Technical Protocol Plan

Quantification Protocol for Solution Gas Conservation

March, 2009

PART A: IDENTIFICATION OF THE PROTOCOL DEVELOPER

A.1. Title of the Proposed Protocol:	
Quantification Protocol for Solution Gas Conservation	
A.2. Lead Protocol Developer:	
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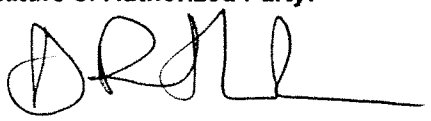
Signature of Authorized Party:  Duncan Rotherham, Vice President	
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PART B: TECHNICAL PROTOCOL PLAN

B.1.a. Description of the Project Type

Solution gas is the natural gas produced in association with crude oil and bitumen production. The solution gas can be flared, vented or conserved. Greenhouse gas (GHG) emissions associated with solution gas venting are included in Canada's National GHG Inventory.[1] Oil and gas projects that release solution gas through normal operations are common in the Province of Alberta, which has established itself as a world-leader in solution gas conservation since the early 2000's through intensive stakeholder meetings, academic and commercial studies and supporting regulation.

In 2007, 672 million cubic meters (or 4.2%) of all solution gas produced in Alberta was flared or vented, which translates into a significant volume of GHG's released into the atmosphere. Solution gas conservation is therefore an effective means of generating emission offsets.

Conservation of solution gas can generally be achieved in three ways: i) injection into a natural gas pipeline; ii) on-site use as fuel gas; and/or iii) combustion to generate electrical power. The proposed protocol will focus on emission offsets generated by conservation through the injection of solution gas into a natural gas pipeline.

The Alberta Energy Resource Conservation Board's (ERCB) *Directive 060: Upstream Petroleum Industry Flaring, Incinerating and Venting* is the most pertinent regulation with respect to solution gas conservation in Alberta. Through *Directive 060,* oil and bitumen extraction sites in Alberta are required to estimate their solution gas generation, a portion of which are required to conserve solution gas. The proposed protocol will apply to the conservation of solution gas that is not required by regulation.

In cases where solution gas conservation is not required, common practice is to vent the gas directly to the atmosphere. Providing emission offsets for solution gas conservation in these cases would provide an incentive to project developers to reduce GHG emissions through the capture and conservation of solution gas.

B.1.b. Description of how real reductions or removals will be achieved

The offsets developed under the proposed protocol will be within the scope and criteria of the Alberta Offset system as described by the *Specified Gas Emitters Regulation (SGER)*.

Scope/Criteria	**Description**
Start Date	Only those oil/bitumen extraction sites that began conserving solution gas after January 1, 2002 will be eligible for crediting.
Credit Duration Period	Projects using this protocol will be eligible to generate credits for 8 years[2], with a possible extension of 5 years, subject to the approval of Alberta Environment. The crediting period begins on the date that emission reductions are first claimed as an offset.
Real	Solution gas conservation projects gather and utilize solution gas (primarily CH_4) that would otherwise be vented to the atmosphere. Real reductions in GHG emissions are achieved via the destruction of methane that would otherwise be emitted to the atmosphere. Note: 1) A small amount of GHG's may be released as a result of the project activities; these will be addressed in the quantification section of the

[1] National Inventory Report: Greenhouse Gas Sources and Sinks in Canada, 1990-2006. Oil and Natural Gas (CRF Category 1.B.2)

[2] The 8 year period is in accordance with the criteria of the Alberta Offset System. The similarity to the average life of an oil well is purely coincidental.

	proposed protocol. 2) The proposed protocol will not directly quantify emission offsets generated through the displacement of natural gas or other fossil fuels; this option will be available to project developers through a flexibility mechanism.
Demonstrable and Quantifiable	The emission offsets from solution gas conservation projects are easily demonstrable and quantifiable using standard techniques. At a minimum, each project site will meter flow rates and periodically analyze gas concentrations, as well as any incremental fossil fuel and electricity consumption.
Not Required by Law	Only those solution gas conservation projects that are not required by any local, provincial or federal regulation, including *Directive 060* at the time when the solution gas conservation begins, will be eligible for crediting.
Ownership	Solution gas projects are unlikely to have any credit ownership issues, as these issues are inevitably linked to the well-established oil and gas rights. In cases of joint ownership, the ownership of any emission offsets created will be addressed privately by the parties through partner contracts, prior to the issuance of offsets.
Counted Once	Only those oil/bitumen extraction sites that emit less than 100,000 tonnes of CO_2e will be eligible to generate offset credits from solution gas projects. An emission reduction from a solution gas conservation project under the proposed protocol will only be used once to create an emission offset; the same emission reduction may not be registered on any other registry or counted elsewhere for compliance purposes without first removing the offset from the Alberta registry.
Verified by a Third Party	The recording of data and information to support emission reduction claims as a result of solution gas conservation projects will be required practice. The required reporting and monitoring procedures will be included in the quantification protocol. This information will allow a Third Party to verify the emission reduction claim.
Occurred in Alberta	The proposed protocol will be applicable only to qualifying solution gas conservation projects located in Alberta.

