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

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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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## 1.1 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:** 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:** Since 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:** 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. Since 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.

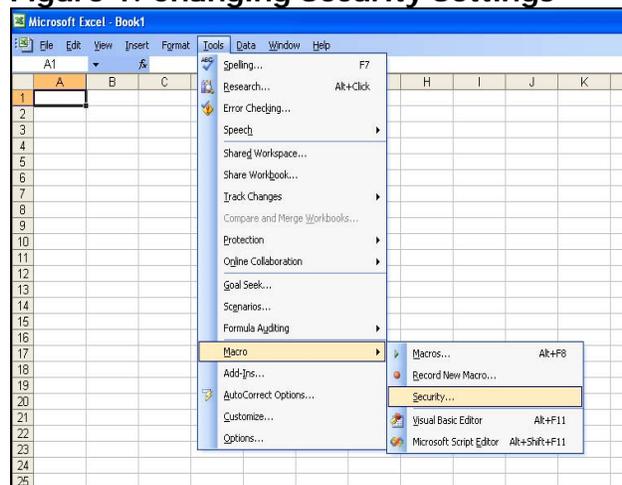
If the Security Warning does not appear when the module is first opened, it may be necessary to change the security settings for macros. To change the setting, first exit out of the Coal module and re-launch Microsoft Excel before opening the Coal module. Next, click on the circular “Office Button” in 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

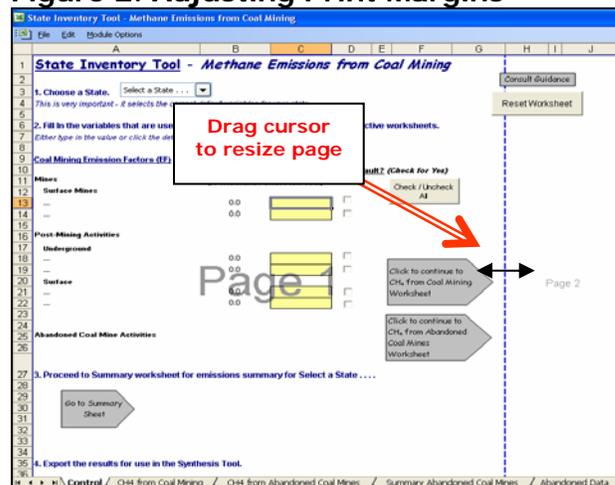
The Coal module contains some features to allow users to adjust the screen view and the appearance of the worksheets when they are printed. Once a module has been opened, you can adjust the zoom by going to the Module Options Menu, and either typing in a zoom percentage or selecting one from the drop 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**



## 1.2 MODULE OVERVIEW

This User's Guide accompanies and explains the Coal module of the SIT. The SIT was developed in conjunction with EPA's Emissions Inventory Improvement Program (EIIP). Prior to the development of the SIT, EPA developed the States Workbook for estimating

greenhouse gas emissions. In 1998, EPA revisited the States Workbook and expanded it to follow the format of EIIP guidance documents for criteria air pollutants. The result was a comprehensive, stepwise approach to estimating greenhouse gas emissions at the state level. This detailed methodology was appreciated by states with the capacity to devote considerable time and resources to the development of emission inventories. For other states, the EIIP guidance was overwhelming and impractical for them to follow from scratch. EPA recognized the resource constraints facing the states and developed the SIT. The ten modules of the SIT corresponded to the EIIP chapters and attempted 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.

Since most state inventories developed today rely heavily on the tools, 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. Volume VIII of the EIIP guidance is a historical document that was last updated in August 2004, and while these documents can be a valuable reference, they contain outdated emissions factors and in some cases outdated methodologies. States can refer to Volume VIII of the EIIP guidance documents if they are interested in obtaining additional information not found in the SIT or the companion User's Guide.

The Coal module calculates methane (CH<sub>4</sub>) 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.

### **1.2.1 Data Requirements**

To calculate CH<sub>4</sub> 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).

