Flaring and Venting Project Team Report

Prepared by the CASA
Flaring and Venting Project Team

For the CASA Board of Directors

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Flaring and Venting Project Team Report

Clean Air Strategic Alliance

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About CASA

The Clean Air Strategic Alliance is a multi-stakeholder partnership composed of representatives selected by industry, government and non-government stakeholders. All CASA groups and teams, including the board of directors, make decisions and recommendations by consensus. The CASA vision is: The air will have no adverse odour, taste or visual impact and have no measurable short or long-term adverse effects on people, animals or the environment.

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Executive Summary

Flaring and venting of solution gas has been a long standing issue of concern for Albertans that was first brought to the Clean Air Strategic Alliance (CASA) Board of Directors in November 1996. Since that time, the CASA Board has created several iterations of a Flaring and Venting Project Team. In turn, these teams have created a number of recommendations to achieve the goal of reducing routine flaring and venting of solution gas. A number of these recommendations have been implemented through regulations and best management practices and resulted in significant reductions in flaring and venting. In 2008, conservation efficiency was at 95.4%. Since its peak in 2006, conservation has decreased steadily, largely due to an increase in solution gas venting from bitumen production. The complete elimination of routine flaring and venting of solution gas has not yet been achieved.

In March 2008, CASA approved a revised terms of reference for the current Flaring and Venting Project Team (FVPT). As per its terms of reference, the FVPT was created to *assess the performance of the upstream oil and gas industry in managing flaring and venting and make recommendations regarding the Alberta flaring and venting management framework.* To do this, the Team looked at what was recommended by the previous FVPT in 2004 and 2005, which recommendations were implemented, and the current trends in solution gas conservation. The Team identified a number of technical and economic topics for further exploration that could have the potential for further reductions in routine solution gas flaring and venting.

At the conclusion of its work, the FVPT could not agree on how to achieve further reductions in routine solution gas flaring and venting. The Team did agree on areas of work needed to fill information gaps. The Team hopes that filling these gaps will provide the necessary information for work to reduce routine solution gas flaring and venting in the future.

Flaring and Venting Project Team Recommendations

No.	Recommendation	Page
1	**Annual Inflation Factor for Net Present Value** The ERCB should adjust the threshold for the Net Present Value each time Directive 60 is updated, to reflect an annual inflation factor in accordance with the Consumer Price Index, using 2006 (-$50,000) as the baseline year.	26
2	**Review of Well Test Time Limits** The ERCB conduct a review of well test time limits for heavy oil and bitumen by June 2013. The ERCB should share the results of the study with industry and the CASA Board of Directors.	27

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1.0 Introduction

Flaring and venting of solution gas at well sites, well flare testing, and flaring at facilities has been a long standing issue for Albertans. Efforts have been made to reduce flaring and venting in Alberta in response to concerns about the combustion efficiency of solution gas flaring, the nature of the by-products of incomplete combustion, the potential for emissions from flares and vents to cause health effects in humans and animals, and the wasting of a non-renewable resource. Additionally, emissions from flaring and venting (carbon dioxide and methane) contribute to rising global levels of greenhouse gas emissions in the earth's atmosphere.

Flaring is the intentional act of burning natural gas, including solution gas (gas produced in conjunction with oil extraction) that is not used, captured or sold due to technical or economic limitations, as part of well testing, or in emergencies due to safety concerns. Venting is the intentional release of natural gas into the atmosphere. Venting has typically been used to dispose of quantities of natural gas that are not economic to use and cannot be flared.

In 1999, CASA stakeholders created a flaring and venting framework. Through the implementation of the framework, solution gas flaring decreased by 77% from 1340 $106m^3$ in 1996 to 306 $106m^3$ 2008. Solution gas venting has decreased by 53% from 704 $106m^3$ in 2000 to 373 $106m^3$ in 2008. The framework has been extended to include facility flaring, well test flaring, and venting of solution gas, resulting in even greater emissions reductions.

In 1999, CASA was recognized with its first Emerald Award for Environmental Excellence for this work. The project also won the Canadian Council of Ministers of the Environment (CCME) Pollution Prevention Award in 2005.

1.1 About the Flaring and Venting Project Team

The Canadian Association of Petroleum Producers (CAPP) first brought the solution gas flaring issue to the Clean Air Strategic Alliance (CASA) Board of Directors in November 1996. In response, CASA established the Flaring Project Team in February 1997 to develop recommendations to address potential and observed impacts associated with solution gas flaring. In its report presented to the CASA Board in June 1998, the 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. The Team's recommendations, for the most part, were implemented by the Alberta Energy Resources Conservation Board (formerly the Alberta Energy and Utilities Board), which initiated new requirements for upstream flaring. These requirements were detailed in *Guide 60: Upstream Petroleum Industry Flaring Guide.*

In September 2000, CASA established a new project team, the Flaring and Venting Project Team (FVPT), to assess the performance of and make recommendations regarding the solution gas flaring and venting management framework for Alberta. The FVPT released a report in June 2002 detailing

their findings and recommendations. The FVPT's work was reflected by a revision to Guide 60 (Dec. 2002).

During its work, 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 on the economics of solution gas flaring and venting be collected by industry and reported to the Energy Resources Conservation Board (ERCB) during 2002 and analyzed in early 2003. The Team reconvened in 2003 and continued its work, starting with an analysis of the data that had been collected. The Team also addressed a number of items that had been deferred in its 2002 report.

The team's second report, which included recommendations to reduce solution gas venting, was approved and released in September 2004. Again, team recommendations were largely implemented through revisions to the Energy Resources Conservation Board's (ERCB) Guide 60, which eventually became Directive 60 (D60), released on November 16, 2006. The latest updates to D60 came into effect January 31, 2007, providing regulatory requirements and guidelines for flaring, incinerating and venting in Alberta. The Directive is aligned with the ERCB and FVPT's goal of reducing flared, incinerated or vented volumes of solution gas by the upstream petroleum industry in Alberta.

The FVPT has a stated goal of eventual elimination of routine solution gas flaring and venting. Using the data provided by industry in 2003, the FVPT recommended that the ERCB require companies to undertake an economic evaluation to determine whether conservation of solution gas is required[1]. Under the revised D60, solution gas conservation is required if the Net Present Value (NPV) of solution gas conservation is greater than -$50,000, using the economic evaluation method prescribed in D60 (see Appendix A for a list of previous team reports).

In March 2008, CASA approved a revised terms of reference for the FVPT (Appendix C). The goal of the current Team is to assess the performance of the upstream petroleum industry in managing flaring and venting and to make recommendations regarding Alberta's flaring and venting management framework. A list of team members is provided in Appendix D. The Team's objectives, and the section of the report describing how they were met, are provided in the table below:

[1] Flaring and Venting in Alberta, Report and Recommendations for the Upstream Petroleum Industry, September 2004

OBJECTIVE	SECTION OF REPORT
1. Evaluate progress in reducing flaring and venting.	1.2.1 and 1.2.2
2. Review the status of the recommendations of the Flaring and Venting Project Team (2004 and 2005 reports).	1.2.1
3. Assess research findings and their implication for the management of flaring and venting. Determine other research needs and recommend further research.	2.1
4. Review flare performance requirements and efficiency standards and determine the feasibility of combustion efficiency standards for all flares.	2.1
5. Assess the feasibility of setting a date for the elimination of routine solution gas flaring and venting at new facilities.	2.2
6. Review the upstream petroleum Flaring and Venting Management Framework and make recommendations for further improvements.	3.0

1.2 Past Management of Solution Gas Flaring and Venting in Alberta

Since the first series of CASA recommendations were implemented in 1998 for flaring and in 2002 for venting, Alberta has achieved considerable success in improving solution gas conservation rates. However, the complete elimination of routine flaring and venting of solution gas has not been achieved.

Additionally, since its peak in 2006, the ERCB has observed a slight decrease in conservation. To understand the reasons for this decrease in conservation rates, the FVPT decided to review recent flaring and venting trends and activity. To do this, the Team looked at what was recommended by the FVPT in 2004 and 2005, what recommendations were implemented, and the current trends in solution gas conservation (See the Summary of Implementation of Recommendations in Appendix E).

1.2.1 Status of Recommendations from 2004 and 2005 Team Reports

In the September 2004 report entitled "*Gas Flaring and Venting in Alberta: Report and Recommendations for the Upstream Petroleum Industry*", 37 recommendations[2] were targeted at the ERCB for implementation through revisions to D60. These revisions focused on the conditions for requiring conservation; how solution gas venting could occur; requirements for well test flaring; flare performance standards; and fugitive emissions management. As reported at the November 2006 CASA Board meeting, all 37 recommendations requesting modification to D60 were implemented.

Three of the recommendations in the 2004 report were targeted at Alberta Energy[3]. Two of the recommendations were implemented through the continuation of the royalty waiver under the *Otherwise Flared Solution Gas Program.* However, as of January 2009, the number of companies participating in the program fell dramatically. The Team discussed some possible reasons for this, including concerns about administrative burden, the 10-year maximum for participation, and the potential drop off of wells that were grandfathered into the program in the 1990s. The third recommendation to continue the Third Tier Exploratory Well Royalty Exemption program was not implemented as the program was eliminated in January 2009 as per the government's *"New Royalty Framework".*

Four of the 2004 recommendations were targeted at industry for implementation[4]. These recommendations focused on the development of several best management practices (BMPs) around venting, well-test flaring, and fugitive emissions. One of four BMPs is now available on the CAPP website, one BMP has been replaced by regulation and two BMPs are currently being revised. A detailed status update on the BMPs is provided in Appendix E.

Two recommendations in the 2004 report were directed to the Air Research Planning Committee[5] of the Petroleum Technology Alliance Canada (PTAC). The recommendation to examine emissions related to the combustion of compounds used in well stimulation and treatment chemicals used down hole was forwarded to the Air Research Planning Committee and they are presently considering how to move forward on the research proposal. The second recommendation, on emissions of heavy metals in flare stack emissions was carried out as research completed by Al Chambers of the Alberta Research Council[6].

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[2] Recommendations to be implemented by the ERCB were 1 – 13, 15 – 25, 28, 29, 30, 32, 33, 34, 36, 37, 38, 40, 41, 42, and 44.

[3] Recommendations to be implemented by Alberta Energy were 14, 27, and 31.

[4] Recommendations to be implemented by CAPP and SEPAC were 26, 35, 39, and 43.

[5] Recommendations to be implemented by the PTAC Air Research Planning Committee were 46 and 47.

[6] *Potential Release of Heavy Metals and Mercury from the UOG Industry into the Ambient Environment - Literature Review*. Prepared for the Petroleum Technology Alliance Canada; prepared by the Alberta Research Council Inc. October 16, 2009.

Finally, two recommendations in the 2004 report were directed at the CASA Flaring and Venting Project Team[7]. The Team did not address the first recommendation to review best practices for leak detection and repair in 2007 because the fugitive emissions best management practices did not become effective until January 1, 2010[8]. In accordance with the second recommendation, the Team did, however, reconvene to review the management framework in the first quarter of 2007 and has completed the review.

In 2005, the FVPT made ten additional recommendations in their report entitled *"Flaring and Venting Recommendations for Coal Bed Methane: Final Report"*. Work to collect information on this source of emissions was undertaken. Further recommendations directed to the ERCB were implemented through changes to D60[9]. Recommendations 8 and 9 were directed at industry (CAPP) to do a literature review to determine what technologies exist for reducing the volume of nitrogen found in produced gas from coal bed methane well testing (Appendix F). The literature review showed that technologies do exist to reduce nitrogen. However, these technologies are not cost-effective to operate with the small volumes of nitrogen present in well test gas. The FVPT did not develop any further recommendations following the results of this literature review. Lastly, recommendation 10 required that the Project Team undertake a review of the framework for Coal Bed Methane beginning in 2007. This review has been completed.

The Flaring and Venting Project team also completed a report entitled *"Flaring and Venting Review of Well Test Time Limits: Final Report"* in June 2005. The first ten recommendations were directed to and implemented by the ERCB through revisions to D60. Recommendation 11 was for the FVPT to review the audit data provided by the ERCB. In April 2008, the ERCB provided the team with information on the audit of well test time limits.

1.2.2 Trends in Flaring and Venting as per ST60B Reports

To get a better understanding of the issues around flaring and venting, the team analyzed historical flaring and venting data submitted to the Petroleum Registry. Detailed information on solution gas flaring and venting is included in this section of the report. During the analysis, individual companies were approached and asked to help better explain trends that were occurring. As the data was examined in more detail, it became apparent that the initial data set included gas containing CO_2, reported as part of vented volumes. The data provided in this section has been adjusted to remove these volumes. Some key trends are shown in Figure 1 and 2 and Table 1 and 2, including the following:

- In 2008, conservation efficiency was at 95.4%. Since its peak in 2006, conservation has decreased steadily, largely due to an increase in solution gas venting from bitumen production.

[7] Recommendations to be implemented by the CASA FVPT were 45 and 48.
[8] CAPP's "Best Practices for Fugitive Emissions Management can be found on their web site at: http://www.capp.ca/library/publications/industryOperations/Pages/default.aspx#phhz6foDX4v7.
[9] Recommendations to be implemented by the ERCB were 1 – 7.

- The key trends in flaring between 2000 and 2008 are as follows (see Figure 1 below):
  - Solution gas flaring volumes are at an all time low. However, solution gas flaring volumes from bitumen production have remained steady since 2004, aside from a small decrease in 2007.
  - Between 2006 and 2008, well test flaring volumes have decreased 109 million cubic meters, or by 36%.
  - Flaring from gas gathering systems, gas plants and gas gathering systems decreased between 2000 and 2007, but increased slightly in 2008 to 186 million cubic meters (a 5% increase from 2007 levels).
- The key trends in venting between 2000 and 2008 are as follows (see Figure 2 below):
  - Since its all-time low in 2005, venting volumes have increased by 25% or 84 million cubic meters. This increase is mostly due to the increase in solution gas venting from bitumen production.
  - Solution gas venting from bitumen production has been steadily increasing since 2005, with an overall increase of 45% or 79 million cubic meters between 2005 and 2008. This increase is largely attributable to the increase in bitumen production over the same time period.
  - Solution gas venting from crude oil production decreased between 2000 and 2006, but has since increased by 19% from 2006 levels to 125 million cubic meters.

