Continuous Miner Fire Exercise

Instructor's Copy

Miner Training Program
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Richlands, Virginia

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[1] This exercise was developed and field tested under U. S. Bureau of Mines research Contract No. H0348040. Information about the design and characteristics of the exercise and the field test results are available in the project technical reports filed with the Bureau of Mines Research Center in Pittsburgh, PA. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies or recommendations of the Interior Department's Bureau of Mines or the U. S. Government.

Contents

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 next section summarizes the results from field tests of the exercise, and reports the miners' evaluation of the activity. 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 and the trainee's questionnaire. Copies of this answer sheet must have the invisible ink answers that appear in Appendix C printed on them[2]. Answer sheets are consumable. One is needed for 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.

Type: Invisible ink

Audience: Underground coal miners

Length: Twelve questions

Skills: Assessing an accident scene before providing first aid to an injured miner
Ordering first aid and fire fighting priorities given a serious fire and an injured miner
Conducting a primary and secondary survey
Diagnosing and treating burns and respiratory distress
Organizing and implementing fire fighting procedures
Deciding when to fight a fire and when to leave and by what routes and means

Location: Underground coal mine with a 36 inch seam height

Problem: You are the acting section foreman. At the end of the day shift you are completing your pre-shift checks for the oncoming second shift at the face in #5 entry. Suddenly you hear someone yelling "Fire!" You respond and find the continuous miner on fire in the last open crosscut between #2 and #3 entries. One miner is down and injured near the fire. The fire is hot and getting out of hand. The mine roof over the burning miner begins to work and fall. Two miners are downwind from the smoke and missing. You must decide what to do to help the injured miner, fight the fire, and locate the missing miners, while keeping your crew and yourself safe.

[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 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 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:

   - Give each person an problem booklet, and each group of 3 to 5 an answer sheet, and a developing pen.

   - Demonstrate how to select and mark answers using the developing 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, encourage class members to discuss the merits of each answer. Add your own ideas.

Performance Objectives for Continuous Miner Fire Exercise

Objective number	Capability verb(s)	Description of required performance and conditions under which it is to occur
1. FA[3]	Recall Apply	The rule that the first step of first aid intervention is to assess the accident scene and risks to first aiders
2. FA	Conduct	A primary and secondary survey to identify and prioritize injuries of an accident victim
3. FA	Weigh Judge	The need to stabilize an injury victim against the need to remove the victim from an unsafe place before stabilization
4. FA/FF	Recall Order	Priorities for selecting among options of providing first aid to an injured miner, warning other miners about a fire, and fighting the fire
5. FF	Recall Identify	Basic procedures that should govern the actions of miners involved in responding to, reporting, fighting, and escaping from a mine fire
6. FF	Recognize Choose	Safe and effective methods for fighting a mine fire given only the resources and personnel available on a typical low coal mine section
7. FF/EE	Judge Determine	When it is appropriate to continue fighting a fire and when it it is prudent to leave the mine
8. EE	Select Identify	The appropriate routes and means to escape a mine fire given a mine map and the location of the fire

[3] Skill and knowledge domain abbreviations:
FA = first aid
FF = fire fighting
EE = emergency evacuation and escape

Master Answer Sheet for the Continuous Miner 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 make a selection. Otherwise you may not get the information you need.

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

1. [You need to do something else first.]

2. [Correct! The source of the fire could be electrical and the machine should be de-energized at the power center. The extinguishers may be useful.]

3. [You are in fresh air. This is unnecessary.]

4. [Dangerous! You would be in dense smoke, fumes, and flames.]

5. [Correct! This should precede any first aid activity. You can see and hear some dribbling of shale over the miner. The roof over Billy Bob looks OK.]

6. [Correct! Others need to be warned about the fire and the miners should be assembled. You need Claude's help to care for Billy Bob.]

7. [You don't know what his injuries are. This could hurt him.]

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

8. [Correct! His lips are blistered. He is wheezing and gasping. His breathing is rapid and shallow. His pulse is about 110 weak and irregular. The skin on the unburned side of his face is pale white and feels clammy.]

9. [Correct! He just moans and says, “I couldn't stop the fire!”]

10. [You need to do something else. Anyway, Claude should be there soon with the first aid kit with its sterile dressings.]

11. [Correct! Both pupils are the same size, and both constrict equally.]

12. [Correct! Everything feels normal and he gives no indication of tenderness.]

13. [Correct! You find no other injuries, only the burns.]

14. [Correct! He wiggles the toes of both boots.]

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

15. [First degree burns do not produce blistering and charring.]

16. [Second degree burns do not produce charred skin and flesh.]

17. [Correct! Charred skin and flesh always indicate third degree burns.]

18. [Correct! Blistered skin indicates second degree burns.]

19. [The hands-on survey does not suggest this. Yet, it is best to play it safe and]
[treat him as if he might have a spinal or head injury.]

20. [Correct! Billy Bob's breathing, pulse, and skin color and the injury itself all]
[suggest he is in shock.]

21. [The hands-on survey you should have done and the accident scene do not]
[suggest this.]

22. [Correct! His lips are blistered and he is having trouble breathing. Inhalation]
[of smoke and hot air can rapidly damage respiratory tissues.]

Question D (Choose only ONE unless directed to Try again!)

23. [Try again!]

24. [Try again!]

25. [Try again!]

26. [Correct! A roof fall could kill all three of you. Do next question.]

27. [Try again!]

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

28. [Claude can do this. You need to be doing something else.]

29. [They refuse. The miner is burning, the top is bad, and they could be hurt.]

30. [The fire is too big now. The extinguishers have little effect on the fire.]

31. [Correct! He needs to be moved away from the face to the assembly point.]

32. [Correct! Water will be needed to attack the fire.]

33. [Correct! The head count shows the roof bolter and his helper are missing.]
[They were last seen in #2 entry at the face. Every one else is accounted for.]

34. [Correct! Miners in other sections of the mine need to be evacuated. You need]
[help, and the conditions at the fire must be reported.]

Question F (Choose only ONE unless directed to "Try again!")

35. [Bad choice! You may die. Try again!]

