible. An exemption should be provided if licensees demonstrate that the net present value for the project is less than negative \$50,000, based on the economic evaluation process defined in the EUB Guide 60. The operators of these sites will be required to review the economic analysis annually, and to conserve if the analysis shows they do not qualify for exemption.

The EUB currently has a temporary (less than 21 day) pipeline process that does not require a pipeline application, only field office consent. (This form can be found in Guide 56, Section 6.9.10, Appendix 5). Turnaround time on these approvals is typically 1 to 3 days, depending on field staff availability. Use of this process to permit temporary tie-ins for testing will provide additional testing in-line, thereby reducing flaring and venting during well tests.

The large number of vents within 500 meters of a residence makes the same rigor that applies to flares within that distance difficult to implement. Operators of vents that are within 500 meters of a residence would be required to consult with residents as per the existing Guide 56 consultation requirements at the time of licensing if the proposed site may vent natural gas.

Figure 7: Solution Gas Venting Decision Tree

5.2 Recommendations

The Flaring and Venting Project Team recommends that:

- 15) The following recommendations will come into effect on Jan 1/2006. These requirements will apply to both existing and new wells/facilities. For the interim period, the decision tree analysis will still be required. Where gas is being conserved it is expected that conservation will continue.
- 16) Licensees must conserve¹⁸ gas at all sites flaring and venting combined solution gas volumes greater than 900 m³/day per site if the EUB Guide 60 decision tree economic evaluation results in a Net Present Value (NPV) of greater than a negative \$50,000.

¹⁸ See footnote 15

- 17) Licensees are encouraged to conserve solution gas at all sites flaring and venting combined volumes less than 900 m³/day per site¹⁹. The EUB may still require an economic evaluation for these sites.
- 18) Licensees of production facilities that are operating within 3 kilometres of each other or other appropriate oil and gas facilities (including pipelines) are required to jointly consider “clustering” when evaluating solution gas conservation economics.
- 19) Licensees of multi-well heavy oil or bitumen lease sites should prebuild solution gas conservation lines as part of initial construction.
- 20) In cases where conservation is determined by the company to be uneconomic but a third-party organization is able to conserve the gas, licensees are expected to either conserve the gas or make the gas available at the lease boundary at no charge within 3 months of a request.
- 21) Conserving facilities shall be designed for 95% conservation with a minimum operating level of 90%. The FVPT encourages conservation to as high a level as possible, noting that current conservation rates industry-wide are approximately 95%.
- 22) For conventional oil sites, where conservation is required, the well(s) would be shut in after completion of the test period (as per recommendation 30) until conservation is implemented.
- 23) For heavy oil and bitumen sites, solution gas conservation should be implemented as soon as possible to minimize flaring and venting. As soon as flow rates show that gas venting could likely exceed 900 m³/day for a 3 month period, tie in should occur as quickly as possible. The period of flow rate determination is not to exceed 6 months. Tie in must also occur within a maximum of 6 months. Shorter tie in times should be pursued wherever possible.
- 24) After December 31, 2005, for any sites flaring or venting combined volumes greater than 900 m³/day and not conserving, a review of conservation economics will be required every year. This information is to be kept on file by the licensee and can be audited by the EUB at any time.
- 25) Operators will be required to consult with residents (e.g. per the existing Guide 56 consultation requirements) at the time of licensing if the proposed site may vent natural gas. Residents may inform licensees if they wish to be consulted on an annual or bi-annual basis.
- 26) CAPP and SEPAC will develop a best practices code for venting close to residences by December 31, 2005.
- 27) A royalty waiver under the Otherwise Flared Solution Gas program should continue to be available to producers that have used the EUB Guide 60 decision tree economic analysis to demonstrate that the solution gas conservation is uneconomic. This waiver should be extended to apply to bitumen sites.

¹⁹ See footnote 15

6. Well Test Flaring Management

Well testing, to determine a well's capability and to determine the appropriate gathering and processing systems required to handle the well's production, may require that gases be drawn off a well. In some cases, these gases are flared or vented. Well testing is done for both oil and gas wells. The FVPT would like to reduce the amount of flaring and venting related to well testing.

In 2003 well testing was the source of 28 % of the total volume of flared gas in Alberta. The total volume flared during well testing decreased by 14 % between 2001 and 2002. The number of Alberta well tests that flared or vented in 2002 was 4,105, compared to 5,972 in 2001 - a decrease of 31% in the number of well tests. The FVPT has raised concerns about the amount of gas flared during tests, the significance of sulphur emissions, the potential impacts of emissions, and the adequacy of public notification.