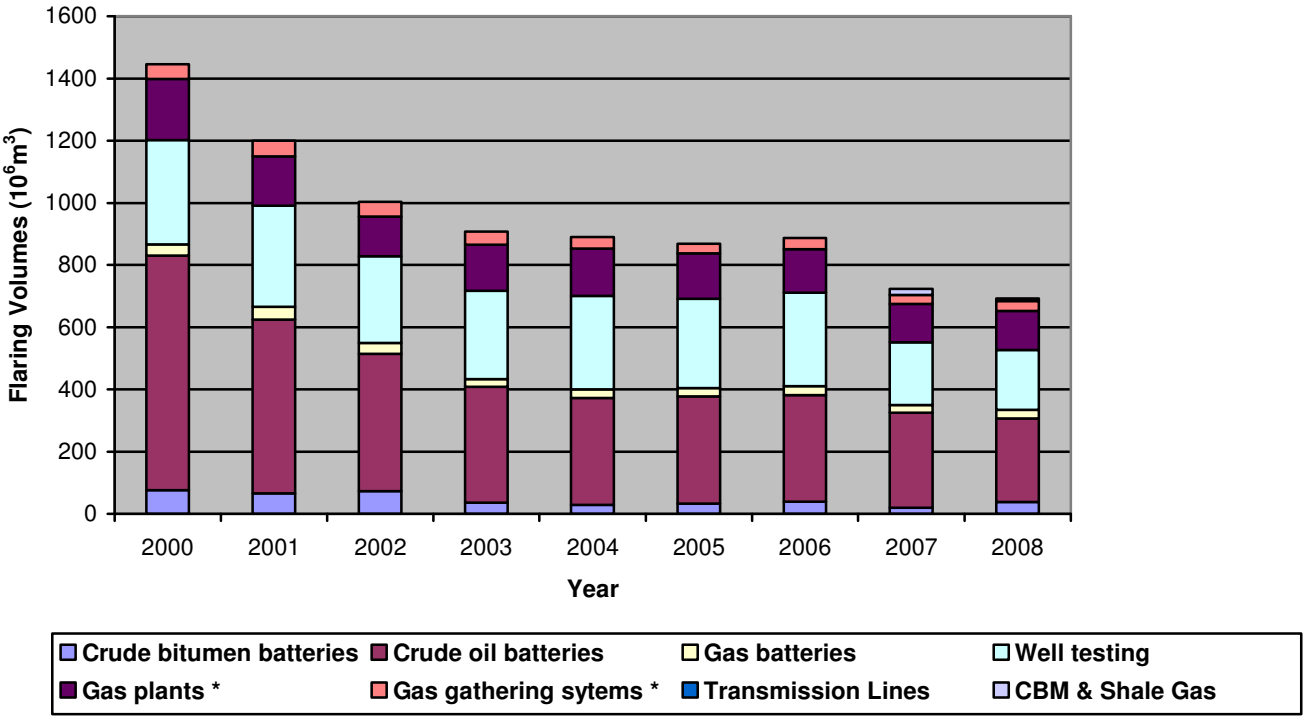

Figure 1 Flaring Volumes by Type (2000 to 2008)

Table 1. Flaring in Alberta from Upstream Petroleum Sources, 2000 – 2008

Year	Crude bitumen batteries 10^6m^3	Crude oil batteries 10^6m^3	Gas batteries 10^6m^3	Well testing 10^6m^3	Gas plants * 10^6m^3	Gas gathering sytems * 10^6m^3	Transmission Lines 10^6m^3	CBM & Shale Gas 10^6m^3	Total 10^6m^3	Total MMcf
2000	76	755	36	335	196	48		n/a	1,446	51,324
2001	66	558	41	326	159	50		n/a	1,200	42,593
2002	73	441	35	280	127	48		n/a	1,004	35,636
2003	36	372	25	284	149	42		n/a	908	32,229
2004	29	343	28	300	153	38		n/a	891	31,625
2005	33	344	27	287	147	31		n/a	868	30,809
2006	39	343	28	301	140	36		n/a	887	31,483
2007	20	305	25	**201**	124	28		20	723	25,662
2008	**38**	**268**	**28**	**192**	**126**	**32**	**2**	**6**	**691**	**24,526**

* The figures for gas plants and gas gathering systems include both flared *and* vented volumes for the years 2000 to 2006.

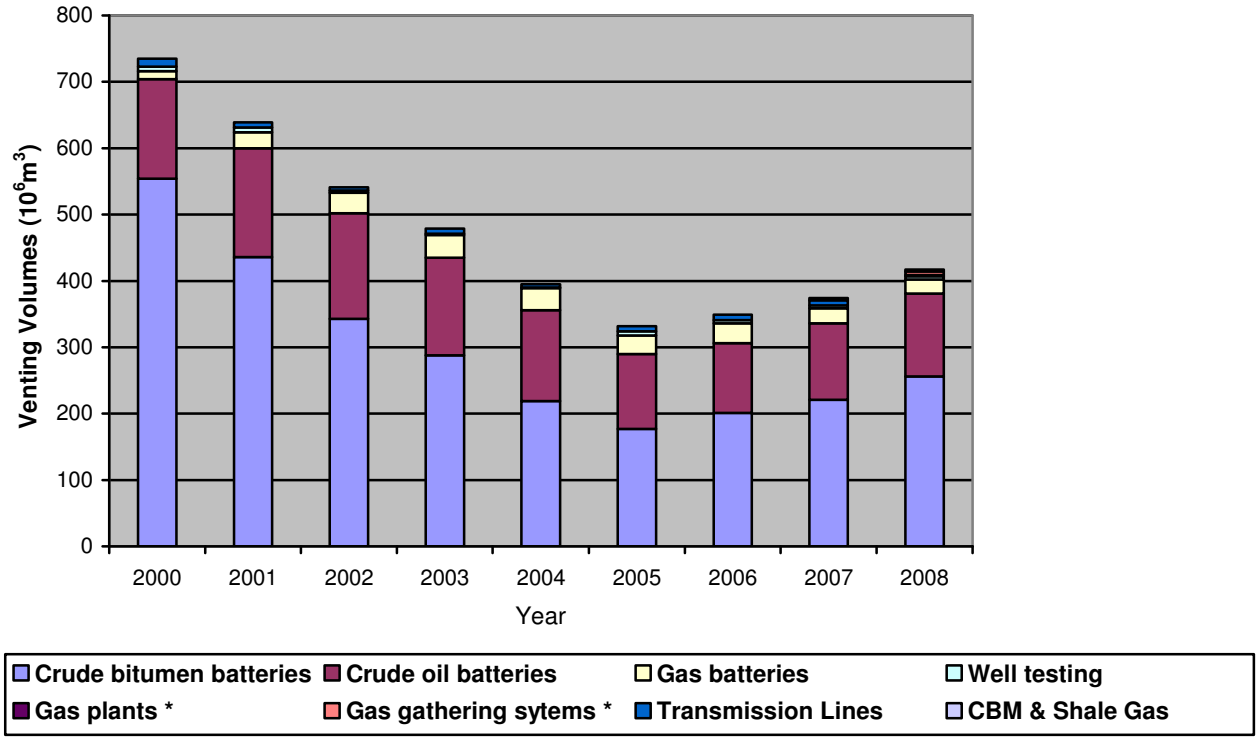

Figure 2 - Venting Volumes by Type (2000 to 2008)

Table 2: Venting in Alberta from Upstream Petroleum Sources, 2000 – 2008.

Year	Crude bitumen batteries 10^6m^3	Crude oil batteries 10^6m^3	Gas batteries 10^6m^3	Well testing 10^6m^3	Gas plants* 10^6m^3	Gas gathering sytems * 10^6m^3	Transmission Lines 10^6m^3	CBM & Shale Gas 10^6m^3	Total 10^6m^3	Total MMcf
2000	554	150	12	7	n/a	n/a	12	n/a	735	26,088
2001	436	164	24	7	n/a	n/a	8	n/a	639	22,681
2002	343	159	31	3	n/a	n/a	5	n/a	541	19,202
2003	288	147	34	2	n/a	n/a	8	n/a	479	17,002
2004	219	137	33	1	n/a	n/a	5	n/a	395	14,020
2005	177	113	28	6	n/a	n/a	8	n/a	333	11,820
2006	201	105	30	5	n/a	n/a	8	n/a	349	12,387
2007	221	115	23	4	n/a	n/a	8	3	374	13,275
2008	**256**	**125**	**21**	**5**	**2**	**5**	**3**	**0**	**417**	**14,804**

Due to rounding, some totals may not exactly match the sum of the source categories

* Venting numbers were not available in previous years

The team focused its work primarily on looking at routine solution gas flaring and venting. In general, reports showed that while conservation of solution gas has improved from 92% in 1996 to 96.3% in 2005, conservation numbers have declined since 2006 (Figure 3 below).

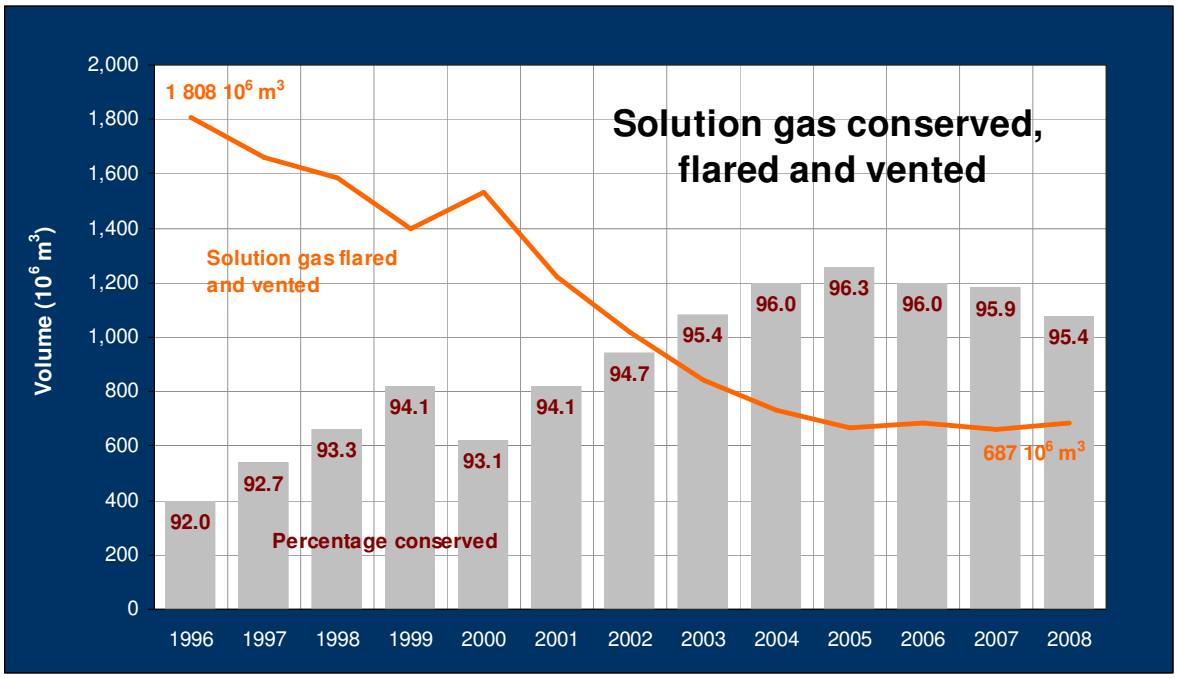

Figure 3. Solution gas conserved, flared and vented in Alberta, 1996-2008 (provided by ERCB).

Figure 4a and 4b show the number of emission sources for solution gas flaring and venting. For these figures, and others in this section, flaring and venting are represented at either the battery or well level (paper batteries are represented entirely at the well level), thus the count of facilities that are flaring and venting is greater than the number of batteries. For 2008, the number of facilities

conserving at less than 90% is about 10-15%. Most facilities (85-90%) were conserving at 90% or more. As one may expect, this smaller number of facilities is representing the largest volume of gas flared and vented.

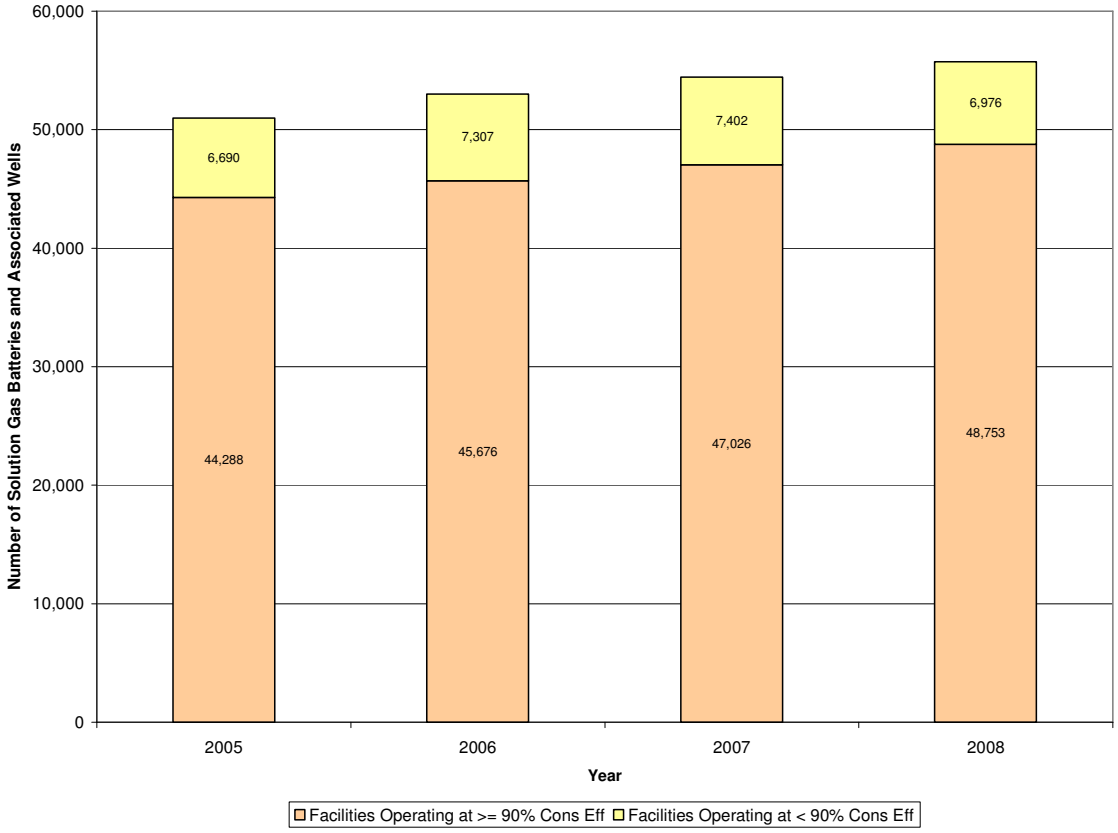

Figure 4a. Number of Operating Oil and Bitumen Batteries and Associated Wells By Solution Gas Conservation Efficiency

