

Delta Mine Cutthrough

(Paper and Pencil Exercise)

Instructor's Copy

Behavioral Research Aspects of Safety and
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¹ This exercise was developed and field tested under U. S. Bureau of Mines research contract no. H0348040. 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.

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Introduction

This document contains all of the materials needed to use the exercise. The first part of the document is the instructor's copy. It tells how to use the exercise, presents the objectives, discussion notes to be used following the exercise, and references. The last part of this document is two appendices. Appendix A is the exercise problem booklet. One is needed for every person in the classroom. Appendix B is the answer sheet. One copy is needed for each group of 2 to 3 persons.

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:** Paper and pencil requiring short written answers and simple modifications to mine ventilation maps
- Length:** Nine sections, 25 questions (One and one-half hours for administration plus one hour for discussion)
- Audience:** Mine supervisors, mine foremen, mine examiners, mining engineers, ventilation engineers
- Skills:** Generating communication and work procedures that minimize the possibility of errors and accidents when making cutthroughs in a mine with multiple sections, crews, and shifts. Anticipating, recognizing, and planning to prevent errors in ventilation arrangements and work procedures when cutting through from one mine section to another. Identifying errors in mine ventilation arrangements given maps of advancing mine sections and their connection at cutthroughs. Selecting a few critical locations at which to take air quantity and gas measurements that will yield maximum information about ventilation conditions in the mine. Interpreting airflow and gas measurement data from a few well chosen locations in a complex mine and making rapid and accurate inferences about the ventilation of the mine and its various sections, especially during changes to the ventilation. Recalling and applying federal laws as they apply to the procedures for making major changes to the ventilation of mine sections and mines as occurs during certain mining activities.
- Location:** Underground coal mine during connection of previously separate sections to form a retreating long wall panel
- Problem:** Planned cutthroughs from one mine section to another are underway over a period of several days and three shifts as a retreating long wall panel is being set up. The mine liberates large quantities of methane. As the work progresses there are many points at which serious errors in communication, ventilation, and work procedures could develop. You must analyze the situation, identify and correct problems, and make sure the ventilation remains adequate throughout the procedure. Otherwise there may be an accident and miners may die. (This is based on an actual mine disaster in which seven miners died.) The exercise provides practice in the critical, planning, problem recognition, judgment and decision making skills needed to cope with the complexity of a cutthrough procedure and the major ventilation changes that may result.

How to Use This Exercise

1. Look at the performance objectives. Decide if the exercise is relevant for your mine training class.
2. Using the problem booklet, work the exercise. Then score your answers using the instructions on the bottom of the answer sheet.
3. Read the "Instructor's Discussion Notes" for the exercise.
4. Become thoroughly familiar with the problem before class so you can present it effectively.
5. Use the specifications in the discussion notes to construct a classroom demonstration apparatus to be used following the exercise.
6. When you present the exercise to the class:
 - Have class members work in groups of 2 or 3 persons
 - Give every person a problem booklet and each group of 2 to 3 one answer sheet and a pencil.
 - Go over the instructions for doing the exercise with the whole group.
 - Have the miners in each small group work through the exercise one section at a time, answering all of the questions before going on to the next section.
 - When everyone has finished, ask class members to discuss the merits of each answer.

An Alternative, Easier Exercise

This exercise is more realistic and difficult than some other similar exercises because it requires persons to generate answers to questions rather than to recognize good and bad responses from a list of alternatives. Thus, the exercise demands more from the person taking it and it takes longer to complete. Because of this a companion invisible ink exercise was developed for this same problem. While still challenging, this other version of the exercise is easier and can be completed in less time, because it presents the person with alternatives to choose from at each point, rather than having to generate these. This companion exercise also more explicitly teaches the basics that are involved when cutting through from one section to another. It also teaches some other content and basics related to reading and interpreting mine ventilation maps and schematics. This other exercise is called "Cutthrough Ventilation Arrangement" (CVA). Instructors may wish to review both the DMC exercise and the alternative CVA exercise to make a decision concerning which one best meets the skill levels of class members and the time available for instruction.

Performance Objectives for Delta Mine Cutthrough

Objective Number	Capability verbs	Description of required performance and conditions under which it is to occur
1. V/MG ²	Develop Generate	Mining, communication and ventilation procedures for cutting through from one section of a mine to another
2. V/MG	Anticipate Describe	Possible errors that could result in unsafe conditions when cutting through from one section of a mine to another
3. V/MG	Identify Correct	Errors in ventilation, communication, and mining procedures given maps and descriptions of section ventilation and mining procedures during a cutthrough from one section to another
4. V/MG	Infer Predict Determine	Likely changes in the ventilation of two mine sections when one section cuts through to another, given airflow readings for both sections before the cutthrough and maps of section ventilation arrangements
5. V/MG	Generate Describe	Methods and means to determine changes in airflow distribution after a cutthrough between two independently ventilated mine sections
6. V/MG	Select	Critical locations at which airflow and methane measurements must be monitored before, during, and after a cutthrough from one section to another, and after a cutthrough has inadvertently been left open
7. V/MG	Select Predict	Critical locations on a mine section at which a few airflow and methane measurements will maximize information about conditions on the section
8. V/MG	Infer Evaluate	Conditions on a mine section given airflow and methane measurements taken at key locations

² Skill and knowledge domain abbreviations:
 V = ventilation
 MG = mine gases

Instructor Discussion Notes for Delta Mine Cutthrough

Use these notes, your own ideas, and the comments and questions of class members to discuss the exercise after the small groups have finished working the problem. You may wish to give a copy of these notes to each group as they finish the exercise. This allows groups that finish early to continue working together while they check their answers against the notes. Later, when all small groups in the class have finished, the notes can be used as a point of reference for the whole class discussion.

Discussion after the miners have worked the exercise is important. Otherwise, errors will not be identified and corrected and many good ideas and opportunities for learning will be missed.

Section A

Question 1

The cutthrough should be curtained off immediately to maintain separate ventilation to 1 Left and 2 Left sections. This is required by law (30 CFR 75.319 and 75.322.) The reason for this procedure is to maintain proper airflow distribution to each working section. If the cutthrough is left open, the airflow distribution can change in both sections. In this gassy mine, methane could accumulate at points where airflow decreased and an explosion could result.

Question 2

Likely errors include failure to plan ahead before the cutthrough so that management, engineering, and all shift foremen, examiners and miners know when the cutthrough is to take place, from what direction, and what specific procedures are to be used to carry out the cut, to communicate between section crews, and to maintain separate ventilation to each section during and after the cutthrough. At the time of the cutthrough the most likely errors are failure to communicate between the two section crews and failure to communicate among the three shifts of workers on each of the two sections.

Question 3

If the two sections are kept separate during and immediately after the cutthrough by using properly placed, tight curtains, no changes should occur in the ventilation to the sections. However, it is still prudent to take air quantity and methane measurements after the cutthrough to make sure the ventilation is separate for each section and operating as intended. If the two sections are not kept separate, it is not possible to precisely predict how the ventilation to the two sections will change. If the cutthrough is left open, most of the air could flow along a newly created pathway. In such a case, airflow in other places on both sections could decrease by large amounts.

Question 4

The procedures can be determined from the likely problems noted in question 1 above. Advanced planning and good communication among management, engineering, mine examiners, section foremen, and all crews of miners across all three shifts on both sections is most important. In addition, specific procedures for the cutthrough should be worked out in detail and filed with MSHA ahead of time. All communication, mining, and ventilation procedures and arrangements should be fully detailed in this plan.

Section B

Question 5

No. The two line curtains are not connected. The E1 face of 2 Left section will not be ventilated. It is okay to separate the two sections by removing the curtain at point A and hanging curtains at points B and C, but there is a better way.

Question 6

Only one curtain is needed to separate the sections. It could be hung in the heading of E3 in the setup entries, about 10 feet from the intersection with E1 in 2 Left section. A line brattice in 2 Left would then be arranged to ventilate the area where the roof bolter is working in C39, and a second brattice arranged to ventilate the face of E1 in 2 Left. The one curtain across the heading of the E3 setup entry would leak less air between the sections than two curtains placed at positions B and C as shown in Figure 2.

Question 7

Look at Figure DN 2A at the end of these notes. This shows one way to properly ventilate the faces after the cutthrough. You may wish to show this figure to your class using an overhead projector. Can you think of a better ventilation arrangement?

Section C

Question 8

No. The E1 face in 2 Left section is not ventilated. The line brattice from the E3 setup entry should be extended around the corner and up to the face of E1 in 2 Left section.

Question 9

If it is properly placed, the one diagonal curtain shown in Figure 3 will keep the setup entries and the 2 Left section separate, just as they were before the cutthrough. Therefore, the airflow readings should be the same as those shown in Figure 1 (within the usual slight variations that occur because of imprecision in measurement and the normal variations in airflow in any mine).

Question 10

The readings might be slightly different. With two curtains there is twice as much area for leakage of airflow. However, even with two curtains that were fitted tightly and made from good material, the airflow readings would be essentially the same as those shown in Figure 1. But it is better to use only one curtain if possible.

Section D

Question 11

As can be seen from Figure 4, there is a dead air space in C39 where the miner is positioned. An improperly positioned curtain across E1 between C39 and C38 creates the dead air space. Methane is probably being liberated from the ribs. The dead air space allows it to accumulate.

Question 12

The most important place to take additional methane readings is toward and behind the wrongly placed curtain in E1 of 2 Left section. The wrongly placed curtain makes the area between it and the tailpiece a dead air space. This section of E1 has a long section of rib from the longwall panel. Much methane could accumulate in this area when there is poor ventilation. Many miners indicate they would take additional methane readings at the faces of E2 and E3, because this is what they usually do. While it is not wrong to do so, it would be wrong to make methane measurements at the faces and not along E1 toward the tailpiece. When the miner helper sees the wrongly placed curtain, he or she should immediately recognize the possible source of the methane, the reason for its accumulation, and the danger.

True or False - When the miner helper finds the wrongly placed curtain and the high level of methane, he or she should immediately tear the curtain down. Why?

False! The curtain should not be taken down immediately, particularly if there is a high level of methane present. A slug of methane would be swept into the face area of 2 Left section. It could produce an air-methane mixture in the explosive range at the face. Equipment at the face could ignite the mixture. You may also wish to ask the class members what should be done to restore the ventilation, who should do it, how, and why?

Question 13

Figure DN 4A at the end of these notes shows one proper ventilation arrangement for this situation. You might show this on an overhead projector and ask class members if there are other or better ventilation arrangements.

Section E

Question 14

No. The face of C40 of 2 Left section is not properly ventilated as the miner makes its cut.

Question 15

Figure DN 5A, included at the end of these notes, shows one proper ventilation arrangement. A second line brattice is hung to ventilate the face as the miner makes the cutthrough in C40. You may wish to show this figure on an overhead projector and discuss alternative ventilation arrangements.

Section F

Question 16

You should not agree with him. He is wrong. The mine examiner is required by 30 CFR 75.303-1 to make air velocity and quantity readings to make sure each section and split have the correct amount and velocity of air traveling in its proper course. After finding the open cutthrough, the examiner should have taken airflow and methane readings in both the intakes and returns of both the setup entries and the 2 Left section. However, he measured the airflow only in the returns. Because these values were similar to those before the cutthrough (see Figure 1) he assumed the ventilation was adequate. Yet, with the cutthrough left open, the flow distribution can change. For example, the flow in the 1 Left intake air entry can increase by a large amount and the flow in the 2 Left intake air entry decrease by a large amount, while the air quantity in the returns for both sections stays approximately the same as before the cutthrough. This is what happened in the actual case upon which this exercise is based. The decrease in quantity of airflow in the 2 Left intake air entry caused methane liberated from the rib of the longwall panel to accumulate.

The examiner is also wrong in assuming that it was okay for the earlier crew to leave the cutthrough open. The 30 CFR 75.322 specifies that no changes in ventilation should occur which materially affect the main air currents or any split of air when the mine is active. The crew completing the cutthrough should have placed check curtains to maintain separate ventilation to the sections as required by 30 CFR 75.319.

Question 17

The foreman should not immediately put up a curtain to separate the two sections. He doesn't know for sure how long the cutthrough has been open. If he puts up the curtain right away, he would be making a major change to the ventilation. Because of a reduced airflow in the 2 Left entries when the cutthrough was left open, methane might have accumulated along E1 and E2 in 2 Left section. If the curtain were put up, the proper quantity of airflow would rapidly be restored to the 2 Left intake air entries. This could cause an explosive concentration of methane to move into the face area of 2 Left section. It could also lower a

high methane concentration near the belt tailpiece until the gas-air mixture was in the explosive range. Equipment at the face or at the belt tailpiece could ignite the methane-air mixture. This is why the foreman must proceed very carefully. The foreman should make airflow, quantity, and methane measurements in both the intakes and the returns on both sections. He should also recognize and alert the other miners to the possible danger and report his findings to the surface.

For these reasons, at this time no changes should be made to the ventilation arrangements. A correct drawing on the answer sheet for question 17 should have the same ventilation arrangement as those shown in Figure 6. At this time, the setup entries and the 2 Left section should not be separated by a curtain.

Section G

Question 18

He should be worried and immediately take methane and airflow measurements in the 2 Left section face and the setup entries in both the intakes and the returns. Only a few airflow and methane readings are needed to figure out what has happened on the section and what needs to be done. The foreman should have acted as if the cutthrough had been open for a long time, even if he did not find someone to ask. At this point, when he learns the cutthrough has been open for nine hours, he should immediately realize his hanging the curtain may have made the situation more dangerous. However, he should not remove the curtain. Rather, he should take additional airflow and methane readings. If he finds methane levels are high, he should immediately order all miners to leave and knock the power to both 2 Left section and the setup entries. Then he should leave and report the situation to the surface.