The EUB publishes aggregate well test data for the 25 individual companies with the greatest number of well tests conducted in its annual Upstream Petroleum Industry Flaring and Venting Report ST 60B. <http://www.eub.gov.ab.ca/bbs/products/STs/st60b-2004.pdf> This link defaults to 2003.

6.1 Establishment of Well Test Flaring and Venting Limits

The FVPT included a number of issues related to well testing in its work, including the need for greater public notification of the intent to flare during the well test period. This would require both that the distance within which notification is required be increased, and that operators be required to disclose their intentions at the initial application stage when residents have the greatest opportunity to state their objections and ensure that they will be dealt with appropriately. The plans for well testing would then be put into the site's approval and could be reviewed if the site did not meet the approval's conditions.

The FVPT agreed that well tests should only be conducted long enough to determine the data required by the EUB and the operator. The group did not reach agreement on the length of time that this would require. It is proposed that a 120-hour limit be put into place and data gathered over a six-month period that would allow the duration requirements of well tests to be assessed. Where warranted, extensions would be provided for an agreed to set of reasons. If an extension is sought, reasons for the extension should be provided to the EUB.

It was identified that the current New Oil Well Production Period (NOWPP) may actually encourage extended flaring at new wells. Once a well is placed on production, it is granted a four-month exemption from maximum rate limitations (MRL). This would encourage maximum production even though solution gas conservation facilities may not have been developed. The FVPT is recommending an extension of the NOWPP to address this issue.

The Third Tier Exploratory Well Royalty Exemption program begins at the start-up of the well and cannot be postponed while the operator installs conservation infrastructure. This encourages the operator to commence production prior to solution gas conservation facilities being in place, in order to take full advantage of the royalty exemption. Currently, the royalty exemption period is tracked based on calendar months. If an operator flares for one day in a month, the entire month counts as part of this period. The FVPT is recommending that recognition be provided for the time period required for well test flaring.

6.2 Recommendations

Therefore, the Flaring and Venting Project Team recommends that:

- 28) The EUB, in partnership with CAPP and SEPAC, set up a program to collect data for a period of well testing across the province, as to the length of tests and volumes of gas flared, and provide reasons if the tests take longer than 72 hours. The Flaring and Venting Project Team be reconvened in Q2 2005 to review the data and develop recommendations regarding the time period for well testing, for implementation January 1, 2006.
- 29) Until January 1, 2006, well testing (including clean up and testing) would be limited to a total period of 120 hours (not necessarily consecutive, i.e. excluding shut in time) per zone tested unless an exemption has been specifically granted.
 - a) Exemptions may be granted:
 - To clean up well bore in unique situations;
 - Where stabilized flow has not been reached; or
 - Where there have been mechanical problems with the well.
 - b) If additional time for well test flaring is needed the EUB should be contacted as soon as possible with the reasons for extension, but not later than the end of the 120 hour period.
- 30) After the well test, if a conventional oil well is expected to flare or vent greater than 900 m³ per day and has an NPV greater than negative \$50,000, the well must be shut-in until conservation is implemented.
- 31) The Third Tier Exploratory Well Royalty Exemption program should provide recognition for the time period required for well test flaring.
- 32) The EUB grant a one month extension to the NOWPP where a well has flared gas for less than 120 hours in the first month of NOWPP and, awaiting tie in to conserve, has subsequently shut in the well for the remainder of the month. Such requests should only be made after the well has been tied in and gas is being conserved.
- 33) Existing flaring permit thresholds continue to apply as outlined in Guide 60 Updates and Clarifications²⁰. This includes a permit threshold of 5% H₂S for sour wells and a threshold for sweet and sour volumes of 200 x 10³m³ for wells that are already tied in, 400 x 10³m³ for development wells, and 600 x 10³m³ for wells such as New Wildcat, Deeper Pool Test or Outpost wells.
- 34) The EUB develop a proposal to ensure that the rights of the public to be heard are protected in circumstances where a company has committed in its initial application to not flare and subsequently is faced with a change in circumstances that would require flaring. The EUB will bring their proposal to the CASA Flaring and Venting Project Team when it reconvenes in the second quarter of 2005.

²⁰ Guide 60 Updates and Clarifications (February 2001) - Section 3.8.1

- 35) CAPP and SEPAC should develop best management practices guidelines for well test flaring by December 31, 2005.
- 36) Once a commingled pool has been established, well testing need only be done on a commingled pool basis, thereby eliminating one or more tests on individual pools, and reducing flaring.

7. Flare Performance Standards

7.1 Research and Data

A considerable amount of research on flare performance has taken place since the last report by the FVPT. Research on combustion enhancement, emission reductions, flare plume monitoring, and well test separator efficiency has occurred under the sponsorship of industry, Environment Canada, and other provincial and federal agencies.

