Biothermica

COMMENTS ON THE CLIMATE ACTION RESERVE'S COAL MINE METHANE PROTOCOL (VERSION 1.0)

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1. Introduction

Biothermica Technologies Inc. ("Biothermica") would first like to thank the Climate Action Reserve (CAR) for the opportunity of providing comments on the public draft of Version 1.0 of the Coal Mine Methane Protocol (the "Protocol"). Our comments are provided from the perspective of a Ventilation Air Methane (VAM) carbon project developer and technology owner, having developed and implemented the first VAM destruction project at an active coal mine in America. This project has been fully operational since March 2009 at Jim Walter Resources' coal mine No.4 in Brookwood, Alabama, using Biothermica's VAMOX® technology. The project is also currently registered under the Voluntary Carbon Standard (VCS).

Biothermica's perception of the Protocol is generally positive, we believe it will enable the generation of real and additional emission reductions. We however wish to underline several elements that could, in our opinion, be improved so as to enhance the Protocol's consistency and clarity. In order to facilitate the reading, the following chapters of this document are numbered similarly to the Protocol's.

2. The GHG Reduction Project

2.1 Project Definition

The Protocol states that it does not apply to projects that capture methane from "abandoned/decommissioned" mines (p8), terms which are defined in the glossary provided on page 47. We believe these provided definitions currently lead to some confusion with regard to the eligibility of several U.S mines. Six (6) different levels[1] of mine activity are indeed mentioned on page 47 and it is not clear what differentiates a "non producing" or "idle" coal mine from a "closed" mine.

These definitions should be clarified in order to allow for a clear determination of project eligibility. In addition, if the mine is decommissioned or closed during the crediting period, projects should be eligible to generate credits for the remainder of the period, as long as the ventilation system is operating.

2.1.2 Ventilation Air Methane Projects

VAM project definition

Biothermica welcomes CAR's shaft-based approach to VAM project definition, as opposed to a mine-based approach, considering ventilation shafts constitute independent emission sources.

The protocol's current language does not however clearly indicate whether several shafts can be included in one project. Page 8 indeed states that "a ventilation air methane project is one that destroys methane from a single ventilation shaft" whereas page 9 reads "the project developer has the ability to combine multiple concurrent project activities into a single project".

The inclusion of several shafts in one project can make practical sense when the cumulated service life of the different shafts is not greater than 10 years. These shafts could be included in one project submittal form and be listed as one project.

Therefore, VAM project developers should have the option of including several shafts in their project.

VAM project expansion

The Protocol states that "if VAM destruction equipment is installed at a shaft that is not part of an existing project, this is considered a new project" (p9). However, the Protocol also states that a project can expand to "include ventilation shafts beyond what was included in the project as defined

[1] Active, abandoned, decommissioned, non-producing, idle, closed

by the project developer at the time of listing" (p39). There is therefore an apparent contradiction between page 9 and page 39, with regard to VAM project expansion.

CAR should clarify the definition of project expansion. We recommend that adding new equipment to a shaft that is part of an existing project as well as including shafts beyond those that were initially listed both be considered as project expansions.

3. Eligibility rules

3.3 Project crediting period

Renewal of the crediting period

Unlike other offset programs such as the CDM or VCS, the crediting period for CAR projects is non renewable, based on the fact that CAR expects offset projects to not be beyond "business as usual" 10 years from the adoption of a protocol.

Biothermica respectfully disagrees with this approach, considering the following aspects:

- To preserve conservativeness, CAR could simply determine that a project must be additional to regulation and common practice in order to renew its crediting period;
- VAM destruction projects generate revenues only from carbon. Therefore under the current rule, if the service life of the shaft is greater than ten (10) years, operational costs will lead to the removal of the equipment and methane will once more be released to the atmosphere after ten (10) years[2].

In addition to the above aspects, it is important to note that VAM project developers already face economic and political uncertainties in the U.S:

- Federal or regional frameworks face political opposition and the announced rules are in constant evolution, notably with regard to the accepted offset project types;
- Many ventilation shafts display very low methane concentrations;
- The price of carbon credits is low;
- VAM projects are capital intensive;
- Carbon is a new commodity;
- VAM technology is very recent.

These aspects make it difficult to secure external sources of financing for VAM projects, difficulty which is only enhanced by a non-renewable crediting period. Our argumentation can thus be summarized by the following two (2) points:

- The renewal of the crediting period for all non-sequestration project types does not contradict CAR's conservativeness principle;
- The non renewal of the crediting period unnecessarily penalizes project developers in a context where there is high political and economic uncertainty.

