

Vulcan Mine Ignition Exercise

Instructor's Copy

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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 answers that appear in Appendix C printed on them². Answer sheets are consumable. One is needed for each person or each small group of 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.

Type: Invisible ink

Length: Eleven questions (25 minutes for administration plus 35 for discussion)

Skills:

- Rescuing injured miners from the face of an entry following a methane ignition
- Being careful not to endanger yourself or other miners while doing so
- Rapidly moving the injured miners to a safer place
- Providing and placing in order of priority first aid treatment for injured miners with obstructed airways, burns, and shock
- Reporting the ignition and the injuries to the surface
- Transporting the injured to the surface

Location: Underground

Problem: You are the on-side shuttle car driver. Just after lunch you pull across the last open crosscut getting ready to go into #4 entry to load coal from the continuous miner. Just as you notice the line curtain is down, an orange fireball covers up the whole continuous miner in the entry, the miner operator, his helper, and the foreman who was also in the entry. After the fireball dies down, through the white smoke in the entry, you can see one miner down and two others walking around by the miner. You must decide what to do.

² You can do this yourself if you have the proper equipment, or you may obtain copies of preprinted answer sheets from NIOSH, Pittsburgh Research Laboratory, Pittsburgh, PA phone 412-386-5901, fax 412-386-5902 or email to minetraining@cdc.gov.

How to Use This Exercise

1. Look at the performance objectives. Decide if the exercise is relevant for your annual refresher class.
2. Work through the exercise with the special 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 maps or illustrations on an overhead projector so you can use these to help explain the problem.
6. When you present the exercise to the class:
 - Explain that the answers from class members will be used to improve the exercise in the future.
 - Give each person an exercise booklet, an answer sheet and a pen.
 - Demonstrate how to select and mark answers using the special pen.
 - Go over the instructions for doing 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, discuss the exercise. Let class members discuss the merits of each answer. Add your own ideas.

Performance Objectives for Vulcan Mine Ignition

Objective number	Capability verb(s)	Description of desired performance and conditions under which it is to occur
1. FA ³	Observe Assess Judge	The accident scene and needs/risks for first aiders and victims
2. MG	Recall Recognize	Origins, probable concentrations and physiological effects of toxic gases resulting from a methane ignition
3. FA/EE	Choose Order	A sequence of first aid and rescue actions that minimize risk of further injury to victim and helpers
4. EE	Identify Discriminate Plan Execute	An escape route to a safer area with less risk to self and others
5. FA	Gather Interpret	Information about injury signs and symptoms through the primary survey to determine extent and nature of injury
6. FA	Choose Judge	First aid treatment procedures from most to least critical
7. FA	Select Recognize	Appropriate first aid procedures for restoring breathing, treating burns, and treating traumatic shock
8. FA	Recall Discriminate Select	Triage procedures for ordering treatment of multiple victim accidents given limited resources and capabilities
9. FA/EE	Recall Recognize Discriminate	The importance of communicating with surface personnel during an emergency to seek information and to report local conditions
10. EE/MG	Recall Identify	Hazardous conditions that can lead to a methane ignition and procedures for preventing or limiting these conditions

³ Skill and knowledge domain abbreviations:
 FA = first aid
 MG = mine gases
 EE = emergency evacuation and escape

Master Answer Sheet for Vulcan Mine Ignition

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 information you need.

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

1. [Dangerous! There are better options.]
2. [Dangerous! There are better options.]
3. [This would be dangerous! There are better options.]
4. [Correct! This will help prevent a second explosion and provide equipment
[that you may need.]
5. [Dangerous! There are better options.]
6. [Correct! If they come out, you have only one person to rescue.]
7. [Risky. Your air will be good, but it could also cause a second explosion.]
[The first ignition set clothes on fire. There may be other burning materials]
[in the entry. These might ignite if fresh air is mixed with more methane.]
8. [Dangerous! There are safer options.]
9. [Correct only as a last resort. You could be overcome by oxygen deficient air,]
[but Skeeter could die if he is not pulled out fast. If you are overcome, your]
[buddies may be able to rescue you with the SCSRs when the units arrive]
[However, SCSRs are not approved for that purpose.]

Remove miners from the entry first! Air is oxygen deficient, even though Bull Dog and the face boss are moving around and carbon monoxide may be present. As methane accumulates the air will get worse. If all miners go in they may be overcome and no one could help. Do the next question.

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

- 10. [Correct! Intake air will protect you and you can examine the three miners for injuries. Develop the box at the bottom of this question.]
- 11. [Methane and smoke from #4 entry might be sucked down on you. Try again!]
- 12. [Too far. Try again!]
- 13. [No need to barricade and a poor place to do so. Try again!]
- 14. [Too far. Try again!]

Answers 12, 13, and 14 all involve unnecessary movement that could cause further harm to the injured miners. They need to be examined and given first aid right away. Do the next question.

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

- 15. [Correct! He doesn't respond. Do the next question.]
- 16. [Pulse is fast and strong. But you should do something else first. Try again!]
- 17. [Pupils normal, both the same size, and they contract in your light. But you should do something else first. Try again!]
- 18. [His hand is warm. But you should do something else first. Try again!]
- 19. [Never! This may cause further injury, pain, and bleeding. Also would waste valuable time. Skeeter might die. Try again!]