As of this report's writing, there are few commercially available methods for measuring flare combustion efficiency in the field. Laser-based systems such as the DIAL system, although they may prove to be of great value, are still being tested in Canada. The FVPT is aware that field tests of newer monitoring technology from the United Kingdom occurred in the spring and summer of 2003, but the team has not had an opportunity to review the test results (<http://www.ptac.org/env/dl/envp0402fr.pdf>). Researchers in Alberta and Ontario are continuing to study flare combustion efficiency and their latest findings continue to indicate that fuel composition and heating value, fuel exit momentum and wind speed are important factors.

The FVPT asked flaring researchers to review the latest gas combustion requirements from the EUB's Draft Guide 60, compare with the latest findings of their research, and provide feedback. Some of the points raised include:

- There is very little data available about the effects of H₂S on combustion efficiency. The efficiency correlations developed by the University of Alberta are based on alkane (straight-chain hydrocarbon) fuels plus carbon dioxide (CO₂) and nitrogen (N₂).
- Some appurtenances (i.e. flare tips) can degrade flare performance at moderate and high wind speeds. Corrosion or other damage to appurtenances can affect design performance and flare efficiency.
- Most toxic compounds are found in the soot particles rather than the gas, therefore sooty or smoking flares are not efficient.
- There is a concern that dioxins could form if produced water gets into the flare.
- Fuel stripping, where fuel escapes unburned, continues to require further research.

7.2 Recommendations

The FVPT defers making recommendations with regard to combustion efficiency standards, as sufficient information is not yet available. Research should be focused on further understanding the relationship between gas composition and flare combustion efficiency and on the further development of methods for calculating and measuring in situ flare efficiency. This work should include investigating the effects of hydrogen sulphide on combustion efficiency.

Additional research is required to better understand fuel stripping (or fuel slip); the ability of fuel to escape the combustion zone without any reaction. This has been identified as a major cause of inefficiency. A means of reducing fuel stripping should be investigated.

Further work is needed on developing protocols for measuring combustion efficiency in the field. The results of the 2003 DIAL LIDAR monitoring project and any further work done with the same monitoring technique need to be reviewed to determine if, or when, this methodology may become available for commercial use.

More testing of existing and potential new flare tips is needed, as well as flare stack design in general, in order to understand current flare performance and limitations, and to work toward designing flare systems for improved combustion efficiency.

Therefore, the Flaring and Venting Project Team recommends that:

- 37) Government and industry should support further flaring research on understanding the relationship between gas composition and combustion efficiency, including the effects of hydrogen sulphide (H_2S) content.
- 38) Government and industry should support further research on understanding the effects of flare stack design, including appurtenances (flare tips) on combustion efficiency.
- 39) CAPP and SEPAC should develop best management practices for maintaining flare equipment in acceptable condition to ensure good combustion performance.
- 40) The EUB and AENV should take the lead on gathering the latest flaring research and in consultation with stakeholders, update flare performance requirements and combustion efficiency related guidelines as appropriate.
- 41) The EUB, AENV, CAPP and SEPAC should continue to review the results of any field-testing of combustion efficiency monitoring methodologies that are occurring.
- 42) The EUB should review the ignition requirements found in American Petroleum Institute Standard 537 and modify EUB requirements as appropriate.

8. Fugitive Emissions

The FVPT believes that there is the potential for significant reductions in fugitive emissions. While operators may be aware that fugitive emissions exist, the extent of the problem may not be known to all operators. The initial cost of Leak Detection & Repair programs may be a barrier to this work, even though this investment is usually paid back quickly through the recovery of lost product. The FVPT feels there is value in encouraging management in the petroleum industry to make the topic of fugitive emissions a higher priority.

The FVPT recommends that CAPP and SEPAC develop a best management practices document by December 31, 2005 to assist the upstream oil and gas industry in managing fugitive emissions and targeting sources that are most likely to have larger volume emissions and be more cost effective to address.

This document should include guidelines on leak detection and repair on components where greater leakage is likely to occur, components such as:

- Components leaking into flare systems
- Gas leakage from compressor seals, and
- Thief hatches and pressure-vacuum safety valves on tanks.

The document should also give consideration to management of larger process vent sources.

The document should discuss methods of flow indicators which could be used to determine leakage and how this information should be used to guide repair decisions and future maintenance.

An inspection form should be developed for a list of typical problem components and service applications to be routinely checked. A standard check sheet to log vent flows and procedures for using this information to trigger appropriate repairs should be developed.

