

DAY 2

November 7, 1995

**Westray Mine**

**Public Inquiry**

HEARD BEFORE: The Honourable Justice P.K. Richard,  
Commissioner

PLACE: Stellarton, Nova Scotia

COUNSEL:

**Solicitors for the Commission:** Mr. J. Merrick, Q.C., Ms. Jocelyn Campbell, associate counsel, Ms. Ena MacDonald, document coordinator

**Solicitors for Department of Justice Canada:** Mr. John Ashley and Ms. Lynn Gillis

**Solicitors for the Department of Justice Nova Scotia:** Messrs. R. Endres, Q.C., J. Traves, and Wm. Wilson, Q.C.

**Solicitors for the United Steelworkers of America:** Mr. Raymond Larkin, Q.C. and Mr. David Roberts

**Solicitor for the Bank of Nova Scotia:** Mr. Mark MacDonald

**Solicitor for the Westray Families Group:** Mr. Brian Hebert

**Solicitors for the Town of Stellarton:** Mr. Phillip Rafuse

**Representing the Canadian Union of Public Employees:** Mr. Robert Wells

**Representing the United Mine Workers:** Mr. Hugh McArthur

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November 7, 1995 - 9:36 hrs.

1 COMMISSIONER Good morning.

2 ALL Good morning.

3 COMMISSIONER Mr. Smales.

4 **MR. THOMAS SMALES**, recalled and previously sworn,  
5 testified as follows:

6 EXAMINATION BY THE COMMISSIONER

7 Q. Mr. Merrick, do you mind if I clear up a few points  
8 from yesterday? I reviewed my notes last evening, Mr.  
9 Smales, and in the course of correcting several  
10 typographical errors, I came upon a few substantive  
11 matters that I would like to get cleared too. When you  
12 referred in your evidence to Photograph No. 25, I don't  
13 think I can aim this thing quite that well, but somewhere  
14 around -- how am I doing, okay?

15 A. Yes.

16 COMMISSIONER Good. You indicated that that was the  
17 sort of a roof configuration that if there was a triangle  
18 of coal that it would be unstable in that sort of a  
19 configuration?

20 A. That's correct.

21 Q. But previously in your evidence you said that coal  
22 itself can make a good roof?

23 A. Yes.

24 Q. Is there a contradiction there?

25 A. There's a part contradiction in that statement, but

MR. SMALES, EXAM. BY COMMISSIONER

1 what is happening in the case of the Photograph No. 25 is  
2 that on the right-hand side the machine will cut to the  
3 roof itself which means that you have produced a loose  
4 end at that point. You have a tapered edge.

5 Q. It's the cutting that makes the loose end, is it?

6 A. Yes. And when you're leaving a coal roof, you would  
7 expect to leave a coal roof of the same thickness  
8 completely across the roadway and it would be that  
9 complete lens of coal which would help to support the  
10 roof above. It's the fact that it is a wedge piece, a  
11 tapered piece, which helps to -- causes it to drop out.

12 Q. Okay, thank you very much. One other point and I  
13 don't want to take you by surprise. We're not trying to  
14 do anything like that, but during the course of my  
15 readings on mining I have the distinct impression that a  
16 booster fan is not really acceptable technology in a mine  
17 and, indeed, if my interpretation is correct, a booster  
18 fan sort of indicates that the main fan is inadequate for  
19 the purposes. And if I recall your evidence yesterday,  
20 you indicated that in proper mine planning the  
21 ventilation or the main ventilating fan ought be  
22 configured for the life of the mine rather than just for  
23 the beginning so that it will be sufficient to ventilate  
24 the mine through all phases. Now I understand that the  
25 US, the Mine Safety and Health Administration, they

MR. SMALES, EXAM. BY COMMISSIONER

1 administer CFR 30 which is the regulations of mine in the  
2 States and they -- in their regulations they seem to be  
3 very stringent on the use of boosters. Have I got that  
4 right or what's the --

5 A. The situation with boosters is very well understood  
6 and, in fact, papers were written on the subject back in  
7 1947. They are used in many, many mines throughout the  
8 world and they are extremely -- it's an extremely well-  
9 documented system. There is a slight problem with  
10 boosters that whatever you put in a booster there is an  
11 element of recirculation in that area. But it is a  
12 technique which is used pretty much everywhere. In  
13 relating the fact that normally you would design the main  
14 fan to a specification, I think I said normally you'd  
15 talk about 10-15 years for that design. Some of the  
16 mines, particularly the -- Europe, have been running for  
17 a hundred and two hundred years. And as they've  
18 progressed there's been the necessity to re-examine the  
19 situation and put in booster fans very successfully and  
20 very efficiently.