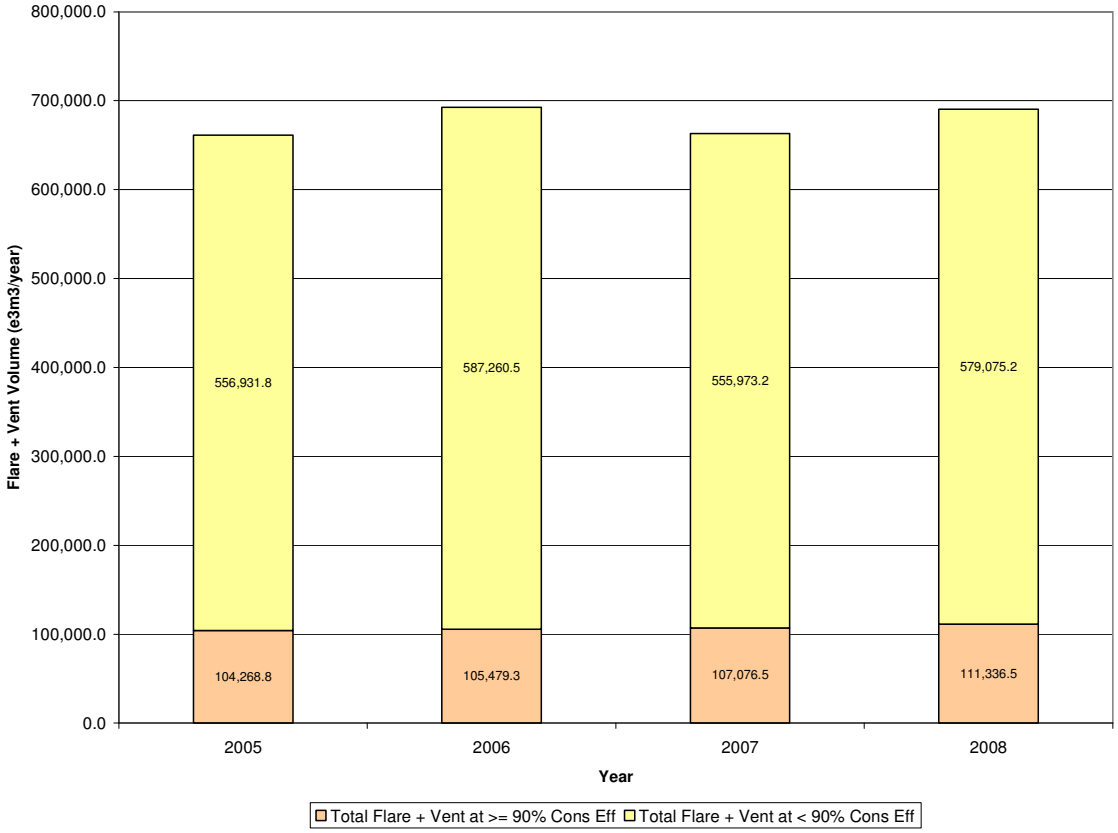

Figure 4b. Solution Gas Flaring and Venting from Oil and Bitumen Batteries and Associated Wells by Conservation Efficiency

If one examines the flare and vent volume associated with the <90% conserving facilities by the online date of production one can see that most of the flare and vent volume (about 1/3) is coming from batteries that came on production in the last 3 years (Figure 5). What is evident is the amount of flare and vent volume coming from batteries which came on prior to the year 2000. At this time additional analysis has not been done but one might expect that a portion of this may come from newer wells tied into older (pre-2000) batteries.

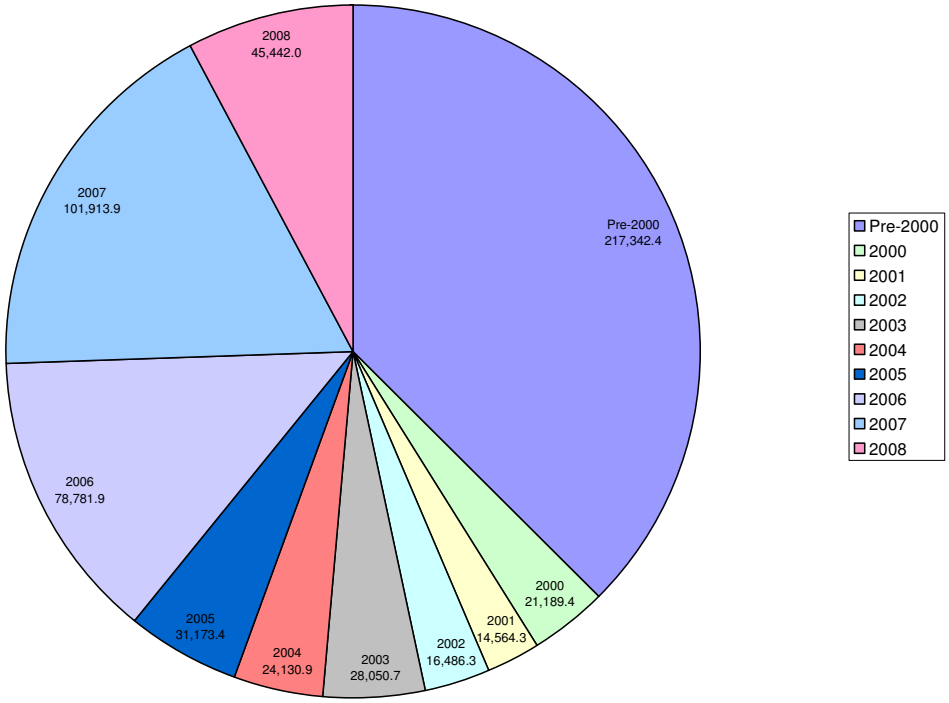

Figure 5. Flaring and Venting in Alberta from Batteries and Associated Wells Operating at <90% Conservation Efficiency by "On Production Date", up to 2008.

We see a relatively large volume (51.6%) coming from smaller flaring and venting batteries (less than 900 m³/d). This is represented by Figure 6 below.

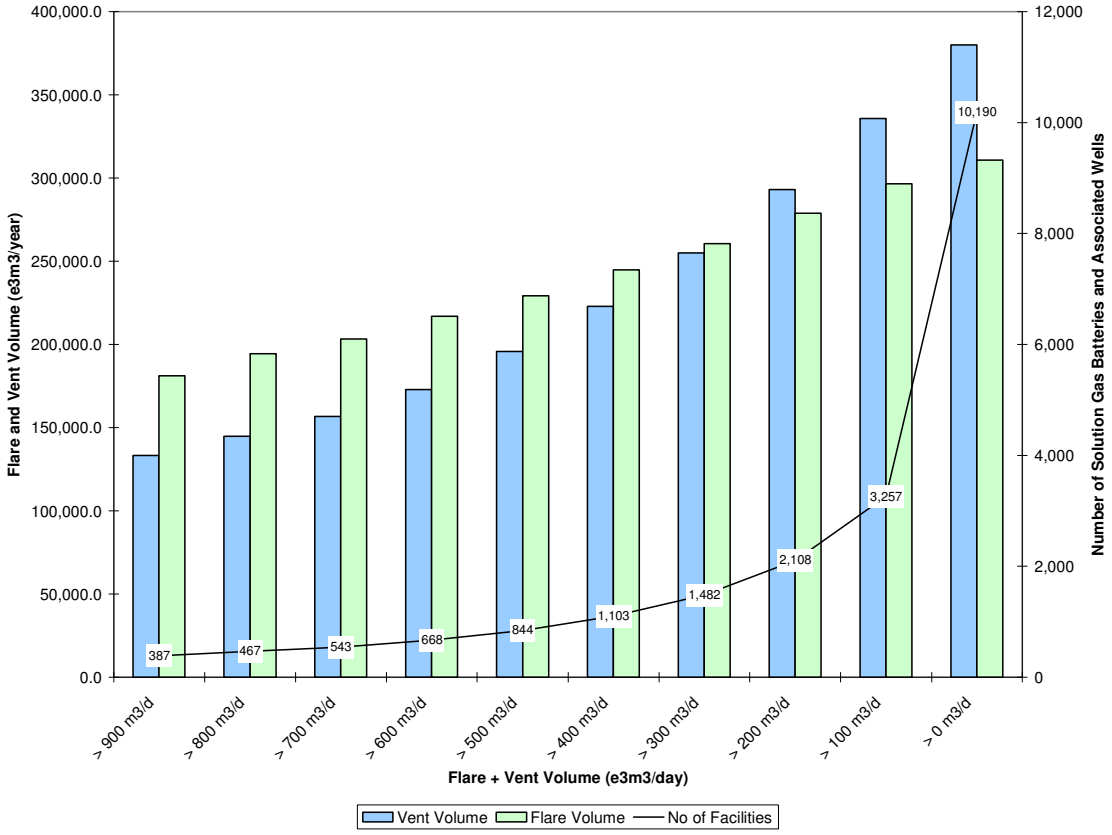

Figure 6. 2008 Solution Gas Flaring and Venting from Oil and Bitumen Batteries and Associated Wells by Daily Volumes.

When examining all batteries producing smaller volumes of gas (<900 m³/d) we see quite high conservation levels, overall, at these sites (Figure 7). Some caution should be taken when viewing this figure as while these smaller batteries are conserving gas today they may represent older batteries which have declined in gas throughput and had put in conservation some ago when gas production at the battery was higher and thus more economic.

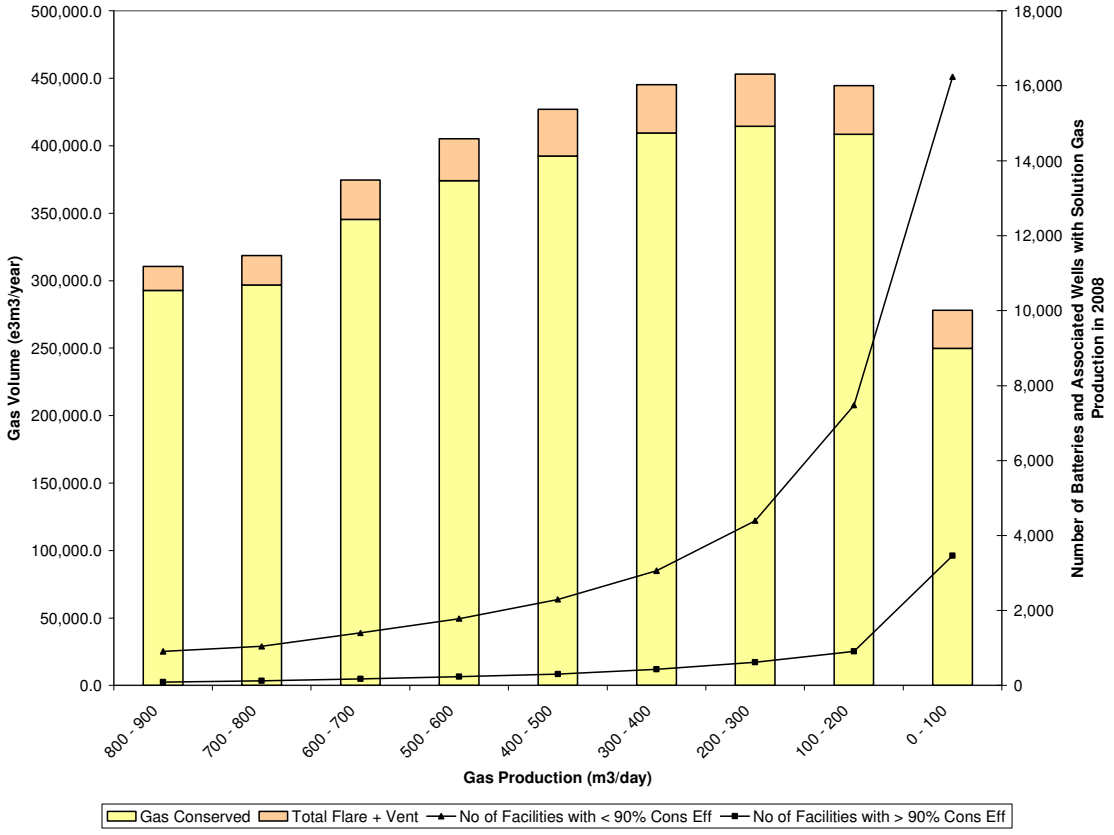

Figure 7. 2008 Conservation at Oil and Bitumen Batteries and Associated Wells by Daily Solution Gas Volumes.

Finally we looked at the largest flaring and venting batteries in the province over time (Figure 8). When examining the top 50 flaring and venting solution gas batteries and wells, one can see this represents a large amount of the flaring and venting taking place (greater than 100 e^6m^3/year).

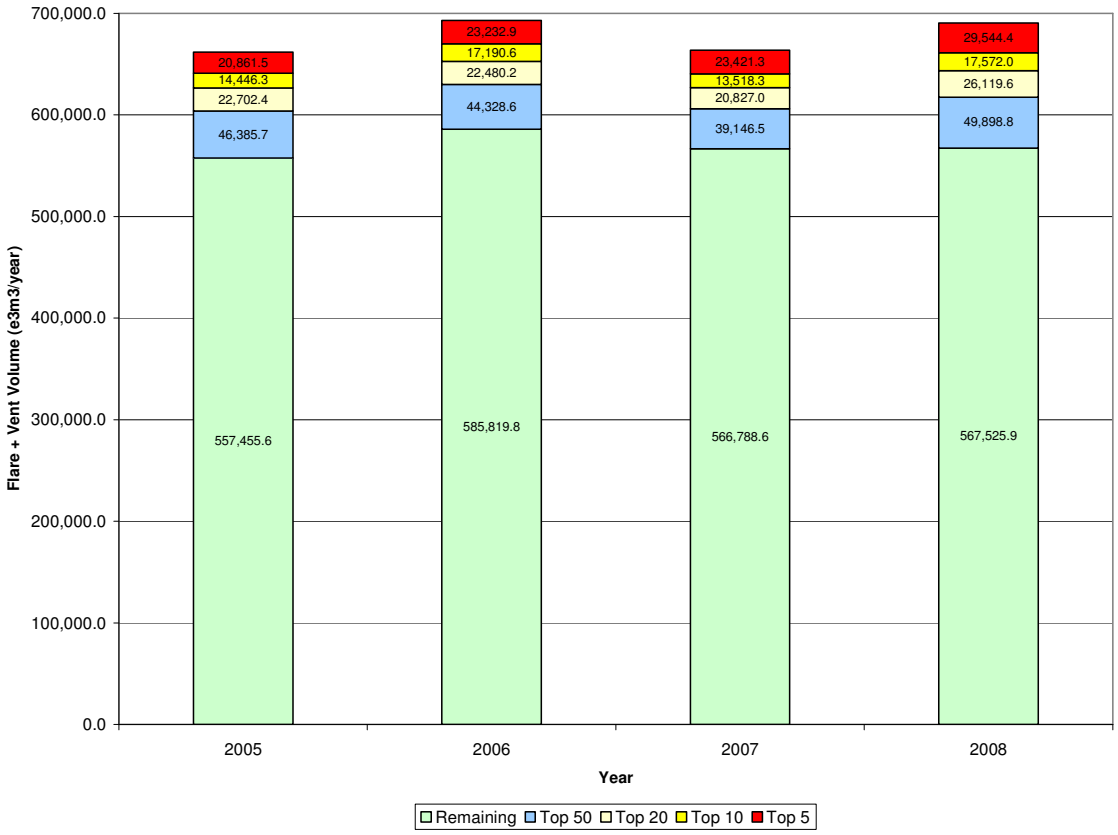

Figure 8. Solution Gas Flaring and Venting from Oil and Bitumen Batteries and Associated Wells by Total Volume Flared and Vented.