The FVPT sees value in documenting the reductions in fugitive emissions achieved. It is recommended that the best management practice should also include a methodology for reporting reductions in fugitive emissions as a result of any leak detection and repair programs implemented.

The Flaring and Venting Project Team recommends that:

- 43) CAPP and SEPAC develop a best management practices document by December 31, 2005 to assist the upstream oil and gas industry in managing fugitive emissions and targeting sources that are most likely to have larger volume emissions and which would be more cost effective to address. CAPP and SEPAC will incorporate improvement to emission factors into the best management practices document as they become available.
- 44) Once a best management practices document has been developed by CAPP and SEPAC, the EUB should require licensees to develop and implement leak detection and repair programs to minimize fugitive emissions from upstream petroleum industry facilities.
- 45) In 2007, the FVPT should review the best practices for leak detection and repair, and its use.

9. Other Research Needs

In the course of its work there were several issues identified, in addition to those already mentioned in this report, which will require ongoing research. They include the following:

There are varieties of methods used to stimulate wells for production, some of which involve injecting compounds into the well. While it is likely that the bulk of these chemicals are captured prior to flaring, it is not known what, if any, products of the combustion of these chemicals are emitted by flare stacks. This will require some research to determine if any of these compounds are flared, and, if so, what the products of combustion are.

Concern was raised about the possible emission of heavy metals through flared solution gas. An initial literature search did not result in any information, and the FVPT recommends that more research be done on this issue.

Therefore, the Flaring and Venting Project Team recommends that:

- 46) The Air Research Planning Committee (ARPC), through its research activities, consider examining whether there are any emissions related to the combustion of compounds used in well stimulation, treatment chemicals used downhole, including drilling and subsequent activity.
- 47) The Air Research Planning Committee (ARPC), through its research activities, consider examining whether there are any emissions of heavy metals in flare stack emissions.

10. Coal Bed Methane

Coal bed methane, or Natural Gas from Coal, is being reviewed through a Multi-stakeholder Advisory Committee (MAC) led by Alberta Energy and Sustainable Resource Development. After some discussion with the MAC, it was agreed that the CASA Flaring and Venting Project Team would develop recommendations for the flaring and venting issues related to coal bed methane development. It is hoped that these recommendation will be presented to the CASA board in the fall of 2004. In order to assist in this work stakeholders from the Canadian Society for Unconventional Gas have been invited to participate in this part of the team's work.

11. Review and Further Work

The experience of the last several years has been that flared and vented volumes have been reduced on a year-by-year basis. A cultural change has been occurring within oil and gas companies, which sees operators making conservation rather than flaring or venting the presumed method of handling solution gas. As the requirements become increasingly stringent, and if gas prices continue to rise, it is anticipated that the actions recommended within this report will continue and increase the downward trend in flared and vented volumes. However, the FVPT would like to see a multi-stakeholder review of the framework, including the exemptions for conservation of solution gas flaring and venting, in 2007, in order to determine if any changes are needed. This review would look at the existing data on flared and vented volumes as well as any further information it requires and, if needed, make further recommendations. The data that is to be gathered on well testing will be reviewed in the second quarter of 2005 and recommendations made if needed. (See recommendation 28)

In addition to the overall review of the framework, there are some specific research items whose results will need to be reviewed. Some of these, dealing with flare efficiency, are mentioned above. These additional research items will need to be reviewed.

The Flaring and Venting Project Team recommends:

- 48) The Flaring and Venting Project Team be reconvened to review the framework in the first quarter of 2007.

Appendix 1: Acronyms and Abbreviations

AENV	Alberta Environment
ARPC	Air Research Planning Committee
CAPP	Canadian Association of Petroleum Producers
CASA	Clean Air Strategic Alliance
CO₂	Carbon Dioxide
DIAL	Differential Absorption LIDAR
DST	Drill Stem Tests
EUB	Alberta Energy and Utilities Board
FPT	CASA Flaring Project Team
FVPT	CASA Flaring and Venting Project Team
GB	EUB general bulletin
H₂S	Hydrogen sulphide
ID	EUB interim directive
IL	EUB informational letter
LDAR	Leak Detection and Repair
LIDAR	Light Detection and Ranging
SEPAC	Small Explorers and Producers Association of Canada
SO₂	Sulphur dioxide
m³	cubic metres
MAC	Multi-stakeholder Advisory Committee
N₂	Nitrogen
N0_x	Oxides of Nitrogen
NOWPP	New Oil Well Production Period
NPV	Net Present Value
OFSG	Otherwise Flared Solution Gas
10³m³	1000 cubic metres
10⁶m³	1 000 000 cubic metres

Appendix 2: Glossary

Clustering: The practice of gathering several solution gas flares or vents at a common point for conservation.