B.2. Description of Background Information/Best Practice Guidance Used

1. Document Title	**2. Publishing Body/Date**	**3. Description**
General Protocol Guidance		
Canada's National Inventory Report: Greenhouse Gas Sources and Sinks in Canada, 1990-2006	Government of Canada (2008)	On behalf of the Government of Canada, Environment Canada releases a national inventory of Greenhouse Gases annually in accordance with international UNFCC reporting standards.
SGER: Alberta Offset System Draft Protocol Development Guidance Document	Alberta Environment (October 2008)	A draft guidance document outlining how to develop protocols for offsets under the Alberta Registry.
ISO 14064-2	International Organization for Standardization (2006)	Provides guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements.
ISO 14064-3	International Organization for Standardization (2006)	Provides guidance for the validation and verification of greenhouse gas assertions.
Protocols Reviewed		
AM0009 Version 3: Recovery and utilization of gas from oil	Clean Development Mechanism –	Approved baseline and monitoring methodology for recovery and utilization of

wells that would otherwise be flared or vented.	Executive Board (November 2008)	gas from oil wells that would otherwise be flared or vented.
AM0037 Version 2.1: Flare (or vent) reduction and utilization from oil wells as feedstock	Clean Development Mechanism – Executive Board (May 2008)	Approved baseline and monitoring methodology for recovery of associated gas (from oil wells) which was previously flared, and subsequently used in an existing or a new end-use facility, to produce a useful chemical product.
Quantification Protocol for Landfill Gas Capture and Combustion, Version 1.	Alberta Environment (September 2007)	General guidance on selection of SSR, quantification and monitoring.
Quantification Protocol for Anaerobic Treatment of Wastewater Projects, Version 1.	Alberta Environment (March 2009)	General guidance on selection of SSR, quantification and monitoring.
Other Resources		
University of Alberta - Flare Research Project - Interim Report Executive Summary	University of Alberta / Environment Canada (June 2000)	High level historical context of flaring of solution gas in Alberta.
Upstream Petroleum Industry Flaring and Venting Report - Industry Performance for Year Ending December 31, 2007	Energy Resources Conservation Board (June 2008)	Addresses solution gas flaring and venting in from all upstream sources in Alberta.
Directive 060 – Upstream Petroleum Industry Flaring, Incinerating and Venting	Energy Resources Conservation Board (November 2006)	The regulation addressing solution gas management practices in the province.
Report and Recommendations of the Flaring Project Team	Clean Air Strategic Alliance (1998)	High level historical context of flaring of solution gas in Alberta.
Information Letter 99-19: Otherwise Flared Solution Gas Royalty Waiver Program	Alberta Department of Resource Development (June 1999)	Other incentives available for solution gas conservation.
Greenhouse Gas Emission Reduction Opportunities for the Upstream Oil and Gas Sector and the Gas Pipeline Sectors in British Columbia	Pembina Institute (July 2000)	Context for oil and gas industries.
ID2001-03: Sulphur Recovery Guidelines for Alberta	Alberta Energy and Utilities Board (August 2001)	Regulation addressing sulphur recovery in the Province of Alberta.

B.3. Regulatory, Legal Requirements and/or Government Incentive/Grant Programs

In accordance with Alberta's SGER, facilities with GHG emissions greater than 100,000 tonnes of CO_2e per year are required to reduce GHG emissions intensity by up to 12% from the average of their 2003-2005 levels by December 31, 2007.

The Canadian Federal Government's "Turning the Corner: Regulatory Framework for Industrial Greenhouse Gas Emissions" document released in March 2008 requires an 18% reduction in emissions intensity from 2006 levels in 2010 for all oil and gas facilities producing over 10,000 barrels of oil per year or emitting more than 3,000 tonnes of CO_2e/year. Emission reductions originating from such oil/bitumen extraction sites will not be eligible to generate offsets under this protocol. The full implications of federal regulation will be assessed once they are finalized.

