
USER'S GUIDE FOR ESTIMATING METHANE EMISSIONS FROM COAL MINING AND ABANDONED COAL MINES USING THE STATE INVENTORY TOOL

JANUARY 17, 2025



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This section of the User’s Guide provides instruction on using the Coal module of the State Inventory Tool (SIT), and describes the methodology used for estimating greenhouse gas emissions from coal mining and abandoned coal mines at the state level.

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Getting Started

The Coal module was developed using Microsoft® Excel 2000. While the module will operate with older versions of Excel, it functions best with Excel 2000 or later. Some of the Excel basics are outlined in the sections below. Before you use the Coal module, make sure your computer meets the system requirements. In order to install and run the Coal module, you must have:

- IBM-PC compatible computer with the Windows 95 operating system or later;
- Microsoft® Excel 1997 or later, with calculation set to automatic and macros enabled;
- Hard drive with at least 20MB free; and
- Monitor display setting of 800 x 600 or greater.

Microsoft Excel Settings

Excel 2003 and Earlier: For the SIT modules to function properly, Excel must be set to automatic calculation. To check this setting, launch Microsoft Excel before opening the Coal module. Go to the Tools menu and select "Options..." Click on the "Calculations" tab and make sure that the radio button next to "Automatic" is selected, and then click on "OK" to close the window. The security settings (discussed next) can also be adjusted at this time.

Excel 2007 and Later: For the SIT modules to function properly, Excel must be set to automatic calculation. Go to the Formulas ribbon and select "Calculation Options." Make sure that the box next to the "Automatic" option is checked from the pop-up menu.

Microsoft Excel Security

Excel 2003 and Earlier: Because the SIT employs macros, you must have Excel security set to medium (recommended) or low (not recommended). To change this setting, launch Microsoft Excel before opening the Coal module. Once in Excel, go to the Tools menu, click on the Macro sub-menu, and then select "Security" (see Figure 1). The Security pop-up box will appear. Click on the "Security Level" tab and select medium. When set to high, macros are automatically disabled; when set to medium, Excel will give you the choice to enable macros; when set to low, macros are always enabled.

When Excel security is set to medium, users are asked upon opening the module whether to enable macros. Macros must be enabled in order for the Coal module to work. Once they are enabled, the module will open to the control worksheet. A message box will appear welcoming the user to the module. Clicking on the "x" in the upper-right-hand corner of the message box will close it.

Excel 2007 and Later: If Excel's security settings are set at the default level a Security Warning appears above the formula box in Excel when the Coal module is initially opened. The Security Warning lets the user know that some active content from the spreadsheet has been disabled, meaning that Excel has prevented the macros in the spreadsheet from functioning. Because SIT needs macros in order to function properly, the user must click the "Options" button in the security message and then select, "Enable this content" in the pop-up box. Enabling the macro content for the SIT in this way only enables macros temporarily in Excel but does not change the macro security settings. Once macros are

enabled, a message box will appear welcoming the user to module. Click on the “x” in the upper right-hand corner to close the message box.

If the Security Warning does not appear when the module is first opened, it may be necessary to change the security settings for macros. To change the setting, first exit out of the Coal module and re-launch Microsoft Excel before opening the Coal module. Next, click on the circular “Office Button” in the top left of the screen. At the bottom of the menu, select the “Excel Options” button to the right of the main menu. When the Excel Options box appears, select “Trust Center” in left hand menu of the box. Next, click the gray “Trust Center Settings” button. When the Trust Center options box appears, click “Macro Settings” in the left-hand menu and select “Disable all macros with notification.” Once the security level has been adjusted, open the Stationary Combustion module and enable macros in the manner described in the preceding paragraph.

Viewing and Printing the SIT

The Coal module contains some features to allow users to adjust the screen view and the appearance of the worksheets when they are printed. Once a module has been opened, you can adjust the zoom by going to the Module Options Menu, and either typing in a zoom percentage or selecting one from the drop-down menu. In addition, data may not all appear on a single screen within each worksheet; if not, you may need to scroll up or down to view additional information.

You may also adjust the print margins of the worksheets to ensure that desired portions of the Coal module are printed. To do so, go to the File menu, and then select “Print Preview.” Click on “Page Break Preview” and drag the blue lines to the desired positions (see Figure 2). To print this view, go to the File menu, and click “Print.” To return to the normal view, go to the File menu, click “Print Preview,” and then click “Normal View.”

Figure 1. Changing Security Settings

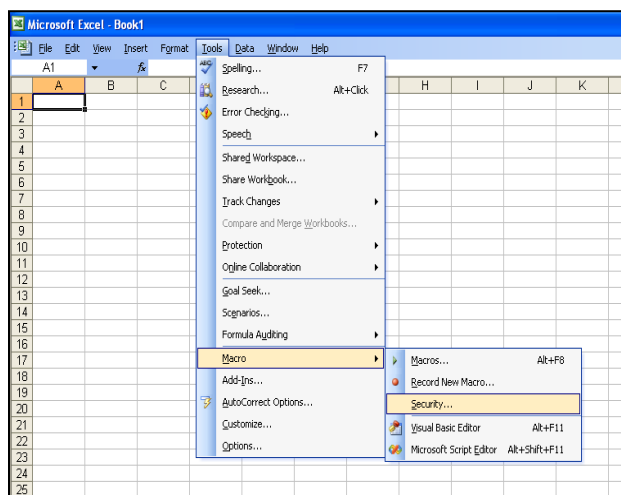
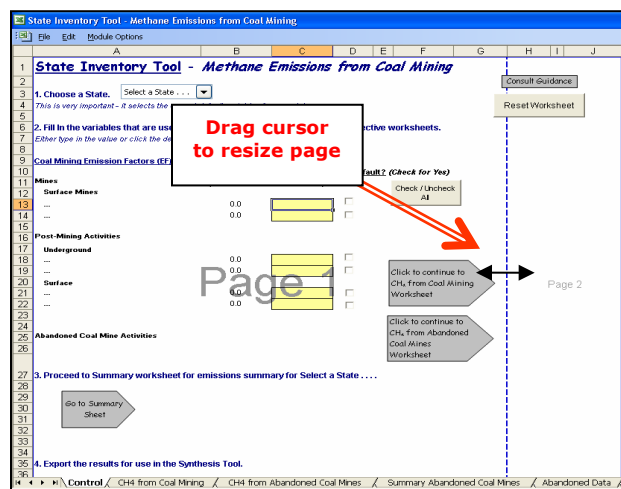