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

- 20. [Something else needs attention first. Try again!]
- 21. [Something else should be done first. Try again!]
- 22. [A critical problem needs attention first. Try again!]
- 23. [There is something else you should do first. Try again!]
- 24. [Correct! You have opened Skeeter's airway. He now breathes regularly and easily. Do the next question.]
- 25. [This would further restrict his airway. Try again!]
- 26. [You cannot get any air into him. Try again!]

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

- 27. [Correct! Eyes are lackluster, unfocused, both pupils dilated.]
- 28. [He moves them at your request, but this is a poor choice unless other signs
[make you suspect a spinal injury.]
- 29. [Correct! Red, moist, and blistered areas cover the right side of the face, neck,
[and right forearm and hand. There are no other visible injuries.]
- 30. [Correct! Pulse is fast (about 130) and weak.]
- 31. [Correct! His hand is cold and damp.]
- 32. [Correct! His breathing is rapid and shallow.]

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

- 33. [This is the correct treatment for minor thermal burns but is not the first thing to
[do for this man. He has a more immediate problem. Try again!]
- 34. [Correct! The face boss is showing signs of shock. Develop the box at the
[bottom of this question.]
- 35. [This may cause vomiting and further fluid loss. Try again!]
- 36. [This will make his problem worse by decreasing the flow of blood to the
[brain. It may kill him. Try again!]
- 37. [This would further wet his clothing and lower his body temperature. It may
[kill him. Try again!]

According to the MSHA First Aid Book, 1980, page ,115, dressings should be moistened only for minor thermal burns. Here the face boss has moderate to critical burns. Dry sterile dressings should be used. Moist dressings add to chilling and deepen shock. Do next question.

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

- 38. [This will make it more difficult for the doctor to clean the burn later on.]
 [Don't do this! Try again!]
- 39. [Correct! This is the proper treatment. Develop the box at the bottom of]
 [this question.]
- 40. [Correct! This prevents the fingers from sticking together and makes later]
 [treatment easier.]
- 41. [This will cause pain, further injury, and bleeding. Try again!]
- 42. [Correct! This will reduce pain and swelling.]

It is O. K. to use moist dressings for Bull Dog's burns because they are less extensive and because he is not in shock. The moist dressing will prevent sticking and reduce pain but not lower his temperature. See MSHA First Aid Book, page 115. If in doubt, use dry sterile dressing. Do next question.

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

- 43. [Correct! The surface people need the details so they can prepare to treat]
 [and transport the injured. They may have information that can help you too.]
- 44. [Correct! He is in shock and needs advanced life support treatment within]
 [one hour or less or he may die.]
- 45. [Air is still bad. Men could be overcome. Might cause a second ignition.]

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

- 46. [Correct! It is important to inform the surface to alert others who can help.]
 [They also need to know that all seven of you are coming out. You also]
 [need to report conditions on the section. Do the next question.]
- 47. [Would waste time. First priority is to get the injured out fast. You need help]
 [to transport the injured. There is no immediate threat from the gases and]
 [methane in #4 entry. The section ventilation is O.K. except in the #4 entry.]
 [Gas in the entry will be sucked out and diluted by the intake air moving]
 [across the face area from #5 to #1 entries. It is also illegal to change the]
 [curtains now. Try again!]
- 48. [Risky! Methane may have accumulated. You could set off a second]
 [explosion. Try again!]
- 49. [Unnecessary and would waste time. Try again!]

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

50. [True! If it were O.K., the machine would have shut down before an explosive level was reached. Try again!]
51. [True! Calculations show that only 1.5 cubic yards of methane is needed for an ignition of this size. This much methane can be released in three minutes in an entry of this size in a moderately gassy mine. Try again!]
52. [Correct! This is false! The mine was wet. Dust explosions are usually more destructive and extensive. Do the next question.]
53. [True! Rarely do investigation reports show that the flame extends further back than the cutter head and its boom. Try again!]
54. [True! This is the most common source of methane face ignitions. Keeping the cutter bits sharp, keeping adequate volume and pressure on the water sprays on the cutter head, not scrubbing the top, and keeping good ventilation all help to prevent face ignitions. Try again!]

Question K

End Of Problem

Finding your score

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

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

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

Highest possible score = 54

Lowest possible score = 0

Instructor's Discussion Notes for Vulcan Mine Ignition

Use the information presented here and on the master answer sheet, your own ideas and experience, and that of the miners in your class to discuss the exercise after it is completed. Group discussion can strengthen knowledge and skills, correct errors, and relate the exercise content to the experiences of the miners. After they have worked the exercise, miners 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 miners think about and remember basic knowledge and skills they may someday need to deal with a mine 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 miners 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. Read through and think about the notes before the class. Don't read the notes to the class members. This would be boring and ineffective. Rather, incorporate the ideas you find here with your own ideas and make these points at the appropriate place in the discussion of the exercise.