36. [SCSR's are designed as escape units only, and are not for search and mine rescue activities. Try again!]

37. [Correct! They may have proceeded toward the outside. If you find they are outside you won't have to search for them. Do next question.]

38. [If you don't take some action, other miners may attempt a search and rescue action and they could be injured. Try again!]

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

39. [Correct! You need to organize the fire fighting activity.]

40. [Correct! He returns to the dinner hole and sends Billy Bob, Claude and the two other miners outside.]

41. [Correct! Good communications are a needed to fight the fire effectively.]

42. [Bad choice! This is illegal, and dangerous for you and your helpers and the missing miners.]

43. [Dangerous! Would put you in bad air and smoke. Anyway, you should know the air is bad in the returns.]

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

44. [Not necessary at this time. Other options may be available to fight the fire.]

45. [You have already reported the fire. Surface personnel should do this. You have other things to attend to.]

46. [Correct! If the miners are to fight the fire from this position, they need to be protected from bad top.]

47. [Correct! He tells you there is a little leakage at the curtain at crosscut 26 by the dumping point, but that everything else looks OK.]

48. [This would jeopardize the miners who are fighting the fire. Without a good supply of air at their backs, smoke will roll back on them.]

49. [Correct! Additional equipment like water cars, foam generators, or an extra water line may help.]

50. [You're wasting time that is needed for more important things.]

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

51. [This is illegal and dangerous. They might be hurt or killed if they tried this.]

52. [Correct! Before you leave you should report the time, your planned route,]
[and your method of travel. Then you should leave promptly.]

53. [This action is illegal. It would place you and the other miners at great risk.]
[The smoke and flames are already rolling back. You would be overcome.]

54. [Correct! This would reduce the chances of an explosion of the fire gases.]

Question J (Choose only ONE unless directed to "Try again!")

55. [You are in 36 inch coal. Crawling out would take a long time. Try again!]

56. [Correct! Remember to tram with the bucket trailing. Look for smoke coming]
[through the stoppings from the belt entry. Do next question.]

57. [You already know the location and condition of the fire. You should not be]
[exploring without the proper help and equipment. Try again!]

58. [There are safer and better options. Try again!]

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

59. [Correct! Their absence could have tempted someone to look for them in the]
[dense smoke and these persons could have died.]

60. [Correct! If possible, miners should go to designated assembly points when]
[there is a fire.]

61. [Donning their filter self-rescuers was necessary for them to get out of the]
[smoke and into the belt entry. SCSRs are not usually available at the face.]

62. [Correct! If the fire had developed more rapidly, of if the stoppings had]
[leaked, they could have been in trouble.]

63. [Correct! Both entries #5 and #6 are intake air courses and would be safer]
[routes than moving out the belt entry.]

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

64. [Correct! This is required by federal law if the fire lasts for 30 minutes or more.]

65. [Correct! Injuries are common during fire fighting.]

66. [Correct! Mine rescue teams are needed to properly fight major fires, to]
[rescue missing miners, and to protect other miners who fight the fire.]

67. [Correct! Many additional supplies are needed.]

68. [Correct! Without this information persons may search for miners who are]
[already safe, or fail to search for trapped miners.]

69. [This should be done only after it is confirmed that the miners are missing,]
[and only by order of a major mine official.]

70. [Correct! This should be done only by order of a major mine official.]

71. [Correct! Procedures for completing this task should be established before]
[a mine fire or other disaster.]

72. [Correct! Ventilation and power are major concerns during a mine fire]
[emergency. It is important that both be maintained as directed by the mine]
[emergency manager.]

73. [These types of investigations should wait until later. Dealing with the fire]
[demands all the available attention and resources.]

Finding your score

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

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

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

Highest possible score = 73

Lowest possible score = 0

Instructor's Discussion Notes for Continuous Miner Fire Exercise

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.

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 2, 5, and 6. Before approaching a victim and providing first aid (1) the accident scene should be assessed to make sure it is reasonably safe for the first aider to approach the victim (5). It is also important to stop the power to the miner (2), particularly if the fire is to be fought with water. Because the fire is already large it poses a serious threat. The other miners on the section need to be warned, assembled, and organized to fight the fire or to leave (6). Donning filter self-rescuers (3) is not necessary as long as the miners stay on the fresh air side of the fire. Immediately dragging Billy Bob to the dinner hole (7) is wrong because his injuries should first be assessed.

Question B - All of the answers except number 10 are correct. Although his burns may be the most obvious injury, you should not immediately begin treating the burns until a primary and secondary survey have been completed. The initial assessment can identify other injuries that may be present and need to be treated first. (it is possible Billy Bob could have been hit by a falling rock or could have struck his head.) Checking Billy Bob's airway, breathing and circulation (8) can all be done at the same time. It is important to do these steps of the primary survey even if Billy Bob is moaning and you know his airway is open. The serious burns on his face reveal that his head was in flame, smoke, or hot air and his airway may have been injured from the heat. Swelling and accumulation of fluid in his airway is a potential threat to his life. While checking his airway, breathing and circulation (ABCs), it is also easy to ask him what happened and where he is hurt (9), check his pupil response with your cap lamp (11), feel his skull and neck spine with your finger tips (12), and ask him to wiggle the toes of his boots (14). These secondary survey procedures help determine his status. The information gained reveals that Billy Bob probably has no head or spinal injuries. The next step is to complete the hands-on secondary survey by feeling his

chest, abdomen, pelvis, middle and lower spine, and his arms and legs to look for other injuries (13). Likewise, the information gained from this aspect of the secondary survey suggests Billy Bob has no other injuries. The total time needed to complete this primary and secondary survey should not be more than a minute or so. The information gained from the survey is important because it prioritizes first aid treatment. Some may argue that this rather complete primary and secondary survey exceeds basic first aid care. Emergency medicine experts disagree and recommend that all first aiders routinely be taught to carry out these simple, lifesaving diagnostic procedures. The procedures themselves will not further injure the victim. The information that the surveys gather can greatly improve the care of the victim by identifying hidden injuries and prioritizing first aid treatment. Some persons argue that because an EMT is nearby, the first aider in this problem should not conduct a primary and secondary survey on Billy Bob. Experienced EMTs and expert first aiders argue otherwise. They point out that it is possible the "nearby" EMT is not available, perhaps having gone on an errand. The first aider should not passively wait for the EMT. Billy Bob might also have some other hidden injury that could be life threatening if not identified and treated early. For example, he could have heavy bleeding. Blood on mine clothing is not always easy to see because the clothing is usually covered with coal dust, and is often damp or oily. A hands-on survey takes only a short time and can identify injuries like these. The mine roof over the continuous miner is weakening because of the fire. Billy Bob may have to be moved from the area at any time. It is important for the first aider to assess the victim's injuries to be better prepared to care for him, including handling during an emergency move.