Following the ERCB presentation, the Team evaluated the data in more detail, reviewing various maps of the province that showed evidence of increased amounts of flaring and venting volumes in some areas. The team discussed that this was most likely attributable to increases in bitumen production. The team's discussions also included the impact of these trends and how best to pursue further reductions in flaring and venting.

2.0 Project Team Methodology

As the Team was gaining an understanding of past performance of the upstream petroleum industry in managing flaring and venting by assessing incoming data and trends, it also turned its attention to how to improve Alberta's flaring and venting management framework. However, before it could make any recommendations for the elimination of routine solution gas flaring and venting, it required information on the technical and economic implications of eliminating routine solution gas flaring and venting in Alberta and how much of the remaining non-conserved volumes are attributed to routine (versus non-routine) flaring.

The Team also identified the need for a method by which decisions could be made to exempt conservation where the environmental or economic costs of conserving gas are considered too high. Thus they sought existing information on current research and initiatives being undertaken that could provide areas for further conservation gains. They also attempted to determine the economic and environmental costs of mandatory conservation through a contract with Golder Associates.

2.1 Gathering Information on Flare Performance Requirements and Efficiency Standards

To gain a better understanding of current research efforts, the FVPT invited Dr. Matthew Johnson, Canada Research Chair in Energy and Combustion Generated Air Emissions at Carleton University, to make a presentation to the team at their April 2009 meeting. Flaring combustion efficiency research has been performed by several organizations since the early 1980s. Researchers have found that combustion efficiency is dependent on cross-wind velocity, fuel exit velocity, fuel type, heating value of fuel, and stack diameter. Findings also show that the emissions from inefficient combustion are primarily unburned fuel and carbon monoxide (CO).

Dr. Johnson highlighted a need to better understand particulate matter (PM) from flares since it is strongly linked with health concerns and has recently been implicated as a potentially significant contributor to global warming. His presentation included some of the highlights of his experiments on soot, as well as some current unknowns, and future directions of his research. (For more details of this presentation, see Appendix G.)

Dr. Johnson's presentation helped to improve the FVPT's overall understanding of combustion efficiency and particulate matter from flares. The Team agreed with Dr. Johnson's recommendation that, due to the absence of complete information, Alberta should not set a combustion efficiency standard at this time. Hence, while the efficiency of flares and research into emissions from flares continues to be relevant information, the team did not take any further action on this issue.

2.2 Generating New Information on the Feasibility of Setting a Date for the Elimination of Routine Solutions Gas Flaring and Venting at New Facilities

The FVPT wanted to assess the feasibility of setting a date for the elimination of routine solution gas flaring and venting by the upstream petroleum industry. To further pursue this area, the Team hired Golder Associates to:

- Provide a framework for quantifying the site-specific financial costs, including stranded oil. and benefits of eliminating routine solution gas flaring and venting, to both industry and the province; and
- Recommend a structure and/or criteria for exempting the requirement to conserve solution gas at individual sources in cases where the environmental impacts caused by conserving the gas are considered to be greater than the benefits associated with conservation.

Golder undertook work to fulfill the above objectives and produced a final report to the FVPT. The results of this report are discussed in section 3.4.

During the course of its discussions, the FVPT members realized that they were unlikely to reach consensus on developing a set of recommendations based on the elimination of routine solution gas flaring and venting. They therefore initiated discussion on both short term and alternative areas that could be explored for further reductions.

3.0 Potential Areas for Further Reductions to Routine Flaring and Venting

The Team brainstormed a list of potential areas, itemized below, that could be explored further as areas where improvements (further reductions) could be made to routine solution gas flaring and venting. The team was able to identify some areas where more work needs to be completed to make progress on particular issues. However, there was no consensus on specific recommendations for future action to reduce flaring and venting, including accountability and timeframes. The discussion below documents each sector's interests and position related to these items.

3.1 Size Threshold for Economic Analysis

Currently, operators with wells that produce less than 900 m³/d of solution gas are exempt from doing an economic analysis on these wells. The Team discussed whether or not this volume limit could be lowered. Some members felt that the 900 $m^{3/}$d threshold does not need to be revised, as this limit reflects the economic threshold for conservation. Others felt that more work could be done to determine whether a lower limit was feasible. The team concluded that they didn't have enough information on the economic impact of lowering the threshold to reach consensus on a recommendation.

In addition to economic feasibility, the Team also explored the technical limits to conservation of small volumes of gas. A representative from Husky Energy, made a presentation to the Team in November 2009 titled *Casing Gas Conservation: Processes and Challenges*. The presentation indicated that Husky's focus was on conserving volumes of vent gas by compressing and dehydrating for supply to a sales gas distribution network.. Vent gas may be used as fuel on-site, or collected and redistributed for off-site use or sale. Besides having the proper infrastructure, challenges associated with gas conservation include freezing (casing gas suction and discharge line, compressor), erratic or intermittent flow rates, backpressure on wells which can affect oil production, and "line pack" (limit to pressure rating of pipe).

The presentation also indicated there are currently no equipment conservation packages available to conserve solution gas by the method of compression into a gas pipeline for volumes less than 500m³/d. According to the presentation, produced gas volumes lower than 500 m^3/day are insufficient to power the smallest commercially available compressor engine and dryer package.

Based on the presentation, a figure of 500 m³/d was suggested by industry as the technical limit for solution gas conservation by using compression and pipelines to move the gas offsite. However, since the presentation was made on behalf of only industry, other stakeholder groups felt they could not accept the information without further validation. Team members agreed that there would be merit in third party research to determine a technical limit(s) for existing technology, and conducting research on new technologies designed to capture small volumes of solution gas thereby lowering the technical limit for compression and pipelining.

The team discussed whether or not the volume threshold for economic analyses could be adjusted to further reduce flaring and venting. Each stakeholder group's interest and positions are identified in the table below:

Non-Government Organizations	**Government**	**Industry**
NGOs suggested conducting an economic analysis on a representative sample of wells producing below 900 m³/day and providing this information to the ERCB. The ERCB could use this economic assessment information to determine to what extent changes to the flaring and venting regulations are needed	Government believes that it may be economic to conserve at lower volumes, notably for fuel use on site. If a lower threshold is not used, then requirements should be in place to require preferential use of solution gas for fuel.	As data showed in the 2004 study on solution gas conservation[10], 900m^3/day of solution gas production is generally the minimum level of production required to make conservation economic. Reducing the threshold would increase the administrative burden to industry with very little benefit in conservation. Further, the ERCB currently has

[10] Rahim (2004) *Solution Gas Flaring and Venting in Alberta: Volume Trends and Conservation Costs*. Report to the CASA Flare/Vent Project Team.

(including changes to the size threshold) and/or to better understand the potential for market based approaches to reducing solution gas flaring and venting.		the authority to request any operator to undertake an economic analysis for any well producing solution gas less than 900m^3/day, if they have reason to believe that conservation is economic.

The Team agreed that further work could be conducted to:

- Gather information from industry on the economics of a representative sample of wells producing in the range of 900 m³/day down to 0 m3/day of solution gas.
- Define a lower technical limit for gas conservation by:
    - Conducting a study to determine the technical limits for conservation of solution gas for low volume wells under a range of scenarios so that the information is available when/if the team reconvenes.
    - Investigating the best available technology and/or operational options for improving conservation at low volumes.

The team could not reach agreement on who should conduct these studies.

3.2 Net Present Value

Currently, an economic analysis of solution gas conservation for wells that vent or flare more than 900 m³/day of solution gas is required. If the analysis shows that conservation is economic, i.e. they have a Net Present Value (NPV) of more than -$50,000, then gas conservation is required. There is no requirement to conduct the economic analysis for wells that vent or flare less than 900 m³/day of solution gas.

The team discussed adjusting the NPV in an attempt to capture additional wells, leading to further reductions in flaring and venting. Some Team members proposed lowering the NPV level. However, the impact on resource development from adjusting the NPV is unknown. Some sectors feel that lowering the NPV could make marginal projects uneconomic, leading to stranded oil until the economics or technology improves. To determine if the conservation gain would be significant, information about the NPV of solution gas flaring and/or venting for wells greater than 900 m³/day is required.

Stakeholder group viewpoints on whether or not the NPV could be adjusted to further reduce flaring and venting are provided below:

Non-Government Organizations	**Government**	**Industry**
In order to address the recent increase in venting and to continue to make progress on solution gas conservation so that human and animal exposure to emissions is reduced and GHGs are reduced, NGOs suggested lowering the NPV below its current level of negative $50,000 to the level that is required to achieve a new conservation target (as discussed in Section 3.8). The NGOs noted that the solution gas study completed in 2004 is out of date and could not used by the 2008-2010 FVPT. A new study is needed if the province is to move ahead with further reductions in flaring and venting.	Government believes that further action is required to reduce flaring and venting. If more innovative options such as market mechanisms etc are not explored and agreed to then the simplest way to improve conservation is by lowering the NPV.	Since the current economic evaluation requirement (to - $50,000 NPV) was implemented, the provincial reduction target for flaring has been exceeded. With this in mind, it seems that the current NPV level is aligned with the CASA goals of economic efficiency and promoting pollution prevention, and is an appropriate balance between resource conservation, environment protection and economics. The solution gas conservation study completed in 2004 showed that the $-50,000 NPV level was the optimum balance between economics and conservation. Industry would support a future study on the costs (capital, operating and stranded oil) and conservation benefits of moving to a lower NPV level.

To determine how far routine solution gas flaring and venting in Alberta can be reduced by adjusting the economic analysis requirements, future work in this area could include the following:

- A review of the economics that have been submitted (for audits) to show larger gas volumes vs. NPV of projects (ERCB).

Some stakeholders supported an investigation into revising the ERCB D60 economic test to move from an absolute dollar value NPV threshold (currently -$50,000) to a test that would evaluate the NPV differential between full project life economics for oil development/production (base case) and the NPV for the base case plus gas conservation (incremental case). With this approach the incremental case would have a lower NPV than the base case and if the differential fell within a predetermined range, e.g. X%, then gas conservation would be required. This approach has the advantage of a built in sensitivity to an oil project's ability to support gas conservation while at the

same not requiring smaller oil projects to fund a disproportionate amount for gas conservation. Specifically, larger oil projects generate more revenue and profit and should be able to contribute more to gas conservation without having a significant impact on a project's NPV and rate of return.

Annual Inflation Factor for Net Present Value

Currently the economic evaluation focuses on an NPV of -$50,000 in current dollars; in other words, the NPV does not fluctuate with annual inflation. With positive annual inflation since the last release of D60, the NPV has become "cheaper" relative to 2006 dollars. The FVPT was able to reach consensus that the NPV figure should be adjusted to account for inflation. The economic analysis is always conducted using the current dollar value, and adjusting the NPV annually will ensure that this value is also current.

Recommendation 1: Annual Inflation Factor for Net Present Value

The FVPT recommends that

> The ERCB adjust the threshold for the Net Present Value each time Directive 60 is updated, to reflect an annual inflation factor in accordance with the Consumer Price Index, using 2006 (-$50,000) as the baseline year.

3.3 Duration of Well Testing and Tie-In

3.3.1 Heavy Oil Well Testing and Tie-in

The team discussed whether flaring and venting volumes can be reduced by reducing the time for testing and tie-in of heavy oil wells. Currently, D60 allows up to six months to test a heavy oil well and up to six months to tie-in solution gas from these wells (if conservation is required under D60). The amount of time required to test and/or tie-in can largely be affected by reservoir characteristics, weather, landowner issues, and equipment procurement.

The Team considered ways to encourage operators to do better than the allowable time period. If these time periods were reduced, conservation of solution gas could begin sooner and less solution gas would be vented. However, the Team could not estimate the volume of solution gas that would be conserved if shorter testing and/or tie-in periods were mandated. This information would be useful if/when the team reconvenes.

Some members of the Team proposed reducing the testing and tie-in period that is currently allowed by Directive 60. An exemption was also proposed for cases where the delay in tie-in is due to landowner concerns about a conservation pipeline. The factor that prevented the team from reaching consensus on this issue was that they did not have access to the extensive information that would be required to make a defensible decision on reducing the testing and tie-in periods.

The team discussed the possibility and feasibility of reducing flaring and venting volumes by adjusting testing and tie-in but could not reach agreement. Differing stakeholder group viewpoints are provided in the box below:

Non-Government Organizations	Government	Industry
NGOs suggested reducing the testing and tie in period for venting at heavy oil wells to 4 months and 4 months.	Currently 72 hrs is allowed for conventional oil to be tested and tied in. For bitumen/heavy oil wells, if gas volumes can be predicted, the test should be concluded at that time. The test should only be conducted long enough to determine that gas conservation is required. In no cases should the test period last more than 6 months. The bitumen/heavy oil well should be shut in following the test period (as is the case for oil wells) unless industry can show that damage to the reservoir is likely. No longer than 6 months from the end of the test period should be allowed. Government, specifically the ERCB, is willing to work with industry and landowners to facilitate shorter tie-in times.	For well testing, the six-month period is often required to understand well production due to reservoir geological characteristics and/or weather constraints (cannot test during cold periods due to equipment freezing), both of which are out of the operators' control. Reducing this timeline could significantly increase the administrative burden for both the ERCB and industry in managing the increased number of exceptions requested. Similarly for pipeline tie-ins, six months is often required to tie-in a well due to landowner negotiations and procurement issues (obtaining the equipment to conserve); both of which are out of the operators' control. Similar to the above, reducing this timeframe also increases the administrative burden for both the ERCB and industry in managing exemptions. In addition, because of the economic value of solution gas, operators who can tie-in sooner than six months will do so, thus maximizing conservation from that well.

Future work in this area could include the following:

- Investigate the possibilities for shortening the amount of time required for heavy oil wells to test and tie-in when factors are within operators' control.

Review of Well Test Time Limits

Information about the "actual" times used by operators for testing and tie-in and the volume of gas flared and vented during this period is required. Previously, the ERCB Red Deer office conducted a provincial survey on the duration of well tests.

Recommendation 2: Review of Well Test Time Limits

The FVPT recommends that

> The ERCB conduct a review of well test time limits for heavy oil and bitumen by June 2013. The ERCB should share the results of the study with industry and the CASA Board of Directors.

3.3.2 Gas Well Testing and Tie-in

The Team also discussed whether flaring and venting volumes can be reduced by reducing the time for testing and tie-in for gas wells. Many of the same arguments for testing and tie-in for heavy oil apply here as well.

The team discussed the 72 hour total flare time for gas well testing. As per Section 6 of the 2005 CASA report, *Flaring and Venting Review of Well Test Time Limits* , the team reviewed the audit data for a percentage of wells exceeding the time limits. More information is required to assess the effectiveness of the 72 hour time limit for gas well testing. In some areas of the province, operators conduct their gas well testing with a voluntarily imposed 8 hour combined maximum. As knowledge of technology increases and there is a change in reservoir types, it may be appropriate to further minimize the general maximum time limit for testing in consideration of the exemptions available.