Section H

Question 19

Yes, additional methane readings should have been taken. The reasons are given in the notes for questions 16 through 18.

Question 20

He should have taken methane readings before puffing up the curtain separating the two sections. However, once he made the mistake of immediately putting up the curtain in C40, he should also have taken additional methane readings. One reading each in the setup entry intake and return air courses where these connect to 2 Left E1 would have been sufficient for the setup entry section side. One or two readings in E2 of 2 Left section at C40 or C39 would have been sufficient. These methane measurements would quickly tell the foreman if dangerous levels of methane had accumulated and were now being moved about because of restoring the airflow of both sections to their original courses and volume before the cutthrough. Figure DN 8 at the end of this section shows one set of positions for

these additional methane measurements. Can you think of better positions to make the measurements?

Question 21

Yes, he should have made additional airflow measurements. The notes for question 16 explain where and why these additional measurements should have been taken.

Question 22

The examiner should have taken two additional airflow measurements, one each in the intake air courses for both the setup entries and for 2 Left section. The correctly marked map for question 22 should have Xs at these two additional points. The intersection of setup entry E1 and 2 Left section E1 is a good position to make the intake airflow measurement for the setup entries. A single airflow reading in the 2 Left intake air course at either E2 or E1 at C39 would have been sufficient. Together, these two additional readings in the intakes, plus the ones the examiner did make in the returns, would have informed him of any major changes in ventilation to the two sections.

Section I

Question 23

The main violations are discussed in the notes for question 16. The ventilation to both sections should have been kept separate before, during, and following the cutthrough as required by 30 CFR 75.319. Leaving the cutthrough open made major changes to the ventilation of the two sections while they were in operation, a violation of 30 CFR 75.322. The preshift examiner and the foreman were in violation of 30 CFR 75.303-1 because they failed to make a complete examination and take enough methane and airflow readings to make sure that the airflow to both sections was adequate. The foreman's quickly separating the sections by hanging a curtain after the cutthrough had been left open for nine hours, was also a violation of 30 CFR 75.322. His action made a major change in the ventilation to the sections while miners were on the section. His action made a bad situation worse and it could have caused an explosion and loss of life. Mine management may not have prepared a plan to carry out the cutthrough. The plan may not have been filed with MSHA. If there was a plan, it was not adequately communicated to the mine foreman, examiners, and miners.

Question 24

The major poor practices involve planning and carrying out proper mining and communication procedures. Procedures that should be established before a cutthrough include:

- a) Management and engineering staff should anticipate the cutthrough long before the actual work is to be done. Specific procedures for making the cutthrough should be written down and communicated to the section foreman, the maintenance foreman, all mine examiners, and the miners on all shifts on both sections before the cutthrough is to take place.
- b) The cutthrough plans, including the mining and communication procedures to be followed, need to be presented to state and federal inspectors prior to the actual cutthrough.
- c) At the time of the cutthrough, accurate surveys should be available to indicate the exact points and probable times for the connection.
- d) The foremen of the section crews on the sections at the time of the cutthrough should talk with one another and with the general mine foreman prior to the shift for which the cutthrough is planned. It should be agreed which crew will cutthrough to which section, at what location and time.
- e) All miners on both sections should be briefed on when and where the cutthrough is to take place and what ventilation and other procedures are to be followed before, during, and after the cutthrough, e.g., location of equipment and miners, specific ventilation arrangements on both sections, changes in mining operations and sequence, if any, etc.

Question 25

Be sure to include your suggestions for how to improve this exercise. Your ideas and those of others will be used to revise the exercise.

Additional Note

This exercise is based upon two actual mine disasters. Both occurred when two sections were connected and the connection left open for some time. In both cases a decrease in airflow on one section allowed the accumulation of methane. In both cases an explosion resulted in the loss of lives. Key sources for the exercise including the two mine disaster reports are found in the references at the end of this section.

