

Belt Fire Exercise

Instructor's Copy

Behavioral Research Aspects of Safety
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U. S. Bureau of Mines
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Introduction

This document contains most of the materials needed to use the exercise. The main part of the document is the instructor's copy. It tells how to use the exercise, presents the objectives, the master answer sheet, the scoring key, and discussion notes to be used following the exercise. The last part of this document is three appendices. Appendix A is the exercise problem booklet. This booklet can be duplicated locally. The booklets are reusable. One is needed for every person in the classroom. Appendix B is the answer sheet. Copies of this answer sheet must have the invisible ink answers that appear in Appendix C printed on them². Answer sheets are consumable. One is needed for each person or each group of 3 to 5 persons who work the exercise.

Exercise Summary

Read this section first. It determines if the exercise is appropriate for your classes. If you choose to use the exercise, examine the table of contents and review the remainder of this document.

<u>Type:</u>	Invisible ink
<u>Audience:</u>	Underground coal miners
<u>Length:</u>	Eleven questions (35 minutes for administration plus 35 for discussion)
<u>Skills:</u>	Mine fire assembly points and primary and secondary escape way routes and procedures Communication among mine face crews and surface personnel during a mine fire Strategies and procedures for locating, fighting, and or escaping a mine fire
<u>Location:</u>	Large underground coal mine
<u>Problem:</u>	You are the foreman for an 8 person crew that is advancing the headings of a longwall entry. You receive a call from the dispatcher reporting smoke coming out the belt entry from your section 5,000 feet out of your position. The air at the face is clear. You must decide how to evacuate the section, what equipment to take with you, gather information about the location and size of the fire, and determine if you should fight the fire or leave. The lives of the 8 miners you supervise, the lives of many other miners in the mine, and the well being of the mine depend upon your judgments and actions.

² You can do this yourself if you have the proper equipment, or you may obtain copies of preprinted answer sheets from MSHA, National Mine Health & Safety Academy, Dept. of Instructional Materials, 1301 Airport Road, Beaver, WV 25813-9426 phone 304-256-3257, fax 304-256-3368 or email to lord-mary@msha.gov.

How to Use This Exercise

1. Look at the performance objectives. Decide if the exercise is relevant for your mine training class.
2. Work through the exercise with the developing pen and score your responses.
3. Read the master answer sheet for the exercise. Look at all the answers.
4. Read the "Instructor's Discussion Notes" for the exercise.
5. Become thoroughly familiar with the problem so that you can present it to your class without reading it. Put the figures on an overhead projector so you can use these to help explain the problem.
6. When you present the exercise to the class:
 - Give each person an exercise booklet, and each group of 3 to 5 persons one answer sheet, and a developing pen.
 - Demonstrate how to select and mark answers using the developing pen.
 - Go over the instructions for working the exercise with the whole group.
 - Explain the problem making sure everyone understands the problem situation.
 - Have the class members work the exercise.
 - When the class members finish, have them figure up their score using the instructions at the end of the exercise.
 - When everyone has finished ask class members discuss the merits of each answer. Add your own ideas.

Performance Objectives for Belt Fire Exercise

Objective number	Capability verb(s)	Description of required performance and conditions under which it is to occur
1. SR/EE ³	Recall Recognize	Emergency procedures for assembly of miners at designated assembly points and proper means for evacuation of a mine given a mine section map and information about a fire
2. SR/EE	Identify Gather	Equipment and materials needed to escape from a mine section in by a fire including materials that may be needed to fight the fire
3. SR/EE	Value Seek Use	Information from the surface about the location and size of the fire in order to make informed decisions about escape routes and whether to fight or flee the fire.
4. EE/FF	Recognize Identify	Effective procedures for gathering information about a mine fire and communicating this information to the surface as a mine section is evacuated
5. FF/EE	Identify Select	Proper positions and procedures from which to examine a mine fire to make decisions about fighting or fleeing the fire
6. SW/CS	Recall	Procedures for fighting underground mine fires to maximize the effectiveness of the fire fighting and minimize the risk to miners

³ Skill and knowledge domain abbreviations:

SR= self-rescue

EE = emergency escape

FF =fire fighting

SW = safe work practices

CS = confined spaces

Master Answer Sheet for Belt Fire Exercise

Use this answer sheet to mark your selections. Rub the developing pen gently and smoothly between the brackets. Don't scrub the pen or the message may blur. Be sure to color in the entire message once you have made a selection. Otherwise you may not get the information you need.

Question A (Choose only ONE unless you are told to "Try Again!")

1. [Dangerous! A hot roller can cause a major mine fire. Try again!]
2. [You should not leave your crew at the face. You may be endangering their]
[lives. Try again!]
3. [If there is a fire, you are placing your crew in danger. Try again!]
4. [Correct. You need to make sure each miner is notified. Do the next question.]

Question B (Select as MANY as you think are correct.)

5. [This wastes valuable time. There are more important things to do.]
6. [Correct. At this time the most important thing is to warn the other miners and]
[have them go to the designated assembly point.]
7. [This wastes time. There are more important things to do.]
8. [Correct. You may need these items to fight the fire and you may have to fight]
[the fire to get out of the mine.]
9. [Correct. This is proper procedure and it will also help alert any miners on the]
[section not already warned that there is a problem.]
10. [Correct. All the miners are present.]

Question C (Choose only ONE unless you are told to "Try Again!")

11. [You need to do something else first! Try again!]
12. [Correct. Do the next question.]
13. [You need to act now, not wait. Try again!]
14. [This is dangerous. Your time may be limited. Try again!]

Question D (Select as MANY as you think are correct.)

- 15. [Correct. You should report that all miners are accounted for and you should]
[also report your route and means of travel out of the section.]
- 16. [Correct. This information can be lifesaving. The dispatcher says that heavy]
[smoke is coming from the belt entry from 2-B section at the neck. But he]
[doesn't know the source of the smoke.]
- 17. [Correct. The surface personnel need to know your intentions and activities.]
- 18. [Correct. There could be a problem with the water supply to the whole section]
[or the whole mine. The dispatcher can check on this. This information is]
[important if you should need to fight a fire.]
- 19. [If a fire burns for over 30 minutes it should be reported, but others at the]
[surface should do this. You have other things to attend to now.]
- 20. [The location and severity of a fire is not yet known. Other miners should not]
[travel inby the possible location of a fire.]
- 21. [Correct. This information is important to surface personnel who can help find]
[the fire and assist you in other ways.]