Question A - The correct answers are 4, 6, and 9. All these actions help prevent further injury and problems. However, answer 9 is debatable. It places the rescuer at risk, but it may also save Skeeter's life. What is best in this situation has to be determined by factors like how long Skeeter has been in the entry, how long it will take to get the SCSRs, how much or how little difficulty the faceboss and Bull Dog have breathing and getting themselves out of the entry, etc. Answers 1, 2, 5, and 8 all have a number of people going into the entry to bring out the injured. All are dangerous! A leading cause of deaths in situations like this is when would-be rescuers are overcome by a bad atmosphere and become victims. Think of all the deaths that you know about where persons went into silos, sewers, or storage tanks to rescue someone and were themselves overcome. Some experts also say answer 7 is correct because hanging the curtain along the right rib would allow rescuers to advance with good air. But most experts think this action is too risky because it might cause a second ignition injuring two or three more miners. It is likely that the methane will continue to accumulate while the rescuers are hanging the curtain. The pair of gloves or shirt that the operator has on the front of the continuous miner may also be burning or smoldering as could other materials on the machine. Restoring ventilation in this situation might create a second explosive mixture of air and methane. There is likely to be disagreement about the best answers to this question, just as there is in real emergencies. It is good to talk about these and think through such situations in the classroom.

Question B - The correct answer is 10. The goal is to get to fresh air but also to move the injured as little as possible until they can be examined and stabilized. The ventilation

on the section is O. K. except for the #4 entry. Coming out the #4 entry and turning left is the quickest way to get to a position of relative safety. You may wish to point out that accident investigations suggest that most situations from which miners must escape are caused by local emergencies on a section. Large disasters that involve the whole mine are less frequent. But a local small cable fire or ignition can also kill and injure miners.

Question C - Only answer 15 is correct, because it is included in the primary survey. It takes little time to do, and it provides much information. All the other choices (except answer 19) are good things to do, but not until you attend to Skeeter's breathing problem.

Question D - The correct answer is 24. Skeeter's blocked airway is the primary concern. His head should be positioned to open his airway. You should suspect a blocked airway because you know his belly and chest are moving but no air is coming out his mouth and nose. An alternative to the head tilt/neck lift technique is the head tilt/chin lift. It is true that Skeeter might have a spinal injury and that moving his head could make it worse. But he will die in a few minutes anyway if his breathing is not restored. His airway was probably blocked by the position of his head and tongue. A finger sweep or pounding on his back should not be attempted until you are sure you have positioned his head to open his airway. The exception would be if there are positive signs of an airway obstruction. Here there are not.

Question E - All the answers except 28 are correct. These actions are part of the primary and secondary survey procedure. Because the faceboss has been up walking around, you know he can move his fingers and toes, and that he probably does not have a spinal injury.

Question F - The correct answer is 34. The faceboss is exhibiting unmistakable signs of shock. He may die within 45 minutes to one hour if his shock is not treated at once. Deep shock rapidly becomes nonreversible and even advanced life support personnel at the surface will not be able to save him if you fail to treat him for shock right now! Treating for shock takes priority over all other matters, including dressing his burns. Pouring water over his burns and using moist dressings will lower his body temperature and deepen his shock. Thirst is often a symptom of shock but drinking can cause vomiting and further fluid loss and also deepen shock.

Question G - Answers 39, 40, and 42 are all correct treatment for Bull Dog's burns. The actions in 38 and 41 would add to his injuries. The miners may want to discuss why moist dressings are used on Bull Dog's burns but not on Skeeter's and the faceboss'. There is disagreement about this matter among experts. The main concern here is not to deepen the shock of the faceboss by lowering his body temperature with moist dressings. Bull Dog is alert and his burns are less extensive and serious. He is not in shock. The procedure recommended here follows the procedures of the MSHA First Aid Book, (1980), page 115, and also is consistent with emergency medicine physicians with experience in first aid treatment of coal miners underground. If you are in doubt or don't know if you should use a moist dressing, use a dry sterile dressing.

Question H - Answers 43 and 44 are correct. You need to inform the surface of local conditions on the section, report the number and condition of the injured, and seek advice and information from the surface that may be useful. Some companies like the miners to report the names of the injured so that the medical personnel who respond at the surface can have any background medical information about the injured (heart problems, diabetes, medication allergies, etc.) available as soon as possible. Other companies prefer not to name the injured miners to avoid rumors and misinformation among other persons who overhear the calls. You may want to discuss this issue in terms of the company policy and emergency medical personnel preferences in your area.

Question I - Answer 46 is correct. It takes little time to call again. The surface personnel need to know when you are coming out. If you are in a mine with track haulage, surface personnel can help clear the track. All four healthy miners may be needed to care for and transport the three injured miners to the surface. Leaving the line curtain to the #4 entry down will produce no more gas elsewhere on the section than with the curtain up. The ventilation elsewhere on the section is intact. Intake air will continue to sweep past the mouth of #4 entry, diluting and pulling out the ignition gases and any new methane that is released from the face. Another interesting discussion topic concerns when and how to restore ventilation to the section. What does the law say should be done to restore ventilation once the miners have left the section? What would you do in this situation if you had a larger crew on the section and why? (Note: Another exercise, Vulcan Mine Recovery, deals with this problem for this mine.)