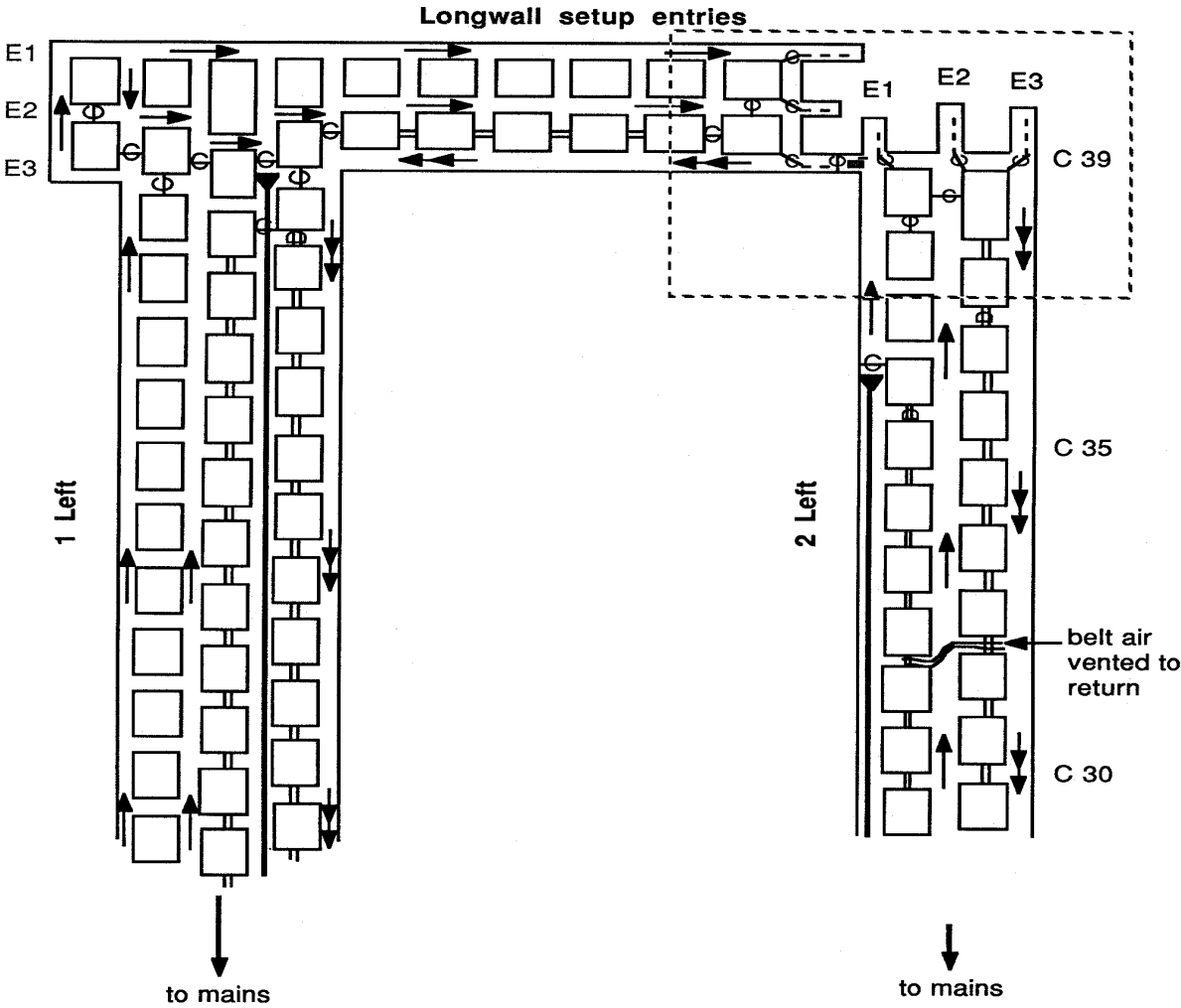


Figure DN 2A: A proper ventilation arrangement for Question 7

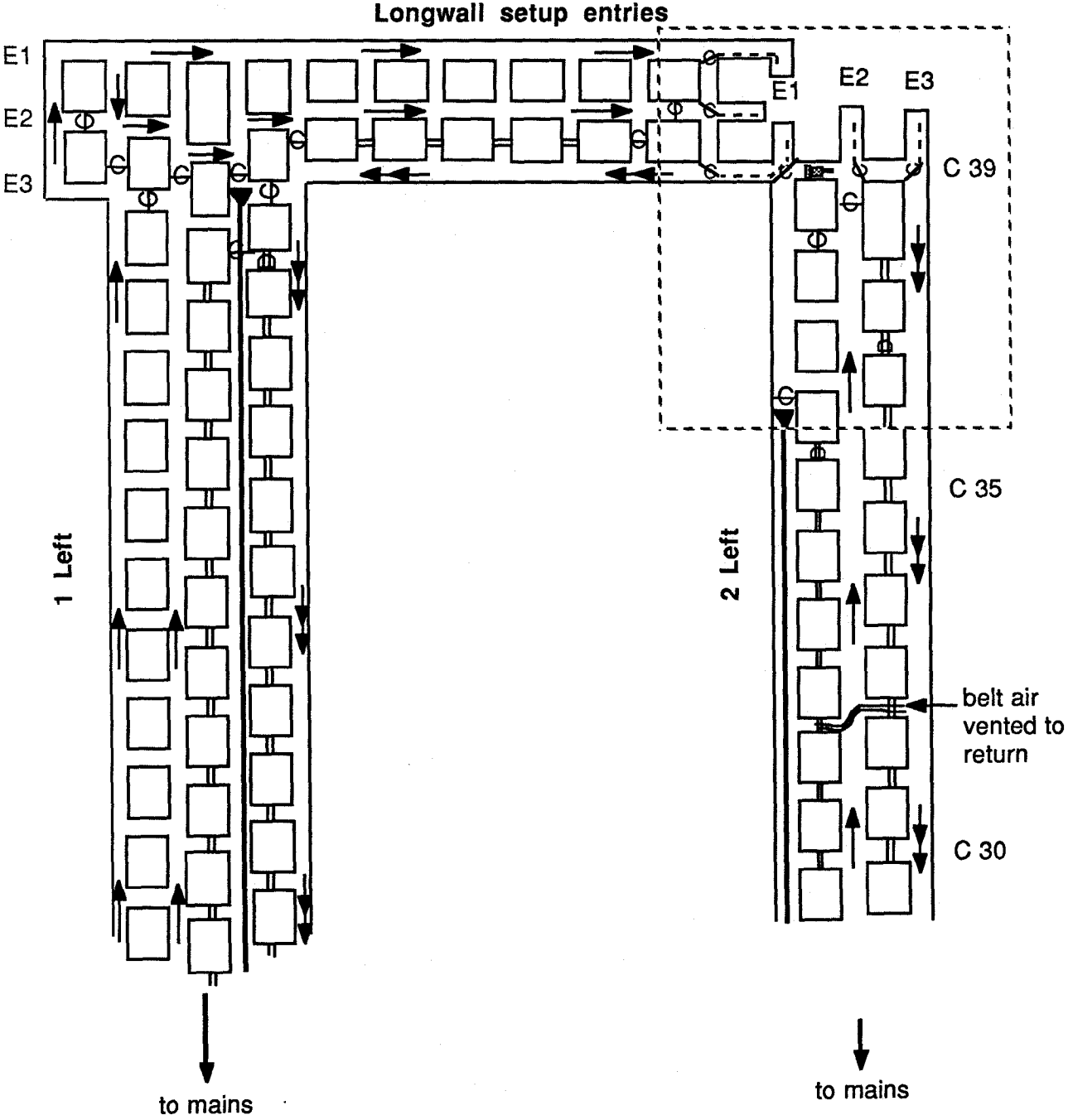


Figure DN 4A: Proper ventilation changes for Question 13

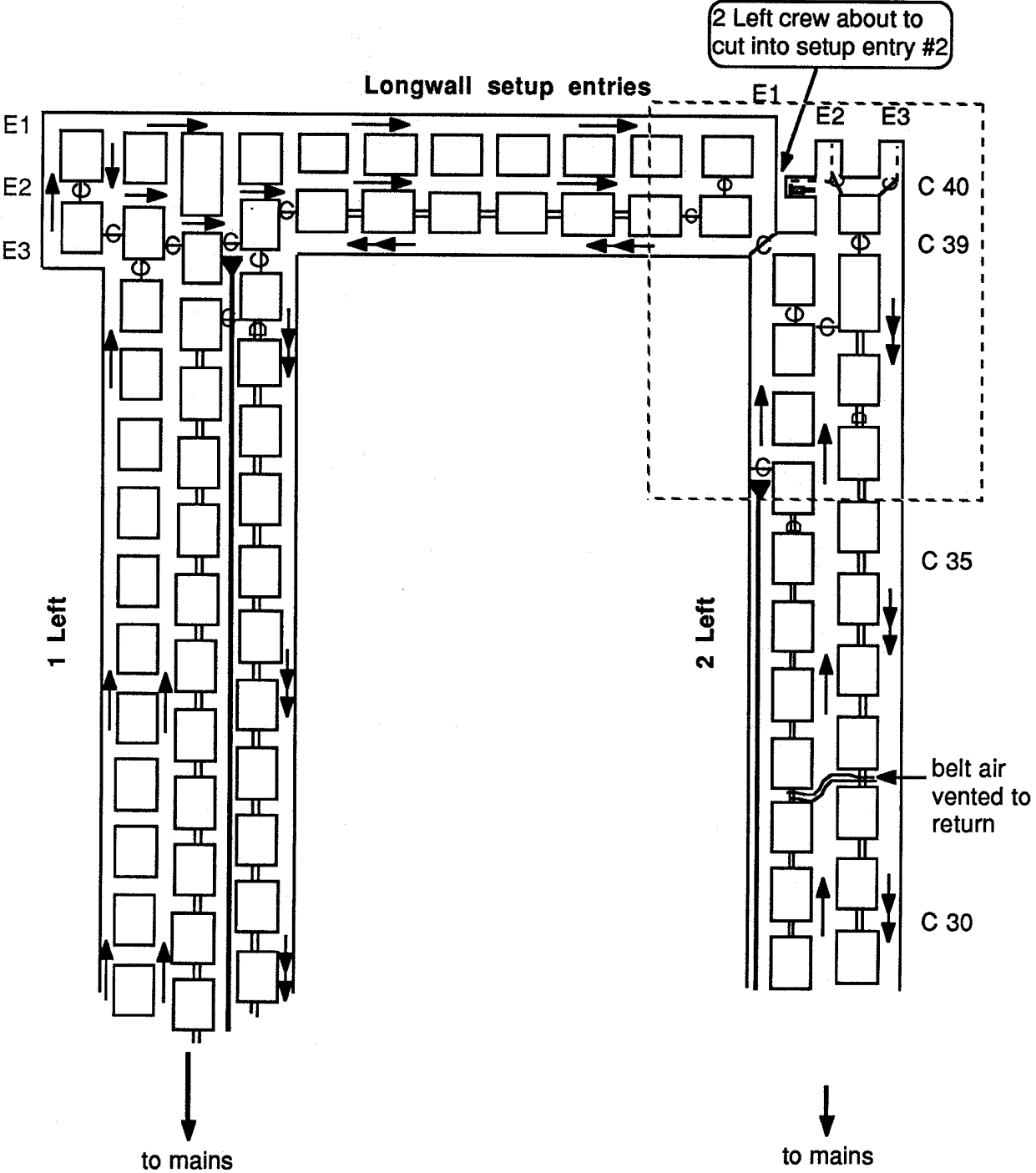


Figure DN 5A: Proper ventilation arrangement for Question 15

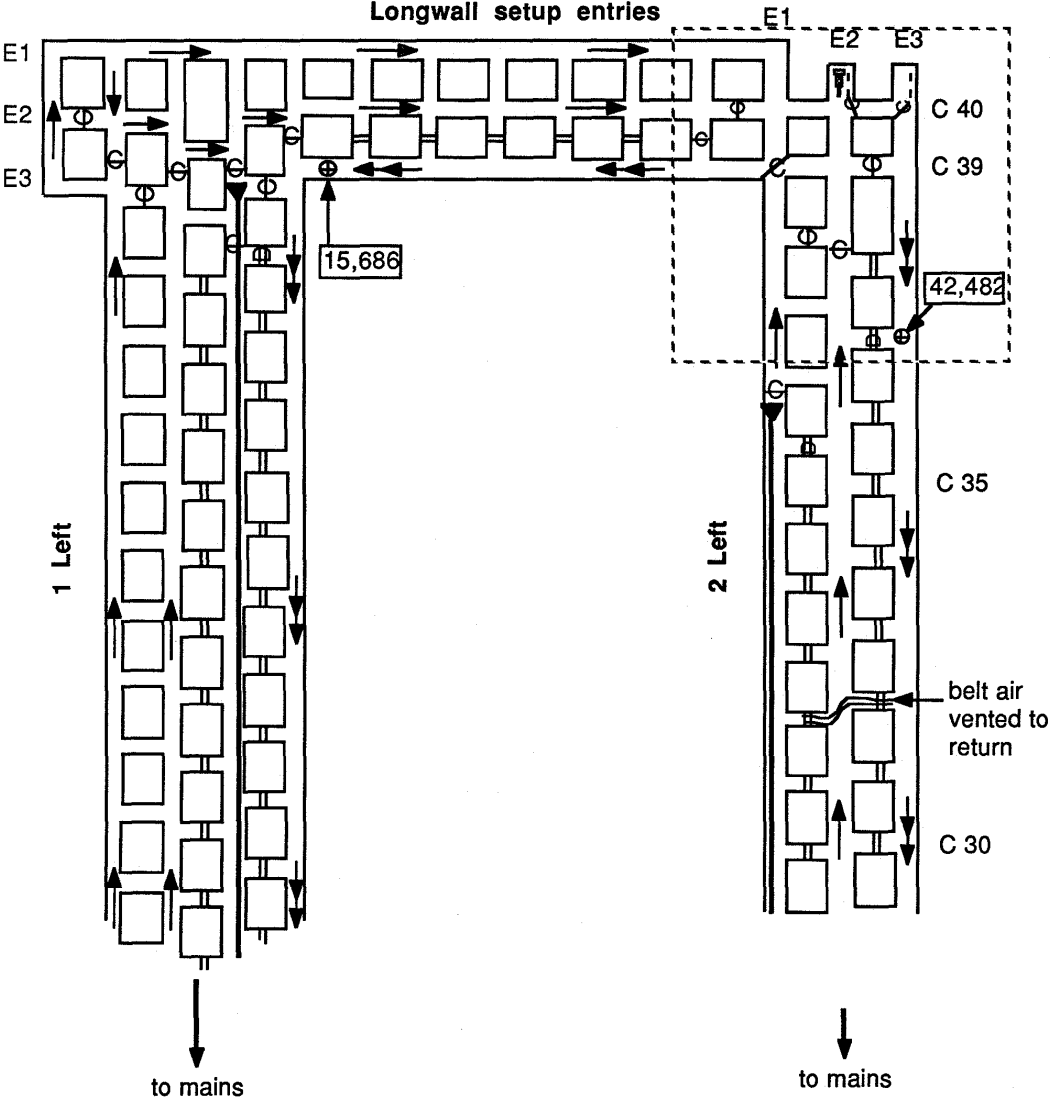


Figure DN 6A: A proper ventilation arrangement for Question 17

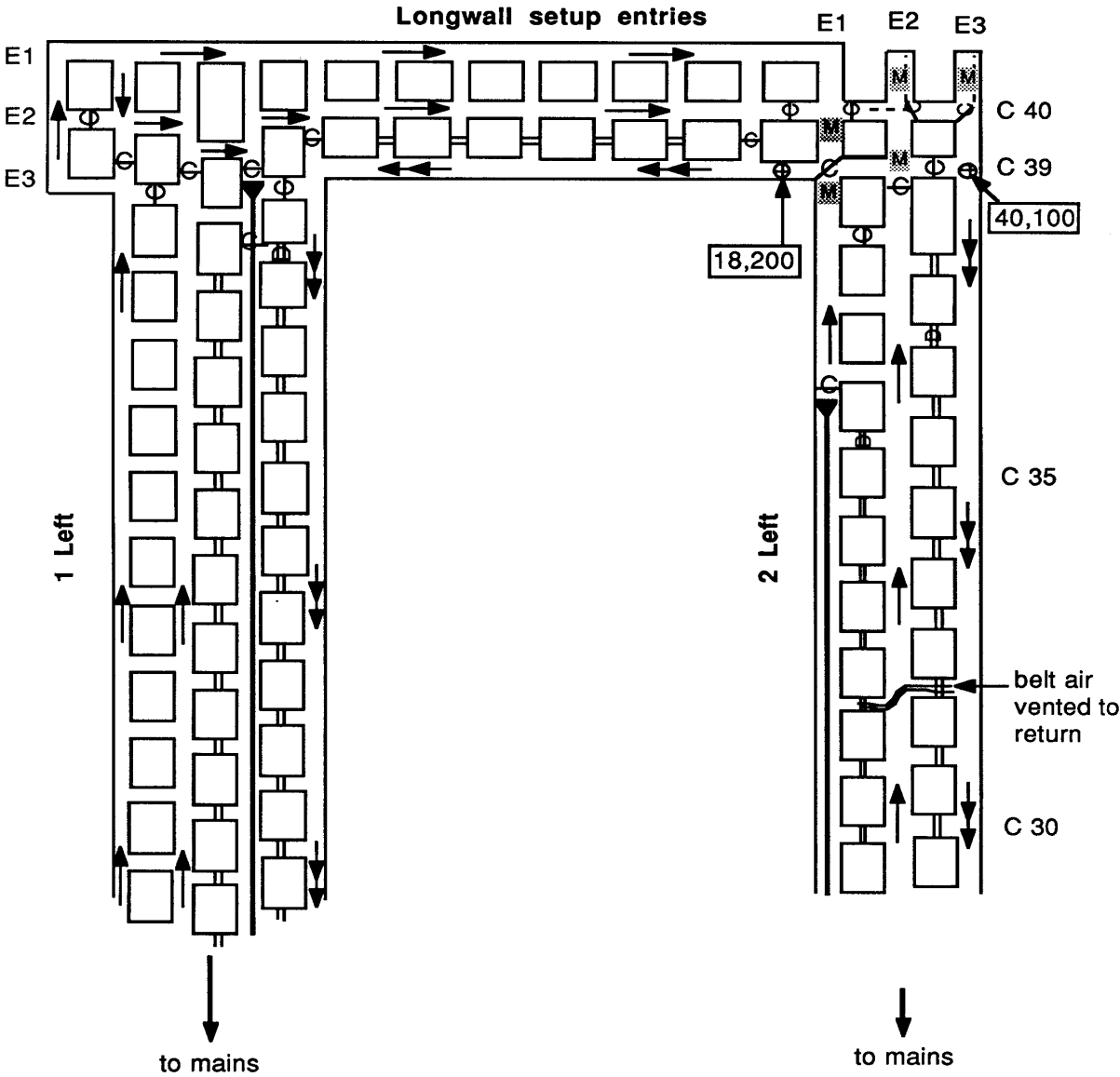


Figure DN 8: Places where additional methane readings should have been taken for Question 20 (Dark Ms are the best locations)

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- Other references consulted in the construction of this exercise include:
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- Kumar, S. (1985). Mine gases. In F. Cameron (Ed.), The Kentucky underground coal mine guidebook (pp. 119-129). Lexington, KY: The Kentucky Mining Institute.
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- Stephens, J. (1985). Explosions, fires, mine rescue, and mine apparatus and instruments. In F. Cameron (Ed.), The Kentucky underground coal mine guidebook (pp. 130-149). Lexington, KY: The Kentucky Mining institute.
- Wala, A. (1985). Mine ventilation. In F. Cameron (Ed.). The Kentucky underground coal mine guidebook (pp. 100-118). Lexington, KY: The Kentucky Mining Institute.

Appendix A: Problem Booklet

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

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

Delta Mine Cutthrough

Problem Booklet

Instructions

This exercise concerns cutting through from one section of a mine to another and the problems that can occur in ventilation. The exercise has several sections. Each section describes situations and events as the cutthrough progresses. A series of maps show how the mining advances and the ventilation arrangements change. In each section there are a few questions. The questions ask you to make judgments and decisions about mining and ventilation procedures as the cutthrough takes place. Just as in real life, the problem unfolds over the time span of several days. When you work the problem, do so a page at a time. Answer all the questions on a page before going on to the next section. The reason for this is that in real life situations one cannot jump ahead to see the future. But one can look back. So do look back to previous parts of the exercise once you have completed them, but don't jump ahead.

You will work the exercise with a small group of persons. Each of you will have your own problem booklet. As you work through the exercise, talk about each section and the questions. Try to come up with the best answers possible by working together.

Have one person in your group write your answers down on one copy of the answer sheet. Following the exercise the instructor will discuss your answers.

Now turn the page and begin the exercise.

Background

Large, gassy mine in 84 inch coal

1,000 hp electric motor operates a Jeffery Aerodyne fan exhausting 690,000 cfm

Total methane liberation at the fan ranges from 2.6 to 3.2 million cubic feet per day

Mining method - block system with generally staggered pillars from 80 to 100 feet on center with 20 foot entries

Mining technique - continuous mining machines with shuttle cars and conveyor belts working to develop a longwall section

Problem

Four crews working two shifts are driving 1 Left and 2 Left 4,800 feet southwest from the Cranesnest mains to develop a retreating longwall section as shown in Figure 1. First Left has four entries with a single air split. Second Left has three entries with a single air split. The ventilation systems for both sections are separate from one another, but both begin and end in the Cranesnest Mains. Three longwall setup entries are being driven from 1 Left section to 2 Left section to form the retreating longwall face. These are ventilated from 1 Left section. The 1 Left section day shift is about to cut through from the longwall setup #3 entry to 2 Left #1 entry, as shown in Figure 1. Assume you are the mine foreman. It is your job to determine what ventilation procedures are necessary to proceed safely.

Study the map on page 3. Then turn to page 4 and begin.