Figure 2. Adjusting Print Margins



1.1 MODULE OVERVIEW

This User's Guide accompanies and explains the Coal module of the SIT. The SIT was originally developed in conjunction with EPA's Emissions Inventory Improvement Program (EIIP) in order to automate the steps states would need to take in developing their own emission estimates in a manner that was consistent with prevailing national and state guidelines. The result was a user-friendly and comprehensive set of eleven modules that help users estimate greenhouse gas emissions at the state level.

Because most state inventories developed today rely heavily on the SIT, User's Guides have been developed for each of the SIT modules. These User's Guides contain the most up-to-date methodologies that are, for the most part, consistent with the Inventory of U.S. Greenhouse Gas Emissions and Sinks (EPA 2024a). Users can refer to the chapters and annexes of the U.S. Inventory to obtain additional information not found in the SIT or in the companion User's Guide.

In 2024, EPA published the results of the 2022 Inventory of U.S. Greenhouse Gas Emissions and Sinks disaggregated by U.S. state (2024b) to make consistent state-level GHG data available for all states for use by states, researchers, and the general public. However, EPA recognizes that there will be differences between the state-level estimates published by EPA and inventory estimates developed by states using the SIT or other tools. Inventories compiled by states may differ for several reasons, and differences do not necessarily mean that one set of estimates is more accurate, or "correct." In some cases, the Inventory of U.S. Greenhouse Gas Emissions and Sinks may be using different methodologies, activity data, and emission factors, or may have access to the latest facility-level information through the Greenhouse Gas Reporting Program (GHGRP). In other cases, because of state laws and regulations, states may have adopted accounting decisions that differ from those adopted by UNFCCC and IPCC to ensure comparability in national reporting (e.g., use of different category definitions and emission scopes consistent with state laws and regulations). Users of state GHG data should take care to review and understand differences in accounting approaches to ensure that any comparisons of estimates are equivalent or an apples-to-apples comparison of estimates.

The Coal module calculates methane (CH₄) emissions from coal mining and abandoned coal mine activities. While the module provides default data for calculating mining, post-mining, and abandoned-mine emissions, if you have access to more comprehensive data sources, they should be used in place of the default data. If using outside data sources, or for a more thorough understanding of the tool, please refer to the following discussion for data requirements and methodology.

1.1.1 Data Requirements

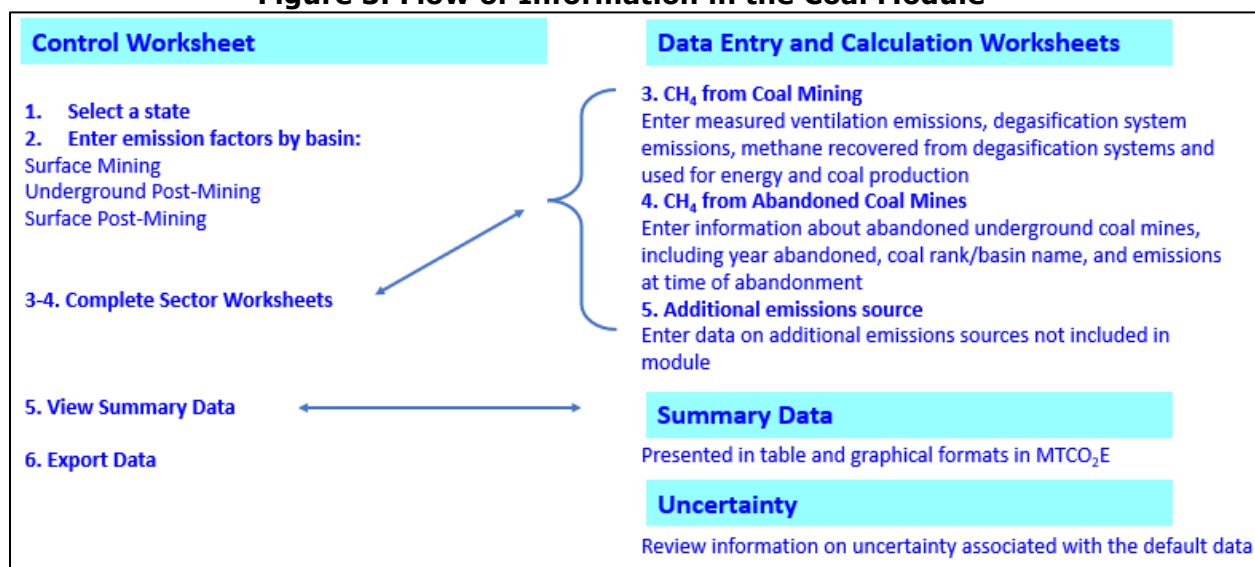
To calculate CH₄ emissions from coal mining and abandoned coal mines, the data listed in Table 1 are required inputs (again, note that defaults are available for most of these data).

