

Base Protocol Plan for the Anaerobic Digestion of Organic Materials

Fast Track Protocol Development Process

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Part I: Identification of the Protocol Developer

1.1 Title of the Base Protocol:

Quantification Protocol for the Anaerobic Digestion of Organic Materials

1.2 Lead Protocol Developer

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1.3 Initiating Entity

TBD

1.4 Rationale for initiating the development of the protocol (optional):

There is industry support behind the development of this protocol and a recognized opportunity to generate greenhouse gas offset credits.

Through the working group members strive to ensure that protocols are:

- Based on a complete life-cycle analysis with consideration of all relevant GHG sources and sinks;
- Consistent in their treatment of cross-cutting issues;
- Based on accurate and unbiased best science and best practice guidance
- Fully transparent; and
- Conservative so as to ensure that environmental integrity is maintained.

Part II: Base Protocol Applicability and Development Approach

2.1 Description of the Project Type:

This protocol is applicable to projects which involve the anaerobic digestion of organic materials to generate biogas, containing methane, and the subsequent use of the biogas in energy generation systems. These projects may include large centralized anaerobic digesters accepting feedstocks from multiple sources or may include smaller on-farm digesters with a single source of feedstock materials. The feedstocks for digestion may include a wide variety of biodegradable organic materials, but commonly include manure, source separated organic wastes, food or agricultural processing residues, bio-solids from wastewater treatment processes, dedicated energy crops (silage), specified risk matter (SRM), or other organic materials. In many projects livestock manure will be the primary feedstock providing a base load of volatile solids to the digester with additional organic materials added to enhance biogas production. For smaller scale on-farm digesters, manure may be digested to improve animal waste management at the farm and to beneficially generate energy.

Anaerobic digestion refers to the microbial conversion of biodegradable organic materials into biogas, consisting of primarily methane and carbon dioxide, under oxygen-free (anaerobic) conditions. Anaerobic digesters vary in terms of sophistication and may range from simple covered animal waste lagoons that capture biogas to heated complete mix digesters with processes to control feedstock loading rates, temperatures and pH in an effort to maximize biogas output.

The major opportunity for generating carbon offsets with this protocol arises from the displacement of fossil fuels with biogas produced from the anaerobic digestion of organic materials. The biogas may be used to generate renewable electricity, thermal energy or may be upgraded and input into natural gas transmission systems.

Additional opportunities to generate carbon offsets will depend on the sources of feedstocks used in the anaerobic digestion process and the manner in which they were previously managed, stored or disposed in the baseline condition. The diversion of organic wastes from landfill to the anaerobic digester may avoid methane emissions from the decomposition of the wastes under anaerobic conditions in the baseline landfill. Methane emissions may also be avoided through the diversion of manure from uncontrolled long term anaerobic storage to controlled anaerobic digestion processes in the project condition. Methane emissions predominantly occur from livestock operations that manage manure with liquid or slurry-based systems (e.g. in anaerobic lagoons, ponds, tanks, or deep pits).

It is recognized that there may be other approaches to avoid methane emissions from manure management or from the decomposition of organic solid wastes in landfill, e.g. composting, land application, incineration, gasification or other aerobic treatment processes. However, at this time, GHG reduction activities not associated with the installation of an anaerobic digester and / or biogas control system (e.g. lagoon cover) are

not applicable under this protocol. Additionally, the avoidance of methane emissions from industrial wastewater treatment systems, such as anaerobic wastewater treatment systems used in the food processing sector, is not applicable under this protocol.

It should be noted that for the sake of conservativeness this protocol does not include the quantification of nitrous oxide (N₂O) emissions from manure production, storage, treatment or land application. The quantification of nitrous oxide emissions associated with the operation of manure management systems and with the application of manure to soils relies on emission factors which have very large uncertainties.¹ The reason for the large uncertainty is the complex nitrification-denitrification emissions pathway whereby organic nitrogen in livestock waste is converted to nitrous oxide.²

As there are multiple opportunities for generating emission reductions from biogas projects, such projects will positively impact Canada's National GHG Inventory. The following impacts will be realized under the associated sectors, as outlined in the National Inventory Report 1990 – 2005: Greenhouse Gas Sources and Sinks in Canada:

- The reduction of emissions from fossil fuel combustion sources as addressed in section 3.2.4 “Fuel Combustion (CRF Category 1.A.1)”;
- The reduction of emissions from organic solid waste landfills as addressed in section 8.2 “Solid Waste Disposal on Land (CRF Category 6.A)”;
- The reduction of CH₄ emissions from manure management as addressed in section 6.3 “Manure Management (CRF Category 4.B.A).”

2.2 Description of Project-specific Technology (if applicable)

Project-specific technology includes anaerobic digestion (AD) systems and associated equipment used to produce biogas and generate energy from biogas combustion. There are a wide variety of technology providers that sell AD units and biogas utilization systems and this protocol does not specify any one type of AD system.

2.3 GHG(s) that will be reduced:

- CO₂;
- CH₄; and
- N₂O

¹ California Climate Action Reserve (CCAR) Livestock Project Reporting Protocol Version 2.1. Capturing and Destroying Methane from Manure Management Systems. August 2008.