Question C - The correct answers are 17, 18, 20, and 22. Billy Bob has third degree burns to his hands (17), second degree burns to his face and mouth (18), he is in shock (20), and his respiratory passages have probably been injured from inhalation of hot air and smoke (23). Burns to the face often result in shock and should always be treated as a serious injury. The primary and secondary surveys, which take less than a minute to complete, rule out probable head or spinal injury (19), and heat exhaustion (21). Billy Bob's pale, cold and clammy skin, his rapid weak pulse, and the nature of his injuries suggest shock. Heat exhaustion would result in hot, flushed skin, heavy sweating, rapid heavy breathing, and usually a strong and rapid pulse. Sufficient exposure to carbon monoxide could result in a bright cherry red color to the skin and lips. However, Billy Bob's injuries suggest a short exposure time to a hot fire without the opportunity to acquire sufficiently high levels of carbon monoxide to produce red coloration of the skin.

Question D - The correct answer is 26, to immediately use a clothing drag to move Billy Bob away from the bad mine roof to a safer place. Having Claude help you place Billy Bob on the stretcher before moving him (27), working to further stabilize Billy Bob before moving him (24), waiting until the roof conditions get worse (25), and setting roof jacks (23), all delay removing Billy Bob and the first aiders from a very dangerous situation. If the first aider has properly carried out the primary and secondary survey, at this point he or she is reasonably sure it won't hurt Billy Bob to drag him to a safer place. If the surveys had shown that Billy Bob did have a head and/or spinal injury, the predicament would be worse. However, if a roof fall were likely, it would still be necessary to remove Billy Bob from the immediate danger before proceeding with other first aid care. Otherwise he and his first

aiders could all be killed or injured. This conflict in rescue and first aid treatment priorities is a topic worthy of discussion by class members.

Question E - The correct answers are 31, 32, 33, and 34. Once Billy Bob was dragged to a safer place Claude should have repeated the primary and secondary surveys, placed sterile dry dressings on the burns, bandaged the dressings in place, continued to monitor the victim's airway, and then immobilized Billy Bob on a stretcher on his back so he could be transported from the mine. It is easier to transport injured victims who are lying on their backs properly secured to a rigid backboard or stretcher. In most cases, hospital emergency room staff also needs victims in the supine position to properly carry out examination and treatment procedures. Time spent placing the victim in the secured supine position not only makes transporting the victim safer and easier, but reduces unnecessary movement and handling later on in the ambulance or emergency room.

The continuous miner fire is large and it demands a number of immediate responses on the part of the acting foreman. It is important that the person in charge immediately prepare to fight the fire with water (32), go the designated assembly point and make a head count (33), and call the surface personnel to report the location, size, and nature of the fire as well as the activity underway on the section to cope with the situation (34). The supervisor's need to perform these duties takes priority over his or her continued involvement in administering first aid care to Billy Bob (28). If the supervisor continues to care for Billy Bob and fails to take charge of the fire situation, there is potential for injury or death of many other miners. The fire could get worse. Miners in other sections of the mine could remain uninformed about the fire. They and others could be trapped and perish. Thus, the mine section supervisor must act decisively and rapidly. In this case leaving Billy Bob's first aid care to Claude, the section EMT, is easy. If the foreman were the only EMT on the section, his or her stopping care for Billy Bob would be more problematic, but would nevertheless be necessary to protect the lives of the other miners on the section and in the mine. Class discussion of this potential conflict in roles and priorities is appropriate.

Question F - The correct answer is 37. The only good option is to call outside and have surface personnel watch for the two missing miners and immediately call the mine section if and when they appear outside. Data from many cases reveal that more than half of all fatalities to persons in confined spaces are to rescuers who are searching for or attempting to help other persons who are trapped in bad atmospheres. Therefore, the acting foreman cannot simply "forget about the missing miners" (38). To do so invites other miners to search for the missing miners and the would-be rescuers could become casualties. Using filter self-rescuers to search for the missing miners (35) would be foolish. The FSRs would not protect against oxygen deficiency, and they are not designed for mine rescue activity. Donning SCSRs and mounting a search for the missing miners (36) is a likely response, but it should not be attempted. The visibility would be very bad and it is likely the missing miners would not be located. If they were located and they were unconscious, it would be difficult to assist them while in heavy smoke and wearing an SCSR. The searchers could also easily become disoriented and lost and have difficulty finding their way to fresh air. The acting foreman must not engage in such a search activity because he or she is needed to organize and direct the fire fighting and evacuation

procedures. The absence of decisive leadership in this situation can make a bad situation far more dangerous.

Question G - The correct answers are 39, 40, and 41. The acting foreman must organize and supervise the fire fighting activity (39), send miners who are not needed to fight the fire outside (40), and make sure one miner is stationed at the pager to maintain constant communication with surface personnel (41). It is illegal and dangerous to shut off the mine fan (42). Flames and smoke would roll back on the fire fighters. It would be foolish to go into the return airway to make air quality measurements (43). This would waste time, prevent the acting foreman from attending to the fire fighting, and he or she could be overcome.