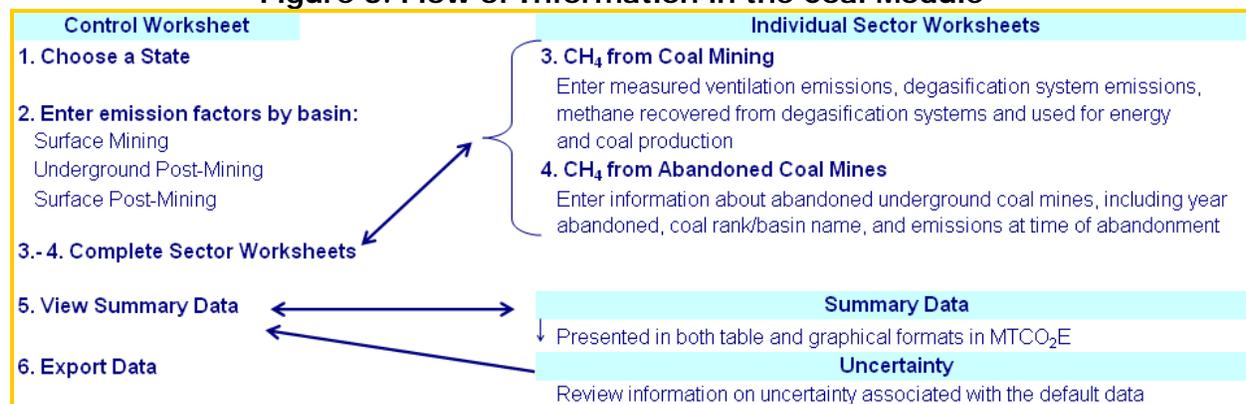
**Table 1: Required Data Inputs for the Coal Module**

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

### 1.2.2 Tool Layout

Since there are multiple steps to complete within the Coal module, it is important to have an understanding of 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.

## 1.3 METHODOLOGY

This section provides a guide to using the Coal module of the SIT to estimate CH<sub>4</sub> 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. Since 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 outlined in the EIIP guidance; however because of the automation of the calculations within the tool, the order of steps discussed in this User's Guide do not follow the order of steps discussed within the EIIP guidance document. 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 CH<sub>4</sub> from coal mining; (4) complete worksheet for CH<sub>4</sub> from abandoned underground coal mines; (5) review summary information; and (6) export data.

