Instructor's Guide - Emergency Decision-making: Underground Coal Mine Escape Scenarios

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This training provides miners and responders opportunities to practice emergency decision-making. As trainees work through simulated mine evacuations, they evaluate and rate options at specific decision points. Feedback is provided based on the ratings given for each option by mine emergency response experts. The simulations are based on actual events at underground coal mines and include the decisions made by miners during these events.

This program is available for free on the NIOSH Mining website.

Photo by NIOSH

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In This Guide

Glossary

~	approximately
<	less than
#	number
CM	continuous miner
CO	carbon monoxide
D	decision
ft	feet
in	inches
info	information
NW	northwest
O2	oxygen
PPE	personal protective equipment
ppm	parts per million
SCSR	self-contained self-rescuer

Who can you train?

You can use these materials to train miners, mine managers, and emergency responders. The content is appropriate for annual refresher classes, mine rescue team training, or preparing responsible persons. You can also use it as a capstone for new miner training or to train inexperienced mining engineers or interns.

Trainees will need a basic understanding of underground coal mining and some background preparation in map reading and emergency response to participate fully. During field testing, this product worked well with groups composed of miners who had mixed levels of experience.

While this training could be administered to individual trainees, it will be a much richer experience if two or more trainees work through the scenarios together. During field testing, the material generated a lot of relevant and valuable discussion among trainees and between trainees and instructors.

Purpose of the training

This product helps trainees improve their mine emergency knowledge and decision-making. Trainees are presented with scenarios based on actual mine emergencies. They are asked to analyze key decision points and evaluate four options for each point. Through this activity, they are encouraged to consider multiple actions that could be taken at any one point in the story. They practice gathering relevant information, determining the pros and cons of possible choices, and considering what miners can do when no good option exists. Optimally, trainees will also practice working with others to come to decision consensus.

Materials needed to teach a class

- Computer with the product installed
- Projector
- Printed handouts for each trainee (see Appendices A–C)
- Pens and pencils

Length of a class

Scenarios vary in length, but generally, you can complete one in approximately 45 minutes. The length of a session depends on the questions that trainees ask and the detail of the discussions. During field testing, the longest sessions lasted about one hour. If you present more than one scenario from a given mine with the same trainees, the time needed for the additional scenarios will be shorter because the introductory remarks and review of the map can be very brief. Having more trainees in a session also tends to make the session longer due to the resulting discussions.

Preparing to teach this material

To review and use the package during a training session, you will need to either connect to a website hosting the program or download it to your computer. You can find the program for free download on the NIOSH Mining website. Please note as internet browsers are updated, conflicts with this program may occur. You may want to test the program using different browsers to determine which one available to you works best.

Start your preparation by opening the program and working through one scenario to become familiar with how the program functions. Access the help page by selecting the "?" on the upper right of most screens throughout the module. The computer screens and handouts provide the needed information to teach a class. The Resources section at the end of this document provides links to information about the events on which this material is based.

Trainer expertise needed

The content provided in the program walks you and your class through each scenario. Therefore, inexperienced mine safety trainers can use this product. You will need a general understanding of underground coal mining, mine maps, and emergency response regulations and procedures. Of course, instructors with more expertise will be able to lead more detailed and richer discussions. Consulting the resources provided later in this document will help you prepare for questions that trainees may ask and direct productive discussions.

Your trainees will gain more from the session if you are comfortable letting them discuss the content among themselves first and then leading class discussions and consensus-building. During field testing, trainees often brought up important points, tied the content to their respective work locations, and helped each other understand the pros and cons of various options. Encouraging these discussions increased engagement and showed trainees that their coworkers saw the relevance of the material to their workplaces.

Choosing a scenario

This training package contains seven independent mine fire escape scenarios set in three mines: that are called Adelaide, Brownfield, and Cokedale. These are not the names of the mines where the actual events that formed the basis of this training occurred. The new names denote that mine features were modified for training purposes. To select a scenario for your class, review the key points covered in each scenario and choose the one best suited to your trainees. See Table 1 for a list of key points and how many decision points are included in each scenario. Also, consider the time you have allotted for your class. You will be able to cover the general topics of emergency evacuation, such as SCSR donning, designated escapeways, and route selection, with any of the seven scenarios.

If including more than one scenario in a single class, it is best if you select scenarios from the same mine. That will focus trainees on the content rather than having them spend time learning about another mine. During field testing, mine rescue teams remained engaged while completing all three scenarios from Adelaide mine on the same day. Annual refresher classes were tested with only one scenario, but with related content added for longer sessions.

Table 1. Key topics covered in each scenario.

Mine	Scenario (# of decision points)	Key Topics
Adelaide	**1 Right** (7)	• Encountering smoke when traveling in a vehicle • Smoke at a ventilation control • Possibility of the escape group splitting • Rescue of coworkers versus self-escape
	2 Northwest Mains (5)	• Encountering smoke in an unexpected location • Chosen escape route blocked • Use of lifelines • Possibility of the escape group splitting • Medical or fitness problem with an escape group member
	3 Left (7)	• Encountering smoke when traveling in a vehicle • Smoke in escape ways • Chosen escape route blocked • Becoming disoriented • Medical or fitness problem with an escape group member • Possibility of the escape group splitting
Brownfield	**4 South** (6)	• Smoke in possible escape routes • Possibility of the escape group splitting • Medical or fitness problem with an escape group member • SCSR donning and functioning
	5 South (6)	• Traveling inby during an escape • Becoming disoriented • Smoke at a ventilation control • Possibility of the escape group splitting
Cokedale	**7 Butt** (5)	• Discovering a potential emergency • Rescue of coworkers versus self-escape • Emergency communication • Encountering smoke when traveling in a vehicle • Chosen escape route blocked • Loss of needed PPE
	8 Face Parallels (7)	• Becoming disoriented • Escape group disagreement about route choice • Smoke at a ventilation control • Possibility of the escape group splitting

Preparing the training room

You will need a computer, projector, and screen to display the pages of the program to trainees.

Trainees should be able to sit where they can work in pairs or small groups and can also be called together for class discussion. Be prepared to distribute two handouts to each trainee. One is a map of the mine where the scenario you have selected takes place. The other is a page, copied two-sided, with an answer sheet on one side and detailed information about the section where the escaping miners were working in the scenario you selected on the other. These handouts are available in Appendices A–C. They are labeled according to the mine and section name for each scenario.