Question J - Answer 52 is false. If the mine were dry the methane ignition could have raised dust from the mine floor and ribs and propagated a major dust explosion, especially if rock dusting was inadequate. Such a dust explosion would likely have killed all the miners on the section.

References

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- Turner, H., & South, J. S. (1979). Report of investigation (underground coal mine) methane-air mixture and/or coal dust ignition. Mine ID No. 15-08413, Martin County, KY. Pikeville, KY: MSHA, District 6.

Scoring Key for Vulcan Mine Ignition

The correct answers are marked with an asterisk.⁴

Question	Answer Number						
A	1	2	3	4*	5	6*	7
	8	9*					
B	10*	11	12	13	14		
C	15*	16	17	18	19		
D	20	21	22	23	24*	25	26
E	27*	28	29*	30*	31*	32*	
F	33	34*	35	36	37		
G	38	39*	40*	41	42*		
H	43*	44*	45				
I	46*	47	48	49			
J	50	51	52*	53	54		

⁴ This page is printed in large type so that it may be copied 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. To save effort and money, ask the trainees to avoid marking in the booklets and collect all the booklets after the class.

You may obtain a copy of the problem booklet from NIOSH, Pittsburgh Research Laboratory. The telephone number for this agency is listed in the footnote on page three of this document and on the Appendix B cover sheet.

Vulcan Mine Ignition Exercise

Problem Booklet

Instructions

Read the problem situation described on the next page. Study the map until you understand the location of the miners and equipment in the problem. 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. For some of the questions, choose only one answer unless you are told to "Try again!". Other questions ask you to select as many answers as you think are correct. Follow the instructions for each question.

After you have selected a choice to a question, look up its number on the answer sheet. Select your answer 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.

Vulcan Mine Ignition Exercise

Background

The wet mine is in 52 inch coal and has a good sandstone top.

It is moderately gassy, but the ventilation is good.

The section was firebossed two hours before the shift.

The face is 4700 feet from the portal by mantrip.

You are the on-side shuttle car operator just returning from lunch.

The utility man has been operating your car while you were eating.

The section is shorthanded with only seven miners.

Problem

After lunch, you tram your car inby toward the continuous miner in the #4 entry. As you get to the last crosscut, you see the line curtain is down. You stop in the middle of the crosscut. You feel intake air moving from your right to the left. (Study Figure 1 until you know your location and the section layout.)

Just as you stop, Bull Dog, the miner operator, starts the ripper and begins a cut on the left side of the face. The miner helper, Skeeter, and the faceboss are standing just to the right of Bull Dog. (See Figure 2.)

Before you can yell to them that the curtain is down, there is a bright orange ball of fire and a "whoosh". The fireball covers all three men in the entry and all of the continuous miner except for the tail boom. You feel hot air on your face. The fireball disappears in a few seconds. The air in the entry is white and smoky but you can see the three men. Bull Dog has gotten off of the miner, grabbed the wash-down hose, and sprayed Skeeter and the faceboss putting out their clothing fires. The faceboss is staggering around near the tail boom. Skeeter is down on his back with his head against the rib. He is not responding to Bull Dog's yelling at him to get up. The line curtain is down as far as you can see into the entry. Now turn to the first question and begin.