The current requirements of Alberta ERCB's *Directive 060* for Upstream Petroleum Industry Flaring, Incineration and Venting have been in effect since January 31, 2007 and provides regulatory requirements regarding conservation of solution gas. *Directive 060* requires upstream oil and gas producers to annually conduct an economic evaluation and potentially implement solution gas conservation subject to specified criterion. Those projects that begin conserving solution gas prior to any regulation requiring conservation are eligible to generate offset credits. In the event that a site that is conserving solution gas voluntarily becomes regulated, the project will remain eligible to generate emission offsets for a period of 12 months from the date the regulatory requirement to conserve takes effect.

B.4. Barriers to Implementation

The biggest identifiable barriers to implementation are the economics of the solution gas conservation. For oil/bitumen extraction sites that are not required to conserve, the capital costs associated with conservation of solution gas are often not recovered by the resulting revenue. Following are some drivers of higher costs/lower revenues associated with solution gas conservation:

1. Pipeline: Sites that are in close proximity to pipeline systems will have lower capital costs associated with transporting the solution gas to a regulated natural gas pipeline (and therefore to market) due to the decreased length of the connector pipe.
2. Compressor Discharge Pressures: The lower the required strength of the compressor, more economic the conservation process will be.
3. Gas Oil Ratio (GOR) distributions: GOR is an estimate of how much solution gas is contained in oil. Sites with higher GOR values are generally more economic due to higher volumes of solution gas available.

The technology associated with the capture, processing and delivery of solution gas is well-known, standardized and scalable in the industry.

B.5. Review of Technology / Scientific Knowledge

The technology being used under the project condition is standard: pipelines, compressors, processing equipment, sampling devices, volumetric flow rate and gas concentration sampling. There is no new technology associated with the conservation of solution gas; identical technology is widely used to conserve solution gas in Alberta as required by regulation.

B.6. Review of Existing Projects

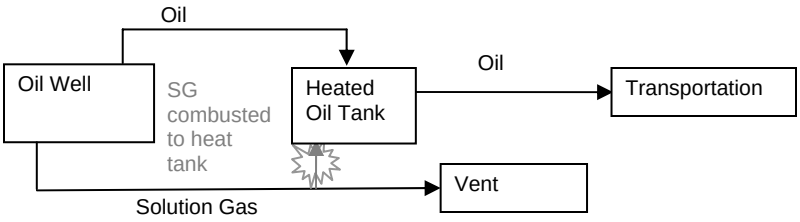
In 2007, 95.8% or 15,328[3] million cubic meters of solution gas were conserved; the remaining 4.2% (or 672 million cubic meters) of solution gas was flared or vented. Assuming none of the solution gas vented or flared in 2006 was required to be conserved by regulation, there is potential for mitigation of approximately 5 Mt CO_2e[4] through conservation of solution gas that is not required by *Directive 060*. The proposed protocol will enable project developers to make conservation projects more economic, delivering significant, real, and quantifiable offsets in Alberta.

B.7. Summary of Quantification Approaches

The baseline condition is venting of solution gas from sites that are not required by existing regulation to conserve solution gas.

Figure 1: Baseline Condition

[3] Upstream Petroleum Industry Flaring and Venting Report -- Industry Performance for Year Ending December 31, 2007
[4] This estimate is based on the following assumptions: 672 million m^3 of solution gas vented or flared annually in Alberta; methane density of 0.717 kg/m^3, an average concentration of 95% methane in solution gas; 52% of solution gas is vented; and a methane global warming potential of 21.

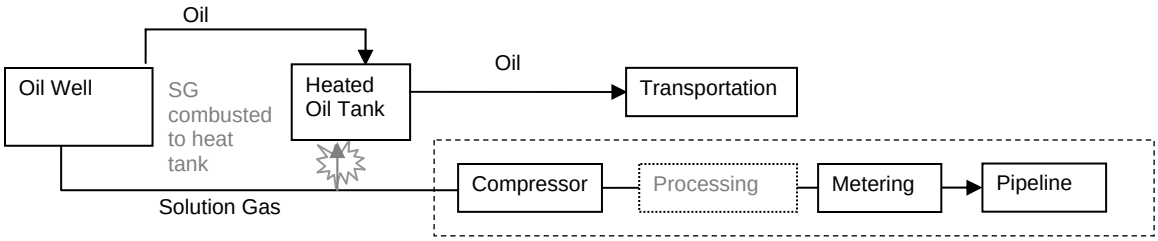


When the oil/bitumen is extracted from the ground, the solution gas dissolved in-situ dissociates. Under the baseline scenario, some of this solution gas is combusted to heat the oil/bitumen held in storage tanks; the remaining solution gas is vented.

The main baseline emission source will be calculated using the volume and concentration of solution gas injected into a natural gas pipeline under the project condition.