3.4 Feasibility of 100% Conservation of Routine Solution Gas at New and Existing Wells

Evaluation and Cost of Eliminating Routine Solution Gas Flaring and Venting, prepared by Golder Associates, provides introductory material on current Alberta Environment (AENV) and ERCB regulatory requirements, limits to reducing the volumes of routine solution gas flaring and venting in Alberta, and a jurisdictional comparison of flaring and venting requirements across North America and world-wide. A list of available flaring and venting reduction technologies is included such as pipelining, recovery, reinjection and conversion to energy through the use of micro-turbines, etc. In the report, drivers for reducing flaring and venting in Alberta include air quality, noise, smoke, heat and light, land and landowner impacts, greenhouse gas emissions, and resource wastage.

Section 4 of the Golder Report describes consultations with a number of stakeholders on issues around achieving 100% routine solution gas conservation, and when exemptions from this requirement should be made. Section 5 and 6 discuss the requirements for a decision-support tool to determine when exemptions from the 100% routine solution gas conservation rule could be allowed.

Finally, the consultant was asked to consider the economic impact (including volumes of stranded oil) of requiring 100% conservation of routine solution gas, with or without exemptions. This was done by estimating the volume of stranded oil and potential lost royalties under a 100% conservation scenario for all sites with vent or flare volumes in excess of 900 m^3/day.

While the Golder report provided a starting point for a discussion of the issues around achieving 100% conservation of solution gas (on a routine basis), the Team felt the results were not robust enough to rely on without further data collection and analysis. Some issues with the final report from Golder included:

- Golder pointed out that the economic impact analysis was not definitive because they were unable to gather sufficient data from industry within the limited scope of their work.
- A thorough and detailed economic impact analysis was out of the scope of Golder's work. This limited the team's ability to make robust recommendations based on Golder's analysis.
- A complete analysis of the economic and environmental impacts of the potential exemptions was not provided.
- The economic analysis that was done did not show clearly how the economic impact assessment data was collected, what data was used, or how the consultant arrived at their recommendations. Therefore, the team was limited in the use of this section of the report.
- Specific definitions of "land types" in the decision tool were not clearly articulated.

The Golder report did not make any clear conclusions on whether or not it was feasible to set a date for the elimination of routine solution gas flaring and venting, nor what the impact of 100% conservation could be. Therefore, the Team did not develop specific recommendations to set a date for elimination of routine solution gas flaring and venting based on the Golder report.

3.5 Greenhouse Gas (GHG) Offset Protocol

Under Alberta's Climate Change Policy, facilities that are below the threshold for regulation (currently 100,000 tonnes of CO_2e/year) are able to generate offset credits for voluntary actions that have approved offset protocols and are real, verifiable and go beyond regulatory requirements. Offsets can not be accrued by projects that reduce GHGs by meeting only the minimum regulatory requirements.

Two companies (Husky and CNRL) have drafted a GHG offset protocol for solution gas conservation. Industry believes the use of this protocol could provide an economic incentive for new solution gas conservation projects below the existing threshold. However, if Directive 60 (D60) was revised to further reduce flaring and venting in Alberta, the volume of solution gas conservation based offsets would be diminished.

Stakeholder group interests on the issue of whether or not a GHG offset protocol is the appropriate mechanism for encouraging conservation are detailed below:

Non-Government Organizations	**Government**	**Industry**
NGOs feel that the use of a GHG offset approach to reduce GHG emissions should be limited to sources of emission that are difficult or not feasible to regulate, which is not the case with solution gas conservation in Alberta. Clearly, solution gas conservation is amenable to direct regulation and NGOs are concerned that, if accepted, this type of offset will become a significant barrier to any future change in solution gas flaring and venting requirements that the Alberta government may deem necessary.	The offset system is designed to incent reductions beyond regulatory requirements – crediting reduction actions not otherwise required by law. The system is designed to compliment regulatory efforts, not to replace them. While issuing offset credits for conserving solution gas beyond the current requirement of D60 is consistent with the policy intent of the offset system, what is significant about this situation is that the potential for industry to generate offset credits may be preventing development of further regulation.	Industry believes the use of offsets will drive conservation beyond regulatory requirements. Clearly, solution gas conservation is amiable to direct regulation through D60 and industry supports the use of regulation to drive conservation to its economic limit. D60's economic limit obliges industry to incur $50,000 with each project. Offsets will drive additional conservation by making very uneconomic projects less uneconomic or marginally economic. Other virtues of the offset system include: ▪ The protocol is inherently flexible. If D60 conservation requirements change, then the protocol requires the use on the new requirements. The use of offsets should not be viewed as a significant barrier to future changes in regulation. ▪ The protocol reflects D60's need for annual economic tests on uneconomic gas. As a result, conservation projects that generate offset credits must confirm annually that the gas is uneconomic by D60 standards. If the annual test shows that the gas is now economic, then offset credits stop. ▪ It is important to note that the price of natural gas is an important variable in D60's economic test. As natural gas prices recover, it is feasible that more and more gas originally deemed to be uneconomic will become

		economic, and not require offsets for conservation. In this way, the use of offsets is a hedge against low Natural Gas prices. ▪ Conservation projects that generate offset credits are fully disclosed for public review. The projects are independently verified and submitted to Alberta Environment for posting on AENV's web site. ▪ AENV reviews offset protocols every 5 years, or more frequently if necessary. AENV reserves the right to withdraw a protocol if it becomes standard practice, or if the protocol is misused or used in an unintended way. ▪ Finally, the Protocol aligns with the CASA principle of economic efficiency and supports the broader Government of Alberta goal of a developing a robust offset market within Alberta.

3.6 Climate Change and Emissions Management Fund

In 2007, the province committed to creating the Climate Change and Emissions Management Fund - one of three compliance options for large industrial emitters to meet Alberta's 12-per-cent emissions intensity reduction in greenhouse gases. Instead of physically reducing on-site emissions, payments can be made into the fund to be used to invest in projects and technology that reduce greenhouse gas emissions in Alberta. The Fund is meant to support a diverse range of projects, which can include greening energy production, conserving and using energy efficiently, carbon capture and storage, enhancement of biological systems and adaptation. Projects must not be required by regulation and must be beyond business as usual. In the first call for proposals in fall 2009, projects were able to receive 50-per-cent of the project funding up to a maximum of $25 million for the life of the project. Program money is made available to the Climate Change Emissions Management Corporation (CCEMC) by the Government of Alberta through a grant agreement.

At least two companies have applied for funding for pipeline infrastructure to enable additional solution gas conservation projects as part of the CCEMC's proposal call in the fall of 2009. These applications were not successful. The CCEMC has issued a call for proposals in the spring of 2010 for energy efficiency projects.

Although the team is not aware of any successful applications for projects that will reduce flaring and venting, there is nothing in the program that would prevent such a project from successfully applying to the Fund. The team sees this fund as a potential source of capital funding for solution gas conservation projects and infrastructure projects (such as gas co-ops).

3.7 Otherwise Flared Solution Gas (OFSG) Royalty Waiver Program

The Department of Energy introduced the Otherwise Flared Solution Gas (OFSG) program to encourage the conservation of solution gas in the province. The department waives royalty on uneconomic solution gas and gas by-products that would have otherwise been subject to a Crown royalty charge. Based on 2009 and 2010 data, there are, on average, about 400 wells per month claiming royalty credits, with about 50 of those wells tied to electrical generation. Between 2005 and 2009, the OFSG granted credits worth about $51 million.

As of January 2009, the number of companies participating in the program fell dramatically. Alberta Energy suggested that the decrease in 2009 may be due to:

- A drop-off of wells that were grandfathered into the program in the 1990s; or
- Those who applied to the program in the 1990s have reached their 10 year participation limit.

The program continues to operate as it was intended and Department of Energy does not anticipate making changes to the program in the near future.

The team discussed some possible reasons that operators aren't participating more fully in the program, including concerns about administrative burden, the 10-year maximum for participation, and the potential drop off of wells that were grandfathered into the program in the 1990s. The team also discussed the potential to "reactivate" the program by increasing public and staff awareness. A summary and update regarding the ERCB directive and the royalty support program to CAPP and SEPAC membership may be warranted. Future work in this area could include an investigation into why CAPP and SEPAC members aren't participating more fully in the Royalty Waiver program.

3.8 Alberta Solution Gas Target Conservation Rate for Flaring and Venting

Currently, D60 includes a target for an absolute provincial volume limit for flaring. The actual volume flared is far below this target. The Province could also establish a target for either a solution gas conservation rate or for a reduction in solution gas flaring and/or venting.

The FVPT discussed the possibility of setting province-wide targets. There was some discussion about allowing flexibility - the approach would not be prescriptive as to how industry chooses to reach the target. Some members of the team noted that a regulatory backstop would be required if the target was not met by voluntary measures. The current provincial threshold for flaring has a trigger point at which action would be taken to reduce flaring below the threshold. It was further noted that the regulatory backstop should be designed in such a way as to not punish companies that took action to lower their flaring and venting volumes.

The Team discussed the difficulties of establishing a target conservation rate for flaring and venting:

- Research would need to be conducted to determine a suitable, achievable, defensible target for a province-wide threshold.
- There were concerns about how a provincial target based on voluntary measures would drive reduction at individual sites.
- There was a suggestion to set targets by region, rather than provincially.

A provincial limit could target heavy oil as that is where the majority of venting is occurring. However, it may also lead to stranded oil in the short term until technological advances or economic changes occur (the 'stranded' oil may incent the development of these technologies). The Golder report, mentioned previously, was intended to provide useful data on the economic cost of this stranded oil but unfortunately, the limitations of the study precluded its use by the Team.

The following table provides stakeholder group viewpoints on establishing an Alberta target conservation rate to increase solution conservation rates:

Non-Government Organizations	Government	Industry
NGOs suggested establishing an Alberta conservation rate target (e.g. 98% for conventional wells and 90% for bitumen wells), thereby allowing a flexible approach to achieving the target. This approach must be accompanied by a clear regulatory backstop if the target is not met. This is consistent with ERCB	If a target were set for venting the mechanism for a regulatory backstop needs to be clear. The regulatory backstop could be done through setting maximum vent limits by site, which may discourage pad drilling, or through a continued decrease in the NPV used in the economic	In principle, industry supports the establishment of a target conservation rate for conventional and bitumen wells with a regulatory backstop. However industry does not support setting arbitrary targets. To be acceptable, targets must be set at levels that are reasonable and economically and technologically achievable. In addition to determining the appropriate target

objectives of continuously reducing solution gas flaring and venting to avoid impacts and waste. The conservation target based approach would require that uneconomic solution gas conservation projects are covered by the overall economics of the well (i.e. solution gas is a waste that must be managed as a regular cost of doing business and therefore a factor in the overall economics of the oil well). This approach could result in a significant reduction of flaring/venting and result in an acceptable level of shut in oil production depending on the level of reduction required and the time allowed to phase in the reductions. The FVPT was not able to agree to do the necessary data collection and analysis that would be needed to set a conservation target and timeline therefore the NGOs recommend that the ERCB do both the data collection and analysis and set province wide target(s) with a deadline for industry to meet the target.	calculation. If a conservation efficiency is used the focus may shift from venting to flaring and venting. Targets with regulatory backstops were part of the last strategy for reducing flaring. Since that time venting has continued to increase. There is no target for venting and requirements in the area of bitumen production are less stringent than conventional oil. The ERCB is prepared to investigate a future target for venting based on further study.	level, industry believes that the following factors must be agreed to when setting conservation targets with regulatory backstops: • Application: the team must agree to whether the conservation target would be applied province-wide, regionally, by company, or on a well-by-well basis • Target timelines: the team must agree to a reasonable timeline for achieving the target • Regulatory backstop: the team must agree to what the regulatory backstop would be. This would include an analysis of the backstop's economic impact and overall effectiveness in reducing venting Through its current process, the Team did not undertake an evaluation to determine an appropriate and reasonable conservation target. Further the Team did not agree to an application basis and timelines, or to a specific regulatory backstop.

3.9 New and Emerging Technologies

The Team did not identify any new solution gas conservation technologies that could be used to drive further reductions in flaring and venting under the current D60 rules. However, industry compiled a list of potential new technologies that could provide alternatives to flaring (e.g. fuel cells, micro-turbine generators, etc. See Appendix I for more details). Some of these technologies were categorized based on whether they were technically feasible and/or commercially viable, or technically or commercially not proven for Alberta's conditions on small well battery projects. The team had some general discussions about this analysis and agreed that it could be used to identify areas to focus future research and innovation into reducing flaring and venting activity.

Further work is also needed to identify incentives to promote research and innovation in new and emerging technologies that could lower technical limits of conserving solution gas. The team agreed that it would be useful to have further information on each of the options and how they perform in Alberta operating conditions.

3.10 Non-Routine Flaring and Venting

As indicated in the team's Terms of Reference, one of their objectives was to assess the feasibility of setting a date for the elimination of routine flaring and venting of solution gas. It was therefore suggested that it would be important to know how much flaring and venting is currently occurring on a routine versus non-routine basis, in order to determine how much additional conservation can be achieved beyond the existing levels. The ERCB was asked to investigate whether this type of information was available. They reported that, in data collection and reporting of flaring and venting volumes, there is no differentiation between routine and non-routine flaring. CAPP was asked to investigate how they report their data and whether or not it would be possible to separate routine from non-routine flaring. They reported to the team that there is no easy way to isolate the non-routine volumes without undertaking a comprehensive industry survey.

Subsequently the ERCB undertook to group the flare and vent data by facilities conserving more than 90% and facilities conserving less than 90%. A conserving facility is defined in D60 as one which is conserving more than 90% (with a design of at least 95%). As such it is suggested that flared gas at batteries operating at greater than 90% would, for the most part, be non-routine flaring. While only a crude estimate the data when grouped this way would suggest that non-routine flaring at solution gas batteries is a small amount of the total as shown in Figure 4B.

Future work could examine potential opportunities to reduce non-routine flaring and venting and identify a plan to pursue any areas of interest. A first step would be for the ERCB and industry to modify data collection and reporting to differentiate between routine and non-routine volumes. In addition, some team members indicated that they are involved in an initiative to deal with management requirements for non-routine flaring, including minimization of flaring volumes and development of risk-based dispersion modeling. However, the team did not investigate this initiative in detail.

3.11 Market-Based Tools

Market-based tools, such as tradable permits, may make gas conservation more economically efficient. However, such tools would have to exist within a framework with clear outcomes and a regulatory backstop. They would also have to work for both large and small operators. Market-based instruments can also be used to incent conservation of flaring and venting by imposing a tax on emissions (such as the BC carbon tax). The team did not pursue detailed examination of market

based tools when it became evident that consensus would not be reached on the need for further mandatory reductions.

3.12 Gas Co-ops

An area identified by the FVPT members as having the potential to improve conservation was incenting the development of more gas co-ops in Alberta. Specifically, the County of Vermillion River, who recently won an Emerald Award[11] for their work, developed a plan to gather the heavy oil casing gas that is routinely vented. Through cooperation with industry partners, oil wells have been connected to the County's pipeline network to capture the gas, which is then pipelined by the co-op. and mixed with other natural gas to be used by customers. The County gathers enough vent gas to fuel 7,500 homes year round, which reduces greenhouse gas emissions by 490,000 CO_2E tonnes/year[12].

