Jurisdiction Module: United States

For use with the Mine Methane Protocol

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Abbreviations and Acronyms

CAA	Clean Air Act
EIA	Energy Information Administration
MSHA	Mine Safety and Health Administration
U.S. EPA	United States Environmental Protection Agency

1 Introduction

This document supplements the Mine Methane Protocol (Protocol) by specifying the requirements applicable to projects located in the United States. Projects in this jurisdiction must comply with both the Protocol and this module to register greenhouse gas (GHG) emission reductions with the Reserve.

Section headings in this document refer to the Protocol.

2 The GHG Reduction Project

2.1 Background

All underground coal mines in the United States are required to establish and maintain ventilation systems meeting detailed specifications set forth in federal regulations; these regulations are enforced by the Mine Safety and Health Administration (MSHA). Under the MSHA regulations, methane concentrations must be kept below 1 percent at the working face. Degasification is therefore an integral and critically important component of the underground mining process. Two primary degasification techniques are available to the operator: ventilation and methane drainage. Methane emissions are vented through mine ventilation shafts or methane drainage wells designed for the express purpose of removing the methane from the mine and venting it to the atmosphere.

2.2 Project Definition

Eligible mines include coal mines and trona mines that are classified by MSHA as Category III gassy underground metal and non-metal mines. Abandoned underground trona mines are not eligible under this Module.

2.2.3 Non-Qualifying Devices

Pipeline injection of recovered mine methane from abandoned underground coal mines and active underground mine methane drainage activities are considered non-qualifying devices for projects in the U.S. due to being common practice. See Appendix A for more information.

3 Eligibility Rules

3.1 Location

Under this Module, projects located in the United States and its territories are eligible to register with the Reserve.

3.5 Additionality

3.5.1 The Legal Requirement Test

Section 3.5.1 of the Protocol establishes the legal requirements test and the minimum threshold for establishing additionality. As of the Effective Date of this Module, the Reserve did not identify any existing federal, state or local regulations that obligate coal or trona mines to destroy mine methane.[1]

3.5.1.1 U.S. EPA GHG Permitting Requirements under the Clean Air Act

Since January 2, 2011, the United States Environmental Protection Agency (U.S. EPA) has been phasing in[2] regulation of GHG emissions from major stationary sources under the Clean Air Act (CAA).[3]

Under this rule, commonly referred to as the "Tailoring Rule," all existing stationary sources emitting more than 100,000 tons (approximately 90,719 MT) of CO_2e emissions per year are required to obtain Title V operating permits for GHG emissions. Historically, underground mines have not been a source category subject to Title V operating permits. However, the Tailoring Rule also requires Prevention of Significant Deterioration (PSD) permits that address GHG emissions for (1) new source construction with emissions of 100,000 tons CO_2e per year or more and (2) major facility modifications resulting in GHG emission increases of 75,000 tons (approximately 68,000 MT) of CO_2e per year or more.[4] An assessment of "best available control technology" (BACT) for GHGs is required as part of the PSD permitting process; the permitting authority will ultimately mandate installation of a selected BACT. It is possible that future PSD permits may require installation of the same abatement technologies that are currently being voluntarily deployed as part of a carbon offset project at a mine. By legally mandating these technologies, PSD permit requirements may make them ineligible for carbon offsets because implementation of these projects would no longer be voluntary.

According to the Reserve's understanding of the EPA Tailoring Rule requirements, new mines or mines that undertake significant expansion may be subject to the new PSD requirements. If a mine triggers the PSD requirements and an official BACT review results in the mandatory installation of a technology that reduces CMM emissions, this activity will not be eligible for carbon offsets. Verification bodies will need to review these permits to ensure that projects are able to pass the Legal Requirement Test.

The Reserve continues to track these developments under the CAA. BACT determinations made at the state level will inform updates to the protocol's tests for additionality over time.

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[1] To ensure that methane remains well below the concentrations at which it becomes explosive, the Federal Coal Mine Health and Safety Act of 1969 requires that methane levels be kept below 1 percent at the working face of the mine. To ensure that this requirement is met, all underground mines (gassy and non-gassy) are required under the same Act to develop ventilation systems that meet detailed specifications laid out in the federal regulations. The methane concentration limits and ventilation requirements are enforced by MSHA. The Act does not require, however, that CMM be destroyed.

[2] All major sources already subject to PSD and/or Title V under the Clean Air Act for other pollutants have been subject to EPA's GHG permitting rules since January 2, 2011. All sources *not* previously subject to the Clean Air Act came under the GHG permitting rules on July 1, 2011, if they triggered the thresholds noted herein.

[3] U.S. EPA published the final rulemaking, "Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule; Final Rule," in the Federal Register on June 3, 2010. The rulemaking is commonly referred to as the "Tailoring Rule," and amended 40 CFR Parts 51, 52, 70, and 71. http://www.gpo.gov/fdsys/pkg/FR-2010-06-03/pdf/2010-11974.pdf#page=1. In the final rulemaking in June 2010, the EPA also committed to undertake another rulemaking to conclude no later than July 1, 2012, which would phase in GHG permitting for smaller sources. However, in July 2012, EPA issued another rulemaking for the Tailoring Rule which continues to focus GHG permitting on the largest emitters, deferring GHG permitting for smaller sources to a later date. http://www.gpo.gov/fdsys/pkg/FR-2012-07-12/pdf/2012-16704.pdf

[4] "PSD and Title V Permitting Guidance for Greenhouse Gases" available at http://www.epa.gov/nsr/ghgdocs/epa-hq-oar-2010-0841-0001.pdf.