Table 1: Required Data Inputs for the Coal Module

Coal Module Sectors	Input Data Required
CH ₄ from Coal Mining	
Surface Mining Activities	Basin-specific emission factors (ft ³ CH ₄ / short ton coal) Surface coal production, by year and basin ('000 short tons)
Underground Mining Activities	Measured ventilation emissions, by year (million ft ³) Degasification system emissions, by year (million ft ³) CH ₄ recovered from degasification systems and used for energy, by year (million ft ³)
Surface Post-Mining Activities	Basin-specific emission factors (ft ³ CH ₄ / short ton coal) Surface coal production, by year and basin ('000 short tons)
Underground Post-Mining Activities	Basin-specific emission factors (ft ³ CH ₄ / short ton coal) Underground coal production, by year and basin ('000 short tons)
CH ₄ from Abandoned Coal Mines	A list of abandoned coal mines with the following information for each: <ul style="list-style-type: none"> • Mine name or number • County of location • Coal rank (bituminous, sub-bituminous, or anthracite) or basin • Year abandoned • CH₄ emissions at time of abandonment (million cubic feet per day) • Current status of mine (venting, sealed, or flooded) • Percent sealed (choose among 50%, 80%, and 95% sealed) • CH₄ recovered (cubic meters per year)

1.1.2 Tool Layout

Because there are multiple steps to complete within the Coal module, it is important to understand the module's overall design. The layout of the Coal module and the purpose of its worksheets are presented in Figure 3.

Figure 3. Flow of Information in the Coal Module*

* These worksheets are the primary worksheets used in the Coal module; subsequent worksheets are used to populate the default data and are provided for informational purposes only.

1.2 METHODOLOGY

This section provides a guide to using the Coal module of the SIT to estimate CH₄ emissions from coal mining and abandoned coal mines. Within the Coal module, there are two main categories of emissions: emissions from mining and post mining activities, and emissions from abandoned underground coal mines. Because the methodology varies considerably by source, the details of each will be discussed in its respective step, following this general methodology discussion.

The Coal module will automatically calculate emissions after you enter the emission factors on the control worksheet and the required data on the individual sector

worksheets. The tool provides default data; however, other state-specific data may be used if available (see Box 1 for suggestions on where to find data).

Box 1: State Coal Mining Data Sources

In-state sources, such as state departments of energy, natural resources, or mines, should be consulted first. Otherwise, default data provided by the Coal module may be used.

The Coal module follows the general methodology from the National Inventory Report (NIR) GHG Inventory by U.S. State. However, the Coal module calculates emissions on an individual mine-by-mine basis. The AMM model used for the national Inventory and the GHG Inventory by U.S. State uses @Risk Monte Carlo simulation software and estimates emissions by basin, state (for reporting years 2020 and onward), and abandoned mine status type, resulting in slightly different estimates. The Coal module also does not provide default data for fugitive CO₂ emissions from coal mining and uses an apportionment approach for underground mine methane emissions for 1991 and 1992, as default data by state is not available.

This User's Guide provides an overview of the estimation methodology used in the Coal module by walking through the following six steps: (1) select a state; (2) enter emission factors; (3) complete worksheet for CH₄ from coal mining; (4) complete worksheet for CH₄

from abandoned underground coal mines; (5) enter additional emission sources; (6) review summary information; and (7) export data.

Step (1) Select a State

To begin, select the state you are interested in evaluating. By selecting a state, the rest of the tool will automatically reset to reflect the appropriate state default data and assumptions for use in subsequent steps of the tool.

Step (2) Enter Emission Factors

Step 2 on the control worksheet involves either selecting the default data provided or entering user-specified emission factors that will be used throughout the tool. To proceed with the default data, select the "Check / Uncheck All" button or check the default box directly to the right of individual yellow input cells. Note that this number can be overwritten if you discover that the data for your state differ from the default data provided by the tool. To enter user-specified inputs, enter data directly into the yellow input cells. If the user-specific inputs do not match the default data in the control worksheet (i.e., the default value is overwritten), the text will appear red. See Figure 4 for locations of the "Check / Uncheck All" buttons, individual default check boxes, and yellow input cells.

Figure 4. Control Worksheet for the Coal Module

State Inventory Tool - Methane Emissions from Coal Mining

File Edit Module Options

1. Choose a State. Colorado

2. Enter Emission Factors

Coal Mining Emission Factors (EF)

	Default Factor (ft ³ methane / short ton coal)	Factor Used (ft ³ methane / short ton coal)	Use Default? (Check for Yes)
Mines			
Surface Mines			
Southwest/Rockies (CO)	66.2	66.2	<input checked="" type="checkbox"/>
...	0.0	0.0	<input checked="" type="checkbox"/>
Post-Mining Activities			
Underground			
Rockies (Piceance)	63.8	63.8	<input checked="" type="checkbox"/>
...	0.0	0.0	<input checked="" type="checkbox"/>
Surface			
Southwest/Rockies (CO)	10.8	10.8	<input checked="" type="checkbox"/>
...	0.0	0.0	<input checked="" type="checkbox"/>

3. Proceed to the Coal Mining worksheet.

4. Proceed to the Abandoned Coal Mines worksheet.

5. Proceed to Summary worksheet for emissions summary for Colorado.

Control / CH₄ from Coal Mining / CH₄ from Abandoned Coal Mines / Summary Abandoned Coal Mines / Abandoned Data / Summary

Surface Mining Activities

The emission factors for surface mining activities entered on the control worksheet are specific to each coal basin and type of mine (underground or surface). The default emission factors from U.S. EPA (2005, 2024a) are in cubic feet of CH₄ per short ton of coal. As discussed in further detail in Step 3, estimating CH₄ emitted from surface mining involves multiplying the quantity of surface-mined coal from each coal basin in a state by the appropriate emission factor for that basin (see Box 2 for a discussion of coal basins). The emission factor accounts for CH₄ liberated from the coal itself and from surrounding strata.