Trainees can be asked to mark their ratings on the answer sheets and these forms can be kept documenting the completion of training. Even if you are not using them for documentation, it is a good idea to give all trainees a little time to mark their answers on their sheets before group or class discussion. This encourages them to think through their rating before they hear the pros and cons of others present during the discussion. During field testing, trainees were not required to complete the answer sheets. Some filled them out completely and others stopped after the first few decision points. Trainees continued participating in group and class discussions even when they did not write their ratings on individual answer sheets.

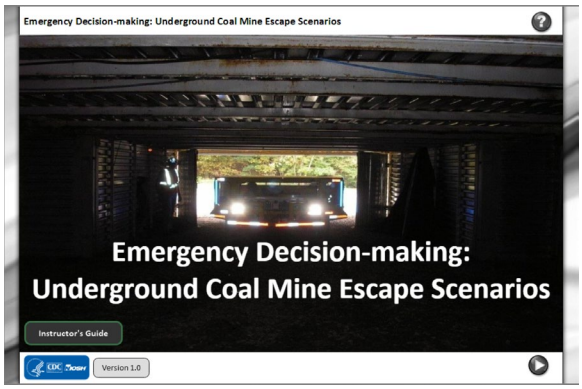
Conducting a session

The following example takes you from the beginning of a session through the first decision point and then jumps to the end of the scenario. The information in the left column explains what you and the trainees will do when you are displaying the program screens on the right The success of the session will depend on the willingness of your trainees to consider the pros and cons of the options presented for each decision point and your ability to lead related discussions. Analyzing each option will be a different way of thinking for trainees who are used to traditional multiple-choice questions where they select one best option. You may have to remind and encourage trainees to assess each answer independently. Reinforce that there often is not one correct answer. Instead, there are good and bad things about each option that should be considered when making decisions. During field tests, miners in annual refresher classes and mine rescue training, had lively discussions about the scenarios, the various options, and how details in the stories were like or different from their workplaces.

Open title screen

Have this up when the session starts.

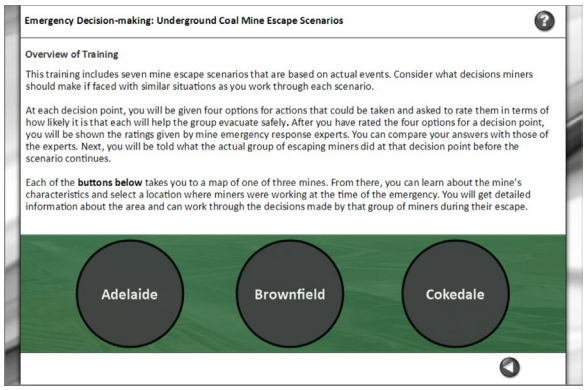
Note: Avoid describing the event as a “fire” or otherwise revealing details that the miners in the scenario did not have at that point during their evacuations.



Explain ratings and chose a mine

Tell trainees what they will be doing. Emphasize that they will not be selecting one best answer but will instead rate four independent options for each decision point.

Select the mine for this training session. (Adelaide, Brownfield, or Cokedale)

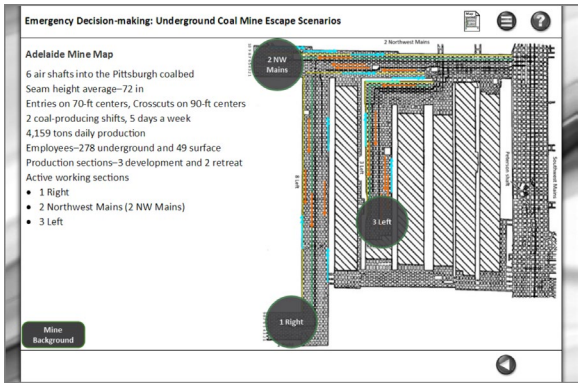


Introduce the mine and choose a section

Point out critical mine information, such as seam height. The Mine Background button takes you to a separate screen with additional details about the mine.

Information about the mine is available to trainees on their handouts.

Select the section for this training session.

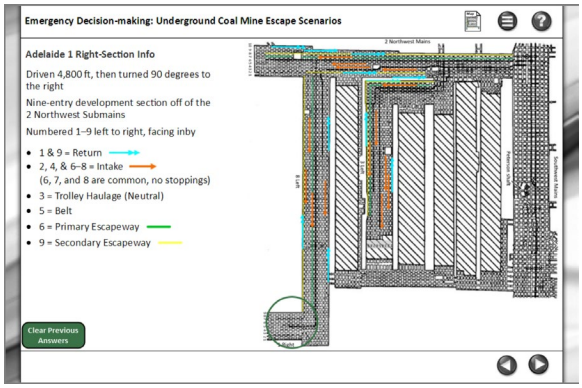


Introduce the section

Point out key section information, such as the locations of escapeways.

The section information is available to trainees on their handouts.

Note: You may want to confirm that previous sessions have been erased by clicking the "Clear Previous Answers" button.

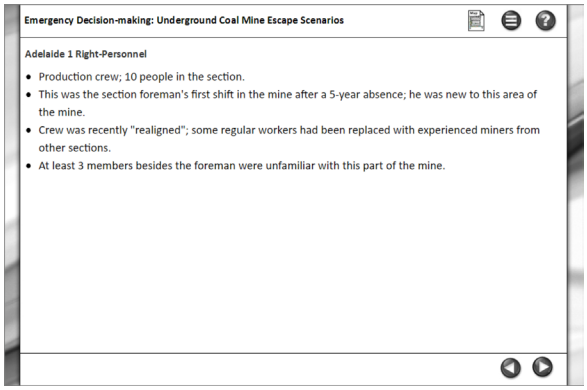


Introduce the personnel

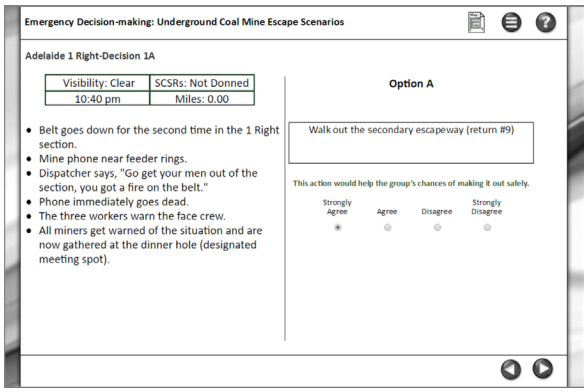
Review the personnel that are part of the scenario, pointing out characteristics that could impact escape, such as familiarity with the mine or with each other.