Longwall setup entries

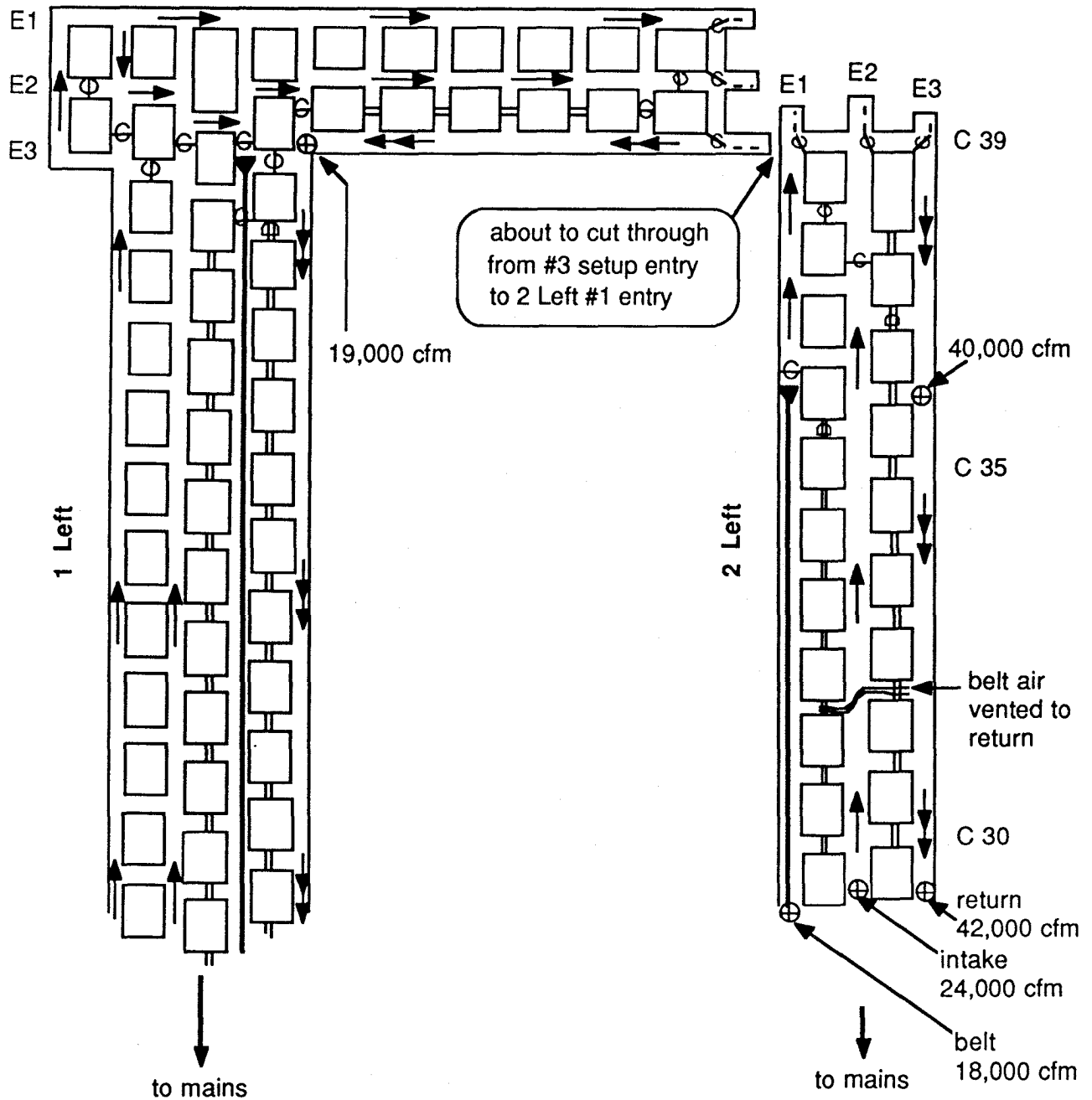


Figure 1: Mine ventilation before cutthrough from setup #3 entry to 2 left section

Section A

The 1 Left section crew is about to cut through from the longwall setup entry #3 to 2 Left section #1 entry, as shown in Figure 1.

Questions

1. When cutting through, what should the 1 Left section crew do to maintain proper ventilation? Why?
2. What are some errors that the section crews could make in this situation?
3. When the cutthrough is completed, what changes, if any, may be expected in the ventilation?
4. What procedures would you recommend in this situation to make sure the work proceeds safely?

Turn to Section B when you have answered these questions.

Section B

The cutthrough from longwall setup entry #3 to 2 Left section #1 entry is completed as shown in Figure 2 on the next page. The 1 Left section roof bolter is now bolting the top in the cutthrough. The 2 Left section foreman tells the brattice man to take down the curtain at point A and to hang curtains at points B and C.

Questions

5. Is the foreman's idea for ventilating the faces a good one? Why or why not?
6. What would you order to be done in this situation? Why?
7. Sketch how you would ventilate the faces on the map in Figure 2A. Mark the section of the map in the doffed line box. (Write only on the answer sheet.)

Turn to Section C when you have answered these questions.

Longwall setup entries

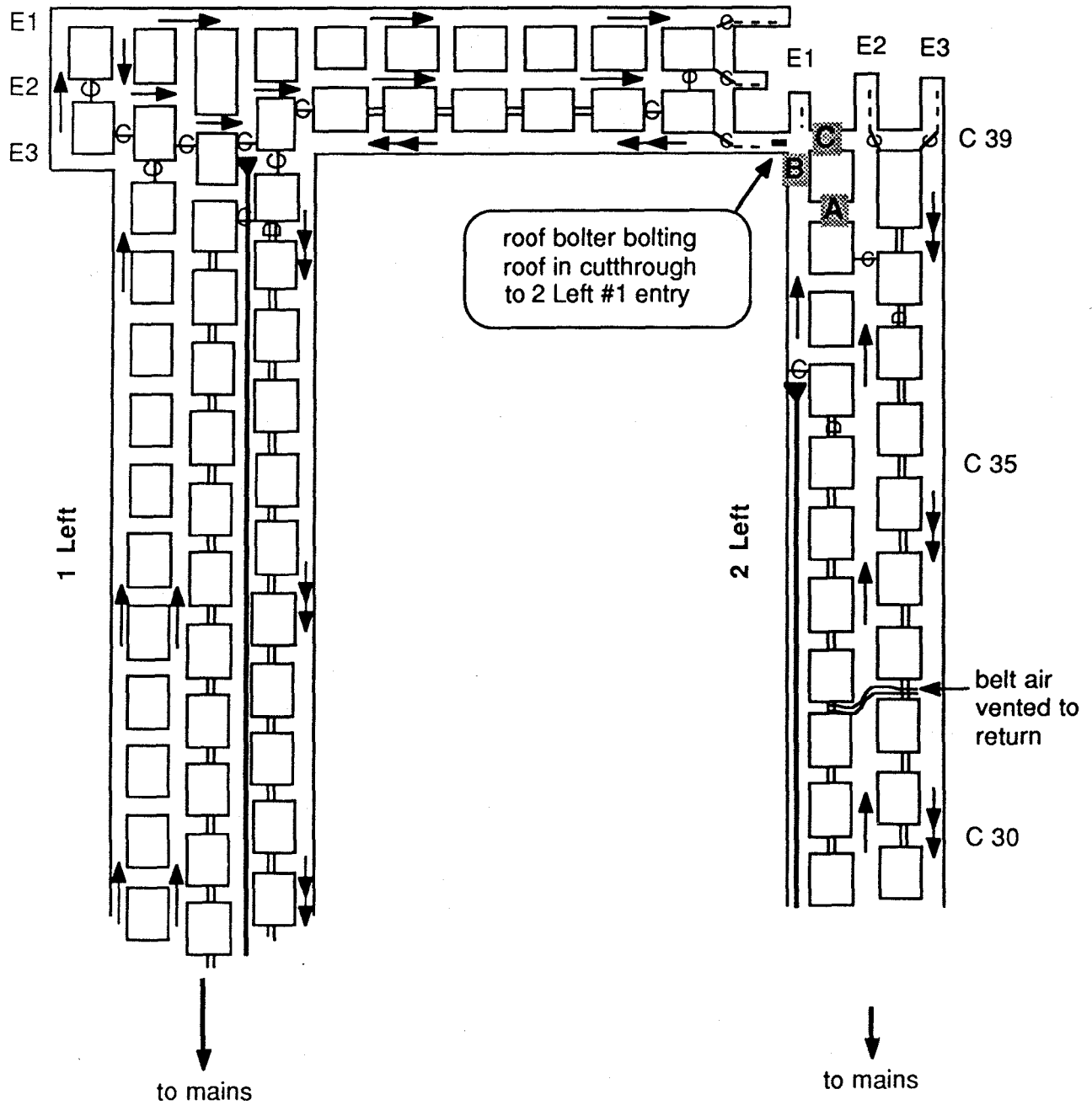


Figure 2: Mine ventilation immediately after cutthrough with curtains at B and C, but not A

Longwall setup entries

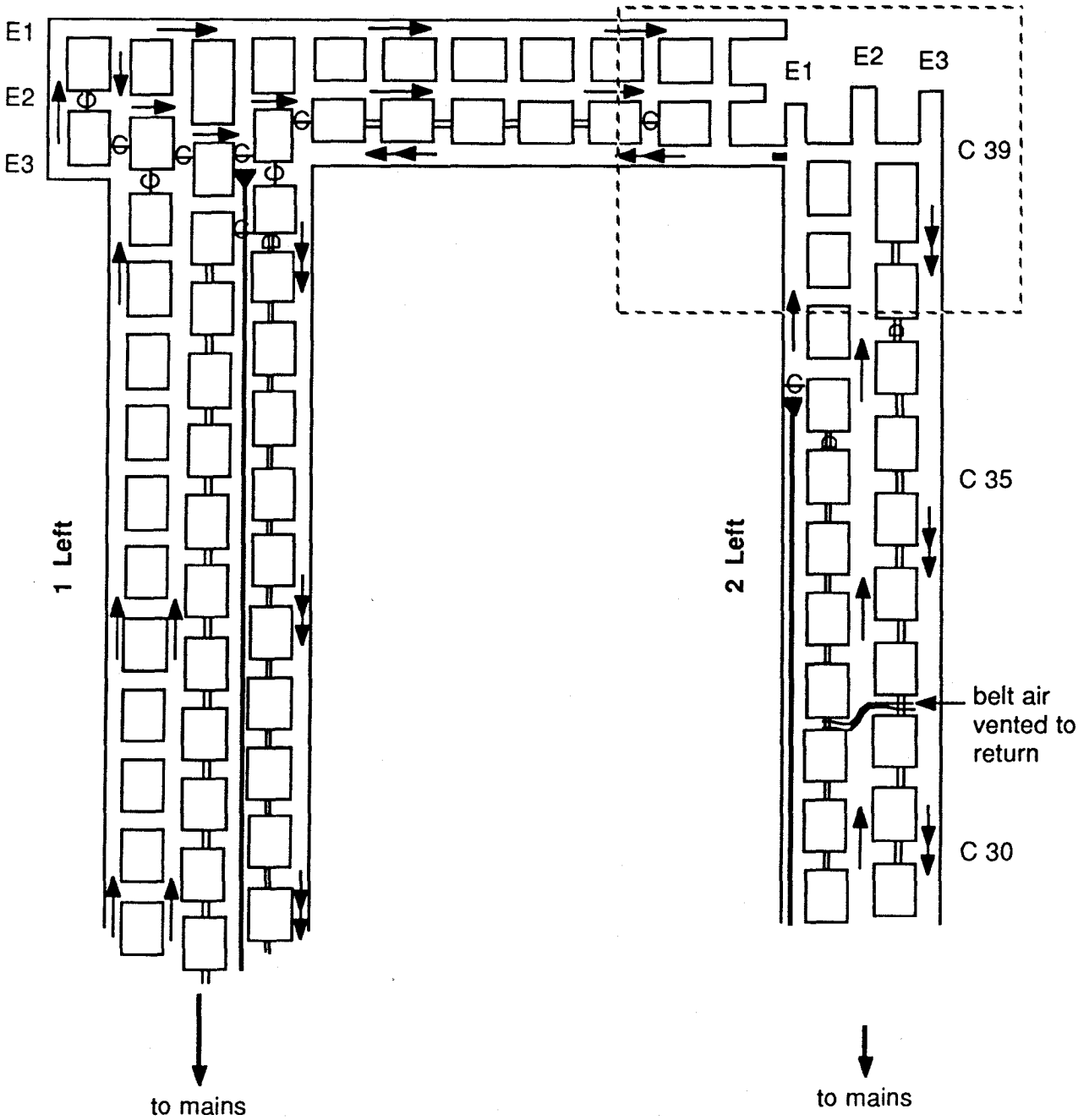


Figure 2A: Sketch your ventilation arrangement for this situation

Section C

The top in the cutthrough has now been bolted. One curtain is placed diagonally across crosscut #39 at 2 Left entry #1 as shown in Figure 3. The curtains shown at positions B and C in Figure 2 are removed. The shift ends. The preshift examiner for the second shift makes air quantity readings at the same locations where earlier readings were made, as shown in Figure 1. Assume the curtain at crosscut #39 is tight and there is minimal leakage.

Questions

8. Is the present ventilation arrangement adequate? Why or why not?
9. In the boxes on the map in Figure 3, write in the approximate air quantity readings the preshift examiner should find. (Write only on the answer sheet.)
10. Look back at Figure 2. Suppose two curtains were placed, one at position B and one at position C. Also suppose that the diagonal curtain at the intersection of crosscut #39 and entry #1 in Figure 3 was taken down. Would the air quantity values you just wrote in the boxes on Figure 3 be different now? Explain.

Turn to Section D when you have answered these questions.