Question E (Select as MANY as you think are correct.)

- 22. [Correct. You learn the surface personnel have no new information about the]
[source of the smoke.]
- 23. [It is a good idea to check, but each stop will take a long time and delay your]
[departure from the section.]
- 24. [Correct. This will help you locate the source of the smoke but will also prevent]
[unnecessarily delaying your departure from the section.]
- 25. [This is unnecessary and it wastes valuable time.]

Question F (Choose only ONE unless you are told to "Try Again!")

- 26. [This may endanger the lives of other miners. Try again!]
- 27. [You need to act, not wait for instructions. Try again!]
- 28. [You need to do something else first. Try again!]
- 29. [Correct. You need to inspect the situation and develop a plan before]
[attempting to fight the fire. Do the next question.]
- 30. [This may endanger the lives of other miners. Try again!]

Question G (Select as MANY as you think are correct.)

- 31. [Correct. It is critical to maintain communications with the fire]
[command center outside.]
- 32. [This will direct gases produced by the fire back over the fire site and could]
[could cause an explosion.]
- 33. [Correct. It is critical to get water on the fire as quickly as possible. You may]
[need more water and materials to fight this fire.]
- 34. [Never send anyone inby a fire.]

Question H (Select as MANY as you think are correct.)

- 35. [This would reverse the air on the belt but would also fan the fire.]
- 36. [Correct. The air movement on the belt needs to be reversed to attack the fire]
[from the outby side.]
- 37. [Correct. It is necessary to divert only enough air to reverse the flow on the]
[belt. To divert more air than necessary would fan the fire.]
- 38. [This is unnecessary at this time. There are more important things to]
[accomplish.]

Question I (Select as MANY as you think are correct.)

- 39. [This wastes valuable time and any chance of bringing the fire under control]
[will probably be lost.]
- 40. [Correct. A continuous stream of water is required to fight the fire.]
- 41. [Correct. To bring the fire under control quickly, you will need as much water]
[as possible on the fire as quickly as possible.]
- 42. [Correct. The site should be selected to eliminate exposure of the fire]
[fighters to bad roof conditions and excessive heat.]

Question J (Select as MANY as you think are correct.)

- 43. [Correct. The surface command center should be continually informed about the status of the fire and fire fighting efforts. This and additional information received from others in and around the mine allows the surface personnel to provide valuable information and assistance to the fire fighting effort.]
- 44. [Correct. This is absolutely necessary to protect the fire fighters from the bad roof conditions that usually result from mine fires.]
- 45. [This would be nearly impossible and very time consuming.]
- 46. [These areas will be thoroughly soaked with water. Applying rock dust is not nearly as effective as water and is not necessary in this case.]

Question K (Select as MANY as you think are correct.)

- 47. [False! As little as 15 to 20 pounds of coal around a red hot roller can ignite a hot fire in as little as 15 to 20 minutes.]
- 48. [False! Most fire resistant belt will ignite from even a small fire in spilled coal round a hot roller.]
- 49. [Correct. The rapid movement of the belt dissipates the heat. But the coal fire itself can be very dangerous unless it is promptly located and extinguished.]
- 50. [Correct. Worn belts can accumulate fabric and debris at rollers and their supports. Friction between this accumulated material and the moving belt can ignite this debris within a few minutes.]
- 51. [False! Studies show that a few feet of burning belt will fill the entry with heavy black smoke and produce CO levels up to 7 percent or 70,000 ppm. One breath of this smoke can be fatal. Burning a piece of belt is like burning a tire. A little material produces a lot of CO rich smoke.]

Finding your score

Number of "correct" answers you colored in = (1)_____

26 minus number of incorrect answers you colored in = (2)_____

Add blanks one and two to get your total score = (3)_____

Highest possible score = 51

Lowest possible score = 0

Instructor's Discussion Notes for Fighting a Belt Fire

Use the information presented here and on the master answer sheet, your own ideas and experience, and those of the persons in your class to discuss the exercise after it is completed. Group discussion can help strengthen knowledge and skills, correct errors, and relate the exercise content to the experiences of the trainees. After they have worked the exercise, trainees enjoy discussing the problem. They also frequently think of better ways to respond to a problem than those listed among the answers. The purpose of the exercise is to help people think about and remember basic knowledge and skills they may someday need to deal with an emergency. The discussion following the exercise can contribute to this goal and tailor the exercise content to the needs of the group you are training.

It is helpful to show overhead transparencies of the answers on the master answer sheet during the discussion, while the trainees look at their problem booklets. This allows you to lead the group through the exercise and to discuss all the answers to each question. Most of the information about why particular answers are correct or incorrect is given on the master answer sheet.

The following notes provide additional information for you to discuss with your class.

Question A - It is important to immediately alert all the crew members on the section to the smoke and have them gather at the portal bus (4), the designated assembly point. Although not listed among the responses, the foreman should also ask the dispatcher for any additional information about the source and location of the fire. This information is important to planning the evacuation from the section and the mine, and for determining whether or not to fight the fire. However, obtaining this information should not involve sending miners from this section outby to look for the fire (2 and 3). The fire could be large and prevent escape from the section. Prompt evacuation of the section is required. Waiting at the face for more information about the fire (1) could endanger lives. Yet, studies of human behavior in fire reveal that it is not uncommon for persons involved in similar situations in fires in large buildings with complex passageways to continue with their normal activity and wait for someone to provide them with more information before attempting an escape. As much as 85 percent of the total time required to escape and reach a relative place of safety is often spent in deciding if there is a fire, if it is serious, in miscommunication about the source and seriousness of the fire, and in continuing with one's ongoing activity before leaving.