This is a good time to have trainees consider how the miners they work with could affect an emergency response.

Note: Be sure trainees are divided into small discussion groups before continuing.



Decision points and rating options



The left side of the screen tells the story. The upper left box includes visibility, SCSR donning status, time, and distance traveled.

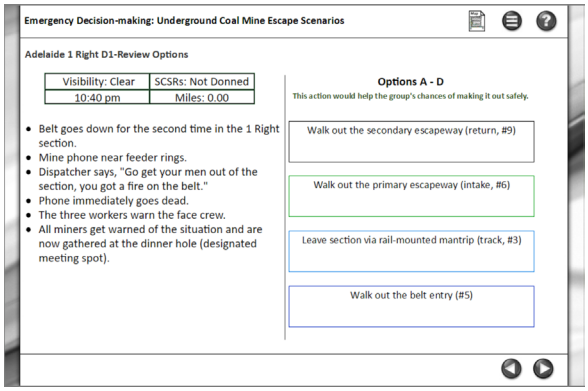
The right side gives an option that the miners in the story could take at that point. Ask trainees to consider if that option would help the miners escape safely.

Remind trainees to first mark their answers on their answer sheets. They should then discuss the option in their small groups.

Call the class together to discuss the option and come up with a consensus class option.

Note: You must select a rating to continue to the next option.

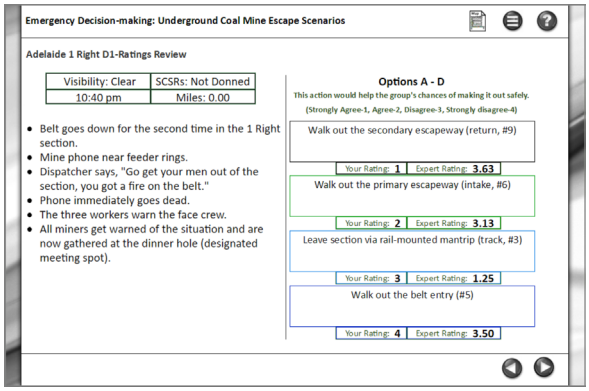
Summary of four options for a decision point



For every decision point, a screen like the one on the right comes up after the fourth option (Option D).

Recap the four options.

Compare class and expert ratings



The new information on this screen is the class rating and an expert rating for each option.

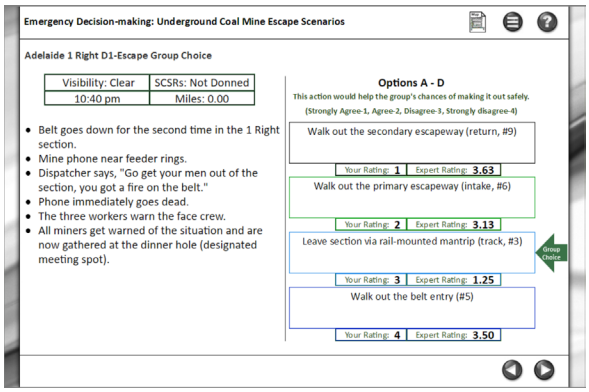
The expert ratings are the average of ratings given by a panel of people with many years of experience in mine emergency response and mine rescue. Because expert ratings are an average, they will be less extreme when the experts disagree.

It is okay if you or the trainees do not agree with the expert rating. The goal of this training is to have trainees practice considering the pros and cons of various options. Discussion about what trainees think of the expert ratings furthers this goal and should be encouraged.

What really happened

Each scenario is based on a real-life mine fire evacuation. The green arrow on this screen indicates the option that the miners took during their escape and moves the story on to the next decision point.

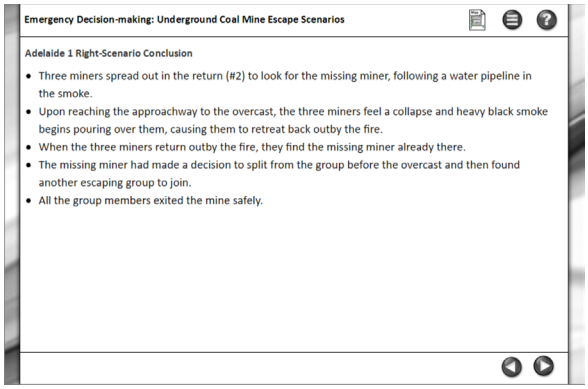
Note: Repeat the process for each decision point. Every decision point has four options.



End the scenario

A screen like the one on the right will reveal what happened to the miners in the story.

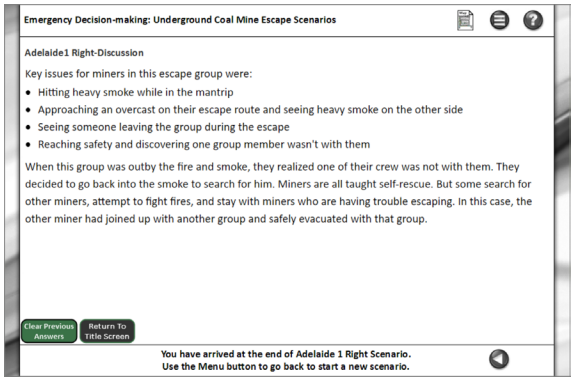
Trainees will care about the outcome of the scenario, and during field testing sessions they often asked if everyone made it out of the mine. The instructors should not confirm who or how many people made it to safety until this conclusion screen.



Scenario wrap-up

Bring up any key topics that were not fully addressed during earlier class discussions.

This is a good time to lead a discussion on how the issues and decisions covered in this training would or would not be relevant at the trainees' respective workplaces.