² This approach is consistent with that used by the California Climate Action Reserve (CCAR) and the Regional Greenhouse Gas Initiative (RGGI). Under the RGGI Model Rule (January 5, 2007) and the CCAR Livestock Reporting Protocol project developers do not receive credit for reductions in nitrous oxide. The CDM “Consolidated baseline methodology for GHG emission reductions from manure management systems” (ACM0010 V.2) and the U.S. EPA Climate Leaders, Draft Manure Offset Protocol (October 2006) on the other hand allow project developers to calculate decreases in nitrous oxide emissions from sources up to, but excluding, land application.

2.4 Description of how real reductions will be achieved:

Anaerobic digestion projects can achieve real GHG emission reductions in as many as three ways depending on the type of anaerobic digestion project and the feedstocks used. Firstly, anaerobic digestion projects may include the generation of electricity, thermal energy or pipeline quality natural gas from biogas, resulting in real GHG reductions from the displacement of fossil fuels or electricity. Secondly, the productive use of manure as a feedstock for anaerobic digestion may avoid methane emissions that would have occurred under the baseline manure management practice (e.g. long term storage of liquid manure in an open anaerobic lagoon). Thirdly, the diversion of organic wastes from landfill to anaerobic digestion facilities may avoid methane emissions that would have occurred from the anaerobic decomposition of the wastes in landfill.

2.5 Base Protocol Flexibility:

The base protocol offers project developers flexibility in a number of ways related to the type of baseline waste management practice for the feedstock to the anaerobic digester and for the energy outputs from the biogas utilization system. The protocol allows for the baseline practice to include land application of manure, manure storage, landfilling (e.g. food processing residues) or incineration (e.g. specified risk materials) of the waste material and does not limit the feedstock to manure only. The protocol allows for the quantification of GHG emission reductions associated with the diversion of wastes from landfill where methane emissions from waste decay are avoided.

The project configuration is also flexible to allow for the quantification of GHG emissions from a variety of biogas uses including the generation of heat, electricity or input into the natural gas pipeline, all of which would displace equivalent quantities of fossil fuels on an energy basis. The protocol allows for the use of biogas and biogas-derived energy outputs on-site or off-site.

Flexibility mechanisms included in the project allow for the use of site-specific emission factors, grouping of SSRs where a single meter or piece of equipment is the only source of data for multiple SSRs and the addition of excluded SSRs back into the protocol when functional equivalence cannot be established (e.g. transportation of feedstocks from off-site).

2.6 Federal, Provincial/Territorial Legal Requirements & Climate Change Incentives

2.6.1 List of potentially relevant requirements:

There are no known requirements for projects to implement anaerobic digestion and biogas utilization systems. There may be legal restrictions on the land application of manure in some jurisdictions to control nutrient loadings to farmland and avoid run-off to

surface water bodies, but this would not result in a requirement to install anaerobic digestion systems.

2.6.2 List of potentially relevant climate change incentives:

There are no known incentives for biogas projects that are specifically referred to as “Climate Change Incentives;” however, there are a variety of market based incentive programs for projects that produce energy from the anaerobic digestion of organic materials, some of which are listed below.

- Ontario:
- The Ontario Biogas Systems Financial Assistance Program offers financial support up to \$35,000 for feasibility studies for anaerobic digestion projects. The OBSFA program also offers to support up to 40 per cent of construction, implementation, and commissioning costs for biogas systems up to a maximum of \$400,000 for each biogas system minus any funding previously received for feasibility studies. The program has a total of \$11.2 million to allocate to projects.
- In an effort to meet its renewable energy supply targets, the Ontario Power Authority created the Standard Offer Program. The program offers \$110 / MWh for electricity produced from renewable power projects less than 10MW in size, which includes bio-energy projects that produce electricity from biogas combustion. The program also offers a premium of \$35.2/MWh for electricity generated at peak times. Under the program OPA takes ownership over all environmental attributes, including GHG reductions not associated with electricity generation. In the case of biogas projects, baseline emissions from manure storage/ handling and from the diversion of other organic wastes from landfill to the AD unit could also generate offsets in addition to the offsets from renewable power generation, but are still retained by OPA nonetheless. At present it appears that most biogas project developers in Ontario will elect to generate electricity and receive the SOP incentive, and will not be able to produce offsets from their projects.
- British Columbia: BC Hydro also has a Standing Offer Program for the developers of small scale generation projects using proven technology, including bio-energy projects (electricity generation from landfill gas, biogas and solid biomass). The price per MWh varies depending on the location of generation as well as the time and day the electricity is delivered. BC Hydro will retain all environmental attributes from renewable energy projects contracted under the SOP and therefore project proponents will not be able to bring offsets to market if they receive this incentive.
- Alberta: Under the Nine-Point Bio-Energy Plan, the Alberta government hopes to stimulate bio-energy development. Biogas electricity generation projects are eligible for a producer credit of \$20/MWh

- Federal: The federal government will invest \$1.48 billion to increase supply of electricity from renewable sources, including biogas, under the ecoENERGY for Renewable Power program. Eligible projects will earn \$10 / MWh and to date one biogas project has applied for the ecoENERGY subsidy.