3.5.2 The Performance Standard Test

Projects pass the Performance Standard Test by meeting a performance threshold, i.e., a standard of performance applicable to all coal mine methane destruction projects, established on an *ex-ante* basis by the Coal Mine Methane Protocol and U.S. Module. The Performance Standard Test outlined in Section 3.4.2 of the Coal Mine Methane Protocol is applicable to projects in the U.S. See Appendix A for more information.

4 The GHG Assessment Boundary

Pipeline injection of recovered mine methane from abandoned underground coal mines and active underground mine methane drainage activities is considered a non-qualifying device. Therefore, SSR 16 is excluded from the GHG assessment boundary.

5 Quantifying GHG Emission Reductions

5.2 Quantifying Project Emissions

To quantify the CO_2 emissions from electricity, project developers must refer to the version of the U.S. EPA eGRID[5] that most closely corresponds to the time period during which the electricity was used. The project shall use the annual total output emission rates for the subregion where the project is located, not the non-baseload output emission rates.

For fossil fuel emissions, project developers must refer to the EPA's GHG Emission Factors Hub for the most recent values.[6]

[5] The eGRID tables are available from the U.S. EPA website: http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html.
[6] The GHG Emission Factors Hub is available from the U.S. EPA website: https://www.epa.gov/climateleadership/ghg-emission-factors-hub

9 Glossary of Terms

Mine Safety and Health Administration (MSHA)	Federal enforcement agency responsible for protecting the health and safety of U.S. miners.

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Appendix A Summary of Performance Standard Development

The analysis to develop the performance standard for the Coal Mine Methane Project Protocol was conducted by Science Applications International Corporation (SAIC) and was completed in May 2009. The analysis culminated in a paper that provided a performance standard recommendation to support the coal mine methane protocol development process, which the Reserve has incorporated into the protocol's eligibility rules (see Section 3).

The purpose of a performance standard is to establish a standard of performance applicable to all coal mine methane management projects that is significantly better than average greenhouse gas production for a specified service, which, if met or exceeded by a project developer, satisfies one of the criterion of "additionality."

The performance standard analysis contained an in-depth study of the following areas:

- Coal mine data trends and regional variations across the U.S.
- Degasification techniques including ventilation, surface pre-mining drainage, horizontal pre-mining drainage, and post-mining gob drainage currently used in coal mines
- Ventilation air methane utilization technologies
- Review of current, pending and anticipated regulations that could affect coal mine methane projects
- Data analysis to establish common practice for coal mine methane management at underground coal mines in the U.S.

A.1 Overview of Data Collection

The primary database used for the SAIC analysis was a coal mine methane emissions database provided by the U.S. EPA.[7] This database provided annual emissions-related data for underground mines classified as gassy by MSHA; the data cover the period 1990 through 2007. For the purposes of this analysis, the annual data for the 2000 to 2007 timeframe was used, covering a total of 295 gassy underground mines. The database provides the following data:

- Company name, mine name, and MSHA ID number
- State and county in which each mine is located
- Daily average and total methane emissions from the ventilation system, as well as the total amount of methane liberated by the mine (equal to the sum of the ventilation emissions and the drainage emissions or capture)
- An indication of whether the mine utilizes a degasification system, and if so, a brief description of the system and the total amount of methane drained through the system
- An indication as to whether the drained methane is captured, and a brief description of how the captured methane is utilized
- Detailed information on the subset of mines using methane capture

To supplement this primary data set, EPA provided a second database containing annual coal production data for the gassy mines for the years 2002 through 2006, along with an indication of

[7] This database is used as the basis for the coal mine methane emissions estimated published in EPA's annual *Inventory of U.S. Greenhouse Gas Emissions and Sinks* reports.

the mine's production status.[8] SAIC also used mine-level production data for 2000, 2001, and 2007, obtained from the Energy Information Administration (EIA).[9] SAIC merged the production data with the emissions database using each mine's MSHA identification number. The final merged dataset included 241 mines for which emissions data for at least one of the eight years in the 2000 to 2007 time frame was available.

EPA also provided a list of longwall mines in the United States that produced in excess of 750,000 tons of coal from January through September 2007, published by CoalUSA magazine. This list was supplemented by SAIC with similar CoalUSA lists for production from 2001 through 2006[10] and a table detailing the production of top non-longwall mines in 2007.[11] SAIC also consulted the mining method information contained in two EPA reports on methane recovery opportunities at gassy mines.[12] They combined the mines on these lists to create a master list of longwall mines in operation during the 2000 to 2007 time period. The master list represents a comprehensive list of longwall mines operating in and around 2007 with the following assumptions:

- The individual lists provide a comprehensive identification of all longwall mines falling above the production cutoff
- Most, if not all, longwall mines would meet the production cutoff when operating at full capacity
- Most, if not all, longwall mines would have operated at full capacity at least in one year during the 2000 to 2007 time period

All remaining mines were assigned to the room and pillar method (the other main underground coal mining method). In keeping with the industry standard definition, a longwall mine is defined as any mine that has at least one longwall face or that opened a longwall face at some point during the 2000 to 2007 period.