Question B - Once the foreman travels to the face, alerts the miners to the smoke and directs them to assemble at the portal bus, he or she should enlist the help of other miners he meets to get this job done rapidly (6). The failure of the water to the continuous miner is an important clue that indicates there may be a serious fire outby on the belt, or that water pressure to the section and to the mine may have failed. This information should be kept in mind, but no effort should be made to restore water to the miner at this time (5). Likewise no time should be wasted hanging a curtain in the number 2 heading (7). The priorities are to warn everyone, to gather extra SCSRs and

fire fighting materials (8), shut down the power to the section (9), and get every one to the assembly point and make a head count (10).

Question C - Once the head count has been made and the miners, the extra SCSRs, and fire fighting equipment are on the bus, the most critical task is to call the dispatcher before or as the crew starts to leave (12). More information is needed, and this information, if available, could help make important decisions about what to do next and what route to use to leave the section and the mine. Sending miners on foot to look for the fire (14), and waiting at the portal bus for more information (13) both delays departure and wastes valuable time needed to escape and/or fight the fire. Immediately getting on the bus and leaving for the surface could get the crew into trouble and could also endanger the lives of other miners. Before or as they start to leave, the foreman and his crew need to call out to seek more information and to report where they are and what they intend to do.

Question D - The call outside to the dispatcher should include telling him where the miners are and that they are about to start out of the section on the portal bus (15), asking for more information about the location of the smoke (16), reporting that the crew has extra SCSRs and fire fighting equipment and that they intend to watch for a fire and fight it if possible (17), that the water pressure to the miner has failed (18) so that others on the surface can check on this and determine if there is water to the section and the mine, and that the air at the face and portal bus is clear (21). Surface personnel need this valuable information to help them warn and evacuate other miners from elsewhere in the mine, and to provide advice and assistance to this section crew as they seek to locate and fight this fire, or to escape the section and mine. The foreman asking the dispatcher to notify MSHA (19) is inappropriate because other persons on the surface should make this decision. The section foreman has other more important things to do. Asking that additional miners be sent into the 2-B section on the track entry (20) is wrong because the location of the fire is not known, and these other miners could be endangered by traveling inby the fire.

Question E - As the 2-B section crew leaves they should continually keep in touch with the dispatcher to report their position and what they have found, and to seek any new information about the source of the fire (22). The portal bus should be stopped at manddoors to check the fresh air and the belt entry for smoke, but not at each manddoor every 300 feet (23). This would delay the departure of the crew too long. However, stopping at every other manddoor at 600 foot intervals would both speed up departure time from the section, and also quickly help locate the source of the smoke (24). Having the foreman or another miner walk ahead of the portal bus to check for smoke and to make methane checks would greatly delay departure from the section and could allow the fire to spread and endanger the lives of the crew. Walking ahead of the bus with a methane detector would be necessary only if there were reason to suspect the presence of methane approaching the explosive range in or near the entry. There is no indication of this situation here, and the ventilation to the section remains normal.

Question F - Once the beltman reports the location of the fire to the foreman, the foreman should immediately report this information to the dispatcher and then

continue outby on the portal bus to inspect the fire (29). The immediate notification of the dispatcher is important to other miners and surface personnel so they can act accordingly. Immediately traveling to the neck of the section, cutting the power to the section, and then going to the surface (26), or going directly to the surface (30) would probably allow the fire to get out of control and could endanger other miners deeper in the mine who might have trouble evacuating the mine if the fire grew rapidly and its smoke fouled the mine ventilation. Likewise, waiting for further instructions at the neck of the section (27) would waste valuable time. It is dangerous to attack the fire without first making an inspection and developing a plan (28).

Question G - Once the foreman and his crew arrive at the fire they should immediately establish telephone communication with the surface as close to the fire as possible (31). That is why they brought the section telephone with them. During the fire fighting the second phone is needed because the phone on the portal bus, while useful, is too far away from the fire site. Immediately contacting the dispatcher to report their arrival at the fire scene, the conditions at the scene, and to make sure additional fire fighting supplies are on the way (33) should also be done immediately. The belt entry regulator should not be changed at this time (32), nor should anyone go inby the fire to curtain off the belt to keep smoke from going to the face (34). The face should continue to be ventilated, and smoke from the fire should be directed toward the face and out the return air course.

Question H - The air on the belt must be reversed slightly from a point just outby the fire so that the smoke flows toward the face and out the returns. For this reason, as close to the fire as possible, but on the outby side, one block should be knocked out of a permanent stopping between the intake air entry and the belt entry (36). Then a curtain should be hung part way across the intake air entry just inby the stopping with the block removed (37). This will direct fresh air into the belt entry and drive the smoke back toward the face, and also prevent the smoke in the belt entry outby the fire from reversing its direction. The object is to create a pocket of fresh air in the belt entry so that the fire fighters can work from this fresh air base. Another block or two can be removed from the stopping if this is necessary, and the curtain across the entry can be adjusted until just enough air from the #2 entry enters the belt entry to stop the outward flow of smoke. Knocking out an entire stopping between the intake air entry and the belt entry just outby the fire, and then curtaining off the intake air entry inby this point (35) would rapidly reverse the smoke. But it would also fan the fire and make it burn much faster and hotter. There is no need to seal the section at this time, nor to prepare to do so (38). Many other options exist including fighting the fire, or making changes to the section ventilation.

Question I - Once the belt air is reversed so the smoke moves slowly toward the face, and a pocket of fresh air is maintained in the belt entry outby the fire, it is important to select a place in the fresh air entry from which miners will enter the belt to fight the fire (42). This place needs to be under good top, outby the fire, and to be free from the heat of the fire. When this is done, two miners should be sent into the belt entry to tap the water line at the hydrant and hook up the fire hose and start fighting the fire with water (40). At the same time, two other miners should be directed to rig a second fire

hose from the water cars that have arrived on the section (41), and then to also begin fighting the fire with water.