Question H - The correct answers are 46, 47, and 49. If the fire is to be controlled, more equipment is needed (46) & (49). If the miners are to stay and fight the fire it is important to check on the amount of smoke leaking through the stoppings from the returns into the neutral air of the belt entry (47). If the belt entry air were heavily contaminated with smoke, this secondary escapeway could be compromised. The air in the intake entries and at the face could also become contaminated with smoke and carbon monoxide if the stoppings between the belt entry and the intake air entries were to leak. It is important to determine the quality of the air in the belt entry to make a decision about staying to fight the fire or evacuating the section. The acting foreman has already reported the fire to surface personnel. These personnel are responsible for notifying federal authorities about the fire (45). The acting foreman should be attending to other matters.

Question I - The correct answers are 52 and 54. The fire is much worse. The mine roof near the fire is becoming weakened and falling. The heat from the fire has decreased the effectiveness of the mine ventilation as indicated by the rollback of smoke. There is not much more the crew can do. It is time to evacuate the section, but it is important for them to call outside before leaving. The condition of the fire, the time of departure, the method of travel, and the route to the surface should be reported (52). The foreman should also direct that all underground electrical power to the mine be cut off (54). Other possible options include placing curtains on the intake side of the fire to slow air flow to the fire, modifications to the section ventilation to short circuit air away from the fire, fighting the fire with mine rescue equipment, and sealing off a portion of the mine section or the entire mine section. Class discussion provides an opportunity to explore these options, their merits, and the procedures for exercising these actions given the ventilation arrangements and policies of the particular mine in which class members work.

Question J - The correct answer is 56, leaving the mine in the usual way by the usual route, e.g. tramming the scoop out the #5 entry. The seriousness of the fire and the low seam height make crawling out the belt entry risky (57) & (58). There is no risk of explosion from fire gases in the #5 entry because the intake air is fresh (55). It is also much faster to travel out of the mine in a scoop that it is to crawl out.

Question K - All of the answers except 61 are correct. If the pinner man and his helper donned their filter self-rescuers to escape from the smoke in the face of the #2 entry, they

were wise. SCSRs are not usually stored at the face and the FSRs would protect against carbon monoxide until the miners could get to fresh air in the belt entry. However, the pinner man and his helper were wrong on all other aspects of their escape. Leaving without reporting to the assembly point at the dinner hole violated standard emergency procedures (60), and endangered other miners who might have searched for the two missing miners (59). When the pinner and helper decided to leave they were foolish to go out the belt entry when they could have used either entry #5 or #6, the primary escapeways (63). If there were a need to escape quickly, crawling 3,500 feet to the outside in 36-inch coal is a poor choice when there is an opportunity to travel by scoop.

Question L - All of the answers except 69 and 73 are correct. Notification of family members about missing miners is the responsibility of the mine superintendent and should only be done when it is determined that miners are missing (71). Attempting to assess blame for the fire (73) is inappropriate now and wastes time when many other more important things need attention. All of the other responses are correct for the reasons given in the feedback to each answer.

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Scoring Key for Continuous Miner Fire Exercise

The correct answers are marked with an asterisk.[4]

Question	Answer Number							
A	1	2*	3	4	5*	6*	7	
B	8*	9*	10	11	12*	13*	14*	
C	15	16	17*	18*	19	20*	21	22*
D	23	24	25	26*	27			
E	28	29	30	31*	32*	33*	34*	
F	35	36	37*	38				
G	39*	40*	41*	42	43			
H	44	45	46*	47*	48	49*	50	
I	51	52*	53	54*				
J	55	56*	57	58				
K	59*	60*	61	62*	63*			
L	64*	65*	66*	67*	68*	69	70*	71
	72*	73						

[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.

You may obtain a copy of the problem booklet from NIOSH, Pittsburgh Research Laboratory, Pittsburgh, PA phone 412-386-5901, fax 412-386-5902 or email to minetraining@cdc.gov.

Continuous Miner Fire Exercise

Problem Booklet

Instructions

Read the problem situation described on the next page. Study the diagram until you understand the location of the workers and equipment in the problem. Next, answer each of the 12 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 special 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.

Continuous Miner Fire Exercise

Background

You are acting section foreman during the absence of the regular section foreman.

You are at the face of the #5 entry on the 001 section making pre-shift checks for the oncoming second shift.

Miners from the first shift are working on the two other active sections in this mine.

Section 001 is 3,500 feet from the portal.

This mine has an average seam height of 36 inches.

The mine is dry, dusty, and not well rock dusted.

The section EMT, Claude Kildare, is the scoop operator. At the moment you think he is at the supply hole unloading bolts and plates.

You are well trained in basic first aid procedures.

A water line, with fire hose outlets and fire hose, extends the full length of the belt.

A one inch flexible water line runs from the dumping point to the continuous miner.

Including yourself, there are 12 miners working on this section today.

Rubber tired battery operated scoops are used to transport supplies and miners to the section.

Problem

As you complete your pre-shift checks of the face area of the #5 entry, you hear someone yelling "Fire!" You crawl out from the face of #5 entry into the last open crosscut and turn right toward the #3 entry. You see the continuous miner burning in the crosscut between #2 and #3 entries. Study Figure 1 on the next page. Then turn to page 5 and do the first question.