In combining and using the data for eight separate years into a single dataset, SAIC characterized each mine according to the furthest development of its drainage system. For example, if a mine used gob boreholes only in some years, but gob boreholes with horizontal pre-mining boreholes in other years, SAIC treated the mine as using both drainage system types during the 2000 to 2007 time frame. Similarly, mines that utilized methane in some years but not in others were treated as having utilization projects in operation in the 2000 to 2007 time frame. The decision to use and combine data for the past eight years into a single dataset was based on a trend analyses which indicated that industry practice with respect to drainage systems and utilization projects has remained fairly stable since 2000 (see Table A.1). Given

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[8] EIA was the original source of the production data.
[9] EIA, http://www.eia.doe.gov/cneaf/coal/page/database.html.
[10] Weir International, Inc. 2008. "U.S. Longwall Mines – Production and Productivity: September 2007 Year to Date (Mines Producing in Excess of 750,000 tons through September)." *CoalUSA*, March 2008; Weir International, Inc. 2006. "United States Longwall Mining Statistics: 1996-July 2006." Table 2: 2006 June Year to Date U.S. Longwall Mine Production and Productivity; "Table: U.S. Longwall Production 2005," *International Longwall News*, 27 March, 2006. At: http://www.longwalls.com/sectionstory.asp?SourceID=s50; NIOSH, 2005. "Table: U.S. Longwall production 2004." *International Longwall News*, 23 March 2005; NIOSH, 2004. "Table: U.S. Longwall output 2003 now working." *International Longwall News*, 7 April 2004; NIOSH, 2003. "Table: U.S. Longwall output 2002." *International Longwall News*, 21 July 2003.
[11] Weir International, Inc. 2008. "Top 50 U.S. Underground Mines (non-longwall) – Production and Productivity: September 2007 Year to Date." *CoalUSA*, March 2008. *CoalUSA*, March 2008.
[12] U.S. EPA, *Identifying Opportunities for Methane Recovery at U.S. Coal Mines: Profiles of Selected Gassy Underground Coal Mines 1999-2003* and *Identifying Opportunities for Methane Recovery at U.S. Coal Mines: Profiles of Selected Gassy Underground Coal Mines 2002-2006*.

this relative stability in coal industry practices, it appeared safe to combine recent data with older data for the purpose of ascertaining current common practice.

Table A.1. Historical Trends in Mines Using Methane Drainage and Capture/Utilization

	Year							
	1990	1995	2000	2003	2004	2005	2006	2007
Mines with Drainage Systems	**33**	**25**	**21**	**18**	**21**	**24**	**21**	**20**
Mines with Gob Wells	n/a	n/a	n/a	8	11	15	12	12
Mines with Gob and Horizontal Pre-Mining Wells	n/a	n/a	n/a	3	3	3	3	3
Mines with All Three Drainage System Types	n/a	n/a	n/a	7	7	6	6	5
Mines with Capture/Use Projects	**7**	**12**	**13**	**12**	**12**	**15**	**15**	**15**
Pipeline	6	12	10	11	10	13	13	13
Electricity Generation	0	0	0	1*	1	1	1	1
Vent. Air Heating	0	0	0	1	1	1	1	1
Thermal Coal Drying	0	1*	1*	1*	1*	1*	1*	1*
Unspecified	1	0	3	0	0	0	0	0
*Mine also sells a portion of its recovered methane to a pipeline.								

Source: Developed using data in U.S. EPA, Coal 07 draft.xls file.

Trona Mines

Data on trona mines operating in the United States was also collected and examined.[13] There are four Category III gassy underground trona mines in the United States, of which two are room and pillar and two are longwall mines. The two longwall mines currently have gob wells, but neither is capturing the coal mine methane for destruction.

A.2 Summary of Analysis

Should the Performance Standard Include the Drainage System?

In order to establish the definition of a coal mine methane project, it was necessary to explore if the installation of a drainage system should be tested using a performance standard, or if the performance standard test could be limited to the installation of coal mine methane destruction devices.

The hypothesis was that federal health and safety regulations influence a coal mine operator’s decision to install methane drainage systems. As stated in Section 3.5.1, there currently exists no federal, state, or local regulations requiring coal mines to reduce, limit, or control their methane emissions. Hence, based solely on a consideration of emissions regulations, all coal mine methane projects would appear to pass the regulatory test screen.

However, the situation for coal mines is complicated by the existence of federal safety regulations that govern methane concentration levels inside the mine. These safety regulations may effectively necessitate the utilization of methane drainage systems under certain gassy conditions. While there is no requirement to capture the methane emitted from such systems, to the extent that these systems may be necessitated by the safety regulations, they should not be considered a part of an additional coal mine methane project. In other words, the safety

[13] Coal Age *U.S. Longwall Census*, February 2009. MSHA ID numbers and liberation rates provided by Steven Pilling, MSHA Green River, Wyoming Field Office, June 2009. Information on drainage systems provided by Jeff Liebert, Verdeo Group, July 2009.

regulations may have important implications for determining the project definition and eligibility rules. Specifically, the methane drainage system may need to be excluded from the project definition if the system was developed as a response to the safety regulations. If this is the case, the methane drainage system does not pass the regulatory test but the methane destruction system may; the project definition should thus include only the destruction system.