21 My experience of the American mines are only from  
22 reading. I've only visited a few and therefore I would  
23 hate to comment on their regulation as such.

24 Q. Perhaps we could enlarge upon that when Mr.  
25 McPherson comes --

MR. SMALES, EXAM. BY COMMISSIONER

1 A. I think he would be the person to really go into the  
2 detail of booster fans, although I think it's fair to say  
3 that I was manager at the mine which had the first  
4 booster fan in England.

5 Q. Okay, thank you very much. Mr. Merrick?

6 MR. MERRICK Thank you, Mr. Commissioner.

7 EXAMINATION BY MR. MERRICK

8 Q. Just on that first point, Mr. Smales, on why the  
9 roof would be shaped in that triangular or that sloped  
10 fashion, can you just take me back on your flip chart for  
11 a moment to where you would have actually roughed that  
12 out. Perhaps if it's a little hard to find it we could  
13 just -- bingo. All right. Now on the Commissioner's  
14 point as to why there would be more of a tendency for it  
15 to fall out or down when it is mined in that fashion as  
16 opposed to when it wouldn't do that, just explain to me  
17 again why that wedge piece falls out?

18 A. The interface of the seam and the roof is on this  
19 line. The machine is on a relatively level floor and the  
20 tendency is to cut, as shown in one of the photographs,  
21 on the right-hand side first. So he extracts an 11-foot  
22 wide block to the seam to that roof, the interface with  
23 the shale above it. Of course, his cutting isn't exactly  
24 precise. He may go an inch or a couple of inches into  
25 the roof in doing, this which means in fact now we have a

MR. SMALES, EXAM. BY MR. MERRICK

1 bit of an edge on that point, and automatically a break  
2 forms on this side when this piece is cut out. Now  
3 what --

4 Q. Why does it automatically form?

5 A. Because of the stresses in the strata above. And  
6 you have pressure down and you have an edge here, so  
7 you're pressing on this coal and producing a shearing  
8 action on this edge.

9 Q. All right. Now it breaks out. Did you tell us if  
10 there is a break point here between the coal and the  
11 shale that is just above it?

12 A. Quite often this parting between the coal and the  
13 shale is such that the coal will move away from that  
14 point.

15 Q. I see. So when you cut to there -- if, for example,  
16 you had a level coal roof in this fashion along  
17 horizontal to the roof of the cut that you have made,  
18 then the coal would be supported on both sides and there  
19 wouldn't be that tendency to fall out?

20 A. That is the point. And if I take a level seam --

21 Q. Yes?

22 A. -- with the strata above, and I cut a rectangle, I  
23 now have a piece of coal which is the same thickness at  
24 each end, so I have a beam of coal. And this has  
25 sufficient elasticity and strength to remain intact

MR. SMALES, EXAM. BY MR. MERRICK

1 during the time that we bolt into, which I'll be talking  
2 about later, into the roof edge.

3 Q. Indeed under that second diagram that you showed us,  
4 that coal can then be used as part of your roof support.  
5 It provides stability to your roof?

6 A. That is a fact.

7 Q. But in this scenario where we cut at an angle,  
8 you've got the exact opposite situation?

9 A. That is correct, yes.

10 Q. All right, thank you.

11 COMMISSIONER Mr. Smales, is it good mining practice to  
12 leave an inch or two inches of coal on the roof when  
13 you're cutting?

14 A. This depends entirely on the conditions of the  
15 strata above the seam. If you have a competent strata  
16 above, then usually you would cut right to the dirt roof.  
17 If you have strata which is not good above, then  
18 sometimes the seam, the seam itself is such that by  
19 leaving an amount -- anything -- some places they're  
20 leaving 10 feet, some places they're leaving six inches.  
21 You have to decide just how much to leave to make it a  
22 competent roof. And this is a factor as you are actually  
23 working the mine.

24 COMMISSIONER Is there an increased danger as you cut  
25 closer to the top of the coal seam of striking sparking

MR. SMALES, EXAM. BY MR. MERRICK

1 material, for instance, as you mentioned yesterday,  
2 pyrite or something like?

3 A. Pyrite within the seam can be anywhere from the --  
4 right from the floor right to the roof.

5 COMMISSIONER Okay.

6 A. And the same goes with ironstone. The other things  
7 that cause sparks are quartzitic materials. And you can  
8 have quartz nodules in the seam at any position; you can  
9 have it in the roof. So it's fair to say that if these  
10 things are about, they can be located anywhere within the  
11 seam or in the roof.