Longwall setup entries

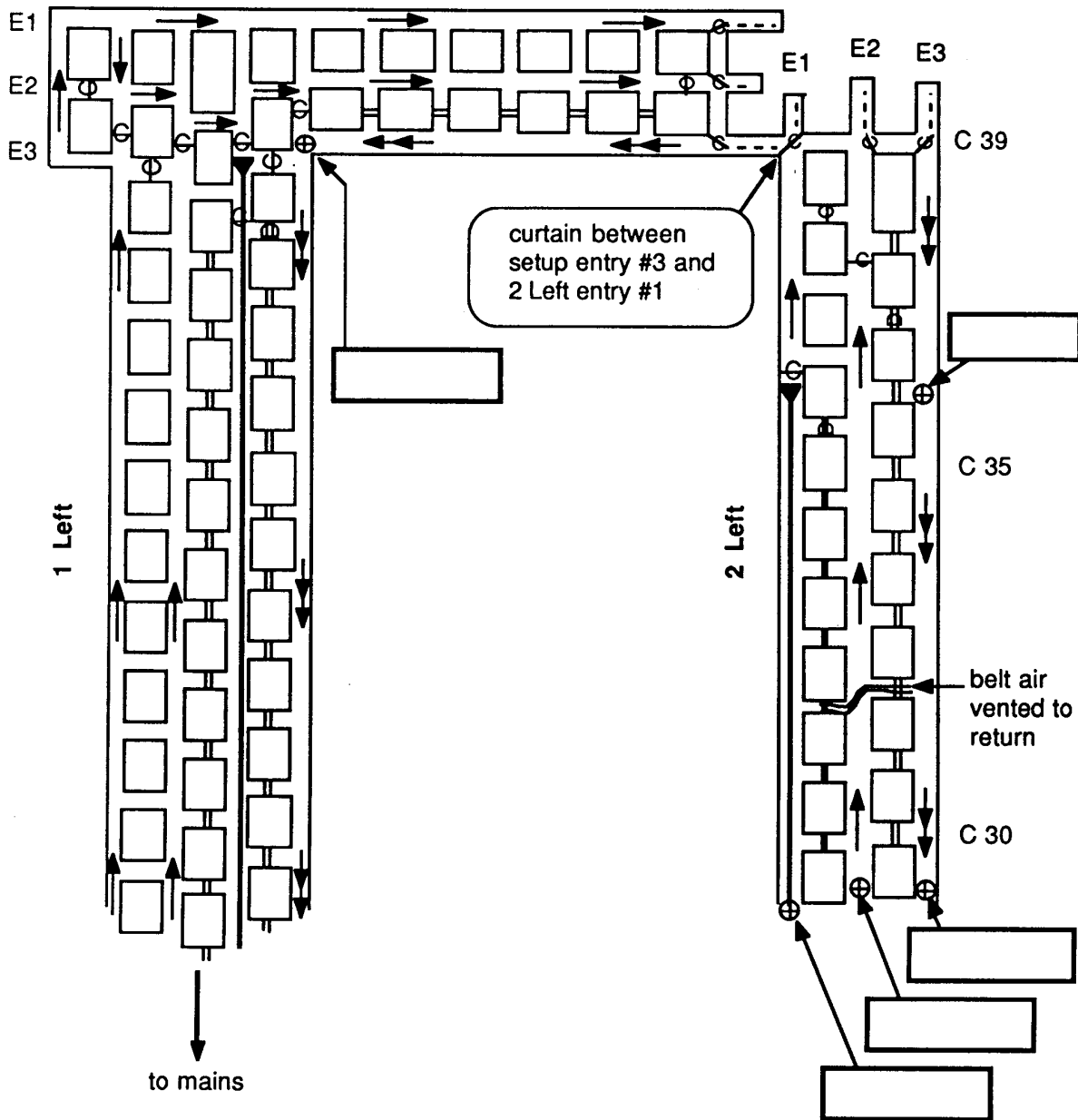


Figure 3: Curtain arrangement and ventilation after bolting cutthrough

Section D

It is now the next shift. The continuous mining machine helper energizes the miner which was left in crosscut #39 between #1 and #2 entries in 2 Left as shown in Figure 4. The methane monitor warning light comes on immediately and the miner won't start. The helper begins checking with a methane spotter. He finds the methane values at the locations shown in Figure 4.

Questions

11. What is the reason for these high methane values?
12. Mark **Xs** on the map in Figure 4 to show other places the miner helper should take methane readings. (Write only on the answer sheet.)
13. What changes would you make in the ventilation of the section? Mark your ventilation changes on the map in Figure 4A. Mark only the section within the dotted line box. (Write only on the answer sheet.)

Turn to Section E when you have answered these questions.

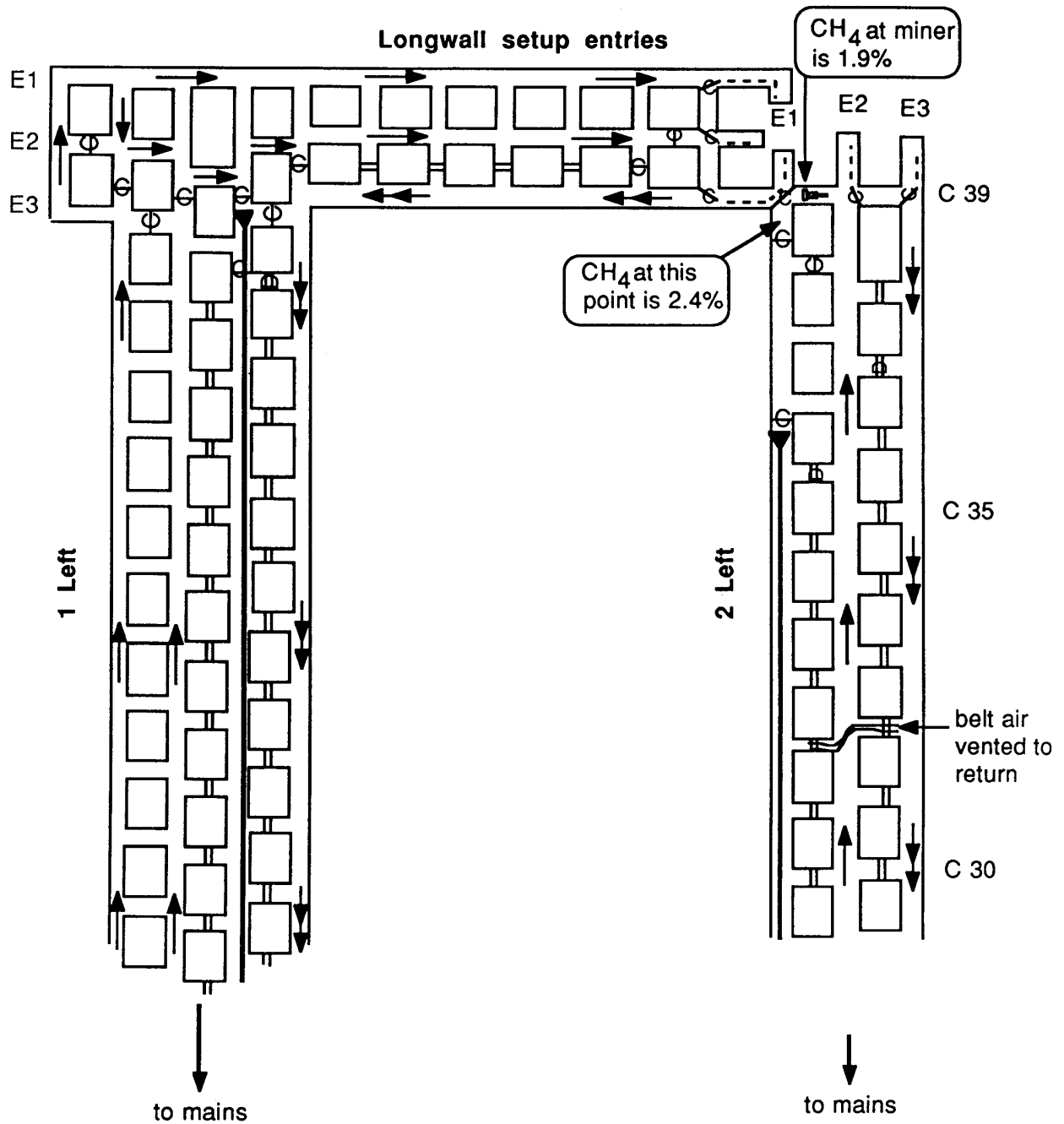


Figure 4: Methane in the face area of 2 Left section is noted

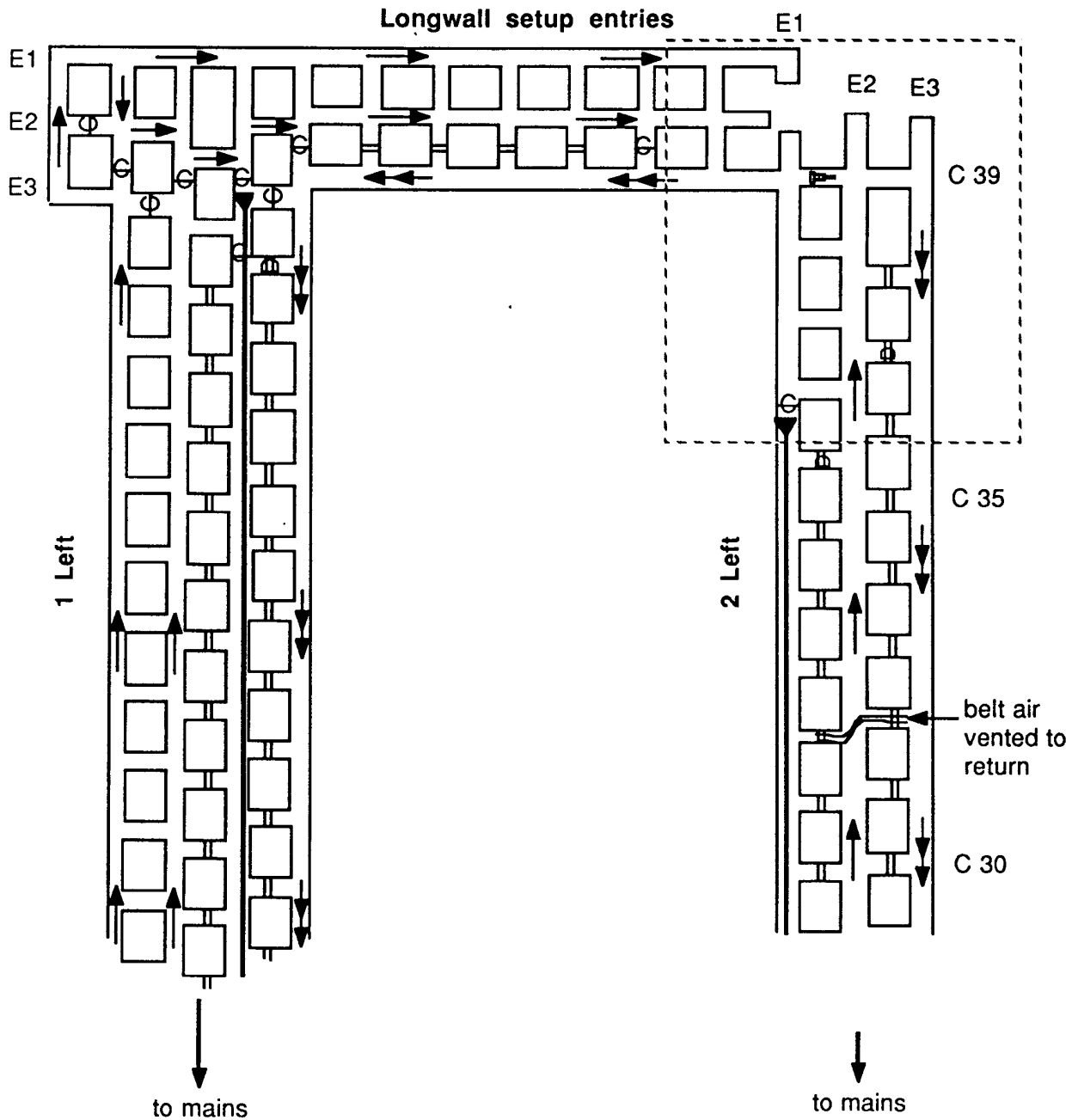


Figure 4A: Sketch a good ventilation arrangement within the dotted line box

Section E

It is now a few days later. The 1 Left section crew has advanced the longwall setup entries #1 and #2 into the heading for 2 Left, #1 entry. The second shift 2 Left crew is about to cut through to the longwall setup #2 entry at crosscut #40 as shown in Figure 5.

Questions

14. Is the section ventilation at the faces of 2 Left and the longwall setup entries all right? Explain.
15. Show the ventilation arrangements you would use, by marking them directly on the map in Figure 5A. Mark the part of the map within the dotted line box. (Write only on the answer sheet.)

Turn to Section F when you have answered these questions.