To test this hypothesis, SAIC therefore conducted an analysis to determine the common practices utilized by coal mine operators to dilute methane concentrations as a function of methane liberation rates. As a first step in their data analysis, they computed arithmetic averages of the annual methane liberation data for each mine in the merged emissions dataset. However, a mine's methane emissions depend heavily on its production rate, as it is the process of removing the coal from the seam that relieves the pressure on the nearby unmined coal and surrounding strata, thereby releasing much of the gas. For this reason, the use of arithmetic average emissions data can lead to distorted results, particularly for mines that were underutilized during all or part of the 2000 to 2008 timeframe.

To correct for this possibility, SAIC developed normalized methane liberation rate estimates for the mines in the merged database for which both liberation and production data were available. Specifically, for each mine SAIC divided the sum of the 2000 through 2007 methane liberation data by the sum of the mine's 2000 through 2007 production to derive average methane liberation per ton of coal produced. They then multiplied this methane liberation rate by the largest of the eight annual production data points in the 2000 to 2007 timeframe to obtain their estimate of normalized methane liberation for the period. The year with the largest production value was used in the calculation in order to increase the likelihood that the resulting methane liberation estimate represents the mine's annual liberation rate when it is operating at full capacity. A mine operator will decide on whether or not methane drainage must be used to meet the regulatory requirements based on the expected methane liberation rate under full capacity operations.[14] Hence it is the methane liberation rate at full capacity that governs the mine operator's decision process; by computing a weighted average methane liberation value for the year in which production reaches its maximum they likewise sought to base their analysis on full capacity conditions. They used a production-normalized average rather than the actual methane liberation observed in the selected "maximum production year" because, as previously noted, the amount of methane liberated can fluctuate significantly from year to year depending on the geologic conditions encountered in each year. By using an average rather than an actual methane liberation value they reduced the potential for distortions introduced by abnormally low or high methane liberation rates in any given year.

It should be noted that production data was lacking for seven of the mines in the merged database; these mines were deleted from the database prior to proceeding with further analysis. Six of the deleted mines were room and pillar operations and hence were not a primary focus of the analysis. The single longwall mine lacking production data does not employ a drainage system.

Figure A.1 below presents a histogram of drainage system usage for the longwall mines, based on the production-normalized annual methane liberation rates for the 2000 to 2007 timeframe. This histogram indicates that the use of methane drainage is highly correlated with the quantity

[14] If the operator were to use a methane liberation estimate based on anything less than full capacity production for the purposes of deciding on the need for a drainage system, the mine would run the risk of being unable to meet the regulatory requirements when operating at full capacity.

of methane produced by a longwall mine. From these results, methane drainage can be considered a common practice for gassy longwall mines.

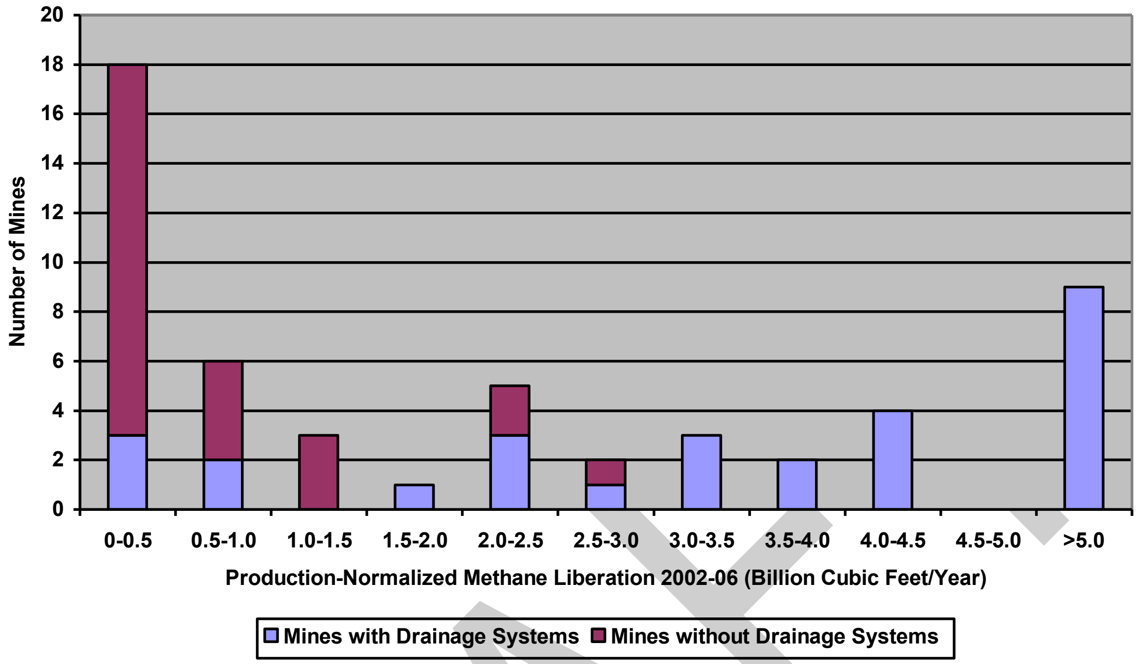

Figure A.1. Histogram of Drainage System Usage by Longwall Mines

There are currently no room and pillar mines with drainage systems in place; there are also no room and pillar mines with either arithmetic average or production-normalized methane liberation quantities in excess of two billion cubic feet.