12 Q. Okay, thank you.

13 MR. MERRICK Just to finish that point, Mr. Smales, so  
14 that depending on the stability of your roof strata just  
15 above your seam will be one of the factors that decide  
16 you on whether you leave part of the coal. And coal  
17 itself then can be -- is of such a nature that it can  
18 provide more stability to your roof?

19 A. It can, yes. Yeah.

20 Q. We looked at the borehole test pit analysis  
21 yesterday that indicated the shaley shale and shaley  
22 layers above --

23 A. Pyritic shale.

24 Q. -- what would you say as to whether, in that kind of  
25 condition, with that kind of roof conditions, leaving a

MR. SMALES, EXAM. BY MR. MERRICK

1 coal roof might be an option?

2 A. I think under any circumstances you would look and  
3 see what are the options. I think in relation to the  
4 situation at Westray you have Miklos Salamon coming  
5 along, and I think his opinion should be looked at before  
6 mine. I would look at the opinion straight from a  
7 practical colliery manager, but he's really expert on the  
8 subject.

9 Q. But I take it it's customary and not unusual for  
10 mines to have coal roofs or to leave part of the seam as  
11 part of the roof to give it additional stability?

12 A. Many mines do leave a coal roof, yes.

13 Q. All right. Now let's come back to where we left off  
14 yesterday; that's talking about the question of  
15 ventilation. You had taken us down through the main mine  
16 ventilating system and we looked at the way that they had  
17 one the main ventilation system and the auxiliary  
18 ventilation in the districts. You were about to tell me  
19 about measurements that had been made as to the volumes  
20 of air that were being used prior to the explosion. Can  
21 you pick up on that?

22 A. I think if we look at the lower plan here the total  
23 amount of air passing along the No. 1 Tunnel was in the  
24 order of 90 cubic meters per second or 200,000 cubic feet  
25 per minute.

MR. SMALES, EXAM. BY MR. MERRICK

1 COMMISSIONER 200,000?

2 A. 200,000.

3 MR. MERRICK Now this is based on what measurements?

4 A. Sorry, 200,000 meters per second, I'm sorry. Cubic  
5 meters per second. These measurements were taken on May  
6 the 8th by the staff at the mine.

7 Q. And they were logged in the records that are in the  
8 possession of the Inquiry?

9 A. And they were logged, yes, by the person who took  
10 them.

11 Q. All right. Let's go through them.

12 A. The total amount of air which passed into the North  
13 was over 100,000 cubic meters per second. And into the  
14 Southwest was 93,000 -- 93.5, sorry. I'm mixing up. May  
15 I retract that, sir? The North area was 100.8 cubic  
16 meters per second which comes out about to 100,000 cubic  
17 feet per minute. And in the Southwest area was 93.5  
18 cubic meters per second.

19 Q. And do you have a conversion of feet per minute just  
20 for those of us who are interested in --

21 A. The feet per minute you can multiply by --

22 Q. All right.

23 A. -- approximately 2.2-thousand which means 93.5. It  
24 comes out about 100,000 cubic feet per minute.

25 Q. All right. So they were splitting the air at the 10

MR. SMALES, EXAM. BY MR. MERRICK

1 Crosscut?

2 A. No. 10 Crosscut, just about 50/50, if you take it  
3 100,000 -- 200,00 cubic feet total, 100,000 in each  
4 direction.

5 Q. All right. Any other measurements?

6 A. The developments in the Southwest No. 2 are showing  
7 in the No. 1 -- Southwest 2, No. 1 heading, 5.2 cubic  
8 meters per second and in the left-hand heading 5.3 cubic  
9 meters per second.

10 Q. Yes.

11 A. This would work out somewhere in the region of  
12 11,000 cubic feet per minute. And in the 1 Southeast  
13 which is the roadway here, that was showing 7.1 cubic  
14 meters per second or about 15,000 cubic feet per second.

15 Q. All right. Any other measurements?

16 A. They're the only five measurements which I obtained  
17 from that information.

18 Q. All right.

19 COMMISSIONER Would those last measurements be at the  
20 face?

21 A. I didn't establish where those figures were made. I  
22 would imagine they were taken by measuring the amount of  
23 air coming out of the -- or going into the exhaust  
24 ducting.

25 COMMISSIONER I see.

MR. SMALES, EXAM. BY MR. MERRICK

1 A. What -- and I say I'm supposing this is the  
2 situation, they have the ducting somewhere towards the  
3 back of the heading, as is shown on the photograph, and I  
4 would imagine that he put his anemometer in there and  
5 traverses anemometer in that position.