Conservation: The recovery of solution gas for use as fuel for production facilities, for other useful purposes (e.g., power generation), for sale, or for injection into an oil or gas pool.

Combustion efficiency: The overall conversion of flared gas to products of complete combustion (i.e., CO₂, H₂O, and SO₂). For the purposes of this guide, combustion efficiency is normally reported as the percentage of carbon in the fuel that is converted to CO₂.

Guide 56: Outlines the EUB's requirements and procedures for filing a license application to construct or operate any petroleum industry energy development that includes facilities, pipelines, or wells.

Guide 60: Provides the EUB's regulatory requirements and guidelines for flaring, incinerating, and venting in Alberta, as well as procedural information for flare permit applications, dispersion modeling, and the measuring and reporting of flared, incinerated, and vented gas. In addition to upstream petroleum industry facilities, the guide also applies to gas transmission facilities licensed by the EUB.

Solution gas: All gas that is separated from oil or bitumen production.

Solution gas flaring baseline: for comparison purposes, the volume of solution gas flared in 1996, which was 1340 10⁶m³. Flared solution gas volumes for other years are compared with this figure.

Solution gas venting baseline: for comparison purposes, the volume of solution gas vented in 2000, which was 704 10⁶m³. Vented solution gas volumes for other years are compared with this figure.

Appendix 3: CASA Flaring and Venting Project Team Members

Brown, Michael	Alberta Energy and Utilities Board - Co-chair
Cormier, Jeff	Alberta Department of Energy
Denman, Keith	Clean Air Strategic Alliance (former Project Manager)
Dhaliwal, Gur	Alberta Department of Energy
Dobko, Randy	Alberta Environment
Drinkwater, John	BP Canada Energy Company
Guyon, Bart	Alberta Association of Municipal Districts and Counties
Hillier, Wayne	Husky Oil
Idriss, Ahmed	Clean Air Strategic Alliance (Project Manager)
Johnson, Kevin	Western Canada Offsets team
Kostuch, Martha	Prairie Acid Rain Coalition
Mackenzie, Alex	Alberta Health and Wellness
Parr, John	Canadian Natural Resources Limited
Peter M. Jones	Alberta Energy and Utilities Board
Peace, Ian	Resident for Accountability in Power Industry Development
Pirker, Henry	South Peace Environmental Association
Ranger, Barry	Small Explorers and Producers Association of Canada
Sargent, Gary	Alberta Cattle Commission (Corresponding Member)
Severson-Baker, Chris	Pembina Institute for Appropriate Development (Co-Chair)
Smith, Ralph	Wildrose Agricultural Producers
Spangelo, Jim	Alberta Energy and Utilities Board
Squarek, John	Canadian Association of Petroleum Producers (Co-chair)

Appendix 4: Summary of 2002 Recommendations

Last year the FVPT recommended a firm reduction target of 50% of the 1996-revised baseline be adopted for solution gas flaring to ensure that the gains made to date were maintained.

The FVPT also recommended that the frequency and volume of flaring and venting be reduced through the implementation of a series of decision trees similar to the solution gas flaring decision tree for venting, facility flaring, and well test flaring.

Its 2002 recommendations were broken down in the following categories:

- Solution Gas Flaring
- Solution Gas Venting
- Facility Flaring
- Well Test Flaring
- Flare Performance Standards

Solution Gas Flaring

1. 670×10^6 m³/year be established as the flaring reduction target to be achieved by the end of 2002 (equivalent to 50% of the 1996 revised baseline).
2. If solution gas flaring exceeds the 670×10^6 m³/year target in any given year, the EUB should impose flaring limitations on non-conserving flaring batteries that will result in sufficient reductions of flared gas to ensure that the target will be achieved in subsequent years.
Reductions should take the form of restricting flare size so there are no solution gas flares larger than 500×10^3 m³/year per battery—or such other maximum flaring rate (for nonconserving batteries) that would reduce total solution gas flared in subsequent years to less than 50% of the 1996 revised baseline. The maximum site flaring limit would be determined by analysis of flare size distribution versus cumulative solution gas flaring volumes in the year the exceedance of the target occurred.
3. Changes should be made to EUB Guide 60 parameters for solution gas conservation economic evaluations as follows:
 - a. Assumed operating costs should be increased to 20% of capital costs for sour solution gas conservation evaluations.
 - b. An industry standard electricity price forecast should be used for solution gas conservation evaluations.
4. The Alberta Department of Energy should extend the OFSG program to bitumen wells.
5. Industry should be requested to submit summary information on decision tree evaluations to the EUB by January 31, 2003, for all routine solution gas flares where conservation was not implemented as of December 31, 2001, including all evaluations completed in 2002. Operators are already required to have this information available for audit purposes under Guide 60, Section 2.4
6. The EUB should issue a general bulletin immediately informing industry that it will be requiring operators to submit summary information on decision tree evaluations.