Conclusion

This analysis strongly supports the hypothesis that the drainage systems currently in place are a response to the regulations. Given these results, we assume that all drainage systems are a response to health and safety regulations. Thus, the installation of a drainage system is not included in the definition of a coal mine methane project and is not tested for by a performance standard.

Recommendation to Use a Common Practice Standard

With the conclusion that the performance standard test must only test the additionality of the installation of a destruction device, it was necessary to determine what type of performance standard test was most suitable for coal mine methane projects.

Coal mine methane projects do not lend themselves to rate- or technology-based comparisons. In general, all coal mine methane projects are characterized by a very high rate of capture, making it difficult to distinguish projects on the basis of a metric such as methane destroyed as a percentage of methane entering the destruction device. Other potential metrics that might be used to establish a performance threshold for coal mine methane projects, such as the total quantity of methane captured on an annual basis, are fraught with difficulties. Specifically, the quantity of methane captured at any given mine is more a measure of the mine's geologic conditions than the performance of the methane capture equipment.

In general, there are no current requirements – federal, state, or local – that should influence a mine operator's choice between venting and utilizing the methane drained from drainage systems. This choice is driven by economic considerations, not regulatory requirements. A common practice standard is well-suited for these projects, in so far as common practice can help us infer whether the decision to install a methane destruction device was influenced by the availability of funding from carbon credits. Specifically, by identifying the conditions under which methane destruction is currently common practice, we can infer that projects operating under those conditions are likely undertaken to use the gas as a valuable byproduct of the mining process, and thus not additional.

Drainage Project Analysis

A strong argument can be made for determining additionality by assessing common practice of coal mine methane destruction by utilization type. As previously noted in Table A.1, only a small number of the mines with known utilization projects use the captured methane for purposes other than for sales to pipelines.

To test this hypothesis, SAIC analyzed a subset of the merged emissions/production database they created. Because the interest here is in mines that already utilize methane drainage systems, they eliminated all mines from the merged dataset that did not employ methane drainage at any time during the 2000 to 2007 timeframe. Following this elimination, they were left with a new data subset covering the 28 mines (all longwall) that employed methane drainage for at least one year during 2000 to 2007. In addition to data on the total annual amount of methane liberated in 2000 to 2007, this new database included 2000 to 2007 data on the annual amount of methane drained and vented at each of the 28 mines. The data set also provided a year-by-year indication as to whether or not all or a portion of the drained methane was captured, and the type of use to which the captured methane was applied (e.g. sales to a pipeline, electricity generation, etc.).

A close review of the database revealed anomalous methane capture indications for five of the 28 mines. Specifically, the data indicated that methane was captured at these five mines in 2002, but not in any of the subsequent years. SAIC reviewed the original EPA data file for these five mines, and found that for 1998 through 2001 the data indicated the mines were not capturing and utilizing methane. Thus the year 2002 was identified as the only year, in a ten-year period, during which methane was being captured at these five mines. In contrast, most of the other mines that practice methane capture are identified as using their capture systems in multiple years. Because of this anomaly, they treated these five mines as *not* utilizing methane capture techniques during the 2000 to 2007 timeframe, since, even if the 2002 data is correct, it appears that the mines' use of methane capture in this one year was atypical and not representative of normal practice at the five mines. In all other cases a mine identified as having employed methane capture at any time during the 2000 to 2007 timeframe was treated as a mine with a utilization project for the purposes of the analysis. See Table A.2 for a summary of this database.

Table A.2. Summary of Drainage System Type and Utilization at Longwall Coal Mines

MSHA ID	State Location	Utilization*	Drainage System Type(s)**
100851	AL	P	GHS
101247	AL	P	GHS
101322	AL	P	GHS
101401	AL	P	GHS
102901	AL	P	GH
503672	CO	H	GH
504452	CO	N	G
504591	CO	N	G
504758	CO	N	G
1514492	KY	N	U
2902170	NM	P	GH
3604281	PA	N	U
3605018	PA	P	G
3605466	PA	P	G
3605466	CO	N	G
3607230	PA	E	G
3607416	PA	N	G
4201890	UT	N	G
4202028	UT	P	G
4403795	VA	P	GHS
4404856	VA	P & TD	GHS
4601318	WV	N	GH
4601433	WV	P	GH
4601436	WV	N	GH
4601437	WV	N	G
4601456	WV	P & E	GH
4601816	WV	P	GHS
4601968	WV	P	GH

*P = Pipeline injection
E = Electricity generation
TD = Thermal coal drying
H = Mine ventilation air heating
N = None

**G = Gob wells
H = Horizontal pre-mine wells
S = Vertical pre-mine wells
U = Unknown

Results

Analysis of the new database found that:

- Use of methane for pipeline sales is common practice, in so far as it is used at 88 percent (15 of 17) of the mines that capture methane, and 53 percent (15 of 28) of the mines that drain methane
- Use of captured methane for electricity generation is uncommon, in so far as it is limited to 12 percent of the mines that capture methane, and 7 percent of the mines that drain methane
- Use of captured methane for heating ventilation air or fueling thermal coal dryers is uncommon (limited to only 6 percent of the mines that capture methane, and 4 percent of the mines that drain methane)

- Application of captured methane to any use other than the above three is not only uncommon but non-existent

There are two possible explanations for the general lack of end-use projects other than those involving sales to pipelines. First, these projects may be generally uneconomic under current conditions. Alternatively, such projects may be economically viable, but *less so* than pipeline sales projects. Under this second interpretation, on-site projects to generate electricity, heat, etc., would be more numerous than actually observed were it not for the fact that they must compete with a generally more preferable end use—i.e. selling the CMM to a pipeline. In other words, one might hypothesize that pipeline projects are in effect distorting the analysis of common practice with respect to other end use project types, by dominating the competition between the various end use options. If true, this hypothesis would suggest that other end use project types are not generally additional, despite their rarity.

To test this hypothesis, SAIC eliminated all of the mines with pipeline sales projects from the database, and considered whether or not other end use projects are common practice within the remaining group of mines – a group for which competition from pipeline projects is not a barrier to the application of other end uses. However, before performing this analysis, it was necessary to first consider that two of the four non-pipeline projects currently in operation (an electricity generation project and a thermal coal drying project) are located at mines that *also* sell a portion of their CMM to pipelines. It appears that these two projects are not being adversely affected by competition from pipeline projects, as they co-exist with the latter. The existence of these co-located projects suggests that there may be other opportunities for the application of on-site end uses at mines that currently sell their CMM - the fact that such co-located on-site projects are uncommon indicates that these on-site applications may be sub-economic, rather than merely less economic than pipeline sales projects. It was determined that the two co-located on-site projects should be excluded from the analysis, because competition from pipeline sales projects did not prevent these two projects from being undertaken.

Focusing then on the two remaining on-site end use projects – projects which *may* not have been undertaken had pipeline sales projects been feasible at these two mines – and on the mines that are currently venting their CMM, SAIC drew the following conclusions with respect to common practice:

- Only one of the 12 mines (8 percent) that utilize drainage systems *not* connected to natural gas pipelines currently captures methane to generate electricity
- Only one of the 12 mines (8 percent) that utilize drainage systems *not* connected to natural gas pipelines currently captures methane to heat the mine ventilation air

Based on the above analysis SAIC concluded that on-site end use projects are uncommon even at mines that do not sell their CMM to pipelines. In fact, CMM end use project types other than electricity generation, ventilation air heating, and thermal coal drying are non-existent. This finding suggests that such project types are generally uneconomic under current conditions, rather than simply less economic than pipeline sales projects. Thus, even if the current pipeline sales projects did not exist, it is not clear that other project types would take their place.

The Reserve believes it is appropriate to consider the entire population of mines with drainage systems, and not just those mines that do not sell CMM to pipelines, when assessing common practice with respect to non-pipeline end use projects.

Regional Analysis

An additional analysis was conducted to assess whether common practice with respect to utilization varies across regions. Whereas common practice with respect to methane drainage is unlikely to exhibit much regional variation, given that the decision to utilize drainage techniques is often driven by *federal* regulations, the same cannot be presumed for methane utilization. On the contrary, given that the decision to initiate a capture and utilization project will generally be driven by economic criteria rather than regulations, regional variations in common practice, reflecting regional variations in the underlying economic criteria, are a real possibility that must be investigated.

Table A.3. Regional Analysis of Methane Utilization among Mines with Drainage Systems

State/Region	Mines with Normalized Methane Drainage >0.25 Billion ft^3			Mines with Normalized Methane Liberation $\leq$0.25 Billion ft^3		
	Mines with Drainage Systems	Mines with Utilization	Percent with Utilization	Mines with Drainage Systems	Mines with Utilization	Percent with Utilization
Pennsylvania	3	3	100	1	0	0
W. Virginia	6	4	67	1	0	0
Virginia	2	2	100	0	0	n/a
Kentucky	0	0	n/a	1	0	0
Alabama	5	5	100	0	0	n/a
Eastern U.S.	**16**	**14**	**87**	**3**	**0**	**0**
Colorado	3	1	33	2	0	0
Utah	1	1	100	1	0	0
New Mexico	1	1	100	0	0	n/a
Western U.S.	**5**	**3**	**60**	**3**	**0**	**0**
Total U.S.	**21**	**17**	**81**	**6**	**0**	**0**

Table A.3 presents the results of the regional analysis. It indicates little regional variation in common practice amongst mines with production-normalized methane drainage in excess of 0.25 billion cubic feet per year. Regardless of their regional location, the majority of the mines in this category captures and utilizes methane (87 percent of the eastern mines and 60 percent of the western mines). None of the six mines draining less than 0.25 billion cubic feet per year capture and utilize their CMM, regardless of mine location. Thus SAIC recommended against establishing regional variations in the common practice standards for coal mine methane projects.