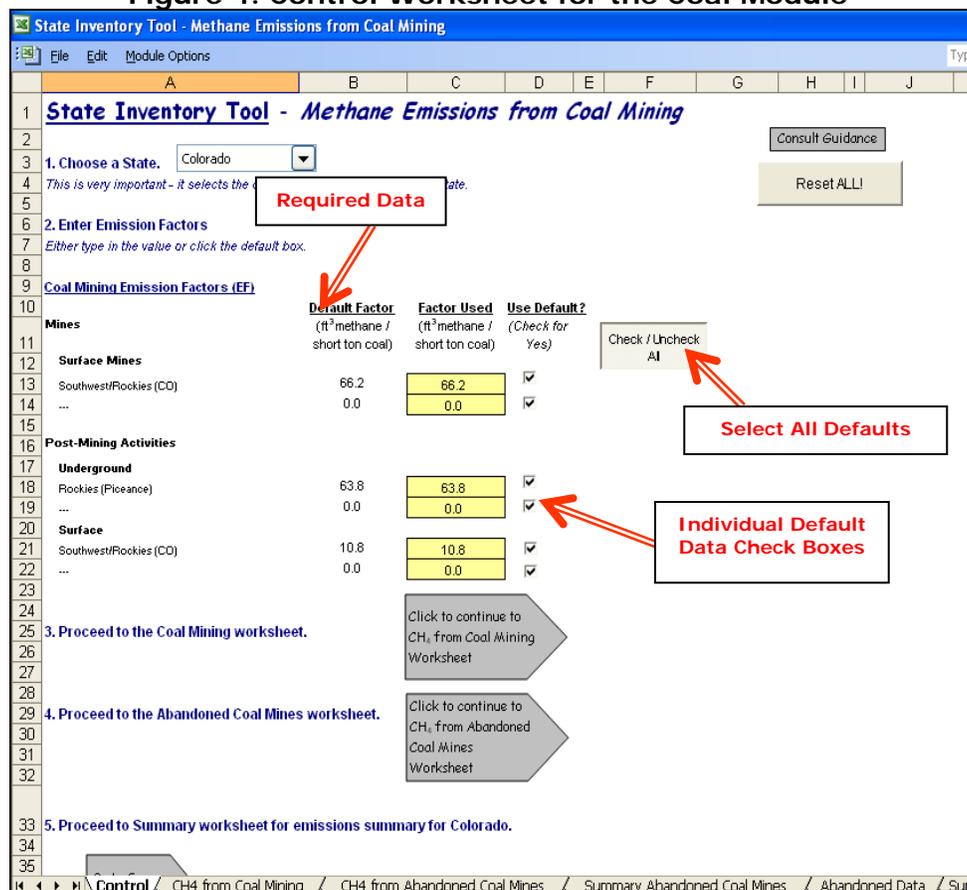
### Step (1) Select a State

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



### 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 (2003) are in cubic feet of CH<sub>4</sub> per short ton of coal. As discussed in further detail in Step 3, estimating CH<sub>4</sub> 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 CH<sub>4</sub> 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 CH<sub>4</sub> emissions. The default emission factors are from U.S. EPA (2003). 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. Since 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 CH<sub>4</sub> from Coal Mining

The CH<sub>4</sub> from coal mining worksheet is divided into emission calculations for underground and surface activities for active mines and post-mining activities.