7. Discussions on future solution gas flare reduction targets are deferred until 2003.
8. The FVPT should be reconvened in the first quarter of 2003 to:
 - a. Evaluate the industry summary information—the evaluation should include development of cost curves for conserving flared solution gas;
 - b. Discuss appropriate future solution gas flare reduction targets;
 - c. Discuss opportunities for government/industry cost-sharing;
 - d. Discuss the potential requirements for periodic review of solution gas flares that have not yet been conserved under the management framework; and
 - e. Make related recommendations.
9. The EUB should provide a mechanism to address concerns regarding the application of the Guide 60 provision that allows operators to apply for exemptions from production curtailment requirements during conservation facility outages.

Solution Gas Venting

10. The EUB and industry should apply the solution gas venting decision tree to all new vent sources immediately.
11. The EUB and industry should apply the solution gas venting decision tree to existing vent sources as follows:²¹
 - a. All companies with less than 50 vent sources²² larger than 800 m³/day²³ should
 - i. By December 31, 2002, evaluate all vent sources greater than 800 m³/day and by December 31, 2003, implement conservation at sources that were evaluated during 2002 and were determined to be economic.
 - ii. By December 31, 2003, evaluate all vent sources greater than 500 m³/day and by December 31, 2004, implement conservation at sources that were evaluated during 2003 and were determined to be economic.
 - b. Companies with more than 50 vent sources larger than 800 m³/day should have the option to manage the vent source evaluations either on the basis of item (a) above or on the basis of total vented volumes by complying with the following:
 - i. By December 31, 2002, evaluate 50% of the vented volumes reported by the company from all sources, and by December 31, 2003, implement conservation at all of the sources that were evaluated during 2002 and were determined to be economic.

²¹ GB 2002-05: EUB Requirements for Evaluation of Solution Gas Vent Gas Conservation, *EUB, May 2002*.

²² A source is defined as all gas vented from a single operating site, such as an oil battery, oil well, or multiple well pad. The EUB will initially use battery records for administering the program and will make appropriate allowances when operators identify situations where multiple sources are reported through a single battery.

²³ The 800 m³/day and 500 m³/day criteria for determining sources that must be evaluated will be based on the annual average daily vent rate calculated from EUB year-end data for 2001.

- ii. By December 31, 2003, evaluate 50% of the remaining vented volume from all sources that have not been evaluated, and by December 31, 2004, implement conservation at all the sources that were evaluated and determined to be economic.
 - iii. By December 31, 2004, evaluate the remaining vent sources greater than 500 m³/day, and by December 31, 2005, implement conservation of all remaining sources that were determined to be economic.
 - iv. Companies that conduct vent source evaluations based on option (b) should have a plan in place by December 31, 2002, that includes the following information, which should be available to the EUB on request:
 - 1. A complete list of vent sources that includes 2001 or subsequent year venting rates, locations, and reporting battery codes;
 - 2. A list of vent sources to be evaluated and a related evaluation schedule; and
 - 3. A current summary of vent sources evaluated in each year.
12. Provision should be made by the EUB for situations where circumstances beyond an operator's reasonable control prevent meeting timelines for implementing conservation.
13. The Alberta Department of Energy should extend the OFSG royalty waiver program to crude oil and bitumen solution gas vent sources.
14. Industry should be requested to submit summary information by January 31, 2003, on decision tree evaluations to the EUB for all routine solution gas vent sources evaluated by December 31, 2002.
15. The discussion of routine solution gas vent reduction targets should be deferred until 2003.
16. The FVPT should be reconvened in 2003 to:
- a. evaluate the industry summary information—the evaluation should include development of cost curves for conserving vented solution gas;
 - b. Discuss setting future vent gas reduction targets;
 - c. Discuss a schedule for evaluating remaining solution gas vents;
 - d. Discuss opportunities for government/industry cost-sharing;
 - e. Discuss the potential requirements for periodic review of solution gas vent sources that have not yet been conserved under the management framework; and
 - f. Make related recommendations.