The County's long-term goal is to become a major supplier of casing vent gas and to provide value for Albertans from this non-renewable resource. They plan to tie in all major venting wells in their area and further develop industrial partnerships to utilize this gas in an environmentally efficient manner, thereby reducing greenhouse gases vented to the atmosphere.

The County of Vermillion River is interested in opportunities to promote their initiative to other counties in Alberta and elsewhere. It is also continuing to look for ways to improve their operations by dealing with issues such as:

- What to do with excess gas during the summer months, when people aren't using their furnaces (i.e. how to match supply and demand throughout the year).
- How to lower the cost of gathering and processing vent gas.
- The impact of royalty rates on the co-op.
- Access to financial capital to conduct this type of project.
- Availability of technology for low gas volumes.
- Fluctuating natural gas prices.

Further details can be found in Appendix H and the County's website.

The Team recognized the use of gas co-ops as an opportunity that could be promoted further under the current policy framework. However, the Team also realized that co-ops may work in some areas, but may not be applicable province-wide. In addition to the issues listed above, there are also challenges to developing and operating gas co-ops such as infrastructure funding, storage of excess gas when demand is low, etc.

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[11] http://www.vermilion-river.com/emerald

[12] As stated on the County's website. See http://www.vermilion-river.com/newsmodule/view/id/2/src/@random49818e1400dbe/.

Future work could include looking at innovative methods of leveraging infrastructure dollars through the Climate Change and Emissions Management Fund or other funds. Other potential work discussed by the FVPT, but not fully explored, included looking at the use of incentives to get companies and co-ops to work together.

3.13 Clustering

Clustering well sites and facilities can be done to further encourage solution gas conservation by making it more economic (e.g. for use in co-ops, electricity generation, re-injection, injection into pipelines, etc.). Future work in the area of clustering could include the following:

- Identifying the incentives/barriers to clustered networks; and
- Identifying geographic areas where it is more economical to cluster solution gas wells

The Team considered how it can encourage operators to improve collaboration when they have the opportunity. It was noted that D60 requires operators to consider clustering. In addition, the ERCB has historically written gas conservation orders, but currently relies on Directive 60 to promote conservation. Although the team could not reach consensus on a path forward for encouraging clustering, the following points were discussed:

- Providing incentives for companies to engage in bilateral or regional discussions with other companies in the region to capture gas that is not mandatory to conserve under D60.
- The benefits of an information campaign and/or workshop to inform operators about the potential for clustering and ensuing benefits.

Clustering and co-ops are examples of things that can be pursued without making any changes to D60.

3.14 Gas Oil Ratio Test

A study of other jurisdictions may produce a gas oil ratio (GOR) test for determining conservation requirements. The current requirement in D60 requires that all wells flaring or venting with a GOR greater than 3000 m^3/m^3 be shut-in until the gas is conserved. Initially this requirement was set when the market value of the oil matched the market value of the gas. While this was not fully discussed with the team, consideration in the future may be given to revising this number to further promote gas conservation and require the well to be shut-in until such time as gas conservation becomes economic. Consideration could be given to revising the various parameters related to the GOR value.

Figure 9, below, shows the flaring and venting batteries that were operating at a conservation level below 90%. The figure looks at the largest GOR wells and sorted them from largest to smallest and cumulatively plotted the combined flare and vent volumes. Approximately half of the flaring and

venting from these batteries (300 e^6m^3/yr) came from wells with a GOR greater than 120. A GOR of 120 is relatively high for heavy oil and bitumen operations. The higher the GOR, the higher the volume of gas and, consequently, the higher the value of gas, as it relates to oil.\

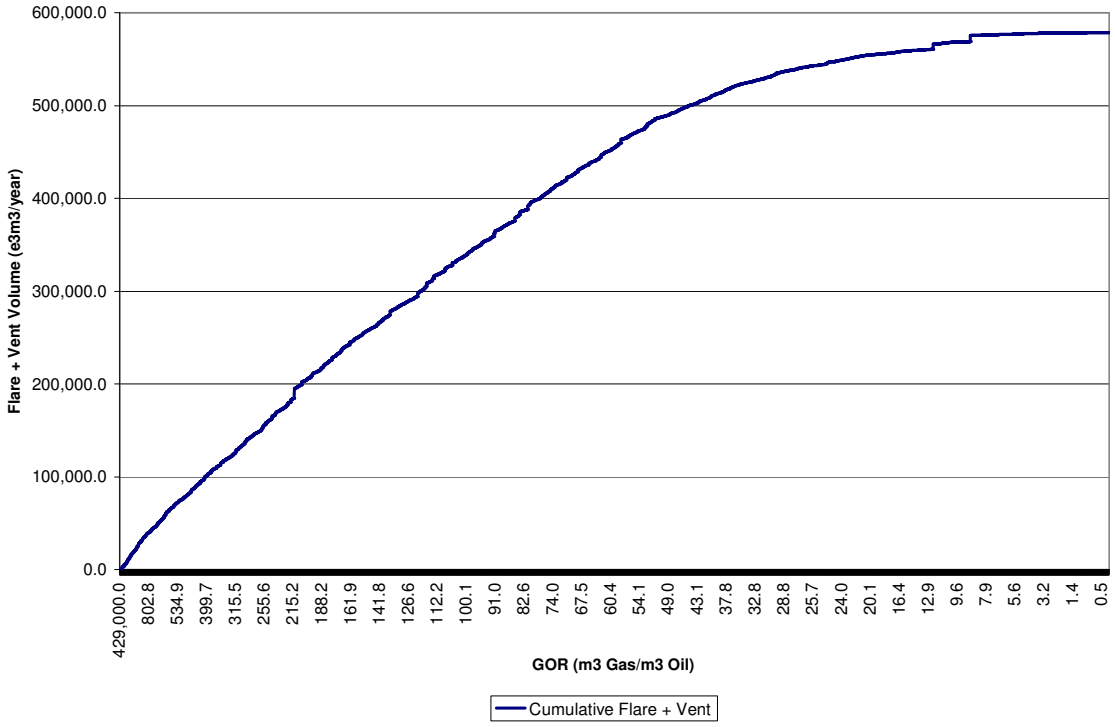

Figure 9. 2008 Cumulative Flaring and Venting from Solution Gas Batteries and Associated Wells by GOR (Highest to Lowest) Operating at <90% Conservation Efficiency.

3.15 Improving Data Accessibility

As the team progressed towards the final stages of work, they realized that they didn't have all the data they needed to evaluate the impact of some of the suggested recommendations. (e.g. estimates of stranded oil, implications of changing the Net Present Value, differentiation of routine vs. non-routine volumes). It also became apparent that some of the data the team would have required to evaluate the impact of its recommendations is not readily available, due to current data collection and reporting methods. Future work should consider whether or not appropriate data is readily available and identify and design a process for collecting the relevant information.

4.0 Conclusion

As per their terms of reference, the FVPT undertook its work to *"assess the performance of the upstream oil and gas industry in managing flaring and venting."* The Team reviewed past team reports and saw that the majority of recommendations have been acted on through implementation of ERCB's D60. This has led to a reduction in solution gas flaring up to and including 2005. However, since 2006, improvements to overall conservation have not been realized and overall conservation has decreased. Since flare volumes continue to decrease, the decreasing trend in conservation is due to increases in venting.

The Team reviewed current research and initiatives in several topic areas, and initiated its own research to assess the feasibility of setting a date for the elimination of routine solution gas flaring and venting at new facilities. Finally, while the FVPT could not come to a consensus on the future steps required to further improve the upstream petroleum Flaring and Venting Management Framework or the priority that should be given to this issue, the Team did identify several areas for further study which may yield future improvements. Due to the absence of the information requirements identified in this report, the lack of agreement on how to achieve further improvements in conservation, and uncertainty about to the priority of the issue, the FVPT feels it cannot go any further. The following table provides each stakeholder group's viewpoints on the future of the Flaring and Venting Project Team:

Non-Government Organizations	**Government**	**Industry**
As this report clearly demonstrates very little further progress on reducing flaring has been realized in recent years and venting has worsened significantly since 2005 in Alberta. • The ENGO members of the project team have tabled several options for pathways forward to reduce flaring and venting. All of these options have been blocked by other members of the team. None of the other members of the team have tabled recommendations that would have resulted in significant reduction of flaring and venting in Alberta. • After 2.5 years of work on this committee, the ENGO members have lost confidence in the Alberta Government's commitment to reduce flaring and venting in Alberta. The ENGO members do not believe that Industry members will voluntarily reduce flaring and venting further unless the Alberta Government clearly signals that it	The Government proposes that the FVPT go into abeyance rather than disbanding for the following reasons: • There is further work for the team to complete that could advance solution gas conservation. Going into abeyance would ensure that the FVPT will reconvene at a future date to undertake the work. Disbanding the FVPT leaves some uncertainty as to whether the team would ever be reestablished. • There would be a body to report to if the additional work suggested in this report is undertaken and completed. • In the absence of the CASA FVPT the Government may have to act to reduce flaring and venting further without the formation of a new FVPT. A CASA consensus based approach is preferred. • Flaring and venting continues to	Industry supports disbanding the CASA FVPT for the following reasons: • At this time, we have covered off the majority of the items in the CASA Terms of Reference. There are no significant outstanding deliverables from the Team's terms of reference that would justify putting the Team into abeyance. • Any future work that CASA undertakes on flaring and venting would go through a new Statement of Opportunity. This robust process ensures that: o The issue is amenable to the consensus process. o Allows the CASA Board to assess the priority of the issue

is a priority to reduce flaring and venting beyond current levels. Therefore, the ENGO members do not believe that spending their limited time and resources working on these issues in a consensus based forum will result in reductions of flaring and venting in Alberta. • The ENGO members are of the view that current levels of flaring and venting in Alberta are unjustified and unnecessary. The extent of flaring and venting in Alberta represents an avoidable risk to human and animal health, are a waste of a valuable public resource, and are a significant and source of GHGs. • The ERCB should take steps to implement new regulations or fiscal measures that significantly reduce the amount of solution gas that is flared and vented in Alberta as soon as possible to safeguard human and animal health, conserve a valuable public resource and reduce GHGs. • The ENGO members in no way support a postponement of work to reduce flaring and venting in Alberta for an arbitrary period of time. • Disbanding the team at this time would clarify for all stakeholders and the public that there is no longer a province wide multi-stakeholder process working towards reducing flaring and venting in Alberta. It would be dishonest to have in existence a CASA team that purports to be working towards reducing flaring and venting in Alberta yet has no mandate and is simply idle. • CASA has very clear and robust process, the Statement of Opportunity process, for convening a project team to conduct work on air issues (We agree with Industry's characterization of this process in this table). The ENGO members would welcome a new statement of opportunity from the ERCB or Industry with a clear statement of intent to work in a timely manner	be an issue of importance to the Government and disbanding the team would seem to suggest to Albertans otherwise. • (The Department of Energy would like to note that they wish to continue their involvement with the FVPT, and would not wish to see the team disbanded.)	and stakeholder commitment to the issue. o Confirms stakeholder commitment on a new and clarified mandate for CASA to address flaring and venting. o Ensures that stakeholders believe that working together to develop consensus-based solutions is more desirable than the alternative. o Provides an opportunity to clearly re-define the issue, which will help to ensure that the future team will be effective in the long run. • Current and forthcoming changes being made within various government departments on regulations and regulatory policies will likely require a new approach to managing environmental issues and resource conservation (i.e., Cumulative Effects Management; Regional Plans; Place-based emissions frameworks; Risk Management; Regulatory Enhancement).

towards real reductions of flared and vented gas in Alberta. • Any work that is undertaken as a result of recommendations made in this report can and should be directed towards the CASA Board. This is the normal procedure for any project team that has completed its work and been disbanded by the CASA Board.		

Appendix A: Glossary

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.

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.

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 ERCB 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.

Non-Routine Flaring
Non-routine flaring is due to planned maintenance activities or unplanned, upset and emergency situations. Flaring in these cases is necessary for safety, environment and property protection reasons. As per D60, non-routine volumes are required to be minimized, in some cases through the development and implementation of a flare management strategy.

Appendix B: Flaring and Venting Project Team References

The following documents are related to the work of the Flaring and Venting Project Team (FVPT). These reports are available online at http://www.casahome.org/?page_id=110, and are also available on request to the CASA Secretariat.

- Golder Associates. 2010. *Evaluation and Cost of Eliminating Routine Solution Gas Flaring and Venting*. Calgary, AB.
- CASA Flaring and Venting Project Team. June 2005. *Flaring and Venting Review Of Well Test Time Limits*,
- CASA Flaring and Venting Project Team. March 2005. *Flaring and Venting Recommendations For Coal Bed Methane*.
- CASA Flaring and Venting Project Team. September 2004. *Flaring and Venting in Alberta, Report and Recommendations for the Upstream Petroleum Industry*.
- CASA Flaring and Venting Project Team. January 2004. *Solution Gas Flaring and Venting in Alberta: Volume Trends and Conservation Costs*.

Appendix C: Flaring and Venting Project Team Terms of Reference

Purpose
To assess the performance of the upstream oil and gas industry in managing flaring and venting and to make recommendations regarding the Alberta flaring and venting management framework.

Objectives
1. Evaluate progress in reducing flaring and venting.

2. Review the status of the recommendations of the Flaring and Venting Project Team (2004 and 2005 reports).

3. Assess research findings and their implication for the management of flaring and venting. Determine other research needs and recommend further research.

4. Review flare performance requirements and efficiency standards and determine the feasibility of combustion efficiency standards for all flares.

5. Assess the feasibility of setting a date for the elimination of routine solution gas flaring and venting at new facilities.

6. Review upstream petroleum Flaring and Venting Management Framework and make recommendations for further improvements.

Context
The Terms of Reference for this Project Team support the objectives identified in CASA's Business Plan, fits well within the priorities, values, and expectations of the Board, and are 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: 1) Protect the Environment; 2) Optimize Economic Performance and Efficiency; and 3) Seek Continuous Improvement.

The following list of facilities and activities specifies what is within the mandate of the team and what is outside the mandate of the team.

Within Mandate:
- Oil and bitumen (in-situ) batteries.
- Unconventional gas production, such as Coal Bed Methane (CBM) wells and facilities.
- Gas facilities – including gas plants, gas batteries, gas gathering systems, well operations, and sour gas dehydrators.
- Well testing.
- Fugitives from all above.

Outside Mandate:

- Sales gas pipelines (transmission company's control).
- Main line straddle plants (not part of upstream oil and gas).
- Crude-oil terminals.
- Mineable oil sands and upgraders.

Report to the CASA Board

The Flaring and Venting Team will report to the CASA Board in Q1 2009.