6 MR. MERRICK And that's just the last point I want to  
7 cover. How would these measurements have been taken? By  
8 what means and --

9 A. These measurements were taken by a standard  
10 anemometer. I think we've seen these, the kind of thing  
11 that's used on the surface, a rotating vein with a clock  
12 on and the normal system in the roadway, he would  
13 actually traverse the anemometer across the roadway  
14 usually for a minute, take a measurement, he would  
15 traverse it again for a minute. If he got a similar  
16 measurement he would accept those two measurements as  
17 being a correct measurement. That gives him the air  
18 velocity. Then he has to measure the width and the  
19 height. And in the case of the trapezoid, he would have  
20 to take at least a couple of measurements of the height  
21 and do a calculation of the area and multiplies the area  
22 by the velocity which gives him the quantity.

23 Q. And this would be done in the range -- it's a hand-  
24 held instrument so that it would be wherever he could --  
25 the extent to which you could reach it that way?

MR. SMALES, EXAM. BY MR. MERRICK

1 A. Yes. With his anemometers, they are supplied with a  
2 long rod so that in fact you can reach up and traverse  
3 substantially the area that the air is passing through.

4 Q. All right. Now let me come to a topic about  
5 monitoring the ventilation in a mine. And perhaps if we  
6 can go to the large plan by reference, while we're  
7 putting that up, tell me about how this particular mine  
8 did its ventilation monitoring beginning with the sort of  
9 main mine ventilation itself?

10 A. The system of monitoring was carried out  
11 electronically in two ways. One set of monitoring was  
12 designed to protect certain apparatus and there were two  
13 points at which this was installed. There were other  
14 monitoring which was relayed to the surface of the mine  
15 and these four places I'll indicate on the plan. This  
16 information was designed to give an indication of what  
17 was happening right through the mine. I think it would  
18 be easier if I do speak --

19 Q. Please.

20 A. -- on the plan.

21 Q. Tell me first about the detectors that were put in  
22 to protect specific items of equipment and what those  
23 items of equipment were?

24 A. In No. 5 Crosscut there was a non-FLP, non-flame  
25 proof transformer, and I'll be talking about this later,

MR. SMALES, EXAM. BY MR. MERRICK

1 flame proof, and, generally speaking, the ventilation  
2 through that crosscut would be fresh air. They are  
3 coming down No. 1 through the crosscut and back into the  
4 return, so it would be fresh air. However, the company  
5 had installed in their monitoring system which monitored  
6 methane and carbon monoxide. The equipment was so  
7 designed that at pre-set levels the power to that  
8 equipment would be isolated. In the case of No. 5  
9 Crosscut, power would have been isolated at 12 parts-per-  
10 million of carbon monoxide and 1.25 percent of methane,  
11 1.25 being the cutoff arrangement for any electricity.

12 Q. Where in relation to the transformer would the  
13 detectors have been located?

14 A. The detectors, normally for this condition, will be  
15 located on the return side of the transformer. That is  
16 nearer to the No. 2 Slope than the No. 1 Slope.

17 Q. And these were merely detection systems that would  
18 automatically cut off power at certain levels?

19 A. Yes.

20 Q. Were they connected anyway to a monitoring system  
21 anywhere else in the mine?

22 A. They were not -- that was at No. 5. There was a  
23 similar system at No. 10 Crosscut in which there were  
24 non-flame proof compressor.

25 Q. Yes.

MR. SMALES, EXAM. BY MR. MERRICK

1 A. And that had exactly the same function. It cut off  
2 the power when the methane rose to 1.25 percent and when  
3 the carbon monoxide was at 12 parts-per-million.

4 Q. And again that wasn't monitored anywhere else. That  
5 was primarily just to cut off power at that level?

6 A. That was a protection for that particular non-flame  
7 proof equipment.

8 Q. All right. Now tell me about the other monitoring  
9 stations that you were referring to?

10 A. The main protection for the ventilation of the mine  
11 was established in four places. In the return No. 2,  
12 just inbye the turn and outbye No. 5 Crosscut.

13 Q. Yes?

14 A. A second monitoring station was established just  
15 inbye No. 10 Crosscut. Two monitoring stations were  
16 established in the North.

17 Q. Yes.

18 A. These stations were connected to a control room in  
19 the coal preparation plant. That control room did all  
20 the work of the coal preparation plant and also had video  
21 terminals which gave information from these control  
22 stations. There were two designations of information.  
23 At -- pardon me, the stations in the return were set so  
24 that if the concentration of carbon monoxide exceeded 25  
25 parts-per-million or methane exceeded 1.25 percent, then

MR. SMALES, EXAM. BY MR. MERRICK

1 the power was cut off.