2.7 Building on existing protocols or proprietary information (if applicable)

Registered name of protocol 1:	Quantification Protocol for the Anaerobic Decomposition of Agricultural Materials
System for which protocol was developed:	Alberta Offset System
Date protocol was completed and approved:	September 2007
Developer of the protocol	
Name:	Keith Driver
Organization:	Blue Source Canada ULC

Registered name of protocol 2:	Draft Quantification Protocol for the Anaerobic Decomposition of Agricultural Materials
System for which protocol was developed:	National Offset Quantification Team
Date protocol was completed and approved:	February 2007- Draft Version (not approved)
Developer of the protocol	
Name:	Keith Driver – lead author Other contributing technical working group members are listed in the draft NOQT protocol
Organization:	Blue Source Canada ULC (formerly Baseline Emissions Management)

Registered name of protocol 3:	Livestock Project Reporting Protocol: Capturing and destroying methane from manure management systems Version 2.1
System for which protocol was developed:	California Climate Action Registry
Date protocol was completed and approved:	August 2008

Developer of the protocol	
Name:	No author noted
Organization:	

2.8 Explanation of how the existing protocol will be adapted:

The existing base protocol will be adapted through an inclusive, transparent and consistent process coordinated through the working group's broad membership. In particular, work will be conducted by a protocol technical working group formed specifically to address adaptation of the protocol in question and potentially other related protocols. Cross-cutting issues groups will also be formed to address issues affecting a range of protocols, and to ensure consistency in approach.

Adaptation of the existing protocol will follow the multi-step process outlined below:

- Collection of technical and background information related to development, review and approval of the protocol to ensure transparency through the adaptation process;
- Review of the protocol to ensure consistency with Canada's "Turning the Corner" action plan and the requirements of the federal offset system. Any areas of inconsistency with the protocol documentation will be identified in this step;
- Review of existing provincial and federal regulations that could impact the surplus nature of the emission reductions from the project activity. This phase will serve to address the surplus requirement relative to applicable federal and provincial legislation;
- Review of the seed protocol's baseline condition to address the incremental nature of the project activity in the Canadian context. This review will include an assessment of the baseline's compatibility with Canadian best practices and potential alternative baseline approaches;
- Review of the protocol to ensure the quantification methodology is consistent with best practice guidance, and applicable to the range of Canadian geographical and climatic conditions;
- Review of the protocol's measurement and monitoring requirements to ensure they are reflective and reasonable in the Canadian context. This will include a review of data collection requirements and frequency of measurement and monitoring;

- Consideration of other environmental impacts and criteria air contaminants, as required by the “Turning the Corner” action plan;
- Additional analysis to address any outstanding issues identified to date that may present a significant challenge to protocol adaptation. This step will include assembly of the technical working group to drive further analysis;
- Redrafting of protocol to address technical issues identified in the previous steps and to ensure it meets the technical and format requirements of the Canadian offset system;
- Review of any material changes made to the quantification approach using project data to ensure the revised methodology is generally consistent with the original documentation;
- Cross-protocol review of the adapted protocol with other protocols, to ensure consistency in scope and approach to quantification;
- Compilation of documents required for submission of the final draft protocol to Environment Canada for approval. The results of all stages of the review and adaptation process will be summarized and compiled to support Environment Canada’s review.

Given the volume of work required under short timelines, multiple agencies will be required to provide a range of technical inputs, perspectives and capacity. To accomplish required tasks and meet timelines, technical resources will be mobilized to provide input; drawing on group member’s significant experience in protocol and project development.

This working group will draw on the experience of Climate Change Central to manage the adaptation process and to ensure broad stakeholder involvement.

2.9 Explanation of the nature of the proprietary information and how it might be used in the Base Protocol:

We are anticipating full disclosure and transparency; therefore no proprietary information should be required.

Part III: Declaration / Consent / Signature

The undersigned acknowledges that the undersigned has read, understood and that the undersigned agrees to abide by all the terms, conditions, instructions, and notices set out in the Guide for Protocol Development.

The undersigned acknowledges that the review of, and comments regarding, this base protocol plan or portions thereof does not ensure that the base protocol plan or portions thereof will be used in an Offset System Quantification Protocol by Canada's Offset System for Greenhouse Gases.

The undersigned is legally authorized to use any and all proprietary (or protected) information found in and submitted with the base protocol plan.

The undersigned is duly authorized to sign this application.

The undersigned declares that the base protocol plan submitted for Canada's Offset System for Greenhouse Gases and the information provided on, with or pursuant to this application is true, accurate and complete.

The undersigned consents to the public disclosure, in any manner including, without limitation, posting on Offset System website, of all the information in the base protocol plan and the information submitted with the base protocol plan.

By protocol developer (individual, or an organization's or a corporation's duly authorized representative, date, name, title)

By: **BLUE SOURCE CANADA ULC**

Name: **KEITH DRIVER**

Title: **VICE-PRESIDENT, OPERATIONS
BLUE SOURCE CANADA ULC**

Signature: _____

Signed this ____ day of _____, 2008