Post-Mining Activities

The next step on the control worksheet requires emission factors for post-mining activities from both underground and surface mines. These emission factors, like those for surface mining activities, are specific to each coal basin and type of mine (underground or surface). These emission factors are later used in the Coal Mining sector worksheet to estimate CH₄ emissions. The default emission factors are from U.S. EPA (2005, 2024a). Once you have entered emission factors for surface mining activities and for post-mining activities, use the gray arrows to navigate to the Coal Mining worksheet.

Box 2: Coal Basin and Rank

Coal is a combustible sedimentary rock formed by the geologic metamorphosis of prehistoric plant materials. Differences in the origins of the sedimentary plant material combined with differing amounts of temperature and pressure acting on the rocks in different areas mean that the characteristics of coal vary from place to place. A basin is a geologic feature that contains a single large coal deposit. While the coal in a basin can vary from place to place, generally it has a number of characteristics in common, including rank.

The most basic difference among types of coal is that of coal rank. The four major coal ranks, in order of increasing purity, are lignite, sub-bituminous, bituminous, and anthracite. Anthracite, as the purest form of coal, is almost entirely carbon, while lower ranks of coal have more and more impurities such as sulfur and ash, with lignite being the least pure. Increased rank also generally goes hand-in-hand with increased heating value, although anthracite has a slightly lower heating value than bituminous coal, on average.

Although the coal within a basin is generally of only one rank, the characteristics of the coal vary within a basin, often even from mine to mine. This module calculates emissions based on emission factors that are based on known characteristics of the following basins: Northern Appalachian, Central Appalachian Basin, Warrior, Illinois, Piceance, Uinta, San Juan, Green River, Raton Mesa, North Great Plains, Forest City, Cherokee, Arkoma, Gulf Coast, Alaska, and Washington. These basins were the smallest scale for which complete information was available for use in the tool and provide a reasonable approximation of the characteristics of the coal within them.

Abandoned Underground Coal Mines

There are no required inputs for abandoned coal mines on the control worksheet. Because the Abandoned Coal Mines sector involves complicated calculations, the gray navigational arrow on the control worksheet takes you directly to the Abandoned Coal Mines worksheet.

Step (3) Complete Worksheet for CH₄ from Coal Mining

The CH₄ from coal mining worksheet is divided into emission calculations for underground and surface activities for active mines and post-mining activities.