Therefore, the crediting period should be renewable for all non-sequestration project types.

[2] Provided no regulation has been enacted

Regulatory changes during the crediting period

Under the current version of the Protocol, if the project activity becomes required by law during the crediting period, the project is no longer able to register GHG reductions. Biothermica respectfully disagrees with this approach, for the same reasons mentioned above with regard to the political and economic uncertainties already faced by CMM and VAM project developers.

In order to provide the minimum certainty required for the financial approval of CMM and VAM carbon projects, a fixed crediting period should be guaranteed, despite subsequent regulatory changes.

3.4 Additionality

Biothermica welcomes CAR's recognition that VAM projects "may need to supplement VAM with CMM" (p13). Many ventilation shafts indeed display concentrations at which no project can technically and/or financially be implemented. Projects at these shafts can only go forward if VAM is enriched with CMM.

There is however an apparent contradiction in the language used by the Protocol. Indeed, the Protocol also states that a single project cannot simultaneously include destruction of methane from a drainage system and destruction of VAM: "a single project may not consist of both drainage system and VAM methane destruction" (p8).

In order to clearly determine that VAM enrichment is eligible, the Protocol should state that a single project can consist of both drainage system and VAM methane destruction if the methane from the drainage system is used by the project to supplement VAM.

4. GHG Assessment Boundary

We do not have specific comments on this section of the Protocol.

5. GHG Reduction Calculation Method

The Protocol does not clearly indicate how the supplemental CMM used to enrich VAM is to be computed in equation 5.5 - Methane Released into Atmosphere (p23) and equation 5.10 - Emissions from Oxidation (p30). With regard to equation 5.10, only VAM is considered.

In order for equation 5.10 to be applicable to projects including VAM enrichment, $VAM_{flow\ rate}$ should be defined as "Average flow rate of <u>methane</u> entering the oxidation unit" and $PC_{CH4,VAM}$ should be defined as "Concentration of methane in the <u>air</u> entering the oxidation unit".

6. Project Monitoring

Non-methane hydrocarbons (NMHC)

With regard to the positioning of the flow meters and methane analyzers necessary to monitor flow rates and concentrations, the Protocol does not require specific positioning. In the same spirit, project developers should have the choice between sampling NMHC content from each drainage type separately or after the junction of the flows leading to each destruction device included in the project. This would enable project developers to determine the most effective way (technically and financially) to position their instruments while complying with the Protocol's requirements.

We recommend that the following sentence be deleted in order to give project developers flexibility with regard to the positioning of their instrumentation: "NMHC content from each drainage type within the project definition shall be sampled separately".

The Protocol also states that "NMHC content shall be demonstrated by a full gas analysis by a certified lab" (p34). Noting that the Protocol does not specify which certification must be demonstrated, it is also our opinion that this requirement is unnecessarily restrictive.

Therefore, NMHC content should simply be demonstrated by a gas analysis performed with equipment for which the calibration certificate is valid.

Cleaning, inspection and field checks

The frequencies required for the cleaning, inspection, field check and calibration of the gas flow meters and methane analyzers (p34) are, in our opinion, reasonable and well balanced. We however recommend a slight modification to the field check requirement in order to allow for the use of portable instruments for field checking methane analyzers.

We recommend that the field check requirement be restated as follows: "gas flow meters and continuous analyzers should be field checked for calibration accuracy, using either a portable instrument or manufacturer specified guidance, at the end of but no more than two months prior to the end date of the reporting period".

7. Reporting Parameters

7.3 Record Keeping

System information

With regard to permits, Notices of Violations (NOVs) and legal consent orders (p40), it is not clear whether the scope of the required documentation is applicable to the project or to the coal mine. Chapter 3.4.3 on Regulatory Compliance (p 13) however states that "project developers shall attest that the project is in material compliance with all applicable laws".

We recommend that the scope of the requirements with regard to permits, NOVs and administrative or legal consent orders be clarified in section 7.3 as applicable to the project's boundaries.

Calibrated portable gas analyzer information

The last information requirement (p40) states that the project developer should retain information on "corrective measures taken if instrument does not meet performance specifications".