In the project scenario the solution gas that would otherwise have been vented is now conserved as per Figure 2.

Figure 2: Project Condition



Note: Not all sites will require the solution gas to be processed.

Under the project condition, the conserved solution gas is compressed and processed (if required[5]) for delivery into the regulated pipeline system. The volume of solution gas is typically measured at the point of entry into the pipeline system. Greenhouse gas emissions, if any, associated with the consumption of electricity or combustion of fossil fuels (including solution gas) to operate the compressor[6], processing equipment, meters[7] may also represent emission sources that will need to be quantified. Flexibility mechanisms that conservatively simplify the quantification will be provided in the protocol.

Industry sources typically cite a 95%-97% methane concentration for solution gas. Annual gas analysis for composition is not uncommon at sites that conserve solution gas, which can be used to determine the heating value of the gas to determine the value of the gas. Currently, in the absence of annual gas analyses, gas purchasers will accept the most recent analyses, which are typically no more than a few years old. The proposed protocol will require periodic gas analyses to determine the methane content of the gas going to sales. Project developers will only receive credit for that portion of the solution gas that is methane.

$$\text{Emissions Reduction} = \text{Emissions}_{\text{Baseline}} - \text{Emissions}_{\text{Project}}$$

[5] Processing refers to any treatment of the solution gas to enable it to meet the standards of the natural gas pipelines including for instance passing the solution gas through driers. Typically, solution gas from oil extraction sites does not need to be processed any further. In such cases the emissions from processing would be zero.

[6] Typically when a compressor is added to a site, there is no incremental power demand off the grid associated with the compressor. (In fact, most sites are not even electrified.) Instead there is a small alternator battery on the compressor that is used both to start the compressor, and provide electricity for any of the instrumentation (pretty much like a car.) In such cases additional (negligible) emissions would be limited to the periodic charging of the battery.

[7] Most meters work based on the pressure of the gas flow they are measuring. In such cases, emissions from metering would be zero.

$$\text{Emissions}_{\text{Baseline}} = \text{Emissions}_{\text{Extraction Equipment Operation}} + \text{Emissions}_{\text{Solution Gas Venting}} + \text{Emissions}_{\text{Fuel Extraction / Processing}}$$

$$\text{Emissions}_{\text{Project}} = \text{Emissions}_{\text{Extraction Equipment Operation}} + \text{Emissions}_{\text{Solution Gas Equipment Operation}} + \text{Emissions}_{\text{Solution Gas Vented}} + \text{Emissions}_{\text{Solution Gas Use}} + \text{Emissions}_{\text{Fuel Extraction / Processing}}$$

B.8. Other Impacts

Installing additional infrastructure such as a connection to a regulated commercial natural gas pipeline could impact the environment: for instance, pipeline could block migration routes or pass through ecologically sensitive areas. However, solutions to these issues exist, and it is expected that all physical infrastructure additions, including the connector pipelines for conserved solution gas, will have minimal ecological impact.

B.9. Assessment of Baseline Scenarios

Best practice guidance from the *Alberta Offset Credit Project Guidance Document* requires considering various approaches to calculating baseline emissions. The table below provides a summary of the different baseline options considered:

1. Baseline Options	2. Description	3. Static / Dynamic	4. Accept or Reject and Justify
1. Historic Benchmark	Assessment of the baseline emissions from site-specific venting of solution gas from oil/bitumen extraction sites over several years prior to the installation of the solution gas capture system.	Static	Reject. The volume of solution gas will change over time depending on the characteristics and volume of extracted oil/bitumen.
2. Performance Standard	Assessment of the typical solution gas conserved from oil/bitumen extraction sites with similar technology employed.	Static	Reject. The volume of solution gas recovered is site-specific. Assigning a baseline to existing solution gas installations would be inaccurate.
3. Comparison based	Assessment of solution gas venting baseline emissions from sites which are not currently required by law or incented by economics to conserve.	Dynamic/Static*	Reject. The volume of solution gas recovered is site-specific.
4. Projection based	Assessment of how much solution gas will be conserved from a particular site using a model and associated assumptions.	Static	Reject. The volume of recovered solution gas is dependent on numerous exogenous factors that make modeling based projections less reliable.
5. Adjusted Baseline	Assessment of site-specific solution gas conservation and adjusting for common industry practices.	Dynamic/Static*	Reject. The volume of solution gas will change over time depending on the characteristics and volume of extracted oil/bitumen.

6. Other: Site Specific	Site-specific measurement of conserved solution gas correlating to the volume of solution gas that would otherwise have been vented.	Dynamic	Accept. The volume of solution gas conserved is site-specific and will vary over time. Site-specific metering of the volume of solution gas conserved is the most appropriate way to establish a baseline.