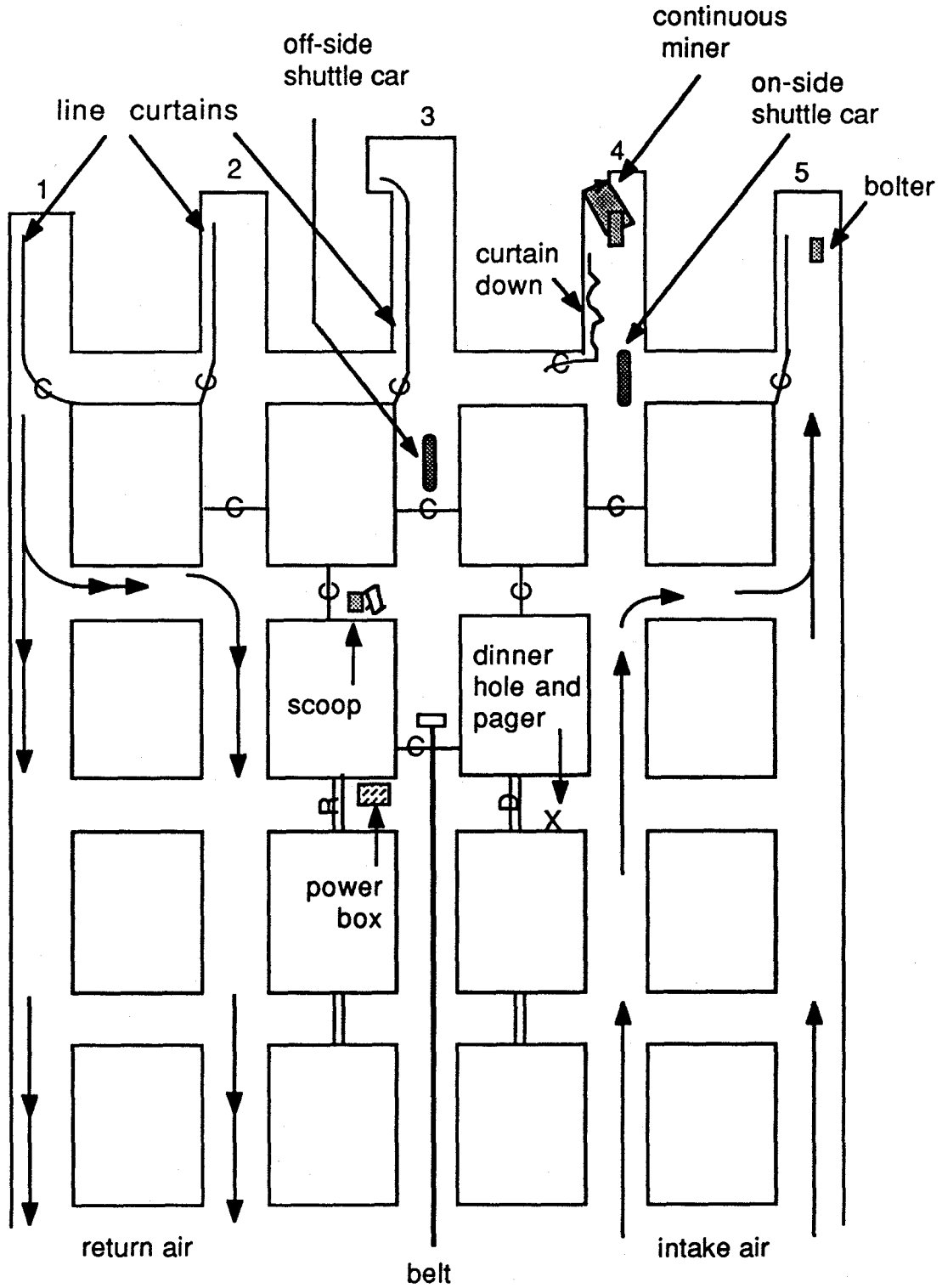


Figure 1: Map showing section ventilation and conditions

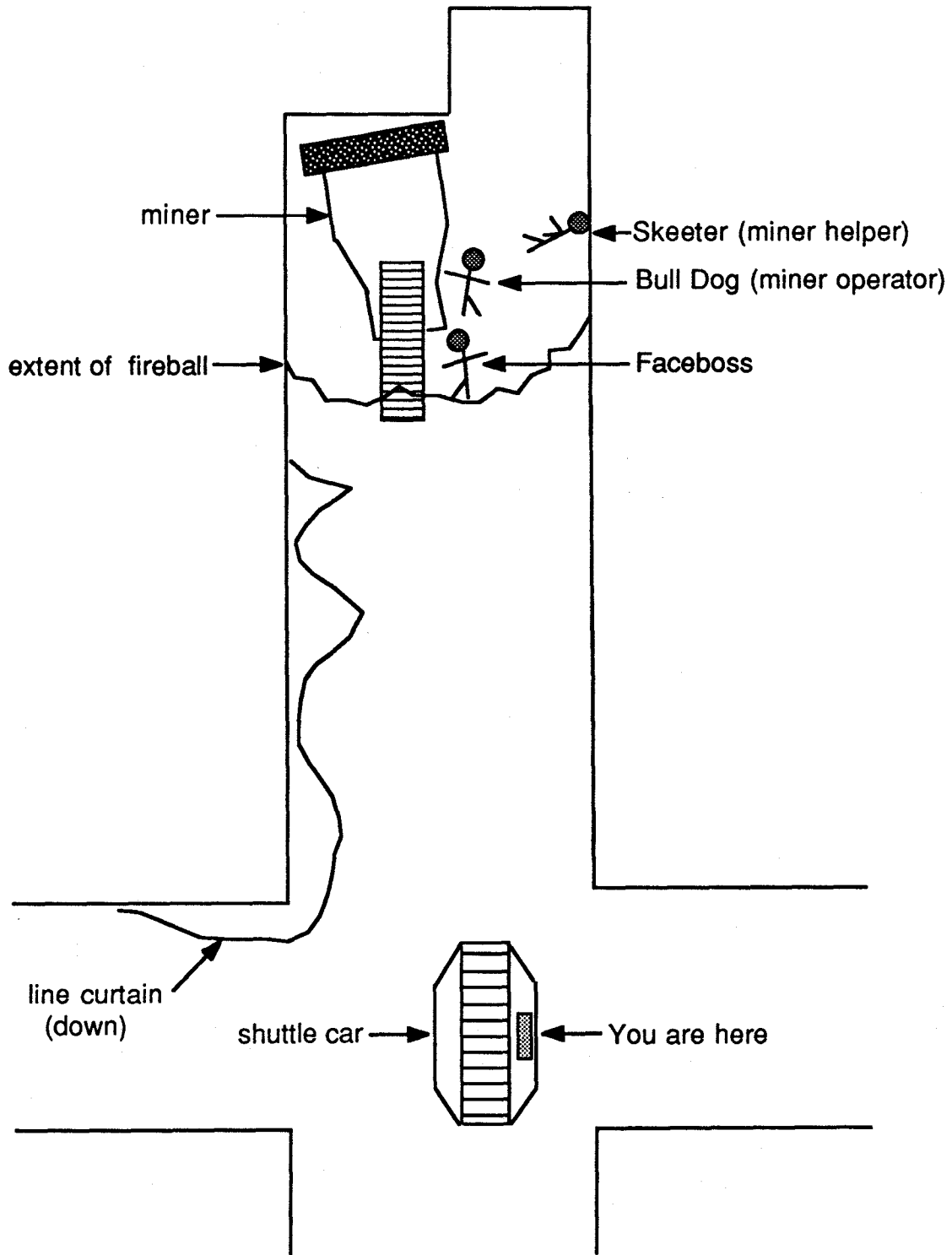


Figure 2: Details of ignition in number 4 entry

Question A

Just as you are getting off of the shuttle car, the roof bolter operator (who was in #5 entry) comes running. The other shuttle car operator and the utility man get there at about the same time. Through the white smoke in the entry you can see the faceboss leaning against the tail boom of the miner. Bull Dog is trying to get Skeeter up but Skeeter is limp and apparently unconscious. There appears to be no fire in the entry but the white smoke prevents you from seeing the front half of the miner and the face.

What things should you and your three buddies do now to help Bull Dog, Skeeter, and the faceboss? (Select as MANY as you think are correct.)

1. All four of you go in, have Bull Dog and the faceboss sit down and examine them for burns and other injuries.
2. Two of you go in and examine Skeeter for possible head and spinal injuries and immobilize him if necessary.
3. Send one miner in all the way to the face to check and make sure there is no fire.
4. Send the utility man to knock the power to the continuous miner and the shuttle car, and to bring back three SCSRs from the dinner hole.
5. Have three of your buddies dash into the entry with you. Drag Skeeter out and get Bull Dog and the faceboss out. Be quick.
6. Immediately yell to the faceboss and Bull Dog to get out of the entry.
7. Put the line curtain up across the crosscut and then extend it into the entry along the right rib, advancing with good air until you get to Skeeter.
8. You and two of your buddies put on your filter self-rescuers (FSRs) and go in and bring out Skeeter (and the others if necessary).
9. Send one of your buddies to get three SCSRs. Have two of your buddies stay outside the entry in the crosscut. Quickly put on your filter self-rescuer. Go in and drag Skeeter out fast using a clothing drag.

When you have made your selection(s), develop the box on the answer sheet under answer 9.

Question B

Bull Dog and the faceboss come out of the #4 entry when you yell to them. You drag Skeeter out without being overcome. Where should you go and why? (See Figure 1.) (Choose only ONE unless you are told to "Try Again!")

10. Turn left at the crosscut and go a few feet toward the #5 entry.
11. Turn right at the crosscut and go a few feet toward #3 entry.
12. Drag Skeeter and walk Bull Dog and the faceboss down to the dinner hole.
13. Drag Skeeter and walk Bull Dog and the faceboss into the #3 entry up near the face and barricade with line curtain.