2 Q. This would be the power to what?

3 A. To the conveying system at that point.

4 Q. All right.

5 A. The conveyers were sequence controlled so, in fact,  
6 the whole of the conveying system would be shut down  
7 inbye that position which meant, of course, that you  
8 wouldn't be filling coal because once again you couldn't  
9 load it. So, virtually, by stopping the conveying  
10 system, you stop the activity inbye except for the roof  
11 bolting machine and possibly the shuttle cars until they  
12 got to halt position.

13 The information also was transmitted to the control  
14 room. And the control room received a warning both  
15 printed on the screen and usually by some kind of warning  
16 signal, a beeper, of that description. That surface  
17 information recorded warnings at 20 parts-per-million and  
18 when the methane exceeded .8 percent --

19 Q. So you would have a warning before the shut down of  
20 the conveyor system?

21 A. A warning which obviously intended for action to be  
22 taken to find out why these levels were reached.

23 Q. Let me ask you this, Mr. Smales, I take it that the  
24 location of a main mine detection system outbye --  
25 relatively outbye most of the mine in your return roadway

MR. SMALES, EXAM. BY MR. MERRICK

1 is probably the most practical or appropriate place to  
2 put a detection system if you want to monitor what's  
3 going on in your whole mine?

4 A. That's correct.

5 Q. Because you're getting air passing it there that is  
6 circulated everywhere in the mine and whatever that air  
7 tells you, it will be an indicator of what's happened in  
8 the mine itself?

9 A. That's correct.

10 Q. All right. Take me to the next main monitoring  
11 system at No. 10 Crosscut.

12 A. This is inbye No. 10 Crosscut.

13 Q. Why would you locate one there if you already had  
14 one up by 5 Crosscut?

15 A. Now the great benefit of all this information going  
16 to the surface is identifying where your problems are.

17 Q. Yes?

18 A. And, ideally, you would put monitoring stations to  
19 monitor what is going on in here, what is going on in  
20 this part.

21 Q. You've referred to the Southwest and the North  
22 districts?

23 A. That is correct.

24 Q. Yes.

25 A. In fact, if you were looking at potential

MR. SMALES, EXAM. BY MR. MERRICK

1 spontaneous combustion problems, you may even put in  
2 monitoring stations on a lot -- or what shall I say, a  
3 more detailed basis than that. You may have even said in  
4 this case, since we have worked out the Southeast 1 area,  
5 we'll monitor on the return side of Southeast 1 since  
6 that would be a potential spontaneous combustion area.  
7 And we'll also monitor on the return side of Southwest 2  
8 which will identify immediately the areas where we have  
9 problems.

10 Q. Now the station that they did put in at 10  
11 Crosscut --

12 A. 10 Crosscut.

13 Q. -- measured what?

14 A. This actually identifies the situation which is  
15 happening in the northern area which included the  
16 Southeast. By subtraction you can obviously determine  
17 what is happening in that total district. For if you  
18 have a quantity of air passing No. 5 Station with .5  
19 methane, and you have a figure of 100,000 cubic feet  
20 passing the inbye station at this point, at .1 per cent  
21 methane, it's quite easy to calculate what quantity of  
22 methane is coming out of the Southwest area by  
23 subtraction. What it doesn't do, of course, is isolate  
24 exactly where that information -- where that problem is  
25 coming.

MR. SMALES, EXAM. BY MR. MERRICK

1 Q. So that by doing your sensing by subtracting one  
2 from the other and thus noticing what the difference is,  
3 you'll know that something is happening in this Southwest  
4 district but you won't know where?

5 A. That is correct. And the purpose of having the  
6 information relayed to your control room is that the  
7 control room person has to be reasonably qualified to  
8 know what he is examining on his monitors and be able to  
9 alert the underground people to go and investigate any  
10 problem that may be arising.

11 Q. So that the person monitoring your system always has  
12 to be alert to the fact that the two readings between 5  
13 Crosscut and 10 Crosscut have to be compared to each  
14 other and the calculations done to be able to know what  
15 it's telling you about the Southwest district?

16 A. Alternatively, he may on a hot line to someone so  
17 that when he gets information, he can speak to them  
18 quickly and say I have this information, what do I do  
19 about it. That would be the only alternative.

20 Q. But it requires that additional degree of  
21 monitoring, if you will, an awareness, to be able to be  
22 alerted to the fact that your system may be telling you  
23 something as opposed to merely being able to see the  
24 readout if you had a monitoring station in the Southwest  
25 or several monitoring stations in the Southwest.