**These baseline approaches may be designed such that they change or stay constant over the registration period; therefore, both designations have been included.*

B.10. Selection of Baseline Scenario

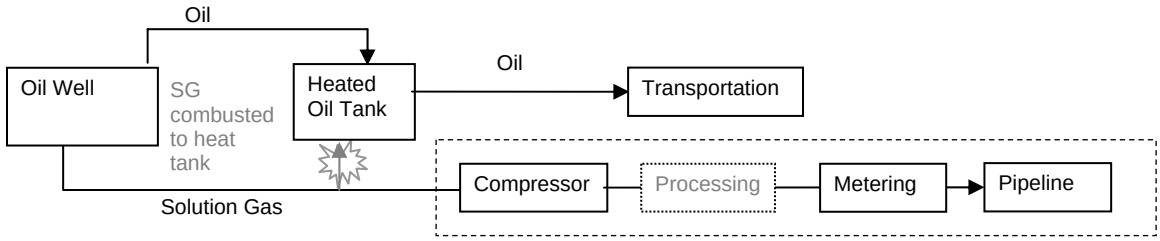
The baseline condition for projects applying this protocol is defined as the volume of methane that would be released to the atmosphere from the venting of solution gas resulting from the extraction of oil and/or bitumen.

The baseline will be quantified via a combination of direct measure, when there is sufficient data available, and industry standard estimation methodologies. The baseline scenario for this protocol is dynamic as the volume of methane would be expected to change materially relative to the location, age and characteristics of the individual oil/bitumen extraction sites. The baseline condition will vary from project to project.

B.11. Definition of Project Condition

The proposed protocol applies to the conservation of solution gas, particularly its delivery to natural gas pipelines, for those sites where solution gas conservation is not required by law.[8]

The baseline condition will be the venting of solution gas from oil/bitumen extraction sites. The project condition will involve capture and processing of solution gas and delivery to the natural gas pipeline, as shown below.



Note: Not all sites will require the solution gas to be processed.

B.12. Functional Equivalence

The reason for the existence of these facilities is to extract oil/bitumen. Functional equivalence is defined by quality and quantity of oil/bitumen produced under the baseline and project conditions. The project condition will not effect the volume or quantity of oil/bitumen produced.

The project and baseline conditions are functionally equivalent since the quantity and quality of oil/bitumen produced remain unchanged.[9]

[8] The government of Alberta already has regulations in place that are designed to conserve solution gas as much as possible. Currently AB ERCB *Directive 060* regulates solution gas management practices in the province. The regulation requires that subject to certain economic criterion if a given oil well emits more than a certain amount of solution gas in a year, then the company that owns the well is required to conserve solution gas. The proposed protocol will apply to those situations where the conservation of solution gas is not required by law.

[9] The solution gas is dissolved in the oil/bitumen, and naturally dissociates when the oil/bitumen is extracted. The conservation of solution gas will not affect the quantity of oil/bitumen extracted.

B.13. Flexibility Mechanisms

The proposed quantification process will focus on the conservation of solution gas and its delivery to natural gas pipelines in oil/bitumen extraction sites that are not required by law to conserve solution gas. There will be flexibility in applying the proposed quantification protocol in the following ways:

1. Project developers may use alternative monitoring methodologies other than those described in the protocol. The developer must justify that the chosen methodology is equivalent or more conservative;

2. Site specific emission factors may be substituted for the generic emission factors indicated in the protocol document. The methodology for generation of these emission factors must be sufficiently robust as to ensure reasonable accuracy;

3. The project developer may choose to claim those emission offsets resulting from the displacement of fossil fuels. In these cases, the volume of fuel displaced should be calculated on an equivalent energy basis;

4. Emission offsets may be generated from those sites where flaring, rather than venting of the solution gas occurs under the baseline condition. Appropriate alterations to the quantification methodology should be made, with suitable justification.

5. The project developer may aggregate offsets from multiple projects to facilitate offset commoditization.

6. The protocol will have the flexibility to adapt to changing solution gas conservation regulation over time.

7. Should a site that is voluntarily conserving solution gas subsequently be required to conserve solution gas due to changes in site conditions, regulations or other external factors, emission offsets may be claimed for a period of 12 months from the date that solution gas conservation is required, provided the other conditions of this protocol are met.

8. Where it is conservative to do so, the quantification methodology contained within the protocol may be simplified by including only the emissions from the use of solution gas in a pipeline under the project condition and the volume of solution gas injected into the pipeline under the baseline condition.

If applicable, the project developer must indicate where flexibility provisions have been used and provide sufficient justification for their use.