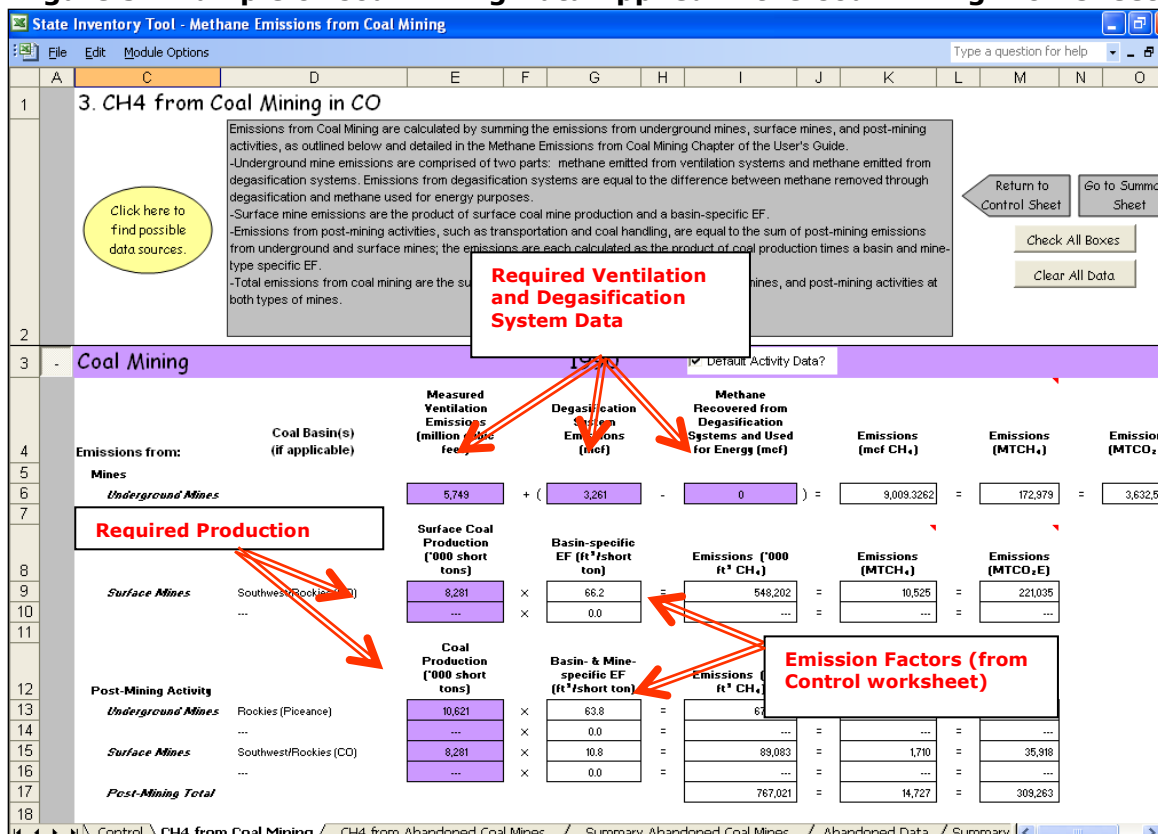
Underground Mining Activities

There are two sources of emissions from underground mining: (1) CH₄ emitted from underground ventilation systems and (2) CH₄ emitted from degasification systems. Emissions from underground ventilation systems are calculated by summing the CH₄ emissions from ventilation systems at each underground mine in the state. Emissions from CH₄ degasification systems are calculated by summing reported or estimated emissions of CH₄ from all mines with degasification systems in the state, and then subtracting the CH₄ that is recovered and used for energy purposes. Figure 5 shows where to enter these data in the purple cells. The total CH₄ emitted from underground mines is the sum of CH₄ emissions from ventilation and degasification systems, in million cubic feet. That amount is converted to metric tons of CH₄ using a conversion factor of 18.92, and subsequently to MTCO₂E by multiplying by the GWP of CH₄. The equation used in the module is shown in Equation 1. The default mine ventilation and degasification system data used in the tool are based on emission factors and data found in Mroz et al. (1983), USBM (1986), and U.S. EPA (2003).

Equation 1. Emissions from Underground Mining Activity

$$\text{Emissions (MTCO}_2\text{E)} = \{ \text{Measured Ventilation Emissions (million ft}^3\text{)} + [\text{Degasification System Emissions (million ft}^3\text{)} - \text{CH}_4 \text{ Recovered from Degasification Systems and Used for Energy (million ft}^3\text{)}] \} \times 18.92 \text{ g/ft}^3 \text{ CH}_4 \times 10^6 \text{ ft}^3/\text{million ft}^3 \times 10^{-6} \text{ MT/g} \times 28 \text{ (GWP of CH}_4\text{)}$$

Figure 5. Example of Coal Mining Data Applied in the Coal Mining Worksheet



Surface Mining Activities

CH₄ emissions from surface mines are estimated by multiplying the state's surface coal production in each coal basin by an emission factor based on the in-situ CH₄ content for the surface coal found in each coal basin. The result is converted to metric tons of CH₄, by dividing by 1,000 and multiplying by a conversion factor of 18.92. That amount is converted to MTCO₂E by multiplying by the GWP of CH₄. Figure 5 indicates the purple cells where you enter the data on surface coal production in '000 short tons, while Equation 2 shows the equation the module uses to calculate emissions from surface mining activities.

Equation 2. Emissions from Surface Mining Activity

$$\text{Emissions (MTCO}_2\text{E)} = \text{Surface Coal Production ('000 short tons)} \times \text{Basin-Specific Emission Factor (ft}^3\text{/short ton)} \times 18.92 \text{ g/ft}^3 \text{ CH}_4 \times 10^3 \text{ ft}^3\text{'000 ft}^3 \times 10^{-6} \text{ MT/g} \times 28 \text{ (GWP of CH}_4\text{)}$$

Post-Mining Activities

Post-mining activity CH₄ emissions from both surface and underground mines are calculated in essentially the same manner as emissions from surface mining activity, as Equation 3 shows. The U.S. EPA estimates that CH₄ emitted during post-mining activities, such as transportation and handling of coal, equals 33 percent of the in-situ CH₄ content for the coal (U.S. EPA 1993). U.S. EPA has used this formula to develop post-mining emission factors, which are used in the module. Figure 5 indicates the purple cells where you should enter the data on surface and underground coal production in '000 short tons.

Equation 3. Emissions from Post-Mining Activity

$$\text{Emissions (MTCO}_2\text{E)} = \text{Coal Production ('000 short tons)} \times \text{Basin- and Mine-Specific Emission Factor (ft}^3\text{/short ton)} \times 18.92 \text{ g/ft}^3 \text{ CH}_4 \times 10^3 \text{ ft}^3\text{'000 ft}^3 \times 10^{-6} \text{ MT/g} \times 28 \text{ (GWP of CH}_4\text{)}$$

Once you have entered the required data on the sector worksheet for each year, the module calculates and totals the emissions from surface mining, underground mining, and post-mining activities. After you have completed the CH₄ from coal mining sector worksheet, use the gray navigational arrow to return to the control worksheet and proceed to the worksheet for emissions from abandoned coal mines.

Step (4) Complete Worksheet for CH₄ from Abandoned Underground Coal Mines

The methodology for determining emissions from abandoned underground coal mines is based on an EPA White Paper, *Proposed Methodology for Estimating Emission Inventories from Abandoned Coal Mines* (Franklin et al. 2004). The module uses a database of abandoned coal mines by state provided in that white paper. Because the methodology is complex, it is explained in detail in the worksheet itself (in the abandoned underground coal mines worksheet, click the button "Click here to view more about the methodology"). Note that the methodology described in this section is only applicable to underground mines, not to surface mines.

For all abandoned mines, CH₄ emissions decline as a function of time; this decline can be calculated by a decline equation representing a decline curve. The decline curves vary based on the time since abandonment, the nature of the coal seam, and the status of the mine (vented, sealed, or flooded), as follows:

- A vented mine is one that can release CH₄ to the atmosphere freely. The emissions of such a mine will depend only on time since abandonment and coal characteristics.
- A sealed mine has been sealed to prevent the escape of CH₄. However, given the nature of rock used to seal mines, such sealing is never 100 percent effective. The

effect of a seal is not to prevent CH₄ emissions, but to slow them—to spread them out over a longer period.

- A completely flooded mine releases little to no CH₄ to the atmosphere. After a mine is abandoned, if it is in an area prone to flooding, it will gradually fill up with water. Therefore, most emissions will occur in the first few years following abandonment, dropping off quickly as the mine floods.