Question J - As the fire fighting gets underway the miners should watch the mine roof near the fire, and place temporary roof supports near the fire as they advance (44). The heat from the fire will have weakened the mine roof and falls are likely. The mine foreman, or someone he designates, should stay in constant communication with the surface throughout the fire fighting activity (43) reporting what is being done and the effectiveness of the fire fighting. There is no time or easy way to bring a roof bolting machine in to support the top in the belt entry near the fire (45). This activity would waste precious time and the fire would get much larger and perhaps out of control. Throughout this problem time is very important. When mine fires become large they often generate strong convection currents and drafts that can overcome the mine ventilation. It is important to control and limit the fire so the mine ventilation system continues to operate as it is designed to. Major changes to the ventilation caused by a fire can compromise escape for other miners elsewhere in the mine, and the changes can make fire fighting difficult or impossible. For fires this large and hot, rock dust is ineffective (46). As the fire fighters advance, the area behind them should be thoroughly saturated with water. Spreading rock dust would be unnecessary and waste time that should be spent on other activities such as carrying timbers, supporting the mine roof, or handling fire hose.

Question K - The correct answers are 49 and 50. Moving conveyor belts do not catch fire from small fires in spilled coal around hot rollers (49). The rapid movement of the belt distributes the heat so that no one point on the belt gets hot enough to ignite. However, as soon as the belt stops, even a small fire in a few pounds of coal produces enough heat that the belt material above it can begin to melt and ignite within a period of about 15 to 30 minutes. Once the belt has ignited it generates its own heat. At this point the belt fire often will spread. The rate of fire growth varies depending upon the belt material. Some belt materials will not spread the fire, but most (even those approved by MSHA as fire resistant) will. MSHA approved fire resistant belting is not necessarily fire proof (48). Rather, the material resists ignition. The best belting will not continue to burn without a continued source of external heat. Experimental studies reveal that most conveyor belts used in U. S. coal mines will ignite from small coal fires, and that once ignited the belt material will continue to burn and produce large amounts of dense, black, toxic smoke with CO concentrations up to 7 or 8 percent (70,000 to 80,000 ppm.) One breath of such an atmosphere will render a person unconscious. Death follows within a few minutes. Visibility in such smoke is a few inches at most. The heat generated is sufficient to damage the mine roof and cause roof falls, and more than enough to ignite the coal ribs. For more information about belt materials, belt fires, fire resistance standards and tests, refer to the experimental studies by Lazzara and Perzak (1987) listed in the references for these notes. Moving belts also catch fire from friction as they rub against accumulated debris at a belt roller or its support structure (50). Worn belts begin to disintegrate. Deposits of the belt fabric and rubber material can accumulate at rollers or other tight clearance points. The friction between the moving belt and this material can rapidly generate a great deal of heat. The heat ignites the debris. The hot fire that results can ignite spilled coal, oil,

and grease, and the coal in the ribs near the belt, or the belt itself if the belt is stopped. A frozen roller can also rapidly be heated red hot by a moving belt. The hot roller tends to decompose the moving belt. The debris that accumulates around the roller then ignites. For a review of research about these and other types of belt fires, refer to the Anderson (1984) article and the Lazzara and Perzak (1987) article listed in the references for these notes.

References

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Scoring Key for the Belt Fire Exercise

The correct answers are marked with an asterisk⁴.

Question	Answer Number						
A	1	2	3	4*			
B	5	6*	7	8*	9*	10*	
C	11	12*	13	14			
D	15*	16*	17*	18*	19	20	21*
E	22*	23	24*	25			
F	26	27	28	29*	30		
G	31*	32	33*	34			
H	35	36*	37*	38			
I	39	40*	41*	42*			
J	43*	44*	45	46			
K	47	48	49*	50*	51		

⁴ This page may be duplicated and used as an overhead transparency.

Appendix A: Problem Booklet

Duplicate this copy of the problem booklet for use in your classes. **Booklets should be printed on only one side of the paper.** Each person in your class should have a problem booklet while they are working the exercise. The problem booklets are reusable.

You may obtain a copy of the problem booklet from MSHA, National Mine Health & Safety Academy, Dept. of Instructional Materials, 1301 Airport Road, Beaver, WV 25813-9426 phone 304-256-3257, fax 304-256-3368 or email to lord-mary@msha.gov.

Belt Fire Exercise

Problem Booklet

Instructions

Read the problem situation described on the next page. Next, answer each of the 11 questions. Do them one at a time. Don't jump ahead, but you may look back to earlier questions and answers. Some questions ask you to select all of the answers that you think are correct. Other questions ask you to select only one answer unless you are told to "Try again!" Follow the directions for each question.

After you have selected a choice to a question, look up its number on the answer sheet. Select your answer(s) to each question by rubbing the developing pen between the brackets on the answer sheet. A hidden message will appear and tell you if you are right. When you have finished, you will learn how to score your performance.

Background

You are the section foreman in 2-B section.

There are 8 miners on your section and there are 7 more sections deeper in the mine inby the neck of your section. Eighty miners are at work on these sections.

Seam height is 60 inches.

2-B section is a 4 entry development section for a longwall panel. The face has advanced 5,000 feet from the neck of the section.

The belt is in #1 entry. The #2 entry is the fresh air entry, #3 entry is the track entry with neutral air moving inby toward the face, and #4 is the return air entry. (See Figure 1.)

The neutral belt air is regulated at the neck of the section and travels out the belt away from the face.

The power center is located in the fresh air entry two pillars outby the face.

Twelve SCSRs are located at the power center, and another 12 are located on the portal bus. (See Figure 1.)

The portal bus is parked behind the supply car at the end of the supply track, 5 blocks outby the face. It runs on track and a trolley wire and has a telephone. (See Figure 1.)

A 3 inch aluminum water line runs parallel to the belt. As required by 30 CFR 75.1100-2b, hydrants are located every 300 feet near the manddoors in the permanent stoppings.

A spanner wrench, fire nozzle, and 500 feet of fire hose are located at the belt tailpiece. The section phone is located in the track entry 2 blocks outby the face. (See Figure 1.)

Problem

The crew has just moved the continuous miner from the #3 entry to the #2 entry and is preparing to make a cut. You have just checked the roof conditions in the #3 face area and are proceeding down the track entry to check on supplies.