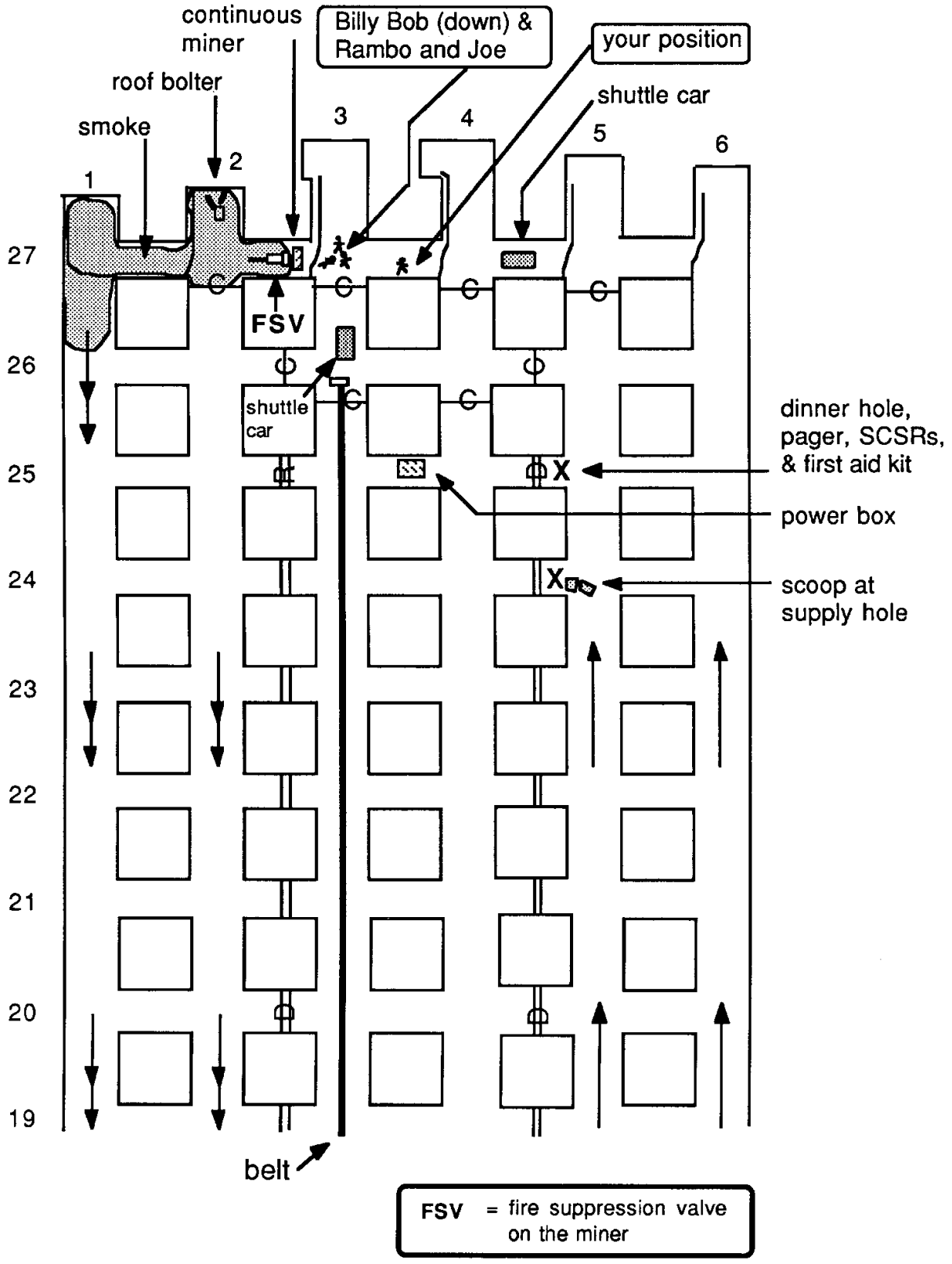

Figure 1: Location of miners accounted for and last known location of the two missing miners

Question A

You find the continuous miner engulfed in dense black smoke and large orange flames. The fire suppression system on the mining machine is not working. The fire is spreading rapidly, fed by oil and loose coal dust that have accumulated on the machine. Billy Bob, the miner operator is lying on his right side on the mine bottom about 15 feet in front of the miner on the fresh air side of the fire. Rambo, a buggy operator, and Joe are bent over him. Rambo says, "Billy Bob is hurt bad!"

What should you do now? (Select as MANY as you think are correct.)

1. Before you do anything else, go to Billy Bob and begin first aid.

2. Send Joe to the power box to de-energize the continuous miner and to bring back a couple of fire extinguishers.

3. Tell Rambo and Joe to put on their filter self rescuers and you do the same.

4. Put on your filter self-rescuer and then manually activate the fire suppression valve on the miner.

5. Look at the mine roof over Billy Bob and the miner to see if it is O.K.

6. Send Rambo across the section in fresh air to get Claude, the EMT, and to warn other miners and have them assemble at the dinner hole.

7. Put Billy Bob on a piece of brattice curtain and have Rambo and Joe drag him to the dinner hole immediately so Claude can begin first aid treatment.

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

Question B

Joe has gone to knock the power to the miner, and Rambo is warning other miners and getting Claude to help you take care of Billy Bob. You start checking Billy Bob's injuries. The left side of his face is covered with blisters. He is dazed and doesn't recognize you. He is moaning softly. The skin on both his hands and fingers is charred. His coveralls are singed.

What would you do now? (Select as MANY as you think are correct.)

8. Check his airway and breathing while taking his pulse on the unburned side of his neck.

9. Ask him what happened and to tell you where he is hurt.

10. Begin treating the burns on his face and hands by wrapping them gently with the clean inside part of your shirt or jacket.

11. Shine your cap lamp into his eyes, one at a time, and look at his pupils.

12. Feel his skull and spine with your finger tips.

13. Quickly check him for other injuries.

14. Ask him to wiggle the toes of his boots.

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

Question C

Your survey of Billy Bob's injuries has taken about a minute. Based upon what you have found, what is wrong with him? (Select as MANY as you think are correct.)

15. First degree burns to the hands and face.
16. Second degree burns to the hands and fingers.
17. Third degree burns to the hands and fingers.
18. Second degree burns to the face.
19. Possible head or spinal injury.
20. Shock.
21. Heat exhaustion.
22. Possible injury to his airway and lungs from smoke inhalation.

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

Question D

Claude arrives on the scene with the first aid kit. You tell him what you have found. He begins to treat Billy Bob and confirms your assessment. You notice the roof over the miner is working and some small pieces of shale are failing in front of the miner, near Billy Bob, Claude, and you.

What should you do now? (Choose only ONE unless you are told to "Try Again!")

23. Go get a couple of roof jacks and set them around Billy Bob and Claude.

24. Help Claude stabilize Billy Bob so you can move him to a safer place as soon as possible.

25. Continue to watch the roof carefully. If it gets worse, tell Claude to help you move Billy Bob to a safer spot.

26. Immediately tell Claude to help you use a clothing drag to move Billy Bob to a safer place.

27. Help Claude carefully roll Billy Bob onto the stretcher. Then secure him to the stretcher, cover him with a blanket and take him to the dinner hole.