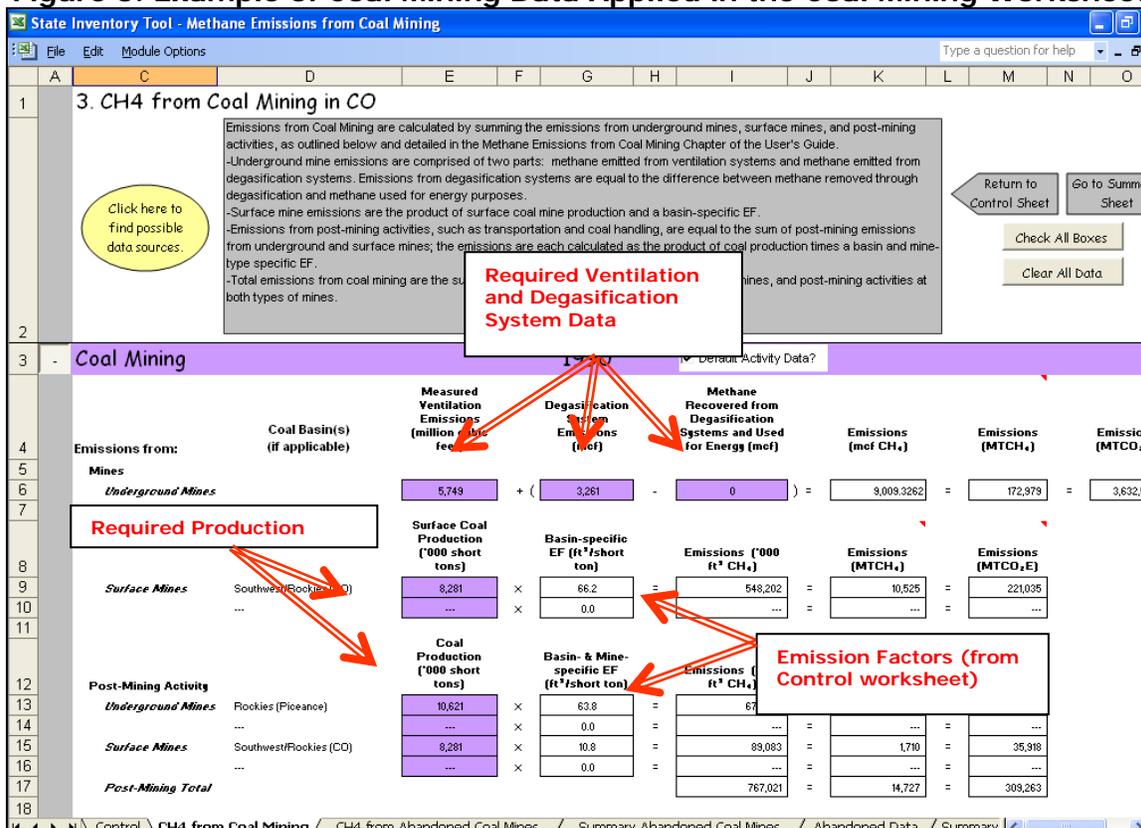
### Underground Mining Activities

There are two sources of emissions from underground mining: (1) CH<sub>4</sub> emitted from underground ventilation systems and (2) CH<sub>4</sub> emitted from degasification systems. Emissions from underground ventilation systems are calculated by summing the CH<sub>4</sub> emissions from ventilation systems at each underground mine in the state. Emissions from CH<sub>4</sub> degasification systems are calculated by summing reported or estimated emissions of CH<sub>4</sub> from all mines with degasification systems in the state, and then subtracting the CH<sub>4</sub> that is recovered and used for energy purposes. Figure 5 shows where to enter these data in the purple cells. The total CH<sub>4</sub> emitted from underground mines is the sum of CH<sub>4</sub> emissions from ventilation and degasification systems, in million cubic feet. That amount is converted to metric tons of CH<sub>4</sub> using a conversion factor of 19.2, and subsequently to MTCO<sub>2</sub>E by multiplying by the GWP of CH<sub>4</sub>. 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 (2005).

### Equation 1. Emissions from Underground Mining Activity

$$\text{Emissions (MTCO}_2\text{E)} = \{ \text{Measured Ventilation Emissions (million ft}^3\text{)} + [ \text{Degasification System Emissions (million ft}^3\text{)} - \text{CH}_4 \text{ Recovered from Degasification Systems and Used for Energy (million ft}^3\text{)} ] \} \times 19.2 \text{ g/ft}^3 \text{ CH}_4 \times 10^6 \text{ ft}^3\text{/million ft}^3 \times 10^{-6} \text{ MT/g} \times 25 \text{ (GWP of CH}_4\text{)}$$

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



### Surface Mining Activities

CH<sub>4</sub> 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 CH<sub>4</sub> content for the surface coal found in each coal basin. The result is converted to metric tons of CH<sub>4</sub>, by dividing by 1,000 and multiplying by a conversion factor of 19.2. That amount is converted to MTCO<sub>2</sub>E by multiplying by the GWP of CH<sub>4</sub>. 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

$$\text{Emissions (MTCO}_2\text{E)} = \text{Surface Coal Production ('000 short tons)} \times \text{Basin-Specific Emission Factor (ft}^3\text{/short ton)} \times 19.2 \text{ g/ft}^3 \text{ CH}_4 \times 10^3 \text{ ft}^3\text{'000 ft}^3 \times 10^{-6} \text{ MT/g} \times 25 \text{ (GWP of CH}_4\text{)}$$

#### Post-Mining Activities

Post-mining activity CH<sub>4</sub> 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 CH<sub>4</sub> emitted during post-mining activities, such as transportation and handling of coal, equals 33 percent of the in-situ CH<sub>4</sub> 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

$$\text{Emissions (MTCO}_2\text{E)} = \text{Coal Production ('000 short tons)} \times \text{Basin- and Mine-Specific Emission Factor (ft}^3\text{/short ton)} \times 19.2 \text{ g/ft}^3 \text{ CH}_4 \times 10^3 \text{ ft}^3\text{'000 ft}^3 \times 10^{-6} \text{ MT/g} \times 25 \text{ (GWP of CH}_4\text{)}$$

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 CH<sub>4</sub> 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 CH<sub>4</sub> 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. Since 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, CH<sub>4</sub> 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 CH<sub>4</sub> 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 CH<sub>4</sub>. 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 CH<sub>4</sub> emissions, but to slow them—to spread them out over a longer period of time.