Using historical events for modern training

Each of the scenarios in this training package are based on actual events that occurred in the late 1980s and early 1990s. Shortly after each event, researchers interviewed miners who were impacted by the events. The researchers asked those who had evacuated to tell the stories of their experiences from the time they heard there was a problem to the point they reached safety. Further details emerged from probing questions related to what decisions were made, who made them, and why given actions were taken. The results of these interviews are detailed accounts, unlike any that had been documented before or since. The lessons learned by those miners, recorded in their interviews, still have relevance today.

Exploring historic events can help trainees learn timeless lessons, but care must be taken to ensure that trainees put the information in context and understand how things have changed since these events took place. The scenarios in this training are drawn from events that predate the 2006 Mine Improvement and New Emergency Response Act (MINER Act) (Public Law 109-236). Discussing this context with trainees early in the session helps lead them to point out when events in the scenario differ from how things are in today's mines and leads to discussions tailored to their worksites. Covering the changes that have resulted from the 2006 law also provides an opportunity to review the relevant legal requirements. Key items for discussion include the following topics.

- SCSRs caches were not required.
- Non-oxygen generating devices (W-65s) were used to get to an SCSR.
- Miners did not routinely walk the escapeways.
- Secondary escapeways could be found in return airways.
- Lifelines were not required in all escapeways.
- Tether lines were not usually available.
- Communication and tracking technologies were not as advanced.
- Refuge alternative regulations were not in place (barricading was the only option).

Many trainees will not have firsthand knowledge of the types of environments that the escapees encountered. Trainees who were working in the industry at the time of the original events are valuable resources because they can share their knowledge and experience, and you should encourage them to do so. As an example, many miners may have never worked in a mine that used track haulage, and those with that experience might explain the danger of encountering an energized trolley wire while walking in smoke. In many of the field test sessions, miners shared relevant information learned based on their work history. Their less experienced coworkers were interested and engaged them in further discussions that led to better understanding of what occurred during the historical events and how the lessons learned applied at their mines.

During field testing of these scenarios, participants often said it would be interesting to have similar training materials developed based on more recent events. This would be possible but would require information to be gathered from miners who escaped from the fires and detailed information about the mine and the emergency event. This information is not available and so these historical events are the best current option. The training method, however, could be used to develop training modules based on actual or simulated mine emergencies.

Acknowledgements

Our thanks to the miners, mine rescue team members, instructors, mine managers, and other mine safety and health professionals who assisted with field testing this training. Your input was important and is greatly appreciated.

Resources

Bauerle TJ [2016]. Ad hoc groups engaged in emergency decision making: a mixed-methods study to improve successful self-escape from underground coal fires. Dissertation. Storrs, CT: University of Connecticut.

MSHA [1988]. Noninjury underground mine fire. By Strahin RA, Wolfe DN, Pogue CW. Marianna Borough, PA: U.S. Department of Labor, Mine Safety and Health Administration, 03-07-1988. Report of Investigation (Underground Coal Mine): Marianna Mine No. 58 (I.D. No. 36-00957), BethEnergy Mines, Inc.

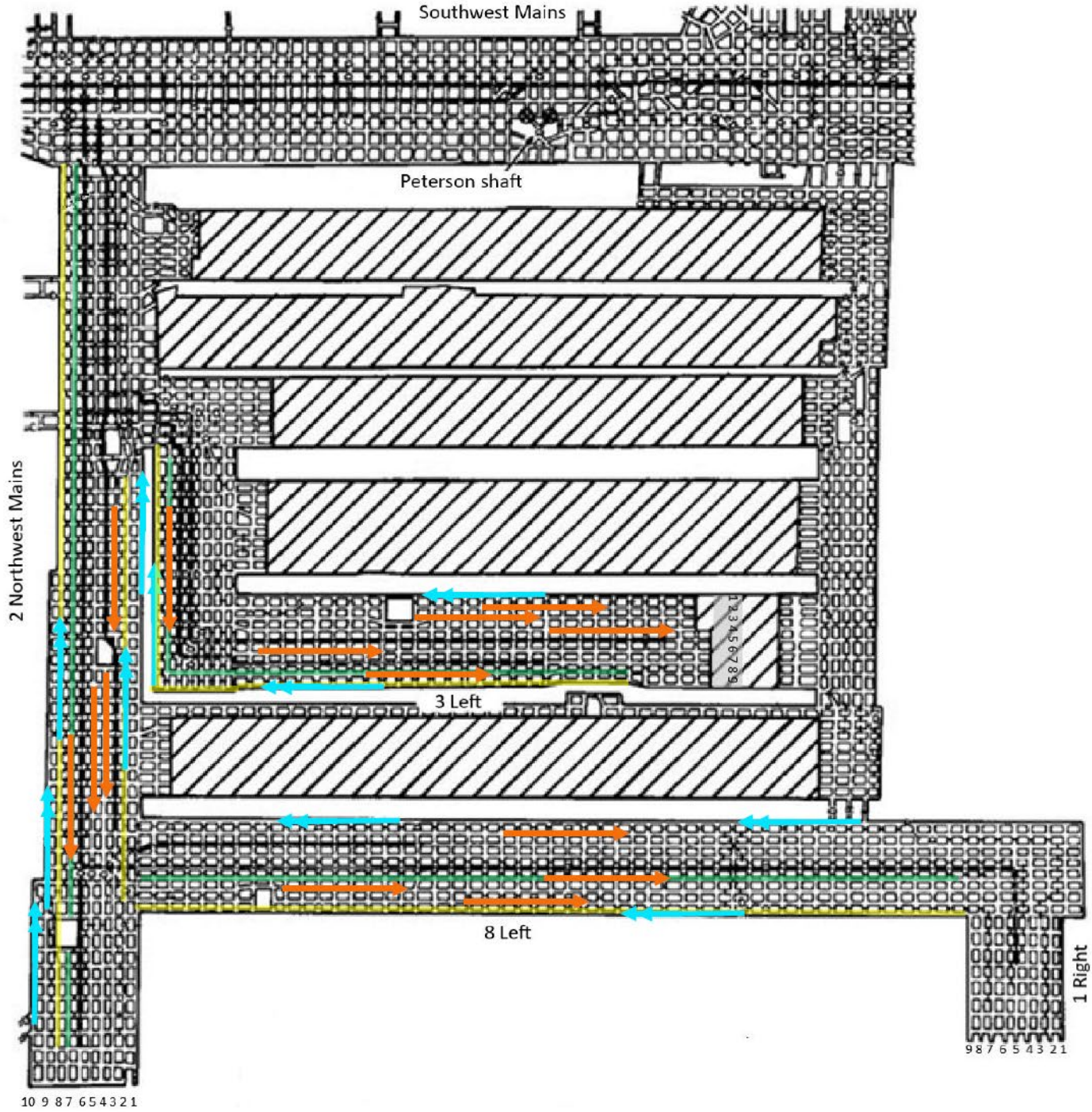
MSHA [1988]. Non-injury machinery fire. By Miller RM, Bondra M. Ebensburg, PA: U.S. Department of Labor, Mine Safety and Health Administration, 09-01-1988. Report of Investigation (Underground Coal Mine): Cambria Slope Mine No. 33 (ID 36-00840), BethEnergy Mines, Inc.