Question E

You and Claude move Billy Bob to #4 entry in the last open cross cut. Claude is taking care of Billy Bob. Rambo and Joe come back with two small fire extinguishers and say they told everybody they saw to meet at the dinner hole. The whole continuous miner is now nearly covered with smoke and flames.

What should you do now? (Select as MANY as you think are correct.)

28. Continue to help take care of Billy Bob.

29. Tell Rambo and Joe to go behind the miner, cut the water line, and attack the fire.

30. Tell Rambo and Joe to attack the fire from the fresh air side with the two fire extinguishers.

31. After Billy Bob has been placed on the stretcher and stabilized, tell Claude and Joe to move him to the dinner hole.

32. Send Rambo to the feeder in the belt entry to hook up a hoseline and bring it to the fire while staying in fresh air.

33. Go to the assembly point and make a head count.

34. Call the surface. Report the conditions on the section and ask for help.

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

Question F

Your head count has shown that the pinner man and his helper are missing. (See Figure 2 on the next page.) What should you do now? (Choose only ONE unless you are told to "Try Again!")

35. Put on your filter self-rescuer and travel up to the #2 entry to the face where they were last seen.

36. You and another miner put on your SCSRs. Then go through crosscut #26 and up to the face of entries # 1 and #2, and then out the returns to look for the two missing miners.

37. Call the outside man and tell him two miners are missing. Have him watch for the missing miners and immediately call your section if they arrive outside.

38. Forget about the missing miners. You have other things to take care of.

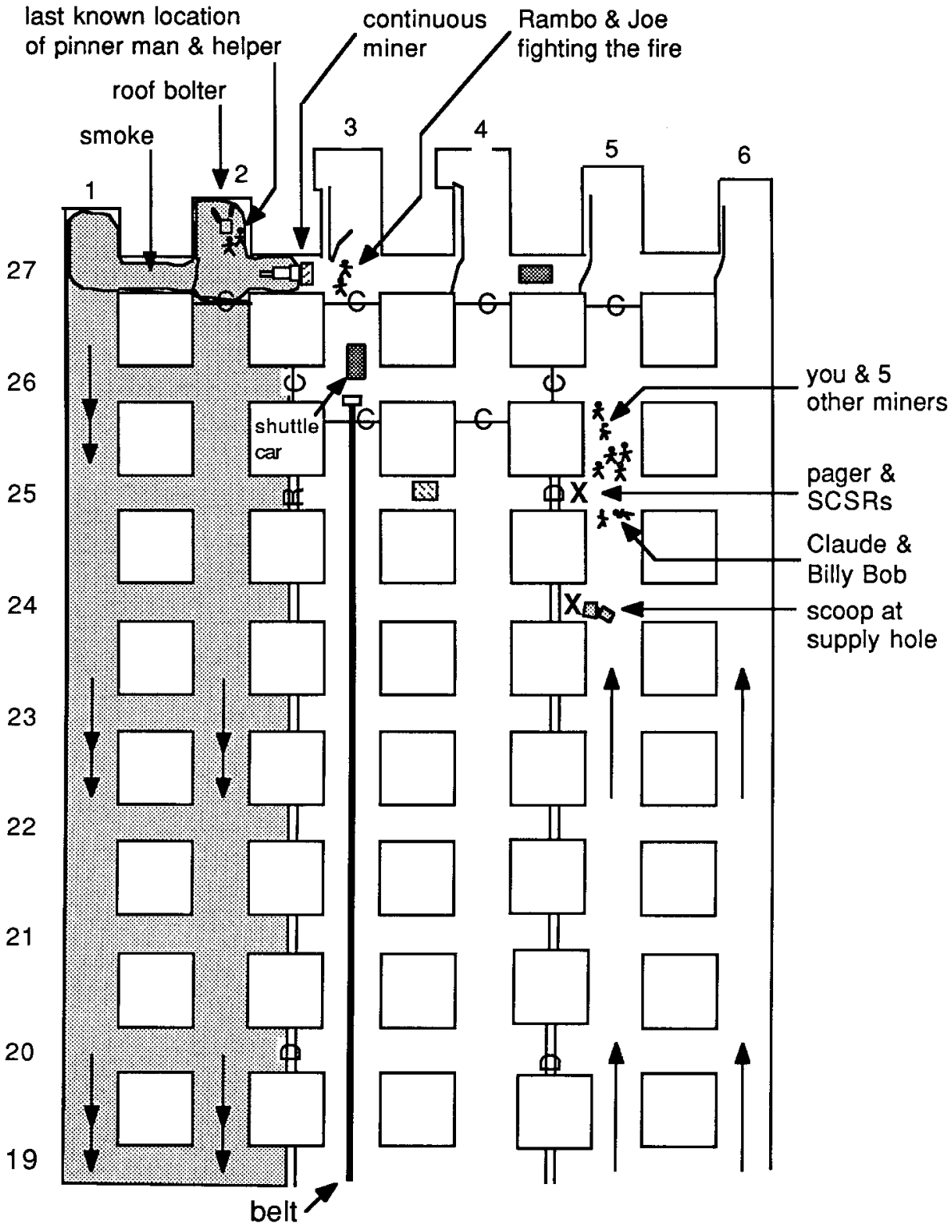

Figure 2: Location of miners accounted for and last known location of the two missing miners

Question G

Keeping in fresh air, you take three miners with you and return to the burning miner. At present this is how the situation stands. You have not accounted for the two missing workers. You find Rambo and Joe near the miner with a fire hose in place and almost ready to fight the fire. The power to the miner has been disconnected at the power center. Claude is taking care of Billy Bob at the dinner hole. All the other miners, except the two missing workers and the five with you, are at the dinner hole.

What should you do now? (Select as MANY as you think are correct.)

39. Assign fire fighting duties to the miners who are with you.

40. Send one miner to tell the others at the dinner hole to go outside immediately.

41. Send one miner to maintain constant communications with the outside man by staying at the mine phone in entry #5 at crosscut 25 at the dinner hole.

42. Tell the miner at the phone to call the outside man and tell him to cut off the fan to keep from feeding oxygen to the fire.