Membership

The Project Team's current membership has representatives from:

Alberta Association of Municipal Districts and Counties

Alberta Beef Producers

Alberta Energy

Alberta Energy Resources Conservation Board

Alberta Environment

Alberta Health and Wellness

Canadian Association of Petroleum Producers

Pembina Agricultural Protection Association

Pembina Institute for Appropriate Development

Prairie Acid Rain Coalition

Resident for Accountability in Power Industry Development

Small Explorers and Producers Association of Canada

Wildrose Agricultural Producers

Appendix D: Flaring and Venting Project Team Members

Bob Barss	Alberta Association of Municipal Districts and Counties
Randy Dobko	Alberta Environment
Andrew Higgins	Canadian Association of Petroleum Producers, on behalf of Canadian Natural Resources Limited
Wayne Hillier	Husky Energy
Robyn Jacobsen	CASA Secretariat
Anna Maslowski	Alberta Energy
Ian Peace	Residents for Accountability in Power Industry Development
Krista Phillips	Canadian Association of Petroleum Producers
Chris Severson-Baker	Pembina Institute
Jolene Shannon	Pembina Agricultural Protection Association
Jim Spangelo	Alberta Energy Resources Conservation Board
John Squarek	Small Explorers and Producers Association of Canada
James Vaughan	Alberta Energy Resources Conservation Board

Alternate Members, Corresponding Members, and Former Project Team Members

Justin Balko	Alberta Health and Wellness
Michael Brown	Energy Resources Conservation Board
Terri Carroll	Small Explorers and Producers Association of Canada
Jeff Cormier	Alberta Energy
Peter Davis	Government of BC, Oil and Gas Commission
Keith Denman	Alberta Environment
Gur Dhaliwal	Department of Energy
Janet Dietrich	Agriculture and Rural Development
John Drinkwater	BP Canada Energy Company
Kim Eastlick	Energy Resources Conservation Board
Brian Free	Alberta Environment
Frank George	Shell Canada Ltd.
Bart Guyon	Alberta Association of Municipal Districts and Counties
Todd Han	Saskatchewan Ministry of Energy & Resources
Chris Hay	Imperial Oil
Bob Hearn	Alberta Energy Resources Conservation Board
Shannon Hiebert	Husky Energy
Debra Hopkins	Alberta Environment
Ahmed Idriss	Clean Air Strategic Alliance
Kevin Johnston	Alberta Energy Resources Conservation Board
Carolyn Kolebaba	Alberta Association of Municipal Districts & Counties
Martha Kostuch	Prairie Acid Rain Coalition
Gary Leach	Small Explorers and Producers Association of Canada
Chow-Seng Liu	Alberta Environment

FindlayMacDermid	Residents for Accountability in Power Industry Development
Christine Macken	Clean Air Strategic Alliance
Alexander MacKenzie	Alberta Health and Wellness
Jerry MacPherson	Alberta Energy
Tom Marr-Laing	Pembina Institute
Kevin McLeod	Clean Air Strategic Alliance
Randal McNeill	Husky Energy
Danielle Moffat	Alberta Energy
Bettina Mueller	Alberta Energy
Jaideep Narayanan	Toxics Watch Society of Alberta
Carol Nykolyn	Alberta Energy
John Parr	Canadian Natural Resources Limited
Tara Payment	Canadian Association of Petroleum Producers
Mike Queenan	Ecological Sound Planning and Community Evolvement (ESPACE)
Ansar Qureshi	Alberta Environment / Alberta Health and Wellness
Saad Rahim	Advanced NPD Inc. (now VaporTech energy services inc.)
Barry Ranger	Small Explorers and Producers Association of Canada
Gene Rawe	Alberta Beef Producers
Michael Rodyniuk	Alberta Beef Producers
Gary Sargent	Canadian Association of Petroleum Producers
Ron Schmitz	Advanced NPD Inc.
Carrie Selin	Agri-Environmental Partnership of Alberta
Rod Sikora	KeySpan Energy Canada
Ralph Smith	Wildrose Agricultural Producers
Rudy Sundermann	EnCana Corporation
Karina Thomas	Alberta Health and Wellness
Will VandenBorn	EnCana Corporation
Len Vogelaar	Alberta Beef Producers
Debby Westerman	Saskatchewan Ministry of Energy and Resources
Mike Zemanek	Alberta Health and Wellness

N.B. The affiliations of some former team members may have changes. The affiliation shown for each person was accurate at the time the individual was active with the team.

Appendix E: Summary of Implementation of Recommendations

Flaring and Venting in Alberta Report and Recommendations for the Upstream Petroleum Industry, September 2004

Part 1. Recommendations to be implemented by the ERCB (formerly, the EUB)
As reported by Michael Brown at the November 2006 CASA Board meeting, all 44 recommendations requesting modification to Directive 60 have been implemented.

Note: Section number references below refer to Directive 060, released November 16, 2006.

1) Recommendations 2 through 13 come into effect on January 1, 2006.
. Recommendations were implemented through rewrite of Directive 060. Directive 060 was released November 16, 2006. The effective date of the new requirements is January 31, 2007.

2) Licensees must conserve solution gas at all sites flaring or venting combined volumes greater than 900 m3/day per site if the EUB Guide 60 decision tree economic model results in a Net Present Value (NPV) of greater than negative $50,000.
See Sections 2.5 (1a), 2.8.1 (10), and 2.8.1 (11)

3) Licensees must conserve solution gas at all sites flaring volumes greater than 900 m3/day per site 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.
See Section 2.5 (1c)

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.
See Sections 2.4 (1b), 2.4 (2c), and 2.5 (3)

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.
See Section 2.6 (1)

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.
See Section 2.4 (2a)

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.
See Section 2.13.3

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%.
See Section 2.5 (4)

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.
See Sections 2.4 (1a) and 3.2 (6)

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.
See Sections 2.4 (2b) and 3.2 (1b)

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.
See Sections 2.5 (2), 2.8 (1b), and 2.8.1 (12)

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.
Section 2.9 (2)

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.
Section 2.9 (3)

Solution Gas Venting:
The Flaring and Venting Project Team recommends that

15) Recommendations 16 through 26 will come into effect on January1, 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.
. Recommendations were implemented through rewrite of Directive 060. Directive 060 was released November 16, 2006. The effective date of the new requirements is January 31, 2007.

16) Licensees must conserve gas at all sites 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.
See Sections 2.5 (1a), 2.8.1 (10), and 2.8.1 (11)

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.
See Sections 2.4 (1b), 2.4 (2c), and 2.5 (3)

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.
See Section 2.6 (1)

19) Licensees of multi-well heavy oil or bitumen lease sites should prebuild solution gas conservation lines as part of initial construction.
See Section 2.4 (2a)

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.
See Section 2.13.3

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%.
See Section 2.5 (4)

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.
See Sections 2.4 (1a) and 3.2 (6)

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.
See Sections 2.4 (2b) and 3.2 (1b)

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.
See Sections 2.5 (2), 2.8 (1b), and 2.8.1 (12)

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.
See Section 2.9 (4)

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.
The data collection program was lead by the EUB Operations and Field Surveillance staff with design input from industry. An EUB Bulletin was developed and released describing the program and its requirements. Data was collected as recommended. The number of tests collected far exceeded expectation, thus providing a very substantial data set. All data was compiled and analyzed. Review by CASA FVPT members led to development of well testing time limit recommendations in June 2005 report. . Recommendations were implemented through rewrite of Directive 060. Directive 060 was released November 16, 2006. The effective date of the new requirements is January 31, 2007.

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.
See Section 3.2 (1), 3.2 (2), and 3.2 (4)
Rather than issue an interim requirement that might soon be changed if the recommendations pointed to a different time limit, it was decided to focus on reviewing the data and making final recommendations for time limits. This project to gather and review the data progressed quickly, as did the development of the recommendations and the writing of the report (released June 2006). The implementation of these time limits will take place January 31, 2007.

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.
Sections 2.4 (1a) and 3.2 (6)

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.
This is now currently available. Operators can contact the EUB Geology and Reserves group to provide evidence of complying with the necessary pre-requisites for this extension.

33) Existing flaring permit thresholds continue to apply as outlined in Guide 60 Updates and Clarifications. 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.
See Section 3.3.1

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.
See Section 3.11 and Appendix 12

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.
Believe that this is currently allowed, but will check again. Have heard that Directive 040 may have a review coming up.

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.
The EUB continues to support this research.

38) Government and Industry should support further research on understanding the effects of flare stack design, including appurtenances (flare tips) on combustion efficiency.
The EUB continues to support this research.

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.
The EUB continues to be closely involved in latest flaring research in many different venues – locally and globally. EUB flare performance and combustion efficiency requirements are based on the latest research.

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.
The EUB continues to review these results.

42) The EUB should review the ignition requirements found in American Petroleum Institute Standard 537 and modify their requirements as appropriate.
EUB staff reviewed API RP 537 and developed the ignition requirements in Section 7.3 with this in mind.

Fugitive Emissions:
The Flaring and Venting Project Team recommends that:

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.
See Section 8.7 (1)

Part 2. Recommendations to be implemented by Alberta Energy
As reported by Sandra Locke at the November 2006 CASA Board meeting:

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.

and,

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.

January 08 update on the OFSG program:

- To encourage conservation of marginally economic solution gas, the Otherwise Flared Solution Gas (OFSG) royalty waiver program will be retained and extended to bitumen wells.
- The new royalty regime takes effect in January 2009 to allow sufficient lead time to implement the required administrative systems and changes to the Natural Gas Royalty Regulation (NGRR). Since the OFSG sections of the NGRR interact with other sections dealing with natural gas royalty administration, the extension to bitumen wells is also scheduled to take effect in January 2009. However, the Departments' legal and regulatory staff are assessing the NGRR to determine if an earlier implementation date for the bitumen well extension is feasible. No timeline for a decision on earlier implementation has been established.

31) The Third Tier Exploratory Well Royalty Exemption program should provide recognition for the time period required for well test flaring.

January 08 update on the Third Tier Exploratory Holiday program for oil:

- The work to change this regulation to comply with the FVPT recommendation was completed in draft form by the Oil Development Business Unit in August 2007.
- The Royalty Review Panel recommended this royalty relief program be eliminated. This recommendation was accepted by the government in the New Royalty Framework.
- The changes to the Third Tier Exploratory Well Royalty Exemption recommended by the CASA FVPT's 2004 report will not be made as the program will be eliminated January 2009 as per the governments "New Royalty Framework".

Part 3. Recommendations to be implemented by CAPP and SEPAC

26) CAPP and SEPAC will develop a best practice code for venting close to residences by December 31, 2005.

This BMP was replaced by new regulation introduced in Directive 60 regarding notifications to residences for venting wells situated close to residences.

35) CAPP and SEPAC should develop best management practices guidelines for well test flaring by December 31, 2005.

This BMP is currently being revised by CAPP; publication is expected in Spring 2011.

39) CAPP and SEPAC should develop best management practices for maintaining flare equipment in acceptable condition to ensure good combustion performance

This BMP is currently being revised by CAPP; publication is expected in Spring 2011.

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.

The CAPP BMP for Fugitive Emissions Management is available on the CAPP website: http://www.capp.ca/library/publications/policyRegulatory/pages/pubInfo.aspx?DocId=116116

Below is the summary of implementation of the recommendations related to BMPs, as reported by Krista Phillips (CAPP) at the August 2010 CASA FVPT meeting:

Best Management Practice Guides	Current Status
1. Fugitive Emissions	Completed and available on the CAPP website[13].
2. Facility Flaring	Completed and available on the CAPP website[14].
3. Well Test Flaring	Currently under revision. Expected publication: Spring 2011
4. Flare Maintenance	Currently under revision. Expected publication: Spring 2011
5. Venting Close to Residences	Replaced by regulation introduced in Directive 60 on ERCB and resident notification for venting wells situated near residences.

[13] CAPP Facility Flare Reduction BMP available at: http://www.capp.ca/library/publications/policyRegulatory/pages/pubInfo.aspx?DocId=116116

[14] CAPP Facility Flare Reduction BMP available at: http://www.capp.ca/library/publications/sourGasFlaringVenting/pages/pubInfo.aspx?DocId=114231

Part 4. Recommendations to be implemented by the Air Research Planning Committee

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.

June 2010 Update: The recommendation was forwarded to the PTAC Air Research Planning Committee and discussed it at their meeting of June 16th, 2010; they are in the process of further expanding the RFP.

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.

June 2010 Update: The Recommendation was covered off in the research done by Al Chambers of the Alberta Research Council entitled *"Potential Release of Heavy Metals and Mercury from the UOG Industry into the Ambient Environment - Literature Review - October 16th, 2009"*.

Part 5. Recommendations to be implemented by CASA/Flaring & Venting Project Team

45) In 2007, the Flaring and Venting Project Team should review the best practices for leak detection and repair, and its use.

- The fugitive emissions best management practices did not become effective until January 1, 2010 (CAPP's "Best Practices for Fugitive Emissions Management can be found on their web site at: http://www.capp.ca/library/publications/industryOperations/Pages/default.aspx#phhz6foDX4v7).
- The FVPT recommends that this recommendation be reviewed at a later date.

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

- Complete.

Flaring and Venting Recommendations for Coal Bed Methane, March 2005

Part 1. Recommendations to be implemented by the ERCB (formerly, the EUB)
As reported by Michael Brown at the November 2006 CASA Board meeting, all 44 recommendations requesting modification to Directive 60 have been implemented.

Note: Section number references below refer to Directive 060, released November 16, 2006.

1. The EUB, in partnership with CAPP and SEPAC, set up a program to collect one month of data on the flaring and venting associated with CBM wells producing less than 1m3 of water per operating day across the province. Data to be collected includes the duration of flaring and/or venting, volumes of gas flared and/or vented, and reasons if the flaring and/or venting extends longer than 72 hours.

2. The Flaring and Venting Project Team be reconvened in Q2 2005 to review the data and develop recommendations regarding the time period for flaring and venting associated with CBM wells producing less than 1m3 of water per operating day for implementation January 1, 2006.
The data collection program was lead by the EUB Operations and Field Surveillance staff with design input from industry. An EUB Bulletin was developed and released describing the program and its requirements. Data was collected as recommended. The number of tests collected far exceeded expectation, thus providing a very substantial data set. All data was compiled and analyzed. Review by CASA FVPT members led to development of well testing time limit recommendations in June 2005 report. . Recommendations were implemented through rewrite of Directive 060. Directive 060 was released November 16, 2006. The effective date of the new requirements is January 31, 2007.

3. Until January 1, 2006, for CBM wells producing less than 1m3 of water per operating day, flaring and venting (including clean up and testing) is limited to a total period of 120 hours for development wells and 720 hours for other wells (period is not necessarily consecutive, i.e. excludes shut-in time) per zone tested unless an extension has been specifically granted by the EUB.
See Section 3.2 (1)
Rather than issue an interim requirement that might soon be changed if the recommendations pointed to a different time limit, it was decided to focus on reviewing the data and making final recommendations for time limits. This project to gather and review the data progressed quickly, as did the development of the recommendations and the writing of the report (released June 2006). The implementation of these time limits will take place January 31, 2007.