MSHA [1990]. Mathies mine fire – trolley system survey. By Checca EL, Helfrich WJ, Skorski DF. Pittsburgh, PA: U.S. Department of Labor, Mine Safety and Health Administration, 10-17-1990. Investigative Report No.: C-050191-09, Mathies Coal Co. #36-00963.

NIOSH [2000]. Behavioral and organizational dimensions of underground mine fires. By Vaught C, Brnich Jr. MJ, Mallett LG, Cole HP, Wiehagen WJ, Conti RS, Kowalski KM, Litton CD. Pittsburgh, PA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2000-126 (IC 9450), https://www.cdc.gov/niosh/mining/works/coversheet45.

Appendix A: Handouts—Adelaide Mine

Adelaide Mine



Legend

Intake

Return

Primary Escapeway

Secondary Escapeway

Mined Out Area

8/6/2019

Emergency Decision-making: Underground Coal Mine Escape Scenarios

Adelaide Mine, 1 Right

This action would help the group's chances of making it out safely.

	Strongly Agree	Agree	Disagree	Strongly Disagree
Decision 1				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 2				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 3				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 4				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○

	Strongly Agree	Agree	Disagree	Strongly Disagree
Decision 5				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 6				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 7				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○

Adelaide Mine, 1 Right

Adelaide Mine Information

6 air shafts into the Pittsburgh coalbed

Seam height average—72 in

Entries on 70-ft centers, Crosscuts on 90-ft centers

2 coal-producing shifts, 5 days a week; 4,159 tons daily production

Employees—278 underground and 49 surface

Production Sections (3 development and 2 retreat)

Three active working sections: 1 Right off of 8 Left; 2 Northwest Mains; and 3 Left

Adelaide Mine Background

Equipment in each section

- Joy Model 12/11 CMs, Joy shuttle cars, Fletcher roof-bolting machines, and S&S scoop cars

Ventilation

- Each section has two separate splits of intake air
- Air used to ventilate the belt entry is also used to ventilate the active working places
- Ventilation plan allowed no separation of the belt and trolley haulage entries
- Separation of belt and trolley entries discontinued in 3 Left, but continued in 2 NW, 8 Left, and 1 Right
- CO monitoring system capable of detecting CO at 1 ppm used and installed in belt entries

Transportation

- Trolley operated locomotives used to haul coal, supplies, and equipment
- Coal moved on 36-in and 42-in belt conveyors to 2 NW bunker coal storage facility
- Coal loaded from bunker via 42-in belt conveyor into 10-ton mine cars to skip hoist bottom
- Galis self-propelled personnel carriers were used to transport workers to and from sections

Emergency breathing equipment

- W65 filter self-rescuer worn on belt
- One hour compressed O2 units available, stored on mantrip

1 Right off of 8 Left Section Information

Driven 4,800 ft, then turned 90 degrees to the right

Nine-entry development section off of the 2 Northwest Submains, numbered 1–9 left to right, facing inby

- 1 & 9 = Return
- 2, 4, & 6–8 = Intake (6, 7, and 8 are common, no stoppings)
- 3 = Trolley Haulage (Neutral)
- 5 = Belt
- Escapeways—6 = Primary, 9 = Secondary

Emergency Decision-making: Underground Coal Mine Escape Scenarios

Adelaide Mine, 2 Northwest Mains

This action would help the group's chances of making it out safely.

	Strongly Agree	Agree	Disagree	Strongly Disagree
Decision 1				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 2				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 3				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○

	Strongly Agree	Agree	Disagree	Strongly Disagree
Decision 4				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 5				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○

Adelaide Mine, 2 Northwest Mains

Adelaide Mine Information

6 air shafts into the Pittsburgh coalbed

Seam height average—72 in

Entries on 70-ft centers, Crosscuts on 90-ft centers

2 coal-producing shifts, 5 days a week; 4,159 tons daily production

Employees—278 underground and 49 surface

Production Sections (3 development and 2 retreat)

Three active working sections: 1 Right off of 8 Left; 2 Northwest Mains; and 3 Left

Adelaide Mine Background

Equipment in each section

- Joy Model 12/11 CMs, Joy shuttle cars, Fletcher roof-bolting machines, and S&S scoop cars

Ventilation

- Each section has two separate splits of intake air
- Air used to ventilate the belt entry is also used to ventilate the active working places
- Ventilation plan allowed no separation of the belt and trolley haulage entries
- Separation of belt and trolley entries discontinued in 3 Left, but continued in 2 NW, 8 Left, and 1 Right
- CO monitoring system capable of detecting CO at 1 ppm used and installed in belt entries

Transportation

- Trolley operated locomotives used to haul coal, supplies, and equipment
- Coal moved on 36-in and 42-in belt conveyors to 2 NW bunker coal storage facility
- Coal loaded from bunker via 42-in belt conveyor into 10-ton mine cars to skip hoist bottom
- Galis self-propelled personnel carriers were used to transport workers to and from sections

Emergency breathing equipment

- W65 filter self-rescuer worn on belt
- One hour compressed O2 units available, stored on mantrip

2 Northwest Mains Section Information

Ten-entry development section turned off of the Southwest Mains, numbered 1–10 left to right facing inby

- 1, 2, & 8–10 = Return
- 3–5 & 7 = Intake (3,4, and 5 are common, no stoppings)
- 3 & 4 = Trolley Haulage
- 6 = Belt
- Escapeways—7 = Primary, 2 & 8 = Secondary

Emergency Decision-making: Underground Coal Mine Escape Scenarios

Adelaide Mine, 3 Left

This action would help the group's chances of making it out safely.