The decline equations for each of these three statuses are shown in Equation 4.

Equation 4: Emissions from Abandoned Mines

$$\begin{aligned}\text{Vented: } q &= q_i \times (1 + aT)^b \\ \text{Sealed: } q &= q_i \times (1-c) \times (1 + aT)^b \\ \text{Flooded: } q &= q_i \times e^{(-DT)}\end{aligned}$$

Where,

q = current emission rate, m³/yr
q_i = emission rate at abandonment, m³/yr
a = constant unique to each decline curve
b = constant unique to each decline curve
T = time since abandonment, yr
c = degree of sealing of the mine (50%, 80%, or 95%)
D = decline rate, fraction per year (given as -0.672)

Emissions are calculated separately for each status of mine in a state, using the decline equations and constants listed in Equation 4. The coal rank, based on the coal basin location of the mine, is used to determine which values of “a” and “b” to use (values of “a” and “b” are built into the module). The module then adds emissions from each status of mine together, along with emissions from mines of unknown status.

Using the Default List of Mines

The module provides a default list of abandoned mines for your state, including information on coal basin, year abandoned, emissions, and status. The source for the default list of mines is the U.S. GHG Inventory (EPA 2024a). To complete this worksheet, follow these steps:

1. Choose whether to use the default mine status; if you have more detailed information about the status of a mine than the module provides, you may change or overwrite the mine status displayed in the green cells. To select the default status for all mines, click the check box at the top of the worksheet, as shown in Figure 6.
2. Choose whether to use the default percent sealed for mines of sealed status. Again, if you have more detailed information about the status of a mine than the module provides, you may change or overwrite the mine status displayed in the green cells—choosing among 50%, 80%, or 95% sealed. Figure 6 shows the location of the cells and of the default check boxes.

- At some mines, CH₄ emissions are collected through a degasification system, and flared or burned to generate electricity. Enter information on amount of CH₄ recovered at each mine as shown in Figure 6. Unfortunately, default information is not available about the amount of gas recovered at each mine.

Figure 6. Example of Default Data Applied in the Abandoned Coal Mines Worksheet

4. CH₄ from Abandoned Mines in CO

Emissions from Abandoned Coal Mines are calculated by summing the emissions from mines that are vented, sealed, or flooded.

-Different coal seams vary in the amount of gas present initially and the way the methane is adsorbed to the coal (i.e. some coals release methane more readily than others).

-A vented mine is one that can release methane to the atmosphere freely. The emissions of vented mines will depend on time since abandonment and coal characteristics.

-A sealed mine has been sealed to prevent the escape of methane. The effect of a seal is to prevent methane from escaping the mine, but such sealing is never 100 percent effective. The effect of a seal is to reduce emissions over a longer period of time.

-After a mine is abandoned and in a flood prone area, the mine will fill with water and no methane to the atmosphere. Therefore, most emissions will occur from mines that are vented or sealed.

Click here to find possible

Click here to view default

Default status and percent sealed check boxes

Change actual status of mine, if it differs from reported status

Enter percent sealed for sealed mines

Enter amount of CH₄ recovered from mines collecting gas

Mine Name	County	Basin	Year Abandoned	Reported Status	Actual Status	Percent Sealed	Methane Recovered (m³/yr)
1. Sanborn Creek	Delta	Piceance	2003	Sealed	Sealed	80%	
2. Dutch Creek No. 1	Pitkin	Piceance	1992	Sealed	Sealed	80%	
3. Dutch Creek No. 2	Pitkin	Piceance	1988	Sealed	Sealed	80%	
4. L.S. Wood	Pitkin	Piceance	1985	Sealed	Sealed	80%	
5. Coal Basin	Pitkin	Piceance	1981	Sealed	Sealed	80%	
6. Bowie No. 1	Delta	Piceance	1998	Sealed	Sealed	80%	
7. Hawks Nest East	Delta	Piceance	1986	Venting	Venting		
8. Bear Mine	Gunnison	Piceance	1982	Sealed	Sealed	80%	
9. Bear Creek Mine	Gunnison	Piceance	1979	Sealed	Sealed	80%	
10. Hawks Nest West	Delta	Piceance	1989	Sealed	Sealed	80%	
11. Flennau No. 2	Meza	Piceance	2000	Sealed	Sealed	80%	
12. Golden Eagle	Pitkin	Piceance	1997	Flooded	Flooded		
13. Allen East & West	Pitkin	Piceance	1986	Sealed	Sealed	80%	
14. Southfield Mine	Moffat	Piceance	1996	Unknown	Unknown		
15. New Elk Mine	Delta	Piceance	1981	Sealed	Sealed	80%	
16. Bowie #3	Rio Blanco	Piceance	1986	Unknown	Unknown		
17. Hawks Nest West	Las Animas	Raton	1986	Sealed	Sealed	80%	
18. Flennau No. 2	Las Animas	Raton	1982	Unknown	Unknown		
19. Golden Eagle	Las Animas	Raton	1989	Unknown	Unknown		
20. Allen East & West	Las Animas	Raton	1989	Unknown	Unknown		
21. Southfield Mine	Las Animas	Raton	1989	Unknown	Unknown		
22. New Elk Mine	Las Animas	Raton	1989	Unknown	Unknown		
23. Bowie #3	Las Animas	Raton	1989	Unknown	Unknown		

Additional Abandoned Coal Mines

Including Additional Abandoned Mines

If you have information on additional abandoned mines in your state that aren't provided in the default data from EPA 2024a, you may add this information by clicking on the "+" sign next to "Additional Abandoned Coal Mines" and entering the required data as shown in Figure 7. Once this sector worksheet is complete, use the gray navigational arrow to return to the control worksheet and then proceed to the summary worksheet. You may also use one of the gray navigational arrows at the top to view a summary worksheet for the abandoned coal mines sector before proceeding to the general summary sheet.