43. Take your instruments and go through a mandoor from the belt entry into the #2 entry. Then check the return air for oxygen deficiency and the presence of carbon monoxide and methane.

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

Question H

Rambo and Joe are fighting the fire with water from the fresh air side. But their efforts are not making much difference. The fire has spread to the ribs and mine floor. The roof is beginning to fall around the continuous miner. The fire has now burned for 30 minutes and is so hot you can't get closer than 20 feet from the machine. The miner monitoring the mine phone comes and tells you that the two missing miners went out the belt entry and are now outside.

What would you do at this point? (Select as MANY as you think are correct.)

44. Lead all of the miners on your section outside and evacuate the mine.

45. Call the outside man to make sure that state and federal regulatory agency officials have been notified about the fire.

46. Call outside to get extra miners to bring in timbers and crib blocks to be used to support the roof on the fresh air side of the fire.

47. Send a miner carrying an unopened SCSR to check the belt entry and to look for smoke leaking through the brattices from the returns and to tell you what he finds.

48. Send a miner to open the regulator and mandoor between the #3 belt entry and the #2 return air entry to short circuit air away from the fire.

49. Call outside for more equipment to fight the fire from the fresh air side.

50. Call the outside man and tell him to chew out the roof bolter operator and helper for going outside without telling somebody.

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

Question I

Ten minutes have passed. Extra hoseline and supplies are on the way. The fire is growing larger. You hear large roof falls in the smoke around the miner. The bad roof conditions around the miner and "rollback" of heavy black smoke are preventing the men from getting close enough to fight the fire from the fresh air side.

What should you do now? (Select as MANY as you think are correct.)

51. Have two miners using the fire hose put on their SCSRs and go around the pillar to the number #2 entry to attack the fire from behind the continuous miner.

52. Call out report that you are leaving. Then lead all of the miners out of the mine immediately.

53. Call out and have the mine fan shut off so the fire won't receive so much air and so you can have a better chance of fighting it.

54. Call out and have electrical power to the underground portions of the mine cut off.

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

Question J

You have ordered all the remaining miners on the section to leave the mine with you. What route should you take and how should you travel? (Choose only ONE unless you are told to "Try Again!")

55. Don't use the scoop because of the risk of explosion. Tell the other miners to follow you as you crawl out the # 5 entry.

56. Follow the usual route and procedures, e.g. load the four remaining miners into the scoop bucket and tram out the #5 entry.

57. Ask one miner to crawl out the belt entry with you so you can check on the smoke and fire as you leave the mine. Tell the other miners to go out the # 6 entry.

58. Tell all of the miners to leave with you and crawl out the belt entry because if the smoke gets bad you can follow the belt outside.

Question K

What can be said about the actions of the roof bolter operator and helper when they put on their filter self-rescuers and went out of the mine in the belt entry without telling anyone? (Select as MANY as you think are correct.)

59. Their action increased the risk for other miners.

60. Their action violated standard emergency procedures for mine fires.

61. They were foolish to put on their filter self-rescuers when SCSRs were available.

62. They were foolish to crawl 3,500 feet out the belt entry in 36 inch coal when there were other better options available.

63. They should have used the primary escapeway rather than the secondary escapeway.

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

Question L

What are the responsibilities of surface personnel during a serious mine fire? (Select as MANY as you think are correct.)

64 Notify state and federal regulatory agencies about the fire.

65. Alert ambulance personnel and ask them to be ready to assist.

66. Alert mine rescue teams.

67. Alert management to gather additional supplies and equipment needed for the fire fighting operation.

68. Look at the check-in and check-out board and make a list of all mine personnel who are underground, on the surface, or unaccounted for.

69. Immediately notify the families of missing miners.

70. Notify state police for crowd and traffic control.

71. Make preparations for informing and dealing with family members if miners are found to be missing.

72. Arrange for someone to guard the mine fan and mine power.

73. Make a list of the persons who are responsible for actions that caused the fire.

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

The fire at this mine was stopped by sealing the section. The entire mine was closed for one week and the section where the fire occurred was closed for 3 months. No one except Billy Bob was injured.

Billy Bob survived because of the good first aid he received. While waiting at the dinner hole to be transported outside, his breathing became more difficult because of swelling in his upper respiratory track. Claude, the EMT, saved Billy Bob's life by inserting an airway to maintain his breathing.

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 33. 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 73 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 places.

Most companies and trainers prefer to obtain copies of the preprinted answer sheets 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 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 for each 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 the Continuous Miner Fire Exercise

Use this answer sheet to mark your selections. Rub the special 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 make a selection. Otherwise you may not get the information you need.

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

1. [ ]

2. [ ]
   [ ]

3. [ ]

4. [ ]

5. [ ]
   [ ]

6. [ ]
   [ ]

7. [ ]
   [ ]

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

8. [ ]
   [ ]
   [ ]

9. [ ]

10. [ ]
    [ ]

11. [ ]

12. [ ]
    [ ]

13. [ ]

14. [ ]

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

15. [ ]

16. [ ]

17. [ ]

18. [ ]

19. [ ]
    [ ]

20. [ ]
    [ ]

21. [ ]
    [ ]

22. [ ]
    [ ]

Question D (Choose only ONE unless directed to Try again!)

23. [ ]

24. [ ]

25. [ ]

26. [ ]

27. [ ]

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

28. [ ]

29. [ ]

30. [ ]

31. [ ]

32. [ ]

33. [ ]
    [ ]

34. [ ]
    [ ]

Question F (Choose only ONE unless directed to "Try again!")

35. [ ]

36. [ ]
    [ ]

37. [ ]
    [ ]

38. [ ]
    [ ]

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

39. [ ]

40. [ ]
    [ ]

41. [ ]

42. [ ]
    [ ]

43. [ ]
    [ ]

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

44. [ ]

45. [ ]
    [ ]

46. [ ]
    [ ]

47. [ ]
    [ ]

48. [ ]
    [ ]

49. [ ]
    [ ]

50. [ ]

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

51. [ ]

52. [ ]
    [ ]

53. [ ]
    [ ]

54. [ ]

Question J (Choose only ONE unless directed to "Try again!")