	Strongly Agree	Agree	Disagree	Strongly Disagree
Decision 1				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 2				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 3				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 4				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○

	Strongly Agree	Agree	Disagree	Strongly Disagree
Decision 5				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 6				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 7				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○

Adelaide Mine, 3 left

Adelaide Mine Information

6 air shafts into the Pittsburgh coalbed

Seam height average—72 in

Entries on 70-ft centers, Crosscuts on 90-ft centers

2 coal-producing shifts, 5 days a week; 4,159 tons daily production

Employees—278 underground and 49 surface

Production Sections (3 development and 2 retreat)

Three active working sections: 1 Right; 2 Northwest Mains; and 3 Left

Adelaide Mine Background

Equipment in each section

- Joy Model 12/11 CMs, Joy shuttle cars, Fletcher roof-bolting machines, and S&S scoop cars

Ventilation

- Each section has two separate splits of intake air
- Air used to ventilate the belt entry is also used to ventilate the active working places
- Ventilation plan allowed no separation of the belt and trolley haulage entries
- Separation of belt and trolley entries discontinued in 3 Left, but continued in 2 NW, 8 Left, and 1 Right
- CO monitoring system capable of detecting CO at 1 ppm used and installed in belt entries

Transportation

- Trolley operated locomotives used to haul coal, supplies, and equipment
- Coal moved on 36-in and 42-in belt conveyors to 2 NW bunker coal storage facility
- Coal loaded from bunker via 42-in belt conveyor into 10-ton mine cars to skip hoist bottom
- Galis self-propelled personnel carriers were used to transport workers to and from sections

Emergency breathing equipment

- W65 filter self-rescuer worn on belt
- One hour compressed O2 units available, stored on mantrip

3 Left Section Information

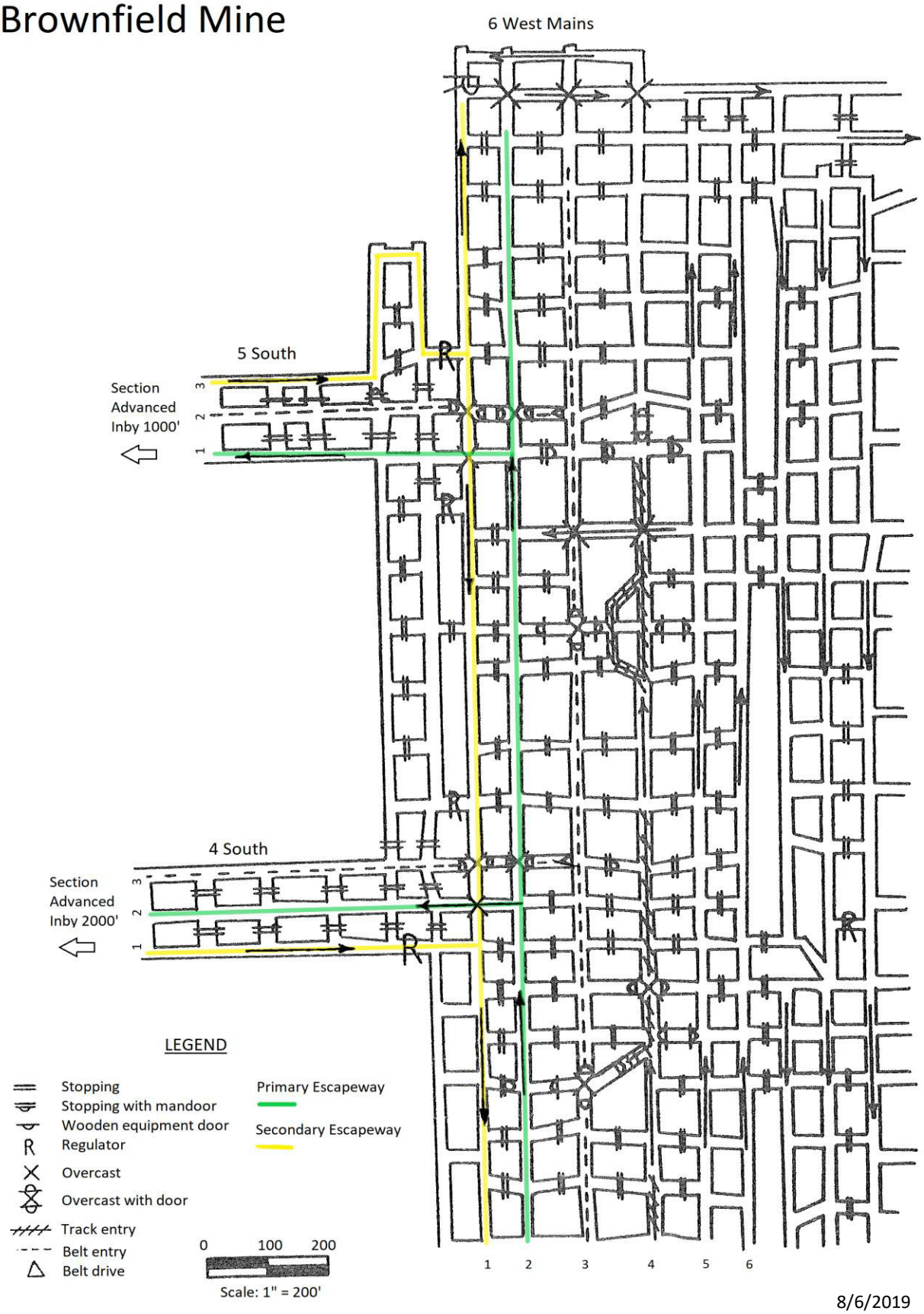
Retreated 500 ft outby

Nine-entry development turned off of the Southwest Mains, numbered 1–9 left to right facing inby

- 1 & 9 = Return
- 2–6, & 8 = Intake (2, 3, 4, 5, and 6 are common, no stoppings)
- 7 = Trolley Haulage (Neutral)
- 5 = Belt
- Escapeways—8 = Primary (separated by stoppings from 7 and 9), 9 = Secondary

Appendix B: Handouts—Brownfield Mine

Brownfield Mine



8/6/2019

Emergency Decision-making: Underground Coal Mine Escape Scenarios

Brownfield Mine, 4 South

This action would help the group's chances of making it out safely.