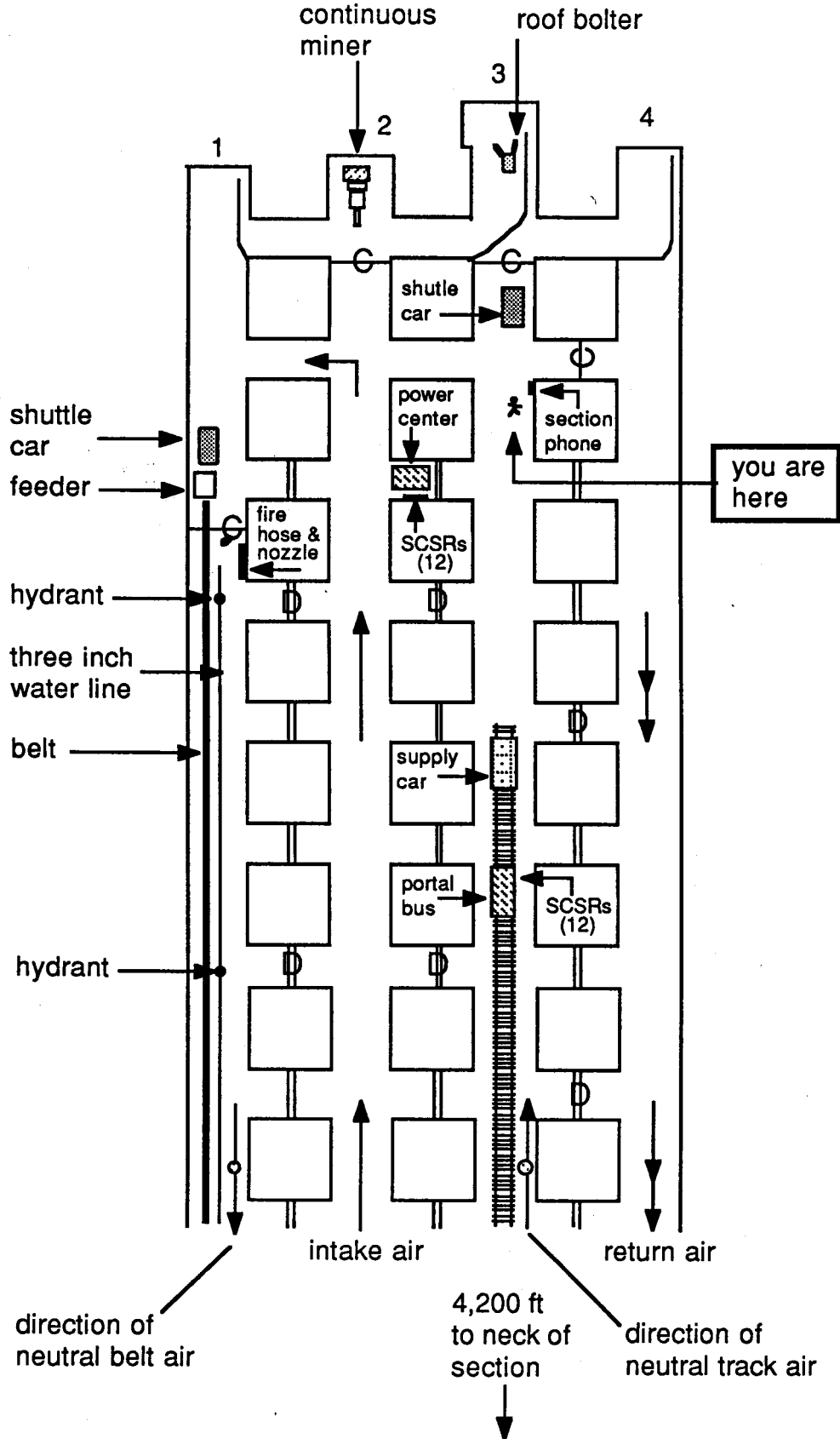


Figure 1: Details of 2-B section at the face.

Question A

As you pass the mine phone it rings. The dispatcher says he received a call from your belt attendant at the neck of the section. The beltman said there was heavy smoke in the belt entry at the neck of the section. What should you do? (Choose only ONE unless you are told to "Try Again!")

1. Don't do anything for awhile. Wait for more information. It's probably just a hot roller.
2. Walk down the belt to find the source of the smoke.
3. Tell the section mechanic to go investigate the problem and then to report back to you.
4. Immediately alert your crew members to the possibility of a fire and have them assemble at the portal bus.

Question B

While alerting your crew, the continuous miner operator tells you he just lost the water pressure on the miner. What should you do now? (Select as MANY as you think are correct.)

5. Tell the miner operator to find the section mechanic and have him check out the problem with the miner's water.
6. Tell the miner operator about the smoke in the belt entry and have him help you alert the other miners and tell them to gather at the portal bus.
7. Tell the miner operator and his helper to hang a line curtain in the #2 entry face to maintain ventilation.
8. After you have warned the crew, have some of the miners help you pick up the wrench, fire nozzle, fire hose, extra SCSRs from the power center, the section telephone, and take these materials to the portal bus.
9. Have someone go to the power center and cut the power to the section.
10. When you get to the assembly point at the portal bus, make a head count.

When you have made your selection(s), do the next question.

Question C

You have everyone assembled at the portal bus with the fire fighting equipment. Twelve additional SCSRs are stored on the portal bus. There is no sign of smoke anywhere on the section. What should you do now? (Choose only ONE unless you are told to "Try Again!")

11. Immediately load the miners and supplies on the portal bus and go out of the mine all the way to the surface if possible.
12. Call the dispatcher and tell him you and the crew are starting to leave.
13. Wait until you get more information from the surface before you leave.
14. Send two miners to walk the belt entry to locate the source of the smoke while you and the other miners wait at the portal bus.

Question D

When you call outside to the dispatcher, what should you say? (Select as MANY as you think are correct.)