Figure 7. Example of Additional Data Applied in the Abandoned Coal Mines Worksheet

State Inventory Tool - Methane Emissions from Coal Mining

File Edit Module Options Type a question for help

4. CH4 from Abandoned Mines in CO

Emissions from Abandoned Coal Mines are calculated by summing the emissions from mines that are vented, sealed, or flooded.

-Different coal seams vary in the amount of gas present initially and the way the methane is adsorbed to the coal (i.e. some coals release methane more readily than others).

-A vented mine is one that can release methane to the atmosphere freely. The emissions of vented mines will depend on time since abandonment and coal characteristics.

-A sealed mine has been sealed to prevent the escape of methane. However given the nature of the rock used to seal mines, such sealing is never 100 percent effective. The effect of a seal is to slow the methane emissions to spread them out over a longer period of time.

-After a mine is abandoned and in a flooded state, the methane is slowly released to the atmosphere. There is no methane to the atmosphere. There is no methane to the atmosphere.

Return to Control Sheet
Go to Summary Sheet
Clear All Data

Click here to find possible
Click here to view default

Abandoned Coal Mines Please click here to view a default list of abandoned coal mines within your state

Additional Abandoned Coal Mines Please click here to create a list of abandoned coal mines within your state

Mine Name	County	Coal Rank	Year Abandoned	Status	Percent Sealed	Active Emissions (mmcf/d)	Methane Recovered (m³/yr)
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							
13.							
14.							
15.							
16.							
17.							
18.							
19.							
20.							
21.							

Control / CH4 from Coal Mining / CH4 from Abandoned Coal Mines / Summary Abandoned Coal Mines / Abandoned Data / Summary

Step (5) Enter Additional Emissions Sources to Additional Emissions Sources Worksheet if Applicable

Users may use this worksheet to input data about additional emissions sources that are not included in this module or any other module. Additional emissions sources should be reported in MTCO₂e. Figure 9 shows two options for entering data into this worksheet (please select only one):

Option A: Add up to ten additional emission sources in column B, lines 15-24. Enter the emissions in MTCO₂e for each year 1990-2022 in the yellow cells.

Option B: Enter the total CH₄ emissions (line 33) for all other emissions sources for each year 1990-2022 in the yellow cells in MTCO₂e.

Figure 8. Example Additional Emissions Sources Worksheet

5. Additional Emission Sources in XX

Additional Emission Sources Data
Please use the "Additional Emission Sources" section of this sheet to enter any additional emission sources you would like to include in the inventory that are not captured in this or any other module. There are two options for entering data in this worksheet (please select only one):

Option A: Add up to ten additional emission sources in the column B, lines 10-19. Select CO₂ or CH₄ from the dropdown menu in column C. Enter the emissions in MMTCO₂e for each year 1990-2021 in the yellow cells.

Option B: Enter the total CH₄ emissions (line 33) for all other emissions sources for each year 1990-2021 in the yellow cells in MMTCO₂e.

For emission sources that do not have any default data or are not accounted for within the State Inventory Tool, state-level data are available here:
<https://www.epa.gov/ghgemissions/state-ghg-emissions-and-removals>

Click here to find possible data sources.

Return to Central Sheet

Clear All Data

Additional Emission Sources (MMTCO₂e)

Option A

Source	Gas	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	CH ₄														
	CH ₄														
	CH ₄														
	CH ₄														
	CH ₄														
	CH ₄														
	CH ₄														
	CH ₄														
	CH ₄														
	CH ₄														

Option B

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Additional Methane Emissions CH ₄														

For emission sources that do not have any default data or are not accounted for within the State Inventory Tool, state-level data are available here:

<https://www.epa.gov/ghgemissions/state-ghg-emissions-and-removals>

Step (6) Review Summary Information

The steps above provide estimates of total CH₄ emissions from coal mining and abandoned coal mines. The information from both worksheets is presented on the summary worksheet, which displays results in metric tons of carbon dioxide equivalent (MMTCO₂e) and metric tons of CH₄ (MTCH₄). Figure 8 shows the summary worksheet. In addition, the results are displayed in graphical format at the bottom of the summary worksheet.