14. Drag Skeeter and walk Bull Dog and the faceboss down to the tailpiece.

Question C

You and your two buddies have Skeeter, Bull Dog, and the faceboss in the first crosscut between the #4 and #5 entries. The intake air is moving and fresh. The utility man returns with a first aid kit and three SCSRs. He says he knocked the power to the miner, shuttle cars, and the bolter. You send him back to the dinner hole to call outside and report what has happened.

You decide to examine Skeeter first because he looks unconscious. He is lying on his back. He has blister burns on his face, neck, upper front chest, and right hand and forearm. What is the first thing you should do for Skeeter? (Choose only ONE unless you are told to "Try Again!")

15. Ask him if he can hear you.
16. Check his pulse.
17. Check his pupils.
18. Feel the temperature of his unburned hand.
19. Remove the shreds of clothing sticking to his burned skin.

Question D

You see Skeeter's chest moving, but no air is coming out of his airway. What is the first thing you should do for him now? (Choose only ONE unless you are told to "Try Again!")

20. Apply sterile dressings to his burns.
21. Roll Skeeter on his side and strike him on the back four times.
22. Do a secondary survey to check for other injuries.
23. Perform a "finger sweep" of his mouth.
24. Gently lift on the back of his neck with one hand and tilt his head backward.
25. Fold a blanket and prop his head up tilting it forward even more.
26. Give Skeeter a breath with mouth to mouth.

Question E

Skeeter is breathing normally. His unburned hand feels warm. His pulse is about 100 and strong. You tell one of your buddies to cover Skeeter's burns with sterile dressings and to tie these gently in place with triangular bandages.

Next you attend to the faceboss. He is sitting on the mine floor leaning against the rib. He is dazed and unresponsive. He repeatedly asks for water. What things would you do for the faceboss at this time? (Select as MANY as you think are correct.)

- 27. Check the appearance of his eyes.
- 28. Ask if he can move his fingers and toes.
- 29. Examine him for location and appearance of burns and other injuries.
- 30. Check pulse rate and character.
- 31. Feel his unburned hand.
- 32. Check his type of breathing.

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

Question F

You have now examined the faceboss for injuries and find only the burns. Keeping in mind the information you just gathered (see Question E), what would you do first for the faceboss at this time? (Choose only ONE unless directed to "Try again!")