	Strongly Agree	Agree	Disagree	Strongly Disagree
Decision 1				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 2				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 3				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○

	Strongly Agree	Agree	Disagree	Strongly Disagree
Decision 4				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 5				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 6				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○

Brownfield Mine, 4 South

Mine Information

One slope and 8 shafts in the upper (C Prime) and Lower Kittaning (B) seams

Average seam thickness 48–54 in

Entries and crosscuts 18–20 ft wide, driven on 60–120 ft centers on CM sections to develop longwall panel sections

3 production shifts per day, 5 days a week

7,000 tons daily production

Employees—804 underground and 65 surface

17 CM sections, 3 longwall sections

Active working sections

- 4 South
- 5 South

Brownfield Mine Background

Ventilation

- 6 propeller-type fans operating exhausting and located on the surface

Transportation

- Coal is transported from face areas by shuttle cars on CM sections and by chain conveyors on longwall sections, then discharged onto belt conveyors
- Series of belt conveyor flights transports coal in the C prime coal seam into a winze hole to the B seam where a belt conveyor transports the coal to a rotary dump area
- Series of belt conveyor flights transport the coal from the B seam to boom loading areas where coal cars are loaded and transported by locomotives to the rotary dump
- On longwall panel development sections, miners would dismount their rail mantrips at the mouth of the section, then board rubber-tired personnel carriers and go to the faces

Emergency breathing equipment

- W65 filter self-rescuer worn on belt
- One-hour compressed O2 units available, stored in section designated assembly point

4 South Section Information

Three-entry longwall development panel advanced 2,000 ft from the mains

- 1 = Return, Secondary Escapeway
- 2 = Intake, Primary Escapeway
- 3 = Conveyor Haulage Belt—Belt entry ventilated by separate split of intake air that moved from the section mouth inby to the belt tailpiece

Emergency Decision-making: Underground Coal Mine Escape Scenarios

Brownfield Mine, 5 South

This action would help the group's chances of making it out safely.

	Strongly Agree	Agree	Disagree	Strongly Disagree
Decision 1				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 2				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 3				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○

	Strongly Agree	Agree	Disagree	Strongly Disagree
Decision 4				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 5				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 6				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○

Brownfield Mine, 5 South

Brownfield Mine Information

One slope and 8 shafts in the upper (C Prime) and Lower Kittaning (B) seams

Average seam thickness 48–54 in

Entries and crosscuts 18–20 ft wide, driven on 60–120 ft centers on CM sections to develop longwall panel sections

3 production shifts per day, 5 days a week

7,000 tons daily production

Employees—804 underground and 65 surface

17 CM sections, 3 longwall sections

Active working sections

- 4 South
- 5 South

Brownfield Mine Background

Ventilation

- 6 propeller-type fans operating exhausting and located on the surface

Transportation

- Coal is transported from face areas by shuttle cars on CM sections and by chain conveyors on longwall sections, then discharged onto belt conveyors
- Series of belt conveyor flights transports coal in the C prime coal seam into a winze hole to the B seam where a belt conveyor transports the coal to a rotary dump area
- Series of belt conveyor flights transport the coal from the B seam to boom loading areas where coal cars are loaded and transported by locomotives to the rotary dump
- On longwall panel development sections, miners would dismount their rail mantrips at the mouth of the section, then board rubber-tired personnel carriers and go to the faces

Emergency breathing equipment

- W65 filter self-rescuer worn on belt
- One-hour compressed O2 units available, stored in section designated assembly point