Facility Flaring

17. The EUB and industry should adopt the facility flaring decision tree for assessment of options for gas plant flaring.
18. The maximum annual total gas plant flaring limits should be established as:
 - a. 1.0% of receipts in the first year of operation and 0.5 % each year thereafter (this is the current EUB requirement for plants) for plants processing less than 1.0 billion (109) m³/year; and
 - b. The greater of 5.0 106 m³/year or 0.2% of receipts for plants processing more than 1.0 109 m³/year.
19. Gas plants should not have more than six flaring events in a six-month period, as defined in the following table:

Approved Plant Inlet Capacity	Flaring Event *
> 500 10 ³ m ³ /d	100 10 ³ m ³ or more
150 - 500 10 ³ m ³ /d	20% of plant 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 where the specified flared volumes are exceeded would be 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 four days at a continuous rate of 25 10³ m³/d would be considered to be one event).

Enforcement consequences for exceedance of the “number of events” (six flare events in a six-month period) should consider the following:

- a. Gas plant operators should be required to monitor flaring events using the facility flare log (flare logs are a current EUB requirement for all facilities). In addition to reporting flare events as required by Guide 60, operators should be required to track the number of flaring events and report exceedance of the “number of events” criterion.
- b. Failure to report an exceedance of six flaring events in a six-month period should constitute a major non-compliance and should result in appropriate EUB enforcement ladder consequences.
- c. Within one month of exceeding the “number of events” criterion, operators should use the facility flaring management framework and submit a plan to correct the situation. The plan should lay out clear timelines and list capital expenditures to correct the associated problems. Any plant modifications should be expected to be on an expedited timeline.
- d. Once the plan has been agreed to by the EUB and the time for corrective action has expired, the EUB should take enforcement action if another exceedance of the “number of events” criterion occurs within 24 months following the time allowed for implementing the plan.
- e. If there is no exceedance of the “number of events” criterion over a continuous 24-month period, the enforcement level should be returned to compliant.

20. CAPP and the Small Explorers and Producers Association of Canada (SEPAC) should develop best management practices guidelines for facility flaring that addresses design and operational options to reduce flaring.
21. The EUB and industry should adopt the facility flaring decision tree for assessment of options for other upstream facility flaring.²⁴
22. The EUB should require separate reporting of flare and vent volumes at upstream petroleum industry facilities.
23. The EUB should review available flaring/venting data on gas gathering systems and gas batteries and make summary information available. This summary should include:
 - a. Information on gas battery and gas gathering systems, as follows:
 - i. Flare distributions by size for gas gathering systems and gas batteries;
 - ii. Geographic information systems (GIS) distribution across the province by flaring and venting for gas gathering systems;
 - iii. GIS distribution across the province for gas batteries with flaring and venting reported separately; and
 - iv. GIS representation of odour complaint distribution, with flaring and venting thematically drawn for gas gathering systems; and
 - b. Information on flare notifications as follows:
 - i. Summary data of flaring notifications for gas gathering systems as reported by each EUB field centre—details should include the rate and duration of flaring, number of public notifications, number of objections, estimated flare volumes, and number of events.
24. The FVPT should be reconvened in 2003 to:
 - a. Evaluate the industry summary information on facility flaring;
 - b. Discuss limits on other upstream facilities; and
 - c. Discuss the potential requirements for periodic review of flaring and venting from facilities.
25. Sour gas plant operators should adopt the preferred practice of minimizing sour gas and acid gas flaring, although in doing so, incinerator stack contraventions could result. This is the right choice and should be strongly endorsed by industry, AENV, and the EUB. As well, CAPP and SEPAC should identify this as a best management practice.
26. AENV should advise its investigators that they should consider the circumstances that led to incinerator stack contraventions, and the focus of their investigation should be on the root cause of the problem. The investigators should consider that processing acid gas through sulphur recovery facilities, even though it may result in increased incinerator stack contraventions, is generally a better alternative than flaring sour inlet or acid gas.
27. AENV should advise operators of opportunities to further mitigate the potential of incinerator stack contraventions by preapplying to AENV for known start-up, shutdown, or specific process conditions that may cause a contravention.

²⁴ EUB Guide 60, Section 1.1, requires all solution gas flares to be evaluated by the end of 2002 and all other permanent facility flares to be evaluated by the end of 2004.