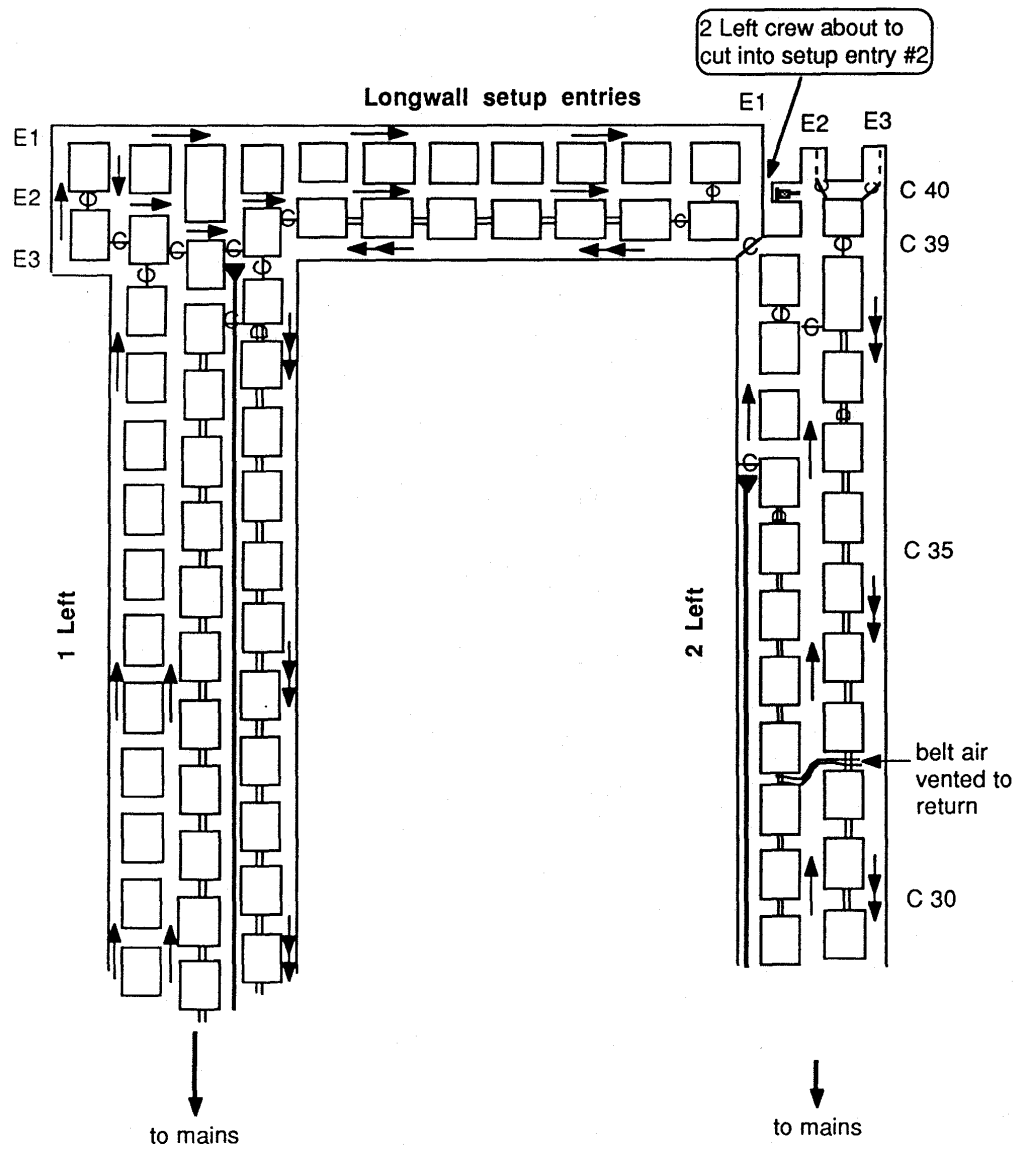


Figure 5: 2 Left crew gets ready to cut into #2 setup entry at crosscut 40

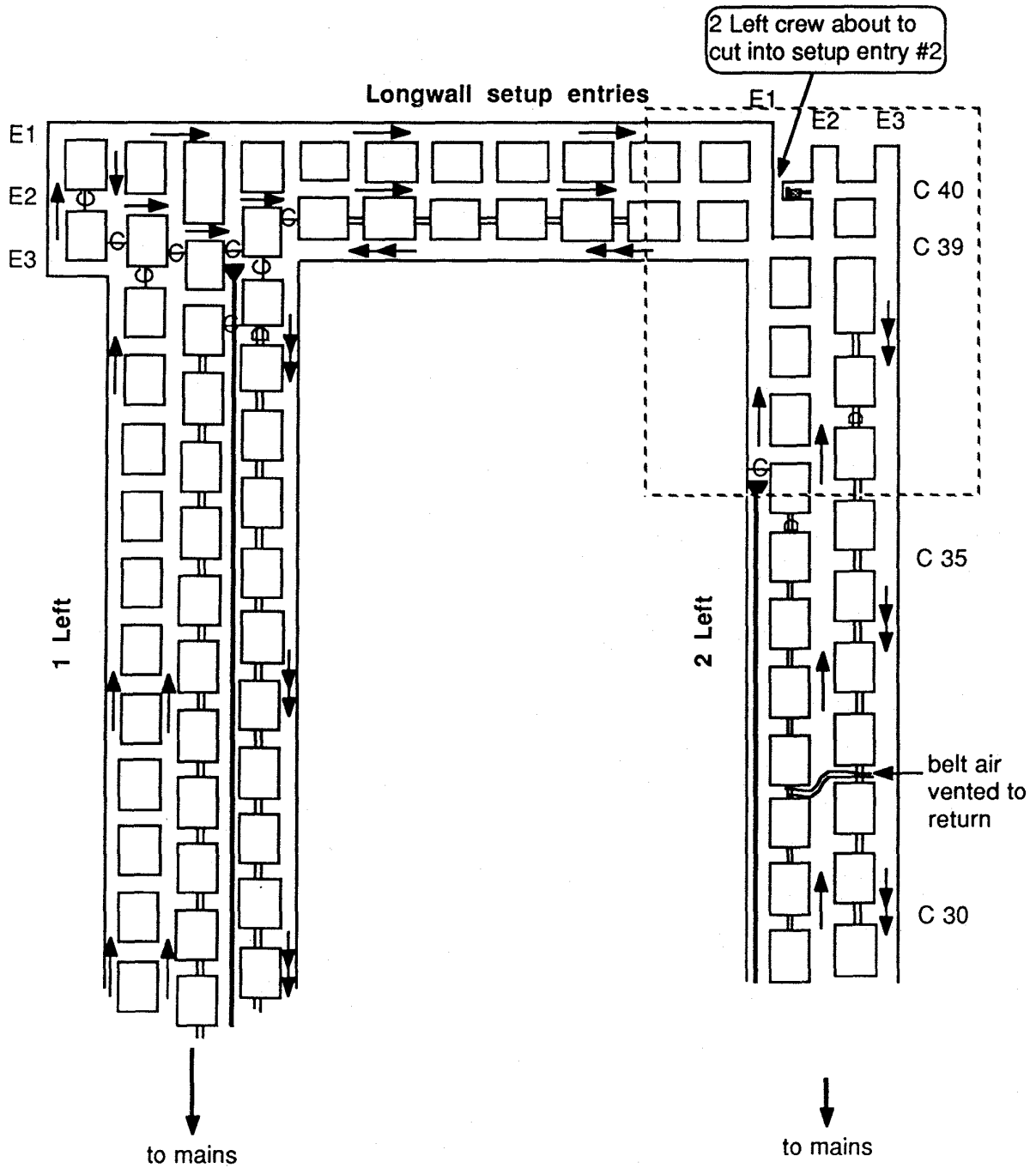


Figure 5A: Sketch a good ventilation arrangement (within the dotted line box)

Section F

The second shift 2 Left crew completes the cutthrough to longwall setup entry #2. The section crews leave crosscut #40 open as shown in Figure 6. Early the next morning the day shift preshift examiner takes the air quantity readings shown in Figure 6. He compares these readings to those he made a few days earlier. (The earlier readings are shown in Figure 1.) After comparing the two sets of readings the examiner assumes the ventilation is O. K.

Questions

16. Do you agree with him? Explain.
17. Suppose you are the day shift #2 Left section foreman. When you come on the section you find the connection between your section and the setup entries open as shown in Figure 6. What would you do? Why? Would you make any ventilation changes to the section right now? If so, mark the changes you would make directly on the map in Figure 6A. Mark within the dotted line box. (Write only on the answer sheet.)

Turn to Section G when you have answered these questions.

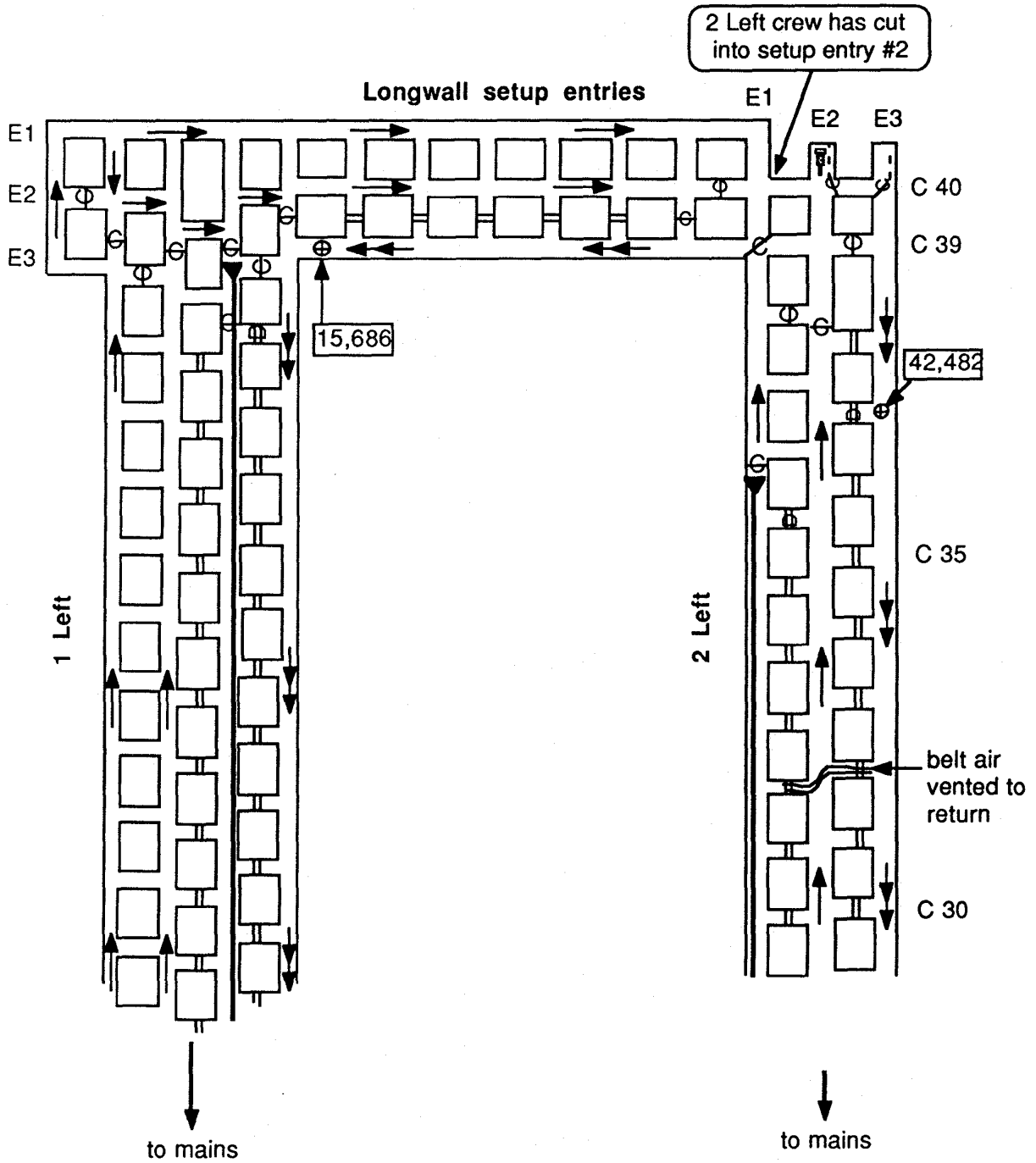


Figure 6: 2 Left crew completes cut into #2 setup entry at crosscut 40

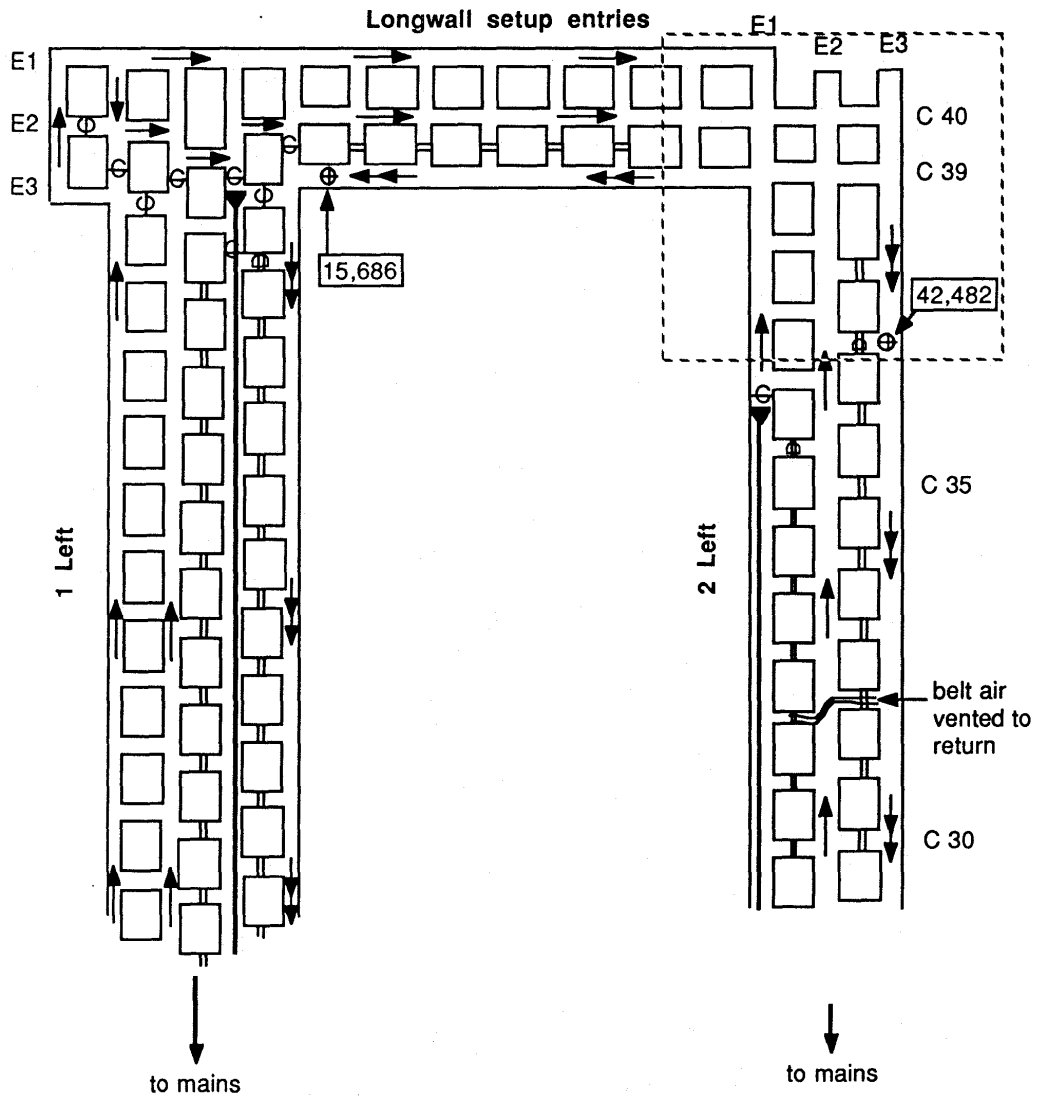


Figure 6A: Sketch your ventilation arrangement within the dotted line box

Section G

The day shift section foreman makes the ventilation arrangements shown in Figure 7. He then takes the air quantity readings at the locations shown in the boxes. When he talks to a mine mechanic, he learns that the connection between #2 Left and the longwall setup #2 entry has been open for nearly 9 hours.