Conclusion

Based on the above analysis of current utilization project types, the Reserve concluded that all projects designed to utilize the methane for any purpose other than pipeline sales shall be eligible as additional under the common practice standard. Depending on the specific utilization project type, such non-pipeline projects are rare to non-existent at present. Projects that include both pipeline sales and other uses (e.g. electricity generation) are to be treated as two separate projects for the purposes of applying the common practice standard, and the project involving uses other than pipeline sales are to be eligible under the common practice standard.
Because of similarities between the regulatory requirements, operating conditions, mining methods, and methane management of gassy underground trona mines and coal mines, the Reserve concluded the same common practice standard also applies to trona mines categorized as MSHA Category III gassy underground metal and non-metal mines.

Ventilation Air Methane Projects

There is opportunity for achieving significant reductions in coal mine methane emissions from ventilation. In 2007, the methane emissions from ventilation systems were more than 10 times greater than drainage system emissions (78.9 million cubic feet versus 7.3 million cubic feet; see Figure A.2). However, the technology available to tap into this potential market is as yet unproven commercially, at least in the U.S.

The technical barrier to the commercialization of methane destruction or utilization technology capable of being used in conjunction with ventilation systems has been the highly dilute character of the methane emitted by these systems. Typically the mine air vented from return air shafts is less than 1 percent methane. The utilization technologies considered thus far require gas with much higher methane content.

There are at present no commercial projects using ventilation air methane destruction or oxidation technology at active coal or trona mines in the United States.[15] Since commercial VAM projects are non-existent at present, the Reserve concludes that all commercial VAM projects be eligible under a common practice standard.

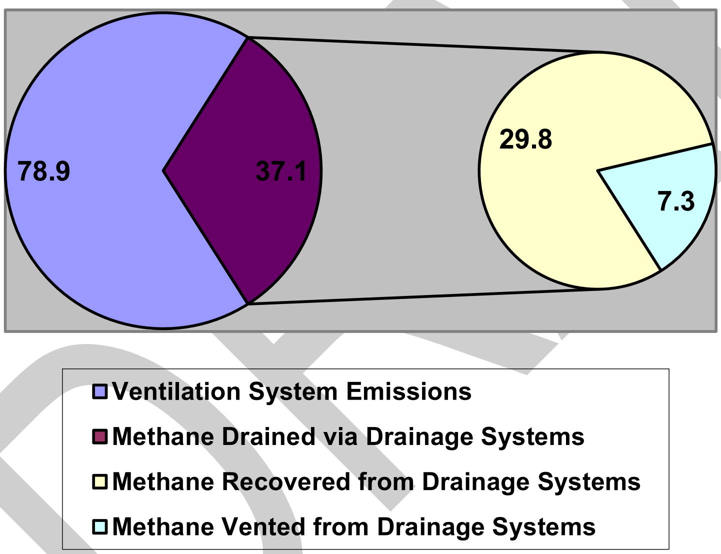

Figure A.2. Ventilation and Drainage System Emissions, 2007 (million cubic feet)

A.3 Evaluation of the Common Practice Standards

The common practice standards summarized above are based on a relatively small number of observations. However, it is important to recognize that this is not a “small sample” problem; rather it is the population of mines that uses drainage, with or without CMM utilization, which is small. With the exception of a very small number of mines with missing data that were deleted from the database, the Reserve believes the analysis covers the entire population of gassy U.S. underground mines. Although we cannot be certain that the original MSHA and EPA databases used as our primary sources provide comprehensive coverage of all gassy mines, all mines with

[15] There is one demonstration project that received approval from the Mine Health and Safety Administration (MSHA) in April 2008.

drainage, and all mines with utilization, this is the intent of these databases and we have no reason to believe that there are significant deficiencies in their coverage.

Thus, while the analysis necessarily rests on a small set of observations, it is nonetheless representative of the population. By pooling the data across eight years (2000 to 2007), SAIC was able to increase the number of mines covered in the analysis, as well as reduce the impact of short-term fluctuations in a mine's methane liberation, drainage and/or production rate on our analysis. Beyond pooling the data, there are few if any viable means of increasing the number of observations used in this analysis. We did consider the possibility of adding data from other countries, but ruled this approach out because we believe that the geologic conditions, mining methods, and economics of mining and CMM recovery are too variable across national borders to enable the application of non-U.S. data to an analysis of common practice within the U.S.

A.4 Updating the Performance Standard

The common practice standards developed for coal mine methane projects are intended to reflect operating practices under current economic, regulatory, and technological conditions. SAIC's analysis of sector trends indicated that common practice was relatively stable or slow to evolve over the analysis period of 2000 to 2007. If and when such conditions change, the common practice standard will be affected. Therefore, the performance standard analyses will be updated on a periodic basis to either confirm that common practice has not changed or to develop new standards reflecting changed conditions.

A.5 2026 Update to the Performance Standard Test

The Reserve conducted a re-assessment of common practice for active underground mines in the U.S. since the development of the U.S. Coal Mine Methane Protocol Version 1.1 in October 2012. Additionally, we evaluated abandoned underground coal and trona mines to determine whether to expand eligibility under the protocol.