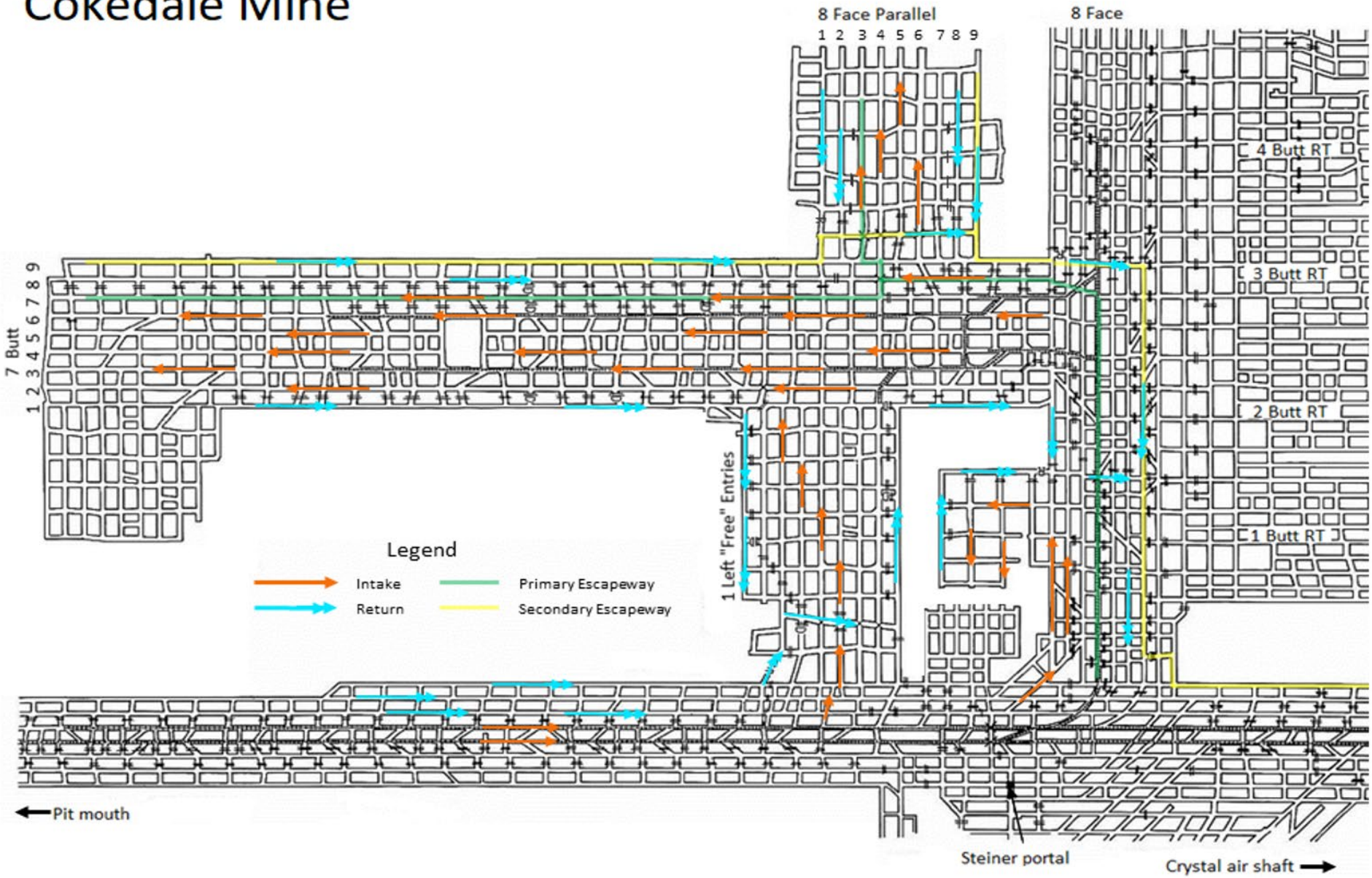
5 South Section Information

Three-entry longwall development panel advanced 1,000 ft from the mains

- 1 = Intake, Primary Escapeway
- 2 = Conveyor Haulage Belt—Belt entry ventilated by separate split of intake air that moved from the section mouth inby to the belt tailpiece
- 3 = Return, Secondary Escapeway

Appendix C: Handouts—Cokedale Mine

Cokedale Mine



8/20/2020

Emergency Decision-making: Underground Coal Mine Escape Scenarios

Cokedale Mine, 7 Butt

This action would help the group's chances of making it out safely.

	Strongly Agree	Agree	Disagree	Strongly Disagree
Decision 1				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 2				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 3				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○

	Strongly Agree	Agree	Disagree	Strongly Disagree
Decision 4				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 5				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○

Cokedale Mine, 7 Butt

Cokedale Mine Information

One drift and 8 shafts into the Pittsburgh Coal Seam, average 66-in thickness

CM operators for development and retreat sections

Entries and crosscuts developed on 16.5-ft width

Entries on 64-ft centers, crosscuts on 96-ft centers

Two production shifts and one maintenance shift per day, five days a week, 6,500 tons daily production

Employees—339 underground and 69 surface

10 working sections, 7 active and 3 spares

Two active working sections impacted by the event: 7 Butt and 8 Face Parallels

Cokedale Mine Background

Ventilation

- 6 exhausting axial-vane mine fans
- Intake air entered at the drift entrance and at 7 intake air shafts
- Ventilation is controlled by regulators located in the return entries near the mouth of each section

Transportation

- Coal is transported from the working faces using shuttle cars and discharged onto belt conveyors
- Series of belt conveyors transported the coal to underground loading tipples where the coal was loaded into mine cars
- 37-ton and 50-ton track locomotives transported trips of loaded coal cars to the mine surface

Ground Control

- Immediate roof was 64 in of roof coal and black shale
- Persistent parting of draw rock about 12 to 18 in above the coal seam
- Roof is supported with mechanically anchored tensioned roof bolts, plus resin grouted bolts is installed on 4-ft by 5-ft centers

Emergency breathing equipment

- W65 filter self-rescuer worn on belt
- One-hour compressed O2 units available, stored on mantrip
- SCSRs stored in designated intake escapeways, within 5 minutes moderate walking time from face, never further than 1,000 ft from personnel working in the section

7 Butt Section Information

Driven 3,200 ft before turning left

Nine entries developed to the left of 8 Face, numbered 1–9 left to right, facing inby

- 1, 8, & 9 = Return
- 2–7 = Intake (2, 3, 4, 5, & 6 common, no stoppings)
- 3 = Track
- Escapeways—7 = Primary, 9 = Secondary

Emergency Decision-making: Underground Coal Mine Escape Scenarios

Cokedale Mine, 8 Face Parallels

This action would help the group's chances of making it out safely.

	Strongly Agree	Agree	Disagree	Strongly Disagree
Decision 1				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 2				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 3				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 4				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○

	Strongly Agree	Agree	Disagree	Strongly Disagree
Decision 5				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 6				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○
Decision 7				
A	○	○	○	○
B	○	○	○	○
C	○	○	○	○
D	○	○	○	○

Cokedale Mine, 8 Face Parallels

Cokedale Mine Information

One drift and eight shafts into the Pittsburgh Coal Seam, average 66-in thickness

CM operators for development and retreat sections

Entries and crosscuts developed on 16.5-ft width

Entries on 64-ft centers, crosscuts on 96-ft centers

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10 working sections, 7 active and 3 spares

Two active working sections impacted by the event: 7 Butt and 8 Face Parallels

Cokedale Mine Background

Ventilation

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- Intake air entered at the drift entrance and at 7 intake air shafts
- Ventilation is controlled by regulators located in the return entries near the mouth of each section

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- Series of belt conveyors transported the coal to underground loading tipples where the coal was loaded into mine cars
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- Persistent parting of draw rock about 12 to 18 in above the coal seam
- Roof is supported with mechanically anchored tensioned roof bolts, plus resin grouted bolts is installed on 4-ft by 5-ft centers

Emergency breathing equipment

- W65 filter self-rescuer worn on belt
- One hour compressed O2 units available, stored on mantrip
- SCSRs stored in designated intake escapeways, within 5 minutes moderate walking time from face, never further than 1,000 ft from personnel working in the section

8 Face Parallels Section Information

Driven to parallel to old 8 Face

Nine-entries developed to the left of 8 Face, numbered 1–9 left to right, facing inby

- 1, 2, 8, & 9 = Return
- 3–7 = Intake (all common, no stoppings)
- Escapeways—3 = Primary, 9 = Secondary