33. Apply moist sterile dressings to his burns.
34. Lay him down on his back on a blanket in a dry level spot. Raise his legs about 12 inches. Cover him with another blanket.
35. Give him small sips of water as he requests.
36. Lay him down in a dry flat place, then prop up his head and shoulders with a folded blanket.
37. Lay him down on his back. Pour cold water over his burns.

Question G

After instructing one of your buddies to apply dry sterile dressings to the faceboss' burns, you attend to Bull Dog's injuries. The back of his left hand and forearm is blistered including the skin between the fingers. His hair is singed, but his face and neck are O. K. You find no other injuries. His pulse is a little fast, but strong and steady. He is alert and has been helping you and the others care for the faceboss and Skeeter. What would you do for Bull Dog at this time? (Select as MANY as you think are correct.)

- 38. Smear burn ointment over the injured area and wrap it with sterile dressings.
- 39. Gently apply sterile dressings moistened with clean water to the burned area.
- 40. Separate each burned finger with a sterile moistened gauze pad before bandaging the hand and forearm.
- 41. Pull away clothing fragments that are sticking to the burn.
- 42. Elevate the burned hand after it is bandaged.

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

Question H

The utility man comes back with another first aid kit. You now have two stretchers. Skeeter is conscious and complaining of pain. His pulse is about 80 and strong. His burns have been properly bandaged with dry sterile dressings held in place by cravats. He is lying on his side on a stretcher with the burned side up. He is covered with a blanket.

The faceboss is almost unconscious. His pulse is weak and fast. His burns have been properly dressed. He is lying on his back on the floor on a folded blanket in a dry spot. His legs are propped up about a foot. He is covered with a blanket.

Bull Dog is alert and helping you take care of the other victims. His hand is properly bandaged. At this point select the most important thing(s) to do. (Select as MANY as you think are correct.)

43. Call the surface and tell them you have burned miners, two severely, one in shock, and the other one with a burned hand.
44. Get the faceboss on a stretcher. Keep the foot end elevated about a foot. Keep him warm and get him to the surface as fast as possible.
45. Have the utility man and another person go into the #4 entry and hang the line curtain all the way to the face.

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

Question I

What should you and the other three miners on the section do before you take the mantrip to the portal to get the injured people out? (Choose only ONE unless directed to "Try again!")

46. Call outside again to report the condition on the section, and tell the surface people you are bringing out the injured on the mantrip.
47. Before you leave, send the utility man and the roof bolter back to hang line curtain and restore ventilation to the #4 entry.
48. Energize the #1 shuttle car and drive it into and across the mouth of the #4 entry to keep other persons out of the area.
49. Energize the roof bolter and send someone into the #5 entry to tram it into the first cross cut.

Question J

All of the following statements about the face ignition in the #4 entry are true except one. Find the FALSE statement. (Choose only ONE unless directed to "Try again!")

50. The methane detector on the continuous miner was not working properly.
51. The line curtain to the #4 entry was down for awhile.
52. The ignition that burned the three miners was mainly a dust explosion.
53. When proper ventilation is maintained, face ignitions of methane are usually confined to a smaller area such as only the cutter head of the miner.
54. A spark from a cutter bit on the sandstone top may have set off the ignition.

Question K

List all the violations of state and federal laws and your company rules that you can find in this problem.

Finding your score

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 35. Write the difference in the second blank on the answer sheet.
3. Add the numbers on the first and second blanks. This is your score.

The best possible score of 54 results from selecting all the correct answers and no wrong answers. The worst possible score of zero results from selecting all the wrong answers and no correct answers.

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 place.

Most companies and trainers prefer to obtain preprinted answer sheets. These are available from NIOSH, Pittsburgh Research Laboratory Pittsburgh, PA phone 412-386-5901, fax 412-386-5902 or email to minetraining@cdc.gov.

The exercise is designed to be used in small groups. You will need one answer sheet for each 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. These may be obtained from the A. B. Dick Company, P.O. Box 1970, Rochester, New York 14692, phone 1-800-225-4835.

Answer Sheet for Vulcan Mine Ignition

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 information you need.

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

- 1. []
- 2. []
- 3. []
- 4. []
[]
- 5. []
- 6. []
- 7. []
[]
[]
- 8. []
- 9. []
[]
[]
[]

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

10. []
[]

11. []

12. []

13. []

14. []

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

15. []

16. []

17. []
[]

18. []

19. []
[]

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

20. []

21. []

22. []

23. []

24. []
[]

25. []

26. []

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

27. []

28. []
[]

29. []
[]

30. []

31. []

32. []

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

33. []
[]

34. []
[]

35. []

36. []
[]

37. []
[]

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

38. []
[]

39. []
[]

40. []
[]

41. []

42. []

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

43. []
[]

44. []
[]

45. []

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

46. []
[]
[]

47. []
[]
[]
[]
[]

48. []
[]

49. []

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

- 50. []
- 51. []
- 52. []
- 53. []
- 54. []

Question K

End Of Problem

Finding your score

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

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

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

Highest possible score = 54

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 determine how many answer sheets and developing pens you will need, see the introductory section of the Instructor's Copy.