First, we reviewed the basis for which the California Air Resources Board (CARB) adopted the Mine Methane Capture Protocol under the Compliance Offset Program. CARB published a Staff Report, in part, evaluating the additionality of destruction of methane at active and abandoned coal and trona mines in the U.S. for the adoption of the CMM Protocol.[16] Based on the U.S. EPA Coalbed Methane Outreach Program (CMOP)[17], which provides information on existing methane recovery projects in the U.S. and identifies potential opportunities for future mine projects, few active surface mines and abandoned underground mines capture and destroy mine methane. Additionally, all active underground mines have ventilation systems, but only a small number destroy the methane. Few were found to have mine methane drainage systems; however, of these mines, most utilized pipeline injection as the end use. As a result, pipeline injection is an ineligible end use for active underground mines with methane drainage systems.

CARB established the following project types as additional:

1. Active Underground Mine Methane Ventilation Air Methane;
2. Active Underground Mine Methane Drainage;
3. Active Surface Mine Methane Drainage; and

[16] *Staff Report: Initial Statement of Reasons, Appendix A: Staff Report and Proposed Compliance Offset Protocol for Coal Mine Methane,* September 4, 2013.
[17] 2022 Data, accessed July 2026

4. Abandoned Underground Mine Methane Recovery.

Project types 1 through 4 are eligible for coal mines; however, only project types 1 through 3 are eligible for trona mines. Since only underground mines are considered under this protocol, only project types 1, 2, and 4 are analyzed further here.

The eligibility of these projects under the COP indicates that they could likely be considered eligible under this protocol. However, we reviewed current CMOP,[18] US EPA GHG Inventory, and other publicly available data to determine whether there have been changes in common practice for underground coal mines since CARB performed their analysis.

There were 185 underground coal mines producing over 201,000 kt of coal in 2022.[19] Underground mines accounted for roughly 72% of methane emissions and 89% of fugitive CO_2 emissions in the sector, emitting 31.5 million tCO_2e of methane and 2.2 million tCO_2. That year, 24.2 million metric tCO_2e of methane was recovered and used,[20] and less than 0.05 tCO_2 was recovered and used or flared.[21] There are 28 underground mines that emit at least 2 million scf of methane per day, 17 of which have drainage systems and 14 recover the methane and two destroyed VAM.[22] All of the underground coal mines were listed under COP, with all but one that remains active as of 2026. Thus, mine methane capture and destruction, as defined in Version 1.1, remains additional as it is not common practice beyond the incentive of the carbon market.

The Reserve also reviewed the common practice of abandoned mines to determine whether the protocol definition should be expanded. Abandoned mine methane (AMM) is another source of methane emissions from coal mining, where abandoned mines emit methane through conduits that are inadequately sealed.[23] AMM emissions were 9.1 million tCO_2e in 2022.[24] Due to the high methane emissions, abandoned mines represent a significant opportunity for voluntary emission reduction incentives.

There are 514 abandoned gassy mines in the U.S.,[25] but only 34 destroy AMM – primarily through natural gas pipeline injection (59%) or flaring (32%).[26] All of these projects have been issued credits under the CARB COP.[27] Therefore, abandoned underground coal mine methane capture and destruction is not common practice beyond the incentive of the carbon market and is considered additional under this protocol. Abandoned underground trona mines are not eligible.

[18] It's important to note that CMOP only reports active mines emitting at least 2 million cubic feet of methane per day and at least 1.5 million cubic feet per day for abandoned mines. Additional abandoned mines are included if they have a mine methane mitigation project.
[19] Section 3.4 EPA Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2022.
[20] Table 3-34 EPA Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2022
[21] Table 3-35 EPA Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2022
[22] One VAM project was registered prior to 2022, with an additional VAM project after 2022.
[23] According to U.S. EPA. https://www.epa.gov/sites/default/files/2016-03/documents/amm_opportunities_database.pdf
[24] Table 3-39 EPA Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2022.
[25] According to the U.S. EPA as of 2015.
[26] Data obtained from CMOP 2022.
[27] ARBOCs Issuance Table, updated June 14, 2026

Acknowledgements

Workgroup

The module was modified from the U.S. Coal Mine Methane Project Protocol Version 1.1. The list of workgroup members below comprises all individuals and organizations who have assisted in developing and updating various versions of the Coal Mine Methane Project Protocol. Not all members were involved in every protocol revision process. For more information see the Reserve Program Manual.

Raphaël Bruneau	Biothermica Technologies Inc.
Keith Driver	Blue Source Canada
David Cartella	Cliffs Natural Resources
John Grubb	Colorado School of Mines
Steve Winberg	CONSOL Energy Inc.
Weidong Yang	DNV Climate Change Services USA
Jay Wintergreen	First Environment Inc.
Joseph D’Amico	Alpha Natural Resources
Jerry Gureghian	Green Holdings
Adam Penque	Greenhouse Gas Services, LLC
Neil Butler	Harworth Energy Ltd
Ken Zak	Megtec
Charlee Bergamo	Raven Ridge Resources, Incorporated
Ronald Collings	Ruby Canyon Engineering Inc
Bill Reynolds	SCC Americas LLC
Melissa Weitz	U.S. EPA
Pamela Franklin	U.S. EPA Coalbed Methane Outreach Program
Jeff Liebert	Verdeo Group, Inc.

Staff (in alphabetical order)

Lead Authors
Jordan Mao
Rachel Mooney

Supporting Staff
Kristen Gorguinpour
Jon Remucal

Previous Versions
Rachel Tornek
Heather Raven
Derik Broekhoff
Tim Kidman
Syd Partridge
Max DuBuisson