MR. SMALES, EXAM. BY MR. MERRICK

1 A. That's correct. That's correct.

2 Q. So it puts all the more onus on those that sit in  
3 the control room to know what they are doing?

4 A. That is -- that's vitally important, yes.

5 Q. All right. Thank you. Now just before we move on  
6 past the 10 Crosscut, I don't think you gave me what that  
7 monitored and what the results would be at certain  
8 levels.

9 A. The picture here is that once again, power is taken  
10 off at the figure of 12 parts-per-million and 1.25 and  
11 the information relayed to the surface is 20 parts-per-  
12 million and .8 --

13 Q. So basically the same alarm levels and shut-off  
14 levels?

15 A. Yes.

16 Q. And it shut off -- would shut off the conveyor  
17 system again like the --

18 A. It would shut off the conveyor system inbye.

19 Q. All right. Take me down to the two stations in the  
20 North, if you would.

21 A. There are two stations in the North and these appear  
22 to have been located for the future rather than for the  
23 conditions at the time. They did indicate quite a lot of  
24 useful information, but as major monitoring stations,  
25 they would have been very useful as the mine developed.

MR. SMALES, EXAM. BY MR. MERRICK

1 I think we can see them, a picture of them, they're very  
2 closely located.

3 Q. Those of us who want to follow you in the exhibit  
4 books can look at Exhibit 45, tab 11, at those blowups, I  
5 assume. Is it tab 11 or tab 14? 14, sorry. No, it's  
6 not even 14. We'll put the big one up on the board to  
7 make it a little easier to read.

8 COMMISSIONER Where's that one in our book now?

9 MR. MERRICK Well, I thought it was at tab 11, Mr.  
10 Commissioner, but I've got my references --

11 MR. LARKIN Tab 8.

12 MR. MERRICK -- tab number 8. I'm indebted to the  
13 union.

14 COMMISSIONER 458 or --

15 THE CLERK Tab 11 and it's the last map.

16 COMMISSIONER Thank you, ma'am.

17 A. I think you can probably see in your sketches or  
18 plans the position of the two stations.

19 MR. MERRICK Can you describe them for me?

20 A. These were identical with the stations at No. 5  
21 Crosscuts. Sorry, at No. 10 and below No. 5 Crosscut in  
22 the No. 2 return. They both passed information through  
23 to the control room. The cutoff levels were set at 12  
24 parts-per-million carbon monoxide and at .75 per cent  
25 methane. The information passed to the control room gave

MR. SMALES, EXAM. BY MR. MERRICK

1 warnings and information at 20 parts-per-million. Sorry,  
2 12 parts-per-million of carbon monoxide and 1.25 per cent  
3 methane.

4 Q. Now that particular station that you're describing  
5 to us right now, what would it be -- what area would it  
6 be controlling or monitoring?

7 A. The whole of the information from there right  
8 through to the intake airway.

9 Q. Now show me the last one.

10 COMMISSIONER Can I have that again?

11 A. From the monitoring station there, the information  
12 would include D Road, B Road, A Road, 1 North right  
13 through to the surface.

14 MR. MERRICK All right. Where was the next one? Or  
15 the last one?

16 A. The last station was located here which is in the  
17 Crosscut between A Road and D Road. This, of course,  
18 would record information relating to B Road, A Road, and  
19 the intake airway, once again to the surface. The only  
20 difference in the information received by the two is the  
21 work that was going on in D Road.

22 Q. Can you give me an explanation as to why they would  
23 put those two monitoring stations so close together?

24 A. No, sir.

25 Q. Is it possible that if they had been intending to

MR. SMALES, EXAM. BY MR. MERRICK

1 move out into the North area, as we've seen on some plans  
2 and will see on some plans, going in this direction, if I  
3 can get my little beeper to work here, going out this  
4 direction here, that they had it there temporarily and  
5 could have moved it relatively easily then to monitor  
6 that district?

7 A. This -- that seems to be the logical explanation of  
8 why this was done. The -- just to correct you, sir, if I  
9 may. The --

10 Q. By all means.

11 A. -- main development was north, straight up there.  
12 So that they would have progressed with the roadways in  
13 that direction which should have meant that the station  
14 there should have come into the return airway of a  
15 roadway going up in that direction. Then they could have  
16 left the protection for an area of room-and-pillar to be  
17 worked in that part. But, obviously, they were working  
18 forward to that situation.

19 Q. All right. Now let me just take you back for a  
20 second. I want to clarify something at the first two  
21 that you told me about. 5 Crosscut and 10 Crosscut.  
22 Looking at our diagram, and we'll start at the No. 5  
23 Crosscut.