Dangerous! There are better options.

Dangerous! There are better options.

This would be dangerous! There are better options.

Correct! This will help prevent a second explosion and provide equipment that you may need.

Dangerous! There are better options.

Correct! If they come out, you have only one person to rescue.

Risky. Your air will be good, but it could also cause a second explosion. The first ignition set clothes on fire. There may be other burning materials in the entry. These might ignite if fresh air is mixed with more methane.

Dangerous! There are safer options.

Correct only as a last resort. You could be overcome by oxygen deficient air, but Skeeter could die if he is not pulled out fast. If you are overcome, your buddies may be able to rescue you with the SCSRs when the units arrive. However, SCSRs are not approved for that purpose.

Remove miners from the entry first! Air is oxygen deficient, even though Bull Dog and the face boss are moving around and carbon monoxide may be present. As methane accumulates the air will get worse. If all miners go in they may be overcome and no one could help. Do the next question.

Correct! Intake air will protect you and you can examine the three miners for injuries. Develop the box at the bottom of this question.

Methane and smoke from #4 entry might be sucked down on you. Try again!

Too far. Try again!

No need to barricade and a poor place to do so. Try again!

Too far. Try again!

Answers 12, 13, and 14 all involve unnecessary movement that could cause further harm to the injured miners. They need to be examined and given first aid right away. Do the next question.

Correct! He doesn't respond. Do the next question.

Pulse is fast and strong. But you should do something else first. Try again!

Pupils normal, both the same size, and they contract in your light. But you should do something else first. Try again!

His hand is warm. But you should do something else first. Try again!

j

Never! This may cause further injury, pain, and bleeding. Also would waste valuable time. Skeeter might die. Try again!

Something else needs attention first. Try again!

Something else should be done first. Try again!

A critical problem needs attention first. Try again!

There is something else you should do first. Try again!

Correct! You have opened Skeeter's airway. He now breathes regularly and easily. Do the next question.

This would further restrict his airway. Try again!

You cannot get any air into him. Try again!

Correct! Eyes are lackluster, unfocused, both pupils dilated.

He moves them at your request, but this is a poor choice unless other signs make you suspect a spinal injury.

Correct! Red, moist, and blistered areas cover the right side of the face, neck, and right forearm and hand. There are no other visible injuries.

Correct! Pulse is fast (about 130) and weak.

Correct! His hand is cold and damp.

Correct! His breathing is rapid and shallow.

This is the correct treatment for minor thermal burns but is not the first thing to do for this man. He has a more immediate problem. Try again!

Correct! The face boss is showing signs of shock. Develop the box at the bottom of this question.

This may cause vomiting and further fluid loss. Try again!

This will make his problem worse by decreasing the flow of blood to the brain. It may kill him. Try again!

This would further wet his clothing and lower his body temperature. It may kill him. Try again!

According to the MSHA First Aid Book, 1980, page ,115, dressings should be moistened only for minor thermal burns. Here the face boss has moderate to critical burns. Dry sterile dressings should be used. Moist dressings add to chilling and deepen shock. Do next question.

This will make it more difficult for the doctor to clean the burn later on.
Don't do this! Try again!

Correct! This is the proper treatment. Develop the box at the bottom of this question.

Correct! This prevents the fingers from sticking together and makes later treatment easier.

This will cause pain, further injury, and bleeding. Try again!

Correct! This will reduce pain and swelling.

It is O. K. to use moist dressings for Bull Dog's burns because they are less extensive and because he is not in shock. The moist dressing will prevent sticking and reduce pain but not lower his temperature. See MSHA First Aid Book, page 115. If in doubt, use dry sterile dressing. Do next question.

Correct! The surface people need the details so they can prepare to treat and transport the injured. They may have information that can help you too.

Correct! He is in shock and needs advanced life support treatment within one hour or less or he may die.

Air is still bad. Men could be overcome. Might cause a second ignition.

Correct! It is important to inform the surface to alert others who can help. They also need to know that all seven of you are coming out. You also need to report conditions on the section. Do the next question.

Would waste time. First priority is to get the injured out fast. You need help to transport the injured. There is no immediate threat from the gases and methane in #4 entry. The section ventilation is O.K. except in the #4 entry. Gas in the entry will be sucked out and diluted by the intake air moving across the face area from #5 to #1 entries. It is also illegal to change the curtains now. Try again!

Risky! Methane may have accumulated. You could set off a second explosion. Try again!

Unnecessary and would waste time. Try again!

True! If it were O.K., the machine would have shut down before an explosive level was reached. Try again!

True! Calculations show that only 1.5 cubic yards of methane is needed for an ignition of this size. This much methane can be released in three minutes in an entry of this size in a moderately gassy mine. Try again!

Correct! This is false! The mine was wet. Dust explosions are usually more destructive and extensive. Do the next question.

True! Rarely do investigation reports show that the flame extends further back than the cutter head and its boom. Try again!

True! This is the most common source of methane face ignitions. Keeping the cutter bits sharp, keeping adequate volume and pressure on the water sprays on the cutter head, not scrubbing the top, and keeping good ventilation all help to prevent face ignitions. Try again!