15. Tell him you and the entire crew are starting out in the portal bus.
16. Ask for more information about the location and source of the smoke.
17. Tell him that you have fire fighting equipment with you and that you intend to look for the cause of the smoke. If you find a fire, you intend to fight it, if possible.
18. Tell him that the water pressure to the miner on the section failed just before you left the face area.
19. Tell him to be sure to report any fire to the local MSHA authorities.
20. Tell him to have extra miners sent into the 2-B section in the clean air of the track entry to help find the source of the smoke and fight the fire, if one is found.
21. Tell him that the air on the section is clear and there is no sign of smoke.

When you have made your selection(s), do the next question.

Question E

You have reported to the dispatcher and left the section in the portal bus. As you travel outby what things should you do? (Select as MANY as you think are correct.)

- 22. Keep in contact with the surface using the telephone on the portal bus.
- 23. Stop the portal bus at every mandoor (300 feet) and check the #1 and #2 entries for smoke.
- 24. Stop the portal bus at every second mandoor (600 feet) and check the #1 and #2 entries for smoke.
- 25. Walk ahead of the portal bus to check for smoke and fire and to make methane checks as you leave the section.

When you have made your selection(s), do the next question.

Question F

You have traveled about 2,000 feet outby the face. You have stopped at a mandoor. There is still no sign of smoke in the track entry or in the #1 and #2 entries. Just as you and your crew get ready to board the portal bus and continue outby you see the belt attendant walking inby in the track entry. He tells you there is a large fire in the belt entry about 500 feet outby your position. He says the fire appears to be confined to the belt entry. He also tells you that near the fire the water line is broken and the water is running. What should you do now? (Choose only ONE unless you are told to "Try Again!")

26. Travel to the neck of the section. Cut the power to the section and then take your entire crew out of the mine on the portal bus.
27. Travel to the neck of the section. Report the conditions to the dispatcher, and wait for further instructions.
28. Proceed to the location of the fire and immediately begin fighting the fire.
29. Call the dispatcher and report the location of the fire. Than travel just outby the source of the fire and inspect the situation.
30. Travel out of the section and continue on until you and your crew are completely out of the mine.

Question G

After reporting the beltman's information to the dispatcher, you continue outby toward the fire. Your inspection at the next two mandoor reveals the information shown in Figure 2 on the next page. You decide to fight the fire. You are in the #2 entry at the mandoor just outby the fire. The smoke is moving slowly outby on the belt. Now what should you do? (Select as MANY as you think are correct.)

31. Establish communications to the outside as close as possible to the fire site.
32. Send someone to close the regulator in the belt entry at the neck of the section to reverse the air flow on the belt.
33. Contact the dispatcher to make sure that water cars and fire fighting materials are on the way to the fire site.
34. Send someone inby on the track entry to the next mandoor to hang a curtain across the belt heading to keep smoke from traveling to the face.

When you have made your selection(s), do the next question.

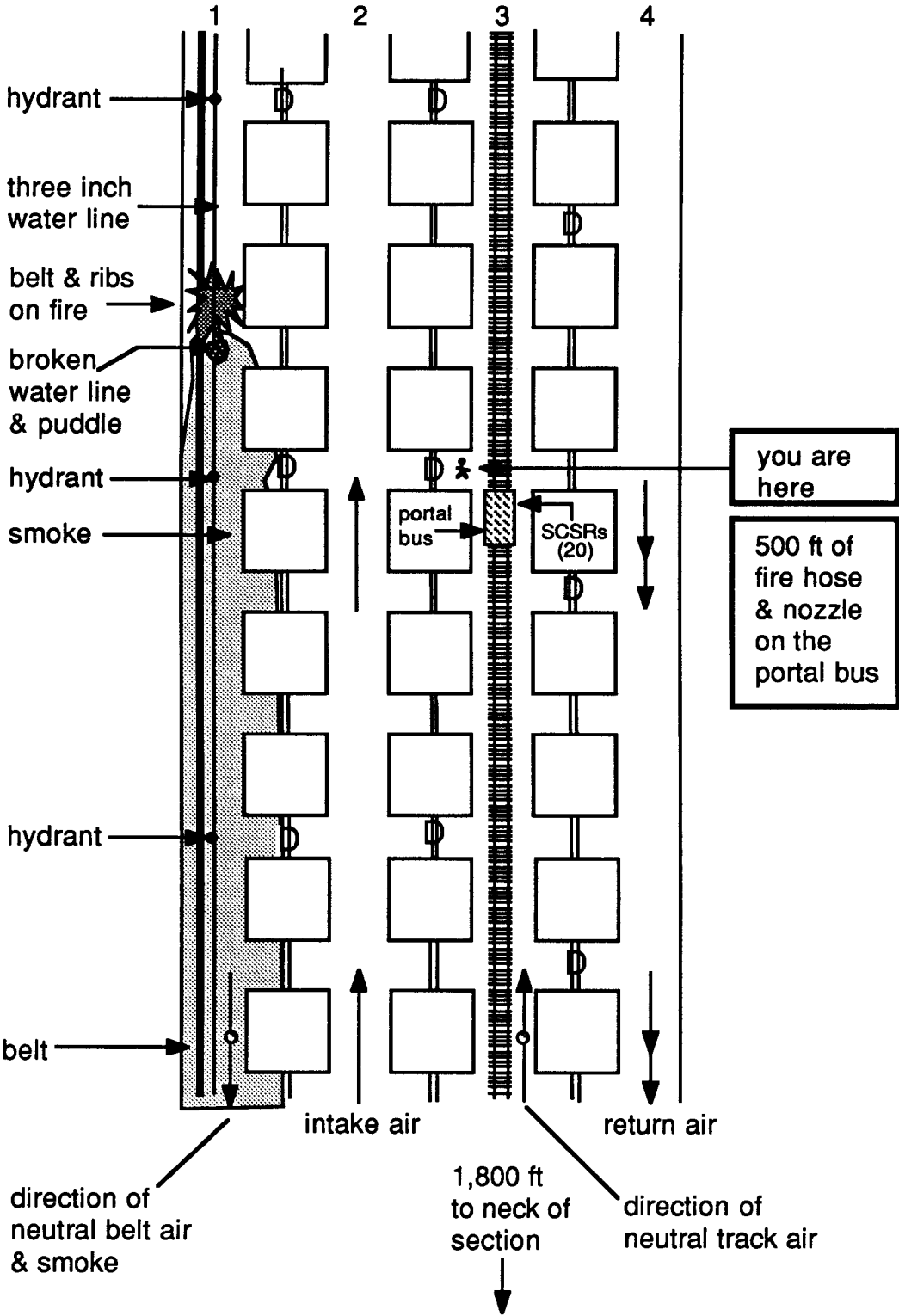


Figure 2: Details on 2-B section 2,500 feet outby the face

Question H

You are now ready to begin fighting the fire. The dispatcher calls and reports that water cars and fire fighting material cars are on the way to the fire site. What should you do next? (Select as MANY as you think are correct.)