Question

18. What should the day shift #2 Left foreman do now? Why?

Turn to Section H when you have answered the question.

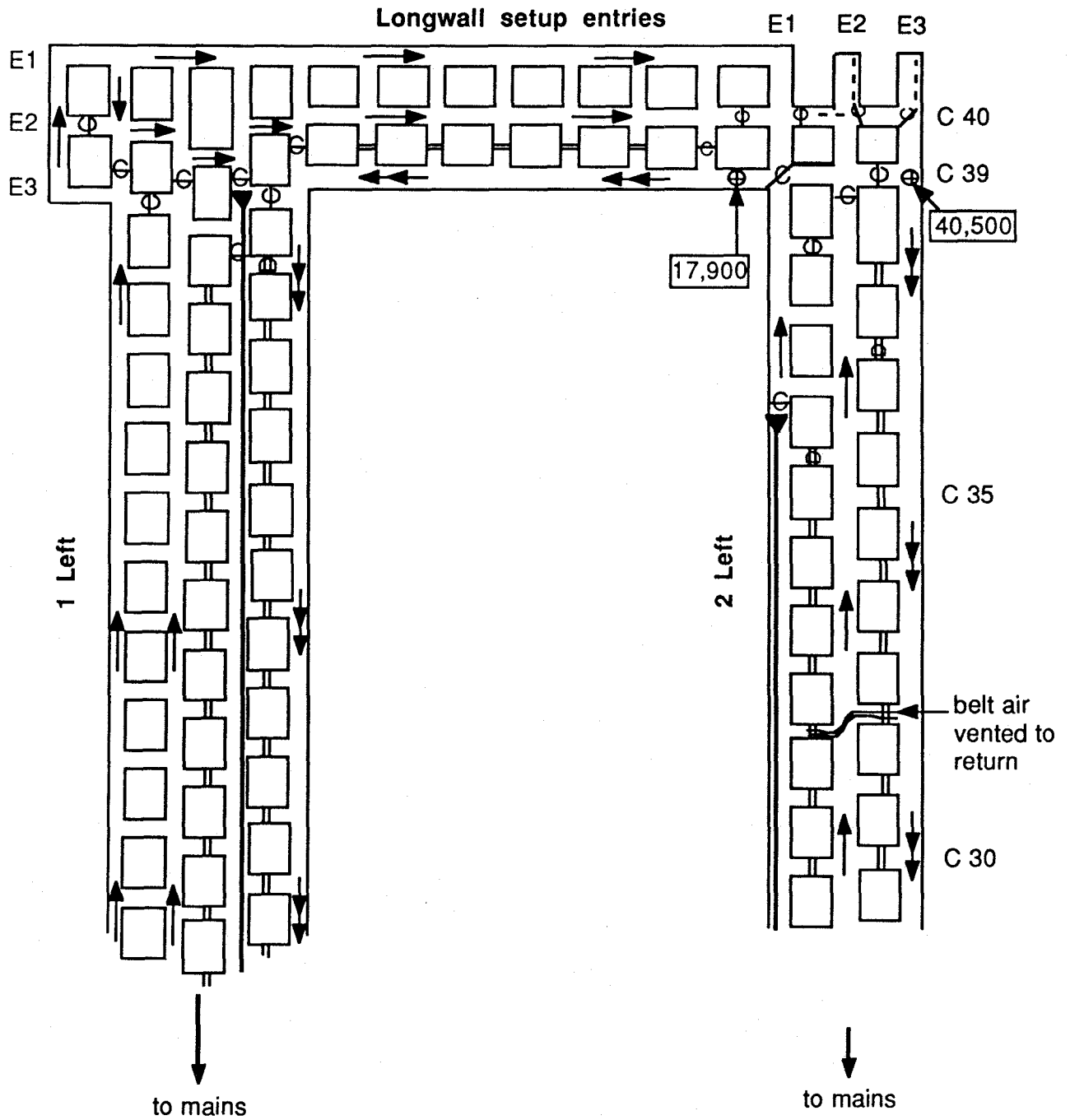


Figure 7: Day shift foreman's ventilation arrangement and air quantity readings

Section H

When the day shift 2 Left section foreman first came on the section he made methane checks at the faces of entries #1, #2, and #3. He found no appreciable methane. Then he found the cutthrough at crosscut #40 open and immediately ordered it curtained off as shown Figures 7 and 8. Then he learned that the cutthrough had been open for nearly 9 hours. After the curtain was up he again made air flow measurements shown at the locations indicated on Figure 8.

Questions

19. After he learned the cutthrough had been open for about 9 hours, should the foreman have taken additional methane readings? Why or why not?
20. If you think the foreman should have made additional methane checks, use an **M** to mark each location. Write your **M**s directly on the map in Figure 8. (Write only on the answer sheet.)
21. Look back at Figure 6. After the cutthrough at crosscut #40 was made by the second shift, the preshift examiner for the day shift took the air flow measurements at the locations shown in Figure 6. Should the examiner have made additional air flow measurements? Why or why not?
22. If you think the examiner should have made additional air flow measurements, mark the locations on the map in Figure 8 using **X**s. (Write only on the answer sheet.)

Turn to Section I when you have answered these questions

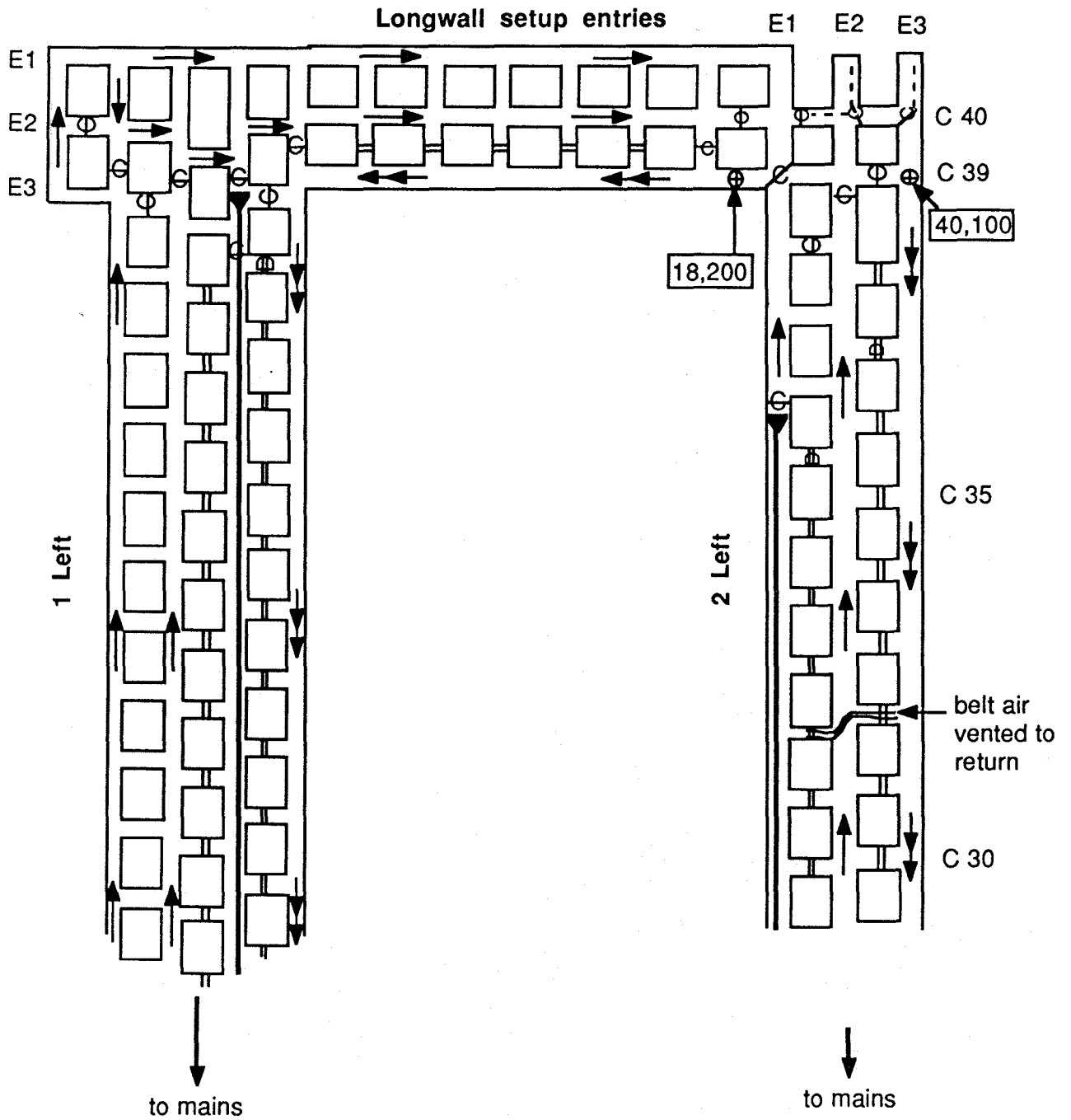


Figure 8: Mark locations of additional methane readings with **M**s and locations of additional air flow readings with **X**s

Section I

Think about the whole problem. Look at all the maps. Then answer the following questions.

Questions

23. What violations of federal and state laws are present in this problem?
24. Identify any poor mining practices you find in this problem.

Appendix B: Answer Sheets

These are the answer sheets. These answer sheets may be duplicated in the normal fashion.

The exercise is designed to be used in small groups. You will need one answer sheet for each group of 2 to 3 persons in your class. The answer sheets are consumable. You will need a new set for each class.

Answer Sheet for Delta Mine Cutthrough

Write your answers to each question on this answer sheet. In most cases you will need to write only a few lines. Sometimes you will be asked to mark on mine maps places where you would make ventilation changes or to take air quantity and methane readings. Mark on the maps provided with this answer sheet.

Section A

Question 1

Question 2

Question 3

Question 4

Section B

Question 5

Question 6

Question 7

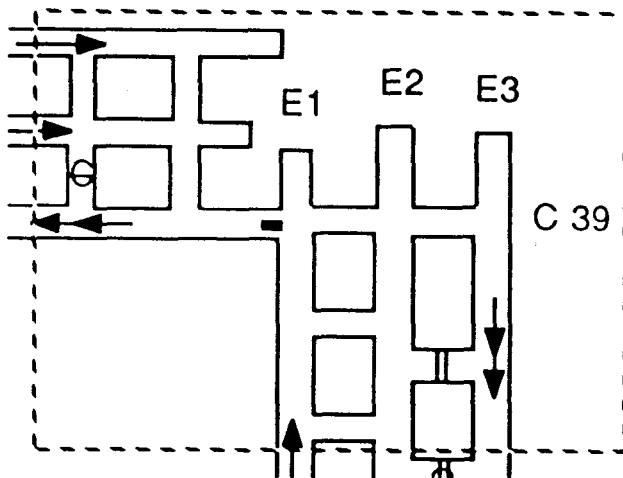


Figure 2A: Sketch your ventilation arrangement for this situation

Section C

Question 8

Question 9

Write the approximate air quantity readings in the five boxes on the map (Figure 3) on the next page.

Question 10

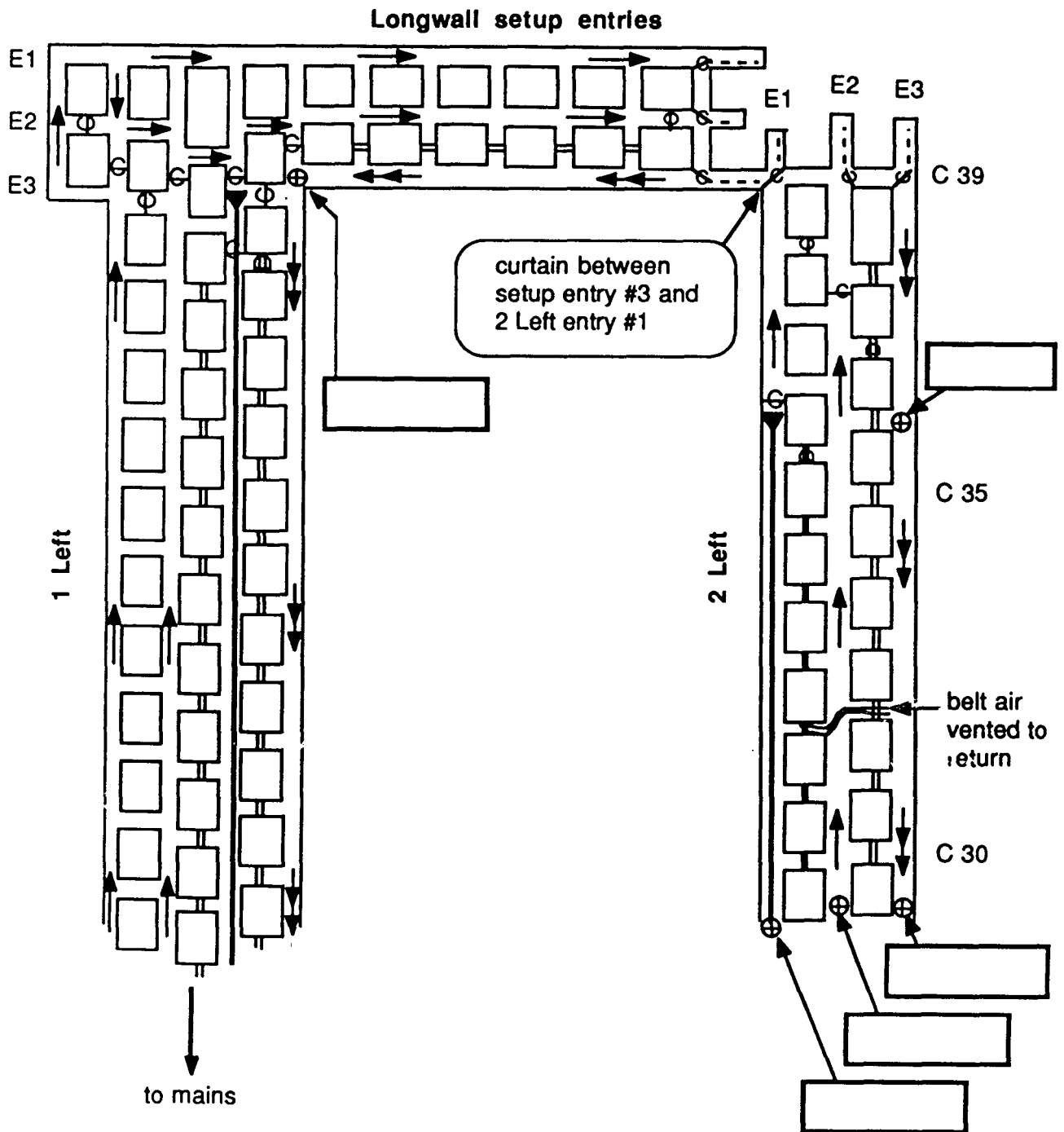


Figure 3: Curtain arrangement and ventilation after bolting cutthrough

Section D

Question 11

Question 12

Mark the map on the next page (Figure 4) with Xs to show where additional methane readings should be taken.