- A completely flooded mine releases little to no CH<sub>4</sub> 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, m<sup>3</sup>/yr  
**q<sub>i</sub>** = emission rate at abandonment, m<sup>3</sup>/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. 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.
3. At some mines, CH<sub>4</sub> emissions are collected through a degasification system, and flared or burned to generate electricity. Enter information on amount of

CH<sub>4</sub> 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. CH<sub>4</sub> 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. Such sealing is never 100 percent effective. The effect of a seal is longer period of time.
- After a mine is abandoned and in a flood prone area, the mine will fill with methane to the atmosphere. Therefore, most emissions will occur

Return to Control Sheet  
Go to Summary Sheet  
Clear All Data

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 CH<sub>4</sub> recovered from mines collecting gas

Mine Name	County	Basin	Year Abandoned	Reported Status	Actual Status	Percent Sealed	Methane Recovered (m <sup>3</sup> /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	1995	Sealed	Sealed	80%	
4. L.S. Wood	Pitkin	Piceance	1995	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. Mesa	Delta	Piceance	1989	Sealed	Sealed	80%	
11. Mesa	Mesa	Piceance	2000	Sealed	Sealed	80%	
12. Mesa	Mesa	Piceance	2000	Flooded	Flooded		
13. Gunnison	Gunnison	Piceance	1997	Flooded	Flooded		
14. Pitkin	Pitkin	Piceance	1986	Sealed	Sealed	80%	
15. Moffat	Moffat	Piceance	1996	Unknown	Unknown		
16. Piceance West	Delta	Piceance	1981	Sealed	Sealed	80%	
17. Pienau No 2	Rio Blanco	Piceance	1988	Unknown	Unknown		
18. Golden Eagle	Las Animas	Raton	1996	Sealed	Sealed	80%	
19. Allen East & West	Las Animas	Raton	1982	Unknown	Unknown		
20. Southfield Min	ton	ton	2001	Sealed	Sealed	80%	
21. New Elk Mine	ton	ton	1989	Unknown	Unknown		
22. Bowie #3	ance	ance	2006	Sealed	Sealed	80%	

Click here to create a list of abandoned coal mines within your state

### Including Additional Abandoned Mines

If you have information on additional abandoned mines in your state that aren't provided in the default data from the EPA (Franklin et al. 2004), 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**

**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, a completely flooded mine releases little to no methane 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

Enter required data for any abandoned mines not on the default list

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.								

**Step (5) Review Summary Information**

The steps above provide estimates of total CH<sub>4</sub> 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 (MTCO<sub>2</sub>E) and metric tons of CH<sub>4</sub> (MTCH<sub>4</sub>). Figure 8 shows the summary worksheet. In addition, the results are displayed in graphical format at the bottom of the summary worksheet.

Figure 8. Example of the Emissions Summary Worksheet in the Coal Module

**4. Colorado Abandoned Coal Mines Emissions Summary**

Summary of Emissions from Default Abandoned Coal Mines

Mine Status (without Unknown Distributed)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
<b>Emissions (WTCO_E/Year)</b>											
Vented	40,975	37,508	34,868	32,767	31,040	29,587	28,341	27,256	26,300	25,448	24,685
Sealed	104,920	92,964	85,145	152,140	131,862	120,063	111,769	219,078	189,311	190,534	174,810
Flooded	-	-	-	-	-	-	-	-	25,972	13,253	6,763
Unknown	79,277	62,624	53,486	47,946	44,300	41,709	39,738	95,954	75,010	63,822	57,222
<b>Total</b>	<b>225,173</b>	<b>193,097</b>	<b>173,500</b>	<b>232,852</b>	<b>207,202</b>	<b>191,359</b>	<b>179,848</b>	<b>342,288</b>	<b>316,593</b>	<b>293,057</b>	<b>263,475</b>

Summary of Emissions from Additional Abandoned Coal Mines

Mine Status	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
<b>Emissions (WTCO_E/Year)</b>											
Vented	-	-	-	-	-	-	-	-	-	-	-
Sealed	-	-	-	-	-	-	-	-	-	-	-
Flooded	-	-	-	-	-	-	-	-	-	-	-
<b>Total</b>	<b>-</b>										

**Step (6) 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.

**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.

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.

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.

## 1.4 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.

## 1.5 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.
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