35. Just outby the fire, knock a stopping out between the #2 and #3 entries. Then curtain off the #2 entry just inby the open stopping to divert all the air inby and carry the smoke away from the fire, up to the face and into the return air.
36. As close to the fire as possible, but on the outby side, remove one block from the stopping between the belt entry and the intake air entry.
37. After removing one block from the stopping between the belt entry and the intake air entry just outby the fire, hang a partial curtain across the fresh air entry to divert enough fresh air into the belt entry to carry the smoke from the fire toward the face.
38. Call the command center on the surface and have them prepare to seal the section.

When you have made your selection(s), do the next question.

Question I

Only enough air has been reversed in the belt entry to carry the smoke from the fire towards the face, and to also slowly clear the air of smoke outby the fire. Soon a pocket of fresh air extends from the fire to the first hydrant outby the fire. Two water cars and a materials car with fire fighting equipment have arrived on the section. What should you do now? (Select as MANY as you think are correct.)

- 39. Wait for the mine rescue team and mine foreman to arrive to direct the fire fighting activities.
- 40. Send two miners to separate the water line at the hydrant one block outby the fire, and to hook up a fire hose in order to fight the fire.
- 41. Send two miners to hook up a fire hose to the water car in order to direct water onto the fire.
- 42. As close as possible but outby the fire, establish a point in the fresh air entry from which to enter the belt entry and fight the fire.

When you have made your selection(s), do the next question.

Question J

You are now prepared to fight the fire. As you and your crew advance toward the fire, what should you do? (Select as MANY as you think are correct.)

- 43. Keep the command center on the surface informed about your activities and your success in controlling the fire.
- 44. Have miners support the roof in the belt entry as you advance on the fire.
- 45. If necessary, withdraw the fire fighters from the area and bring in a roof bolting machine to bolt the top.
- 46. To prevent the fire from re-kindling, direct two miners to apply a thick coat of rock dust to the mine ribs, top and bottom just behind the fire fighters as they advance up the entry.

When you have made your selection(s), do the next question.

Question K

The quick reaction and effective fire fighting strategies of the foreman (you) and the crew prevented serious damage to the mine, and may have saved many lives. All other miners present in the mine were promptly and safely evacuated. The fire was rapidly controlled and extinguished. The damaged section was soon recovered. In any fire emergency, it is important to provide for the safety of miners involved in fighting the fire, and for the evacuation of all other miners who are or who could become affected by the fire.

Now think about the fire described in this exercise. Then read each of the following statements. Select the statements that you think are true. (Select as MANY as you think are correct.)

47. A hot belt roller won't start a serious fire unless there are a few hundred pounds of coal around or near the roller.
48. If a conveyor belt is MSHA approved as fire resistant, it won't ignite from a small coal fire near a belt roller.
49. A moving conveyor belt rarely catches fire from a small coal fire in spilled coal around a hot roller.
50. Worn conveyor belts are more likely to start fires than belts that are in good condition.
51. A section of burning belt that is only a few feet long in an entry with an air velocity of 200 to 400 linear feet per minute will not generate enough smoke to prevent miners from safely traveling in the entry down wind from the smoke.

End of Problem

Scoring your performance

1. Count the total number of responses you colored in that were marked "correct". Write this number in the first blank on the answer sheet.
2. Count the total number of "incorrect" responses you colored in. Subtract this number from 26. Write the difference in the second blank on the answer sheet.
3. Add the numbers in the first and second blanks on the answer sheet. This is your score.

The best score is 51. The worst score is 0.

Appendix B: Answer Sheet Blanks

These are the answer sheet blanks. Copies of these blank answer sheets may be duplicated in the normal fashion. However, the answers that are found within the brackets must be printed on these blank answer sheets in invisible ink. These answers are found in Appendix C. If you have the capability to print invisible ink, make copies of the blank answer sheets. Make a master of the answers that appear in Appendix C. Then print the invisible ink on the blank answer sheets, being careful to make sure all pages print and that the appropriate answers line up with the appropriate blanks. The Master Answer Sheet shows all the answers in their proper places.

Most companies and trainers prefer to obtain copies of the preprinted answer sheets from MSHA, National Mine Health & Safety Academy, Dept. of Instructional Materials, 1301 Airport Road, Beaver, WV 25813-9426 phone 304-256-3257, fax 304-256-3368 or email to lord-mary@msha.gov.

The exercise is designed to be used in small groups. You will need one answer sheet for each group of 3 to 5 persons in your class. The answer sheets are consumable. You will need a new set for each class.

A developing pen is also needed by each person who marks an answer sheet.

Answer Sheet for Belt Fire Exercise

Use this answer sheet to mark your selections. Rub the developing pen gently and smoothly between the brackets. Don't scrub the pen or the message may blur. Be sure to color in the entire message once you have made a selection. Otherwise you may not get the information you need.

Question A (Choose only ONE unless you are told to "Try Again!")

- 1. []
- 2. []
[]
- 3. []
- 4. []

Question B (Select as MANY as you think are correct.)

- 5. []
- 6. []
[]
- 7. []
- 8. []
[]
- 9. []
[]
- 10. []

Question C (Choose only ONE unless you are told to "Try Again!")