Question 13

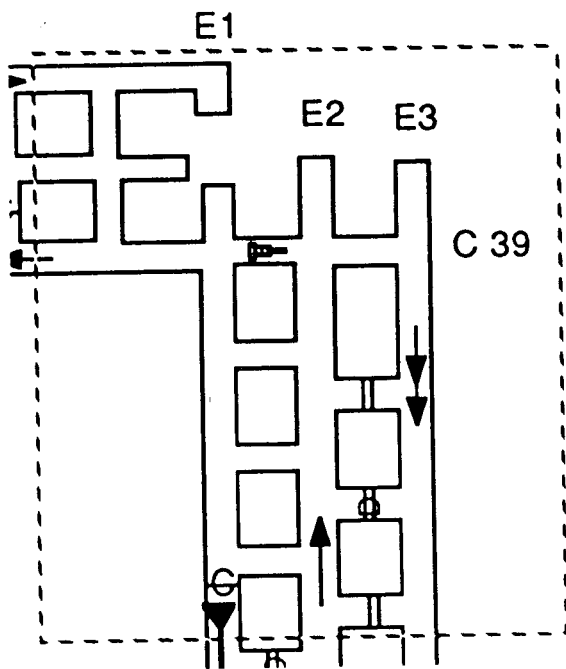


Figure 4A: Sketch a good ventilation arrangement within the box

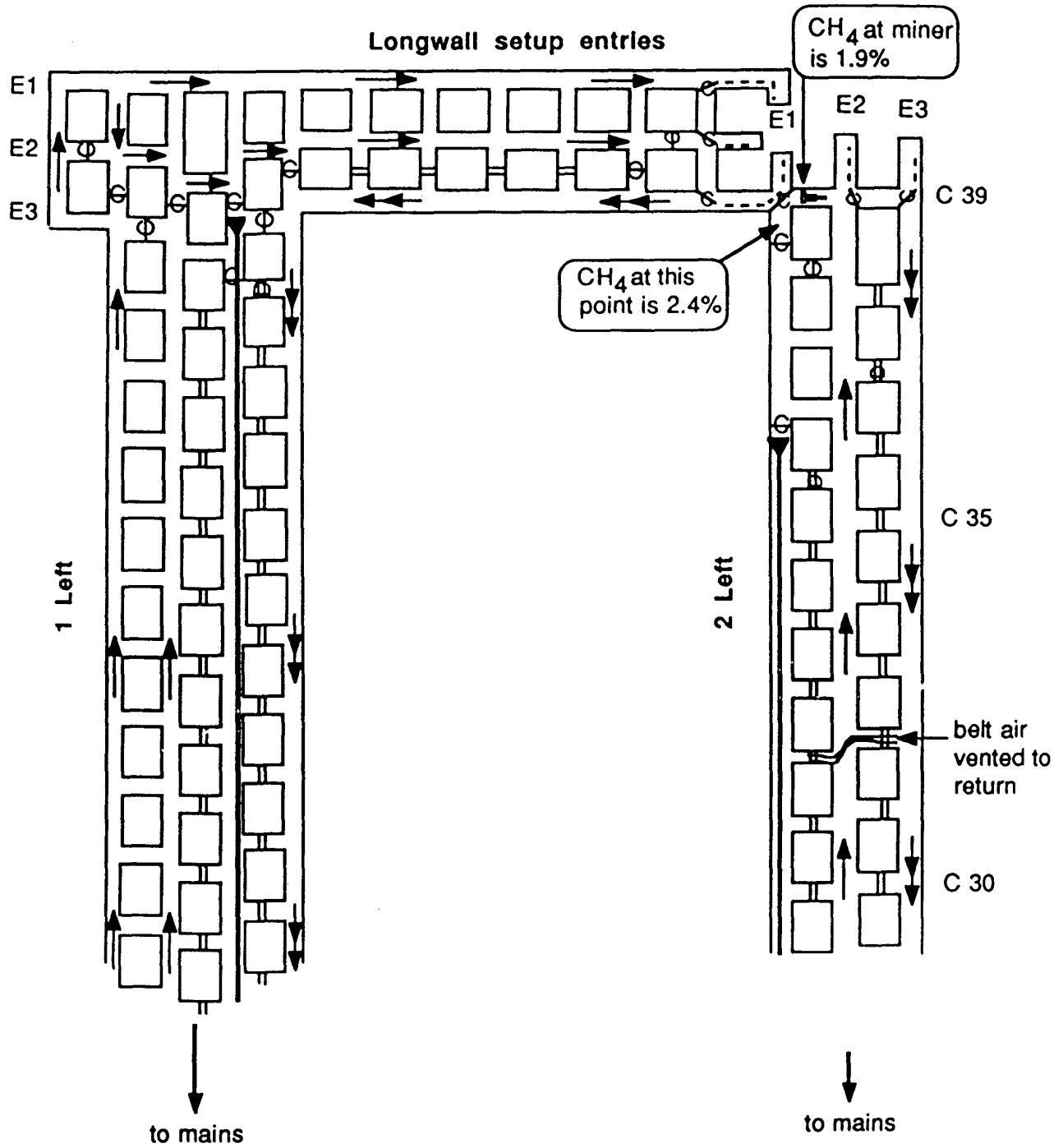


Figure 4: Methane in the face area of 2 Left section is noted

Section E

Question 14

Question 15

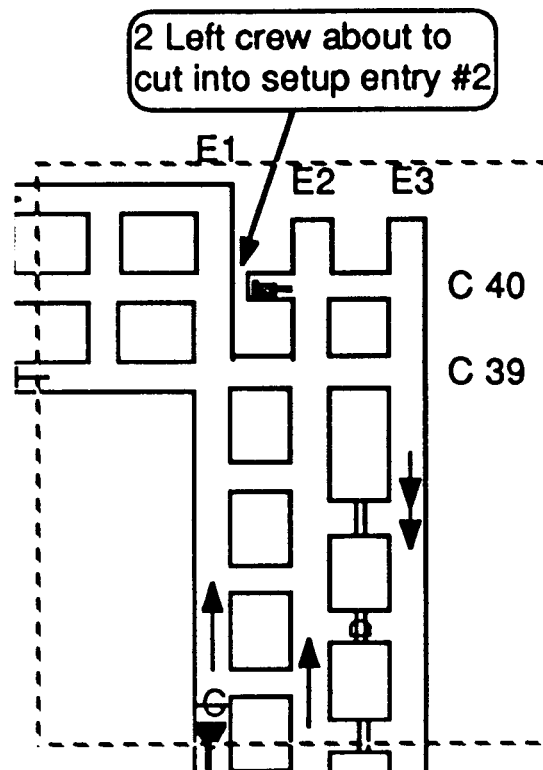


Figure 5A: Sketch a good ventilation arrangement within the box

Section F

Question 16

Question 17

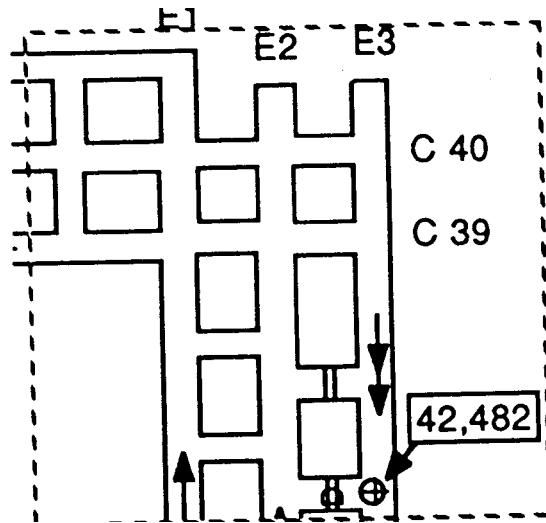


Figure 6A: Show any changes you would make in the ventilation arrangements shown in Figure 6

Section G

Question 18

Section H

Question 19

Question 20

Use **M**'s to mark additional points on the map on the next page (Figure 8) where methane checks should be made.

Question 21

Question 22

If you think they are needed, use **X**s to mark additional points on the map on the next page (Figure 8) where air flow measurements should be made.

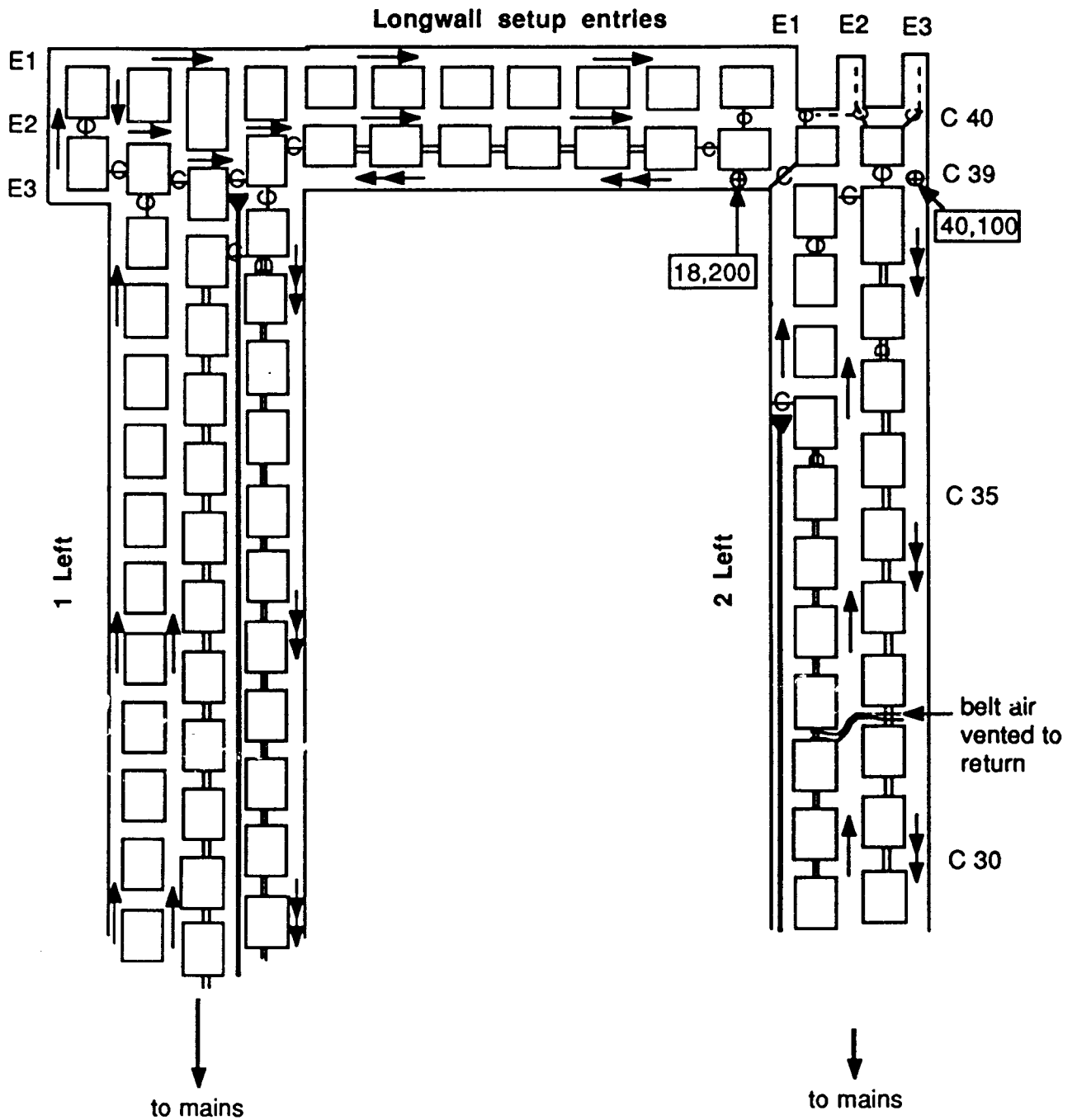


Figure 8: Mark locations of additional methane readings with Ms and locations of additional air flow readings with Xs

Section I

Question 23

Question 24

Question 25