55. [ ]

56. [ ]
    [ ]

57. [ ]
    [ ]

58. [ ]

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

59. [ ]
    [ ]

60. [ ]
    [ ]

61. [ ]
    [ ]

62. [ ]
    [ ]

63. [ ]
    [ ]

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

64. [ ]

65. [ ]

66. [ ]
    [ ]

67. [ ]

68. [ ]
    [ ]

69. [ ]
    [ ]

70. [ ]

71. [ ]
    [ ]

72. [ ]
    [ ]
    [ ]

73. [ ]
    [ ]

Finding your score

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

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

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

Highest possible score = 73

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.

You need to do something else first.

Correct! The source of the fire could be electrical and the machine should be de-energized at the power center. The extinguishers may be useful.

You are in fresh air. This is unnecessary.

Dangerous! You would be in dense smoke, fumes, and flames.

Correct! This should precede any first aid activity. You can see and hear some dribbling of shale over the miner. The roof over Billy Bob looks 0.K.

Correct! Others need to be warned about the fire and the miners should be assembled. You need Claude's help to care for Billy Bob.

You don't know what his injuries are. This could hurt him.

Correct! His lips are blistered. He is wheezing and gasping. His breathing is rapid and shallow. His pulse is about 110 weak and irregular. The skin on the unburned side of his face is pale white and feels clammy.

Correct! He just moans and says, “I couldn't stop the fire!"

You need to do something else. Anyway, Claude should be there soon with the first aid kit with its sterile dressings.

Correct! Both pupils are the same size, and both constrict equally.

Correct! Everything feels normal and Billy Bob gives no indication of tenderness.

Correct! You find no other injuries, only the burns.

Correct! He wiggles the toes of both boots.

First degree burns do not produce blistering and charring.

Second degree burns do not produce charred skin and flesh.

Correct! Charred skin and flesh always indicate third degree burns.

Correct! Blistered skin indicates second degree burns.

The hands-on survey does not suggest this. Yet, it is best to play it safe and treat him as if he might have a spinal or head injury.

Correct! Billy Bob's breathing, pulse, and skin color and the injury itself all suggest he is in shock.

The hands-on survey you should have done and the accident scene do not suggest this.

Correct! His lips are blistered and he is having trouble breathing. Inhalation of smoke and hot air can rapidly damage respiratory tissues.

Try again!

Try again!

Try again!

Correct! A roof fall could kill all three of you. Do next question.

Try again!

Claude can do this. You need to be doing something else.

They refuse. The miner is burning, the top is bad, and they could be hurt.

The fire is too big now. The extinguishers have little effect on the fire.

Correct! He needs to be moved away from the face to the assembly point.

Correct! Water will be needed to attack the fire.

Correct! The head count shows the roof bolter and his helper are missing. They were last seen in #2 entry at the face. Every one else is accounted for.

Correct! Miners in other sections of the mine need to be evacuated. You need help, and the conditions at the fire must be reported.

Bad choice! You may die. Try again!

SCSRs are designed as escape units only, and are not for search and mine rescue activities. Try again!

Correct! They may have proceeded toward the outside. If you find they are outside you won't have to search for them. Do next question.

If you don't take some action, other miners may attempt a search and rescue action and they could be injured. Try again!

Correct! You need to organize the fire fighting activity.

Correct! He returns to the dinner hole and sends Billy Bob, Claude and the two other miners outside.

Correct! Good communications are needed to fight the fire effectively.

Bad choice! This is illegal, and dangerous for you and your helpers and the missing miners.

Dangerous! Would put you in bad air and smoke. Anyway, you should know the air is bad in the returns.

Not necessary at this time. Other options may be available to fight the fire.

You have already reported the fire. Surface personnel should do this. You have other things to attend to.

Correct! If the miners are to fight the fire from this position, they need to be protected from bad top.

Correct! He tells you there is a little leakage at the curtain at crosscut 26 by the dumping point, but that everything else looks O.K.

This would jeopardize the miners who are fighting the fire. Without a good supply of air at their backs, smoke will roll back on them.

Correct! Additional equipment like water cars, foam generators, or an extra water line may help.

You're wasting time that is needed for more important things.

This is illegal and dangerous. They might be hurt or killed if they tried this.

Correct! Before you leave you should report the time, your planned route, and your method of travel. Then you should leave promptly.

This action is illegal. It would place you and the other miners at great risk. The smoke and flames are already rolling back. You would be overcome.

Correct! This would reduce the chances of an explosion of the fire gases.

You are in 36 inch coal. Crawling out would take a long time. Try again!

Correct! Remember to tram with the bucket trailing. Look for smoke coming through the stoppings from the belt entry. Do next question.

You already know the location and condition of the fire. You should not be exploring without the proper help and equipment. Try again!

There are safer and better options. Try again!

Correct! Their absence could have tempted someone to look for them in the dense smoke and these persons could have died.

Correct! If possible, miners should go to designated assembly points when there is a fire.

Donning their filter self-rescuers was necessary for them to get out of the smoke and into the belt entry. SCSRs are not usually available at the face.

Correct! If the fire had developed more rapidly, of if the stoppings had leaked, they could have been in trouble.

Correct! Both entries #5 and #6 are intake air courses and would be safer routes than moving out the belt entry.

Correct! This is required by federal law if the fire lasts for 30 minutes or more.

Correct! Injuries are common during fire fighting.

Correct! Mine rescue teams are needed to properly fight major fires, to rescue missing miners, and to protect other miners who fight the fire.

Correct! Many additional supplies are needed.

Correct! Without this information persons may search for miners who are already safe, or fail to search for trapped miners.

This should be done only after it is confirmed that the miners are missing, and only by order of a major mine official.

Correct! This should be done only by order of a major mine official.

Correct! Procedures for completing this task should be established before a mine fire or other disaster.

Correct! Ventilation and power are major concerns during a mine fire emergency. It is important that both be maintained as directed by the mine emergency manager.

These types of investigations should wait until later. Dealing with the fire demands all the available attention and resources.