In order to clarify that the instrument considered is the verified instrument and not the pre-mentioned calibrated portable gas analyzer, we recommend that the required information be labelled as "corrective measures taken if the verified instrument does not meet performance specifications".

8. Appendix C - Data substitution

Biothermica welcomes CAR's recognition that "unexpected events or occurrences may result in brief data gaps" (p67). The substitution methodology provided for missing concentration and flow readings is, in our opinion, fair and well balanced. The Appendix does not however provide guidance with regard to data gaps occurring for parameters used to adjust flow rate and/or concentration readings, namely pressure and temperature.

If for a given period of time, unadjusted flow rate or concentration is available but pressure and temperature are unavailable, the substitution methodology should be applied to pressure and temperature and the substitute values should be used to adjust the flow rate and/or methane concentration.

This procedure is more accurate and conservative than requiring project developers to use a past adjusted flow rate or concentration when actual pressure and temperature are unavailable for brief periods. The underlying reasoning is that methane concentration and flow rate (unadjusted or adjusted) variations have a much greater impact on emission reductions than temperature and pressure variations. We shall illustrate this with an example.

For the purpose of a simple demonstration, we shall take the example of a VAM project with one oxidizer and not take into account project emissions from energy consumption. The general equation for emission reductions is the following:

ER = BE – PE **(1)**

Where:

ER	Emissions reductions of the project activity (tCO_2e)
BE	Baseline emissions (tCO_2e)
PE	Project emissions (tCO_2e)

Considering we use a simplified example where emissions from energy consumption are not taken into account, we have:

ER = MMox * GWP – PEox * GWP – MDox * CEF_{CH4} **(2)**

Where:

MMox	Methane measured sent to oxidizer (tCH_4)
PEox	Project emissions of non oxidized methane (tCH_4)
MDox	Methane destroyed through oxidation (tCH_4)
CEF_{CH4}	Carbon emission factor for combusted methane (2.75)
GWP	Global warming potential of methane (21)

Equation (2) can also be translated in the following equation:

ER = MMox * 21 – MMox (1 – Eff)*21 – MMox * Eff * 2.75

or:

ER = MMox * Eff * 18.25 **(3)**

Where:
Eff Destruction efficiency of oxidizer[3]

Emission reductions are therefore proportional to MMox, which can also be computed as:

MMox = $VAM_{flow\ rate}$*$PC_{CH4,VAM}$*$D_{CH4,corr.inflow}$*time **(4)**

Where:

$VAM_{flow\ rate}$	Average flow rate of methane entering the oxidation unit (scf/s)
$PC_{CH4,VAM}$	Concentration of methane in the air entering the oxidation unit
$D_{CH4,corr.inflow}$	Density of methane entering the oxidation unit corrected for pressure and temperature (tCH_4/scf)
time	Time during which the oxidation unit is operational (s)

[3] Must be monitored for a VAM project (concentration of methane in exhaust gas from oxidation unit)

Using the equation for the adjustment of the flow rate, also provided in the Protocol (p31), we have:

$MMox = VAM_{flow\ rate,\ unadjusted} * (520/T) * (P/1) * PC_{CH4,VAM} * D_{CH4,corr.inflow} * time$ **(5)**

Where:

$VAM_{flow\ rate,\ unadjusted}$	Unadjusted flow rate of methane entering the oxidation unit (cf/s)
T	Measured temperature of the air entering the oxidation unit (^oR) ($^oR = {}^oF + 459.67$)
P	Measured pressure of the air entering the oxidation unit (Atm)

Equation (5) illustrates how flow rate variations have a proportional impact on MMox (and therefore emission reductions), whereas temperature variations on a Fahrenheit scale have a much smaller impact. For instance, even a 10°F variation from 70°F to 80°F, namely a 14% variation, leads the correction factor for temperature to vary from 0.98 (520/530) to 0.96 (520/540), namely a 2% variation of MMox. With regard to pressure, absolute pressure is typically very stable, presenting even less variability than absolute temperature.

The same reasoning can be applied to the concentration parameter if the equipment used requires the measured concentration to be adjusted for temperature and pressure. Concentration variations will have a proportional impact on emission reductions and it is therefore more accurate to use the monitored unadjusted value for methane concentration, with substitute values for pressure and temperature, than to use a past adjusted value for methane concentration.

It should therefore be allowed to substitute for pressure and temperature <u>simultaneously</u> if they are both unavailable, since the key parameters are the unadjusted flow rate and methane concentration.