Figure 9. Example of the Emissions Summary Worksheet in the Coal Module

B	C	D	E	F	G	H	I	J	K	L	M	N	O	P		
4. Colorado Abandoned Coal Mines Emissions Summary											Return to Control Sheet		Return to Data Input Sheet		Go to Coal Summary Sheet	
Summary of Emissions from Default Abandoned Coal Mines																
Mine Status (without Unknown Distributed)																
Emissions (MTCO ₂ E/Year)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002			
Vented	54,633	50,011	46,491	43,689	41,387	39,449	37,788	36,341	35,066	33,931	32,911	31,988	31,147			
Sealed	132,996	117,377	107,229	196,796	180,582	162,740	150,671	293,147	253,058	230,155	214,234	216,236	210,470			
Flooded	3,354	1,712	873	446	227	116	59	30	34,645	17,679	9,021	44,180	22,544			
Unknown	105,703	83,499	71,315	63,927	59,066	55,612	52,984	127,939	100,013	85,096	76,297	70,667	66,766			
Total	296,687	252,599	225,908	304,858	281,262	257,917	241,502	457,457	422,783	366,861	332,463	363,071	330,927			
Emissions (Gg CH ₄ /Year)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002			
Vented	1.95	1.79	1.66	1.56	1.48	1.41	1.35	1.30	1.25	1.21	1.18	1.14	1.11			
Sealed	4.75	4.19	3.83	7.03	6.45	5.81	5.38	10.47	9.04	8.22	7.65	7.72	7.52			
Flooded	0.12	0.06	0.03	0.02	0.01	0.00	0.00	0.00	1.24	0.63	0.32	1.58	0.81			
Unknown	3.78	2.98	2.55	2.28	2.11	1.99	1.89	4.57	3.57	3.04	2.72	2.52	2.38			
Mine Status (with Unknown Distributed)																
Emissions (MTCO ₂ E/Year)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002			
Vented	54,633	50,011	46,491	43,689	41,387	39,449	37,788	36,341	35,066	33,931	32,911	31,988	31,147			
Sealed	231,149	194,912	173,450	256,158	235,429	214,380	199,870	411,947	345,927	309,173	285,081	281,855	272,467			
Flooded	10,904	7,676	5,967	5,012	4,446	4,088	3,844	9,169	41,789	23,757	14,471	49,228	27,313			
Total	296,687	252,599	225,908	304,858	281,262	257,917	241,502	457,457	422,783	366,861	332,463	363,071	330,927			
Emissions (Gg CH ₄ /Year)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002			
Vented	1.95	1.79	1.66	1.56	1.48	1.41	1.35	1.30	1.25	1.21	1.18	1.14	1.11			
Sealed	8.26	6.96	6.19	9.15	8.41	7.66	7.14	14.71	12.35	11.04	10.18	10.07	9.73			
Flooded	0.39	0.27	0.21	0.18	0.16	0.15	0.14	0.33	1.49	0.85	0.52	1.76	0.98			
Summary of Emissions from Additional Abandoned Coal Mines																
Mine Status																
Emissions (MTCO ₂ E/Year)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002			
Vented	-	-	-	-	-	-	-	-	-	-	-	-	-			
Sealed	-	-	-	-	-	-	-	-	-	-	-	-	-			
Flooded	-	-	-	-	-	-	-	-	-	-	-	-	-			
Total	-	-	-	-	-	-	-	-	-	-	-	-	-			
Emissions (Gg CH ₄ /Year)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002			
>	Control	CH4 from Coal Mining	CH4 from Abandoned Coal Mines	Summary Abandoned Coal Mines				Abandoned Data		Abandoned Data Inputs						

Step (7) Export Data

The final step is to export the summary data. Exporting data allows the estimates from each module to be combined later by the Synthesis Module to produce a comprehensive GHG inventory for the state.

To access the "Export Data" button, return to the control sheet and scroll down to the bottom (step 6). Click on the "Export Data" button and a message box will open that reminds the user to make sure all steps of the module have been completed. If you make any changes to the Coal module later, you will then need to re-export the results.

Clicking "OK" prompts you to save the file. The file is already named, so you only need to choose a convenient place to save the file. After the file is saved, a message box will appear indicating that the data was successfully exported.

Note: the resulting export file should not be modified. The export file contains a summary worksheet that allows users to view the results, as well as a separate data worksheet with an unformatted version of the results. The second worksheet, the data worksheet, contains the information that is exported to the Synthesis Tool. Users may not modify that worksheet. Adding/removing rows, moving data, or making other modifications jeopardize the ability of the Synthesis Module to accurately analyze the data.

While completing the modules, you are encouraged to save each completed module; doing so will enable you to easily make changes without re-running it entirely.

Following data export, the module may be reset and run for an additional state. Alternatively, you may run the remaining modules of the SIT to obtain a comprehensive profile of emissions for your state.

1.3 UNCERTAINTY

In the upper right-hand corner of the summary worksheet is a button: “Review discussion of uncertainty associated with these results.” By clicking on this button, you are taken to a worksheet that discusses the uncertainty surrounding the activity data and emission factors, and how the uncertainty estimates for this source category affect the uncertainty of the emission estimates for your state.

1.4 REFERENCES

- Franklin, P., E. Scheehle, R.C. Collings, M.M. Coté, and R.C. Pilcher. 2004. *White Paper: Proposed Methodology for Estimating Emission Inventories from Abandoned Coal Mines*. U.S. EPA, Prepared for 2006 IPCC Greenhouse Gas Inventories Guidelines Fourth Authors Experts Meeting. Energy: Methane Emissions for Coal Mining and Handling, Arusha, Tanzania.
- Mroz, T.H., Ryan, J.G., and Bryer, C.W. 1983. *Methane Recovery from Coalbeds: A Potential Energy Source*. Report prepared for U.S. Department of Energy. DOE/METC/83-76.
- USBM. 1986. Circular 9067, *Results of the Direct Method Determination of the Gas Contents of U.S. Coal Basins*. U.S. Bureau of Mines.
- U.S. EPA. 2024a. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2022*. Office of Atmospheric Protection, U.S. Environmental Protection Agency, EPA 430R-24-004. Available at: <https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks>.
- U.S. EPA. 2024b. *Inventory of U.S. Greenhouse Gas Emissions and Sinks By State: 1990 – 2022*. Office of Atmospheric Protection, U.S. Environmental Protection Agency. Available at: <https://www.epa.gov/ghgemissions/state-ghg-emissions-and-removals>.
- U.S. EPA. 2005. *Surface Mines Emissions Assessment*, U.S. EPA Draft Report, November 2005.
- U.S. EPA. 2003. *Methane Emissions Estimates & Methodology for Abandoned Coal Mines in the U.S.* Draft Final Report. Washington, DC. June 2003.
- U.S. EPA. 1993. *Anthropogenic Methane Emissions in the United States: Estimates for 1990*. Report to Congress. U.S. Environmental Protection Agency, Office of Air and Radiation. EPA 430-R-93-003. April. Washington, DC.