4. If additional time for flaring or venting of CBM wells producing less than 1m3 of water per operating day is needed, the EUB must be contacted as soon as possible with the reasons for the extension, but not later than the end of the 120 or 720 hour period.
Extensions may be granted:
• To clean up the well bore in unique situations;
• Where stabilized flow has not been reached; or
• Where there have been mechanical problems with the well.
After the well test, the well must be shut-in until gas conservation is implemented.
See Sections 3.2 (2), 3.2 (4), and 3.2 (6)

5. Existing flaring permit thresholds continue to apply as outlined in Guide 60: Updates and Clarifications available at http://www.eub.gov.ab.ca/bbs/products/guides/g60/g60-updates.pdf. This includes a permit threshold of 200 103m3 for wells which are already tied in, 400 103m3 for development wells, and 600 103m3 for exploratory wells. These thresholds correspond to Tier 3, Tier 2, and Tier 1 as defined in Guide 60 (see section 3.8.1, Feb 2001, Guide 60: Updates and Clarifications).
See Section 3.3.1 (2)

C. Recommendations for Wet CBM
6. For CBM wells producing more than 1m3 of water per operating day, flaring or venting must cease (gas must be conserved) within 6 months of gas production for an individual well exceeding 100 103m3 for any three-month period (approx. 1100 m3/day). Shorter tie-in periods must be pursued whenever possible. Operators must notify the EUB as soon as gas production exceeds 100 103m3 for any three-month period at a CBM well producing more than 1m3 of water per operating day that is flaring or venting.
For CBM wells producing more than 1m3 of water per operating day that do not trigger the above (i.e. 100 103m3 for any three-month period), flaring and venting is limited to the lesser of:
• a total period of 18 months, including the period to tie the well in, or
• a total volume of 400 103m3 for Tier 2 (development) wells or 600 103m3 for Tier 1 (other) wells, per zone tested. Wells that are already tied-in would be treated as Tier 3 and allowed a maximum flare volume of 200 103m3.
See Section 3.2 (7)

7. If additional flare times or volumes are needed to test a CBM well producing more than 1m3 of water per operating day, the operator must make a written request for such to the EUB as early as possible and in no case later than the end of the 18 month or volume allowance flare or vent period. Any extension request must include the reasons for the extension. Extensions may be granted to allow for additional flare time or volume for reservoir evaluations or where other special circumstances warrant.
See Section 3.2 (7c)

<u>Part 2. Recommendations to be implemented by CAPP and SEPAC</u>

8. A literature review should be conducted by CAPP by May 31, 2005 to determine whether there are any methods other than flaring or venting to remove nitrogen from CBM wells.

- Complete

9. Operators of wells negotiate to allow gas with higher nitrogen content to be delivered into pipelines.

- Not completed

Part 3. Recommendations to be implemented by CASA/Flaring & Venting Project Team

10. The Flaring and Venting Project Team review the flaring and venting framework for Coal Bed Methane when it reconvenes in the first quarter of 2007.

- Complete

Flaring and Venting Review of Well Test Time Limits, June 2005

Part 1. Recommendations to be implemented by the ERCB (formerly, the EUB)

1. Oil and gas well test flaring/venting (including clean up, completion, and testing) be limited to a total period of 72 hours (not necessarily consecutive, i.e. excluding shut in time) per zone tested. If flaring/venting for longer than 72 hours is required the following reasons will be accepted by the EUB:
- ***To clean up the well bore in unique situations;***
- ***Where stabilized flow has not been reached; or***
- ***Where there have been mechanical problems with the well.***

a. The operator must document these reasons and keep the information on file for audit by EUB when requested, but need not request permission to extend the flaring/venting past 72 hours.
b. If the audited operator failed to justify the exceedance of the 72 hours limitation, then the EUB enforcement policies would apply.
See Sections 3.2 (1), 3.2 (2), and 3.2 (3)of Directive 60??

2. If additional time for well test flaring/venting is needed, for reasons other than those mentioned above, the EUB should be contacted as soon as possible with the reasons for extension, but not later than the end of the 72 hour period.
See Section 3.2 (4)

3. When well test information indicates clean up is complete and the well flow is stabilized, flaring/venting must be discontinued.
See Section 3.2 (6)

4. For dry CBM wells classified as development wells, well test flaring/venting (including clean up, completion, and testing) be limited to a total period of 120 hours (not necessarily consecutive, i.e. excluding shut in time) per zone tested. If flaring/venting for longer than 120 hours is required the following reasons will be accepted by the EUB:
- ***To clean up the well bore in unique situations;***
- ***Where stabilized flow has not been reached; or***
- ***Where there have been mechanical problems with the well.***

a. The operator must document these reasons and keep the information on file for audit by EUB when requested but need not request permission to extend the flaring/venting past 120 hours.
b. If the audited operator failed to justify the exceedance of the 120 hours limitation, then the EUB enforcement policies shall apply.
See Sections 3.2 (1), 3.2 (2), and 3.2 (3)

5. If additional time for well test flaring/venting is needed, for reasons other than those mentioned above, 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.
See Section 3.2 (4)

6. When well test information indicates clean up is complete and the well flow is stabilized the flaring or venting must be discontinued.
See Section 3.2 (6)

7. For dry CBM not classified as development wells, well testing flaring/venting (including clean up, completion and testing) would be limited to a total period of 336 hours (not necessarily consecutive, i.e. excluding shut in time) per zone tested. If flaring/venting for longer than 336 hours is required the following reasons will be accepted by the EUB:
• To clean up the well bore in unique situations;
• Where stabilized flow has not been reached; or
• Where there have been mechanical problems with the well.
a. The operator must document these reasons and keep the information on file for audit by EUB when requested, but need not request permission to extend the flaring/venting past 336 hours.
b. If the audited operator failed to justify the exceedance of the 336 hours limitation, then the EUB enforcement policies shall apply.
See Sections 3.2 (1), 3.2 (2), and 3.2 (3)

8. If additional time for well test flaring/venting is needed, for reasons other than those mentioned above, the EUB should be contacted as soon as possible with the reasons for extension, but not later than the end of the 336 hour period.
See Section 3.2 (4)

9. When well test information indicates clean up is complete and the well flow is stabilized, the flaring or venting must be discontinued.
See Section 3.2 (6)

10. EUB will review EUB's well test requirements (i.e. Guide 40) by January 1, 2006 to see if flaring/venting from well tests can be reduced.
EUB Resources Applications staff have reviewed this issue and do not feel there are Directive 040 Requirements that encourage or require unnecessary flaring. Staff also indicated that Directive 040 may be undergoing review soon, and welcome input.

<u>Part 2. Recommendations to be implemented by CASA/Flaring & Venting Project Team</u>

11. The Flaring and Venting Project Team review the audit data when the FVPT reconvenes in the first quarter of 2007.
- EUB Operations and Field Surveillance staff are developing a process for auditing well testing.
- Review by F&V team still pending.

Appendix F: Nitrogen Removal from Coal Bed Methane

CAPP
CANADIAN ASSOCIATION OF PETROLEUM PRODUCERS

Memo

DATE April 28, 2005

TO John Squarek

FROM Tara Payment

SUBJECT Nitrogen Removal from Coalbed Methane

I was able to find two technologies that could potentially be feasible for removing nitrogen from coalbed methane: 1) Molecular Gate® and 2) NitroSep™. Below is a brief summary of the two technologies.

Technology	**Molecular Gate®**	**NitroSep™**
Manufacturer	Engelhard Corporation	Membrane Technology and Research Inc.
Location	Iselin, NJ	Menlo Park, CA
Application	Traps N_2 and CO_2 in fixed bed of adsorbent material at high pressure while CH_4 flows through at near feed pressure.	Membrane system divides gas into two streams: <4% N_2 (sent to pipeline) and 30-50% N_2 (used to fuel compressor engines). In some cases, third stream is produced, 60-85% N_2 (flared or reinjected).
Construction	Skid-mounted	Skid-mounted
Power Source	Gas-powered generator; uses tail gas from process as fuel	Gas-powered compressor; fueled by second gas stream.
Website	www.engelhard.com/moleculargate	http://www.mtrinc.com/Pages/NaturalGas/NitrogenRemoval/nr.html
Contact Phone	732.205.6979	650.328.2228
Contact E-mail	michael.mitariten@engelhard.com	kaaeid@mtrinc.com

Engelhard Corporation sent much information on Molecular Gate®, attached. Also attached is the website information for NitroSep™. Gas Liquids Engineering Ltd. (based in Calgary) indicated that they have looked into both technologies and found that they were too operating-cost prohibitive.

Costain Oil, Gas & Process Ltd. (based in Manchester, UK) also advised that there is likely no economical technology for our purposes, based on the very small flow and the varying nitrogen level. General capability information for nitrogen rejection for Costain is attached.

Let me know if you want me to pursue any of the above further.

Appendix G: Gathering Information on Flare Performance Requirements and Efficiency Standards

To gain a better understanding of current research efforts, the FVPT invited Dr. Matthew Johnson, Canada Research Chair in Energy and Combustion Generated Air Emissions at Carleton University, to make a presentation to the Team. Dr. Johnson is currently completing a research project that will report the level of GHG emissions from flaring and venting in Alberta.

The FVPT invited Dr. Johnson to attend a meeting in April 2009 to assist with the fulfillment of the Team's objective to assess research findings and their implication for the management of flaring and venting, and to determine other research needs and recommend further research (Objective 3). This section summarizes the information provided by Dr. Johnson during his presentation.

Original flaring combustion efficiency research was performed by the United States Environmental Protection Agency (USEPA) in the early 1980s. The Alberta Research Council (ARC) also looked at this topic in the mid-1990s but their focus was on small solution gas flares. Since 1996, further research has been conducted by the University of Alberta, Natural Resources Canada and Carleton University, with a focus on combustion efficiency of solution gas flaring. Researchers have found that combustion efficiency is dependent on cross-wind velocity, fuel exit velocity, fuel type, heating value of fuel, and stack diameter. Findings also show that the emissions from inefficient combustion are primarily unburned fuel and carbon monoxide (CO).

The University of Alberta did research on combustion efficiencies and found that predicted efficiencies were over 90% for the range of conditions studied. Since 2005, Carleton University has been conducting research on emissions and flaring. Carleton University has also been collaborating with the National Research Council on some on-going research focussed on:

- Developing and improving models for flare efficiency and flare greenhouse gas emissions;
- Developing measurement protocols for quantifying soot flux in flare plumes; and
- Using novel methods to detect and locate fugitive emissions.

Looking ahead, researchers have identified a need for quantitative models based on realistic flare gas composition data. Particulate matter (PM) and volatile organic compounds (VOC) have not been quantified in terms of mass emitted per mass of flare gas consumed. High momentum flares are largely unexplored. Finally, accurate measurement protocols for estimating flare volume are desired, especially internationally as a means to establish GHG emission numbers.

Dr. Johnson highlighted a need to better understand PM from flares since it is strongly linked with health concerns and has recently been implicated as a potentially significant contributor to global warming. Highlights from experiments conducted with soot (a component of particulate matter) in a

wind tunnel at the University of Alberta and work done by Carleton University/Natural Resources Canada included:

- The maximum amount of soot emitted was at zero cross-wind.
- Natural gas did not emit detectable particulates.
- Soot emissions were not strongly dependent on wind speed.
- Soot is strongly influenced by sampling conditions.
- Fuel composition is key – there is an order of magnitude change in soot yield for a small change in fuel composition.
- Camera-based techniques for measuring soot flux in plumes, at least for visibly sooting flares, shows promise for significant improvement over the opacity standard as determined by a certified visible emissions reader currently in use.

Dr. Johnson's presentation also identified some of the key unknowns as follows:

- The current database of wind tunnel experiments is based on overly simplified fuel mixtures of methane with CO_2 or nitrogen.
- Need more comprehensive models – currently can't predict the behaviour of an individual flare.
- There is little understanding to reliably estimate soot emissions.
- Camera-based field diagnostics (already have most of what's needed to continue development).

Finally, future directions for research on soot from flares include the following:

- Test measurements for soot for a broad range of conditions, including: flow, diameter, base fuel, and fuel mixture.
- Soot particulate property characterization.

Overall, this presentation improved the understanding of the FVPT. However, the Team concluded that Alberta cannot set a combustion efficiency standard at this time. Hence while the efficiency of flares and research into emissions from flares continues to be relevant information to improve overall understanding of the issues with flaring, it did not affect the outcome of this process.

Appendix H: Informational Outline: Alberta Casing Vent Gas in Heavy Oil Areas

County of VERMILION River

INFORMATIONAL OUTLINE
ALBERTA CASING VENT GAS IN HEAVY OIL AREAS

Goal/s

- The County of Vermilion River's long term goal is to become a major supplier of casing vent gas and to provide Albertan's value from this non-renewable resource.
- To tie in all major venting wells within our area and further develop industrial partnerships to utilize this gas in an environmentally beneficial manner.
- To reduce the volume of green house gases vented to atmosphere

Vent Gas Scenario Description	Casing Vent Gas Production Rate		Co_2E tonnes/ year	Oil Prod m^3/day	Gas Royalty Rate Vented from an oil well as of 2009-01-01 %	Gas Royalty Rate For a Gas Well of this volume %
	M^3/day	GJ/day				
ERCB Guideline-Oil Volume #1	900	31.79	4,494	1.00	5.00	5.00
ERCB Guideline-Oil Volume #2	900	31.79	4,494	5.00	21.98	5.00
ERCB Guideline-Oil Volume #3	900	31.79	4,494	20.00	41.25	5.00
Exceeding Guideline Rate #1	3600	127.15	17,975	1.00	14.59	9.25
Exceeding Guideline Rate #2	3600	127.15	17,975	5.00	30.08	9.25
Exceeding Guideline Rate #3	3600	127.15	17,975	20.00	41.25	9.25

- The average home uses 200 GJ/yr
- A legally venting oil well, 900 m^3 (33 GJ/day), could supply 56 homes/yr if gathered and reduce emissions by approximately 4,494 CO_2E tones/yr
- The County presently utilizes over 1000 GJ/day casing vent gas in their main fuel gas gathering infrastructure (equivalent of heating 1825 average size homes)
- 1000 GJ/day correlates to a 140,000 CO_2E tones/yr reduced greenhouse emissions
- The County allows industrial companies to gather and transport casing vent gas in our pipeline systems. The industrial and residential volumes are equivalent to serving 7500 homes year round and correlates to 490,000 CO_2E tonnes/yr reduced greenhouse gas emissions
- There are approximately 5700 Heavy Oil Wells in our area
- There are wells in our area venting volumes estimated in excess of 3600 m^3/day

Issues That Hinder Casing Vent Gas Gathering

- Typically, gathering and processing casing vent gas is marginally economical.
- Royalty rates for casing vent gas are linked to the oil production of the well which can make for higher royalty rates than if this gas came from a gas well.
- There appears to be no capital funding available to assist in gathering casing vent gas like the previous ICAP program.

Possible Methods of Enhancing Casing Gas Gathering

- Access to carbon capture money for future gathering system projects
- Recognition in the way of carbon credits for gathering vented gas
- Restructuring of the royalty rates for casing vent gas in heavy oil areas
- Assistance from the ERCB to encourage gas gathering

DRS

Appendix I: New and Emerging Technologies