- 11. []
- 12. []
- 13. []
- 14. []

Question D (Select as MANY as you think are correct.)

- 15. []
[]
- 16. []
[]
[]
- 17. []
- 18. []
[]
[]
- 19. []
[]
- 20. []
[]
- 21. []
[]

Question E (Select as MANY as you think are correct.)

- 22. []
[]
- 23. []
[]
- 24. []
[]
- 25. []

Question F (Choose only ONE unless you are told to "Try Again!")

- 26. []
- 27. []
- 28. []
- 29. []
[]
- 30. []

Question G (Select as MANY as you think are correct.)

- 31. []
[]
- 32. []
[]
- 33. []
[]
- 34. []

Question H (Select as MANY as you think are correct.)

- 35. []
- 36. []
[]
- 37. []
[]
- 38. []
[]

Question I (Select as MANY as you think are correct.)

- 39. []
[]
- 40. []
- 41. []
[]
- 42. []
[]

Question J (Select as MANY as you think are correct.)

43. []
[]
[]
[]

44. []
[]

45. []

46. []
[]

Question K (Select as MANY as you think are correct.)

47. []
[]

48. []
[]

49. []
[]

50. []
[]
[]

51. []
[]
[]
[]

Finding your score

Number of "correct" answers you colored in = (1)_____

26 minus number of incorrect answers you colored in = (2)_____

Add blanks one and two to get your total score = (3)_____

Highest possible score = 51

Lowest possible score = 0

Appendix C: Invisible ink Answers

These pages contain the answers that must be printed in the blanks of the answer sheet in Appendix B. These answers are spaced and sequenced correctly so that they exactly match up with the appropriate blanks on the answer sheet blank.

Once the answers have been printed in the answer sheet blanks, the developing pen reveals the formerly invisible printed message.

You may obtain preprinted answer sheets or you may prepare your own copies. To learn more about these options, and to determine how many answer sheets and developing pens you will need, see the introductory section of the Instructor's Copy.

Dangerous! A hot roller can cause a major mine fire. Try again!

You should not leave your crew at the face. You may be endangering their lives. Try again!

If there is a fire, you are placing your crew in danger. Try again!

Correct. You need to make sure each miner is notified. Do the next question.

This wastes valuable time. There are more important things to do.

Correct. At this time the most important thing is to warn the other miners and have them go to the designated assembly point.

This wastes time. There are more important things to do.

Correct. You may need these items to fight the fire and you may have to fight the fire to get out of the mine.

Correct. This is proper procedure and it will also help alert any miners on the section not already warned that there is a problem.

Correct. All the miners are present.

You need to do something else first! Try again!

Correct. Do the next question.

You need to act now, not wait. Try again!

This is dangerous. Your time may be limited. Try again!

Correct. You should report that all miners are accounted for and you should also report your route and means of travel out of the section.

Correct. This information can be lifesaving. The dispatcher says that heavy smoke is coming from the belt entry from 2-B section at the neck. But he doesn't know the source of the smoke.

Correct. The surface personnel need to know your intentions and activities.

Correct. There could be a problem with the water supply to the whole section or the whole mine. The dispatcher can check on this. This information is important if you should need to fight a fire.

If a fire burns for over 30 minutes it should be reported, but others at the surface should do this. You have other things to attend to now.

The location and severity of a fire is not yet known. Other miners should not travel in by the possible location of a fire.

Correct. This information is important to surface personnel who can help find the fire and assist you in other ways.

Correct. You learn the surface personnel have no new information about the source of the smoke.

It is a good idea to check, but each stop will take a long time and delay your departure from the section.

Correct. This will help you locate the source of the smoke but will also prevent unnecessarily delaying your departure from the section.

This is unnecessary and it wastes valuable time.

This may endanger the lives of other miners. Try again!

You need to act, not wait for instructions. Try again!

You need to do something else first. Try again!

Correct. You need to inspect the situation and develop a plan before attempting to fight the fire. Do the next question.

This may endanger the lives of other miners. Try again!

Correct. It is critical to maintain communications with the fire command center outside.

This will direct gases produced by the fire back over the fire site and could cause an explosion.

Correct. It is critical to get water on the fire as quickly as possible. You may need more water and materials to fight this fire.

Never send anyone in by a fire.

This would reverse the air on the belt but would also fan the fire.

Correct. The air movement on the belt needs to be reversed to attack the fire from the outby side.

Correct. It is necessary to divert only enough air to reverse the flow on the belt. To divert more air than necessary would fan the fire.

This is unnecessary at this time. There are more important things to accomplish.

This wastes valuable time and any chance of bringing the fire under control will probably be lost.

Correct. A continuous stream of water is required to fight the fire.

Correct. To bring the fire under control quickly, you will need as much water as possible on the fire as quickly as possible.

Correct. The site should be selected to eliminate exposure of the fire fighters to bad roof conditions and excessive heat.

Correct. The surface command center should be continually informed about the status of the fire and fire fighting efforts. This and additional information received from others in and around the mine allows the surface personnel to provide valuable information and assistance to the fire fighting effort.

Correct. This is absolutely necessary to protect the fire fighters from the bad roof conditions that usually result from mine fires.

This would be nearly impossible and very time consuming.

These areas will be thoroughly soaked with water. Applying rock dust is not nearly as effective as water and is not necessary in this case.

False! As little as 15 to 20 pounds of coal around a red hot roller can ignite a hot fire in as little as 15 to 20 minutes.

False! Most fire resistant belt will ignite from even a small fire in spilled coal round a hot roller.

Correct. The rapid movement of the belt dissipates the heat. But the coal fire itself can be very dangerous unless it is promptly located and extinguished.

Correct. Worn belts can accumulate fabric and debris at rollers and their supports. Friction between this accumulated material and the moving belt can ignite this debris within a few minutes.

False! Studies show that a few feet of burning belt will fill the entry with heavy black smoke and produce CO levels up to 7 percent or 70,000 ppm. One breath of this smoke can be fatal. Burning a piece of belt is like burning a tire. A little material produces a lot of CO rich smoke.