Well Test Flaring

28. The EUB and industry should adopt the well test flaring decision tree for assessment of options to eliminate or reduce well test flaring.
29. During the upcoming review of Guide 56, the EUB should:
 - a. Review its requirements to ensure that operators disclose plans for flaring at the well application stage as part of public notification and consultation;
 - b. Require operators to notify the public if commitments regarding flaring made during the well application process are subsequently changed. This would provide the public with access to rights currently available through the EUB regulatory process;
 - c. Facilitate stakeholder input on public notification and consultation distances for well applications.
30. CAPP and SEPAC should develop best management practices guidelines for well test flaring.
31. The FVPT should be reconvened in 2003 to discuss:
 - a. Maximum flare volumes for well testing and completions;
 - b. A maximum limit on sulphur emissions related to well test or completions flaring; and
 - c. Public notification distances for well test flaring.
32. The EUB should more incorporate well test flaring data into the annual statistical series report ST-60B: Upstream Petroleum Industry Flaring Report. Information should include the following:
 - a. Total volumes flared for completion and testing of wells;
 - b. Total sulphur emissions from completion and testing of wells;
 - c. Provincial ranking of well completions and test flaring by company,²⁵ including:
 - i. Number of wells tested;
 - ii. Total volume flared; and
 - iii. Total sulphur emissions.
33. The EUB should ensure that adequate information is reported for each well test involving flaring, including:
 - a. The flare permit volumes applied for, approved, and actually flared;
 - b. Volumes flared from well completions and testing that do not require flare permits;
 - c. The purpose of well test flaring (i.e., cleanup or testing) and type of well (i.e., exploratory or development);
 - d. H₂S content of flared gas and total sulphur emitted during flaring; and
 - e. Duration of well completions and test flaring.

²⁵ Special consideration should be given by the EUB to limit disclosure of data where applicants have a limited number of well tests such that public reporting in this format compromises the confidentiality of an exploration venture.

34. The EUB should consider waiving flare permit requirements for operators conducting in-line testing, where they are proposing to flare only small volumes of gas containing less than one tonne per day of sulphur.

Flare Performance Standards

35. The EUB should continue to monitor research and update flare combustion efficiency related guidelines as appropriate on the following:
 - a. Minimum gas heating values and consider complaint histories for acid gas flaring to determine if heating value requirements should be amended; and
 - b. Other flare stack design parameters including minimum gas exit velocity.
36. The EUB should review its design standards and operational requirements for liquids separation technologies.
37. The EUB should review current guidelines with respect to minimizing smoking and sooty flares.
38. Government and industry should continue to fund research toward:
 - a. Developing design correlations and measurement protocols for flare combustion efficiency;
 - b. Improving the understanding of the phenomenon of fuel stripping and its causes, with the ultimate goal of defining operating limits for minimizing fuel stripping;
 - c. Understanding how flare tip additions such as wind-shrouds affect combustion performance;
 - d. Evaluating the effects of brine carry over on the formation of hazardous flaring products;
 - e. Evaluating the effects of H₂S on combustion efficiency and the formation of products of incomplete combustion; and
 - f. Gathering field data on the characteristics of actual stream entering the flare stack (including size and composition of fuel droplets, solution gas compositions, and flow rates).

The FVPT be reconvened in 2003 to discuss the findings of flaring research and the potential of setting combustion efficiency standards.

Appendix 5: Terms of Reference for the CASA Flaring and Venting Project Team

Purpose

- 1) To assess the performance and make recommendations regarding the Alberta solution gas flaring management framework.
- 2) To develop recommendations to address a broader range of flaring and gas venting issues in Alberta.

Objectives

- 1) Determine whether the solution gas flaring reduction targets for 2000 and 2001 have been met.
- 2) Determine, based on improved information, firm future reduction targets, time lines, and threshold volumes for solution gas flaring.
- 3) Evaluate the royalty treatment of flared and vented gas cost sharing programs and their implication for achieving future reduction targets.
- 4) Evaluate the approval process and determine if fixed-term approvals are required.
- 5) Review performance requirements and efficiency standards, and determine the feasibility of combustion efficiency standards for all flares.
- 6) Assess research findings and their implications for management of flaring and venting.
- 7) Review information on gas venting and mitigating approaches, and recommend a venting management framework, including short-term actions and long-term strategies.
- 8) Review and develop recommendations with regard to the EUB Guide 60 and Guide 60: Updates and Clarifications documents.
- 9) Develop recommendations for a strategy to respond to the issues associated with flaring and venting.

Note

Objectives (1) through (6) came from Section 6.0 of the CASA Flaring Project Team's 1998 report. To reflect the broader scope of the FVPT, objectives (3) and (6) have been expanded to include all flaring and venting and (5) to include all flaring.

Context

The Terms of Reference for this project team supports the objectives identified in CASA's *Business Plan 1999-2002* and fits well within the priorities, values, and expectations of the Board, and is in accordance with the CASA vision for air quality.

Recommendations developed by the project team will reflect CASA's goals for air quality in Alberta, namely:

- Protect the environment.
- Optimize economic performance and efficiency.
- Seek continuous improvement.