24 COMMISSIONER Which diagram?

25 MS. CAMPBELL Tab 11.

MR. SMALES, EXAM. BY MR. MERRICK

1 MR. MERRICK Tab 11, first map.

2 MS. CAMPBELL Second map.

3 MR. MERRICK Second map, sorry. The one that shows the  
4 Mains. Second map under tab 11.

5 COMMISSIONER Second map at tab 11.

6 MR. MERRICK It should be a map. There's a yellow  
7 sheet in between that --

8 COMMISSIONER Yes.

9 MR. MERRICK That's what's causing me some confusion.  
10 It's the second map which shows the mains.

11 CLERK This one right here. We don't have it up here.

12 MR. MERRICK I just want to confirm with you your  
13 cutoff points. You testified that on methane it would be  
14 1.25 per cent. Where are you getting that information  
15 from?

16 A. Which one are we looking at? Are we looking at the  
17 No. 2 Slope or --

18 Q. No. 2 Slope, I'm sorry. The main detection system.

19 A. The cutoff point for the underground part says "U-G-  
20 T-P-L Carbon monoxide 25 parts-per-million and methane  
21 1.25." I may have misread, I'm sorry. I have problems  
22 seeing with long distance and short distance.

23 Q. So do I. I just want to confirm the one that's in  
24 the crosscut, the one that's protecting the transformer  
25 in there. The cutoff point for methane --

MR. SMALES, EXAM. BY MR. MERRICK

1 A. It's 12 parts-per-million and .25.

2 Q. Not 1.25?

3 A. No. Point two five. The reason for that, of  
4 course, is that, really, you're putting fresh air through  
5 that point and, frankly, if you had any more than .25  
6 you'd really want to look at what is happening.

7 Q. All right. The only other point I wanted to  
8 clarify, I think you said when we went down to the No. 10  
9 Crosscut the system that was in there protecting the  
10 equipment, I just want to confirm what the cutoff point  
11 is on that.

12 A. Which plan are you looking at Mr. Merrick?

13 MS. CAMPBELL The very next one.

14 MR. MERRICK Next plan. Next page over. And there was  
15 a monitoring system just in the crosscut.

16 A. Correct.

17 Q. I think you said the cutoff point was 1.25 per cent  
18 methane.

19 A. I'm sorry, I was wrong. It was .25. Once again,  
20 that should be fresh air.

21 Q. All right. Thank you.

22 COMMISSIONER The one in No. 10?

23 MR. MERRICK In No. 10, that's right. Yeah. Now that,  
24 I take it then, consists of the sort of main monitoring  
25 system that existed in the Westray Mine. If I can refer

MR. SMALES, EXAM. BY MR. MERRICK

1 to it as the "main detection system." What else did they  
2 have, or did they do, to monitor and know what was  
3 happening with their ventilation?

4 A. I think before moving on to that I should mention  
5 the point that a main monitoring system has a sensing  
6 head which picks up the information. And that sensing  
7 head is one fixed position. In this -- in the case -- of  
8 Westray, I did see a sensing head located in the centre  
9 of the roadway at approximately seven feet in the air.

10 Q. Which one was this?

11 A. This was in No. 10 Crosscut.

12 Q. This was after the explosion?

13 A. After the explosion. So where it was located  
14 before, I just don't know. But it is a normal thing with  
15 monitoring systems to place the monitoring head in the  
16 roadway somewhere in the general body of the atmosphere.  
17 And I think if you remember back to what I was saying  
18 yesterday about layering, usually it -- the head, sensing  
19 head, is not placed up in the roof. So you do get  
20 general body information at one point only in that  
21 airway.

22 Q. Now the location that you saw this particular  
23 sensing head in the No. 10 Crosscut --

24 A. Yes.

25 Q. -- how would that then compare to what you would

MR. SMALES, EXAM. BY MR. MERRICK

1 consider to be the normal location for such a sensor?

2 A. That looked about the same as I've seen at most  
3 mines.

4 They're usually just put above the head so that  
5 people don't bang their heads on them. There are not  
6 many people seven feet tall. And they usually put them,  
7 you know, somewhere a third to halfway across the  
8 roadway.

9 Q. All right. Now you've just noted for us that this  
10 kind of a main detection system does have its, not  
11 deficiencies, but its areas --

12 A. Limitation.

13 Q. -- where it can't -- its limitations --

14 A. Limitation.

15 Q. -- including the detection of particular problem  
16 pockets or areas.

17 A. That is correct.

18 Q. So what else does a -- did Westray do to monitor  
19 what was happening with their ventilation system?

20 A. The same line of defence as the routine ventilation  
21 survey. And what is carried out there is the measurement  
22 of the quantity of air which is passing through places  
23 and the quantity of air which is being delivered to rooms  
24 and places which have a blank end. You measure the  
25 quantity and you also measure the velocity. Because I

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1 think later on Malcolm McPherson will be telling you that  
2 velocity is very important when layering is a problem.  
3 So you want to know the velocity and you want to know the  
4 quantity of air because that shows whether your design  
5 features are being accomplished.

6 In addition, when the person who carried out the  
7 routine ventilating surveys was doing his work, he would  
8 also take readings of methane. I've been corrected on  
9 that. They apparently say "methane" in this part of the  
10 world. I'll still keep on saying "methane."

11 Q. Well, you've got me broken around to your habit.  
12 I'm calling it "methane" now.

13 A. That's great. They -- he would measure methane in  
14 these particular spots at which he took his quantity  
15 surveys. So that, normally, he would do this once a week  
16 and this would give some indication what was happening at  
17 the time he measured these quantities. He would  
18 preferably measure on the last shift in the week where  
19 you're working a five or six day week, but in this  
20 particular mine it was continuous work, so there would be  
21 -- once the build up of methane had been achieved due to  
22 production, then virtually any day of the week should  
23 have resulted in measurements being uniform and  
24 systematically carried out. In a mine which runs five  
25 days, Monday to Friday, then there's a gradual build up

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1 of the methane from the Monday to the Friday as the  
2 production is made.

3 Q. In a mine such as Westray though, how often would it  
4 be normal for an employee to do a ventilation survey?

5 A. In a mine of this description surveys of the main  
6 air quantities could be carried out once a month; that  
7 is, on the main airways. The splits and the air which is  
8 being passed by the auxiliary ventilation system must be  
9 measured at least once a week and possibly even more  
10 often. It would be -- should be measured whenever a fan  
11 is moved. And if you remember, every time you move your  
12 crosscut out and move your main ventilation in, then you  
13 moved your auxiliary fans. So immediately you move your  
14 auxiliary fan you should check again to make sure that  
15 you're delivering the right quantity and you're also  
16 removing the legislated, not more than the legislated,  
17 amount from the main body of the airstream.

18 Q. And is it customary when doing these surveys, on  
19 whatever period that they're doing it, to generally do  
20 them in the same location each time?

21 A. Yes. The points are identified for the main  
22 measurements, but, obviously, the ones which are dynamic,  
23 then the person making those measurements has to move  
24 into those positions.

25 Q. Now you told us how the individual would do the air

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1 volume measurements by moving the instrument around in  
2 the roadway. What would you do to test for methane?

3 A. That individual would carry a methanometer. I think  
4 you have a photograph of --

5 Q. We'll come to one in a minute.

6 A. Yes.

7 Q. Generally, where would the measurements be taken in  
8 the roadway itself?

9 A. He would actually normally measure what we call a  
10 "general body," which is the in the centre of the  
11 roadway. But he should really also check the roof level  
12 and then any pockets which he sees along the side of the  
13 roadway if he is actually a fully-trained ventilation  
14 officer.

15 Q. All right. And is that what ventilation surveys  
16 would normally consist of?

17 A. That would be the minimum. At intervals --

18 Q. Just before we go on to that. How would these be  
19 recorded? Are they normally recorded? How do we have a  
20 record of these?

21 A. He would have a work book which he -- in which he  
22 recorded the information underground. Usually, the spots  
23 at which he would be taking the measurements would be  
24 already identified and the area of those spots be  
25 identified. He may, while underground, examine his

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1 calibration curve for the anemometer. The anemometer  
2 itself has to be calibrated. The dial readings may come  
3 out and show 300 feet per minute, but in fact, the true  
4 speed might be 250 feet per minute, so he has a  
5 calibration curve for every anemometer. And he may  
6 correct those figures so that he'll have his initial  
7 figure of 300 in the one column, the 250 in the next  
8 column, area -- do a multiplication. He sometimes does  
9 this work underground. He sometimes does the recording  
10 on the surface. And then he would normally record the  
11 whole lot in a suitable book at the surface of the mine.

12 Q. Have you found any traces of records maintained by  
13 Westray of ventilation surveys that were being conducted?

14 A. I've seen a number of surveys of a limited -- very  
15 limited nature over -- at intervals of one week. I've  
16 examined, probably, a half dozen at least.

17 Q. All right. And we'll get into those a little later  
18 with Mr. McPherson. Let me ask you -- I cut you off a  
19 moment ago, you were about to --

20 A. Yes. It's necessary to examine what is happening,  
21 or what is going to happen at your mine every so often to  
22 what is known as a "pressure survey." And this records  
23 the resistance of the roadway and the amount of pressure  
24 which is being lost in any particular length of roadway.  
25 If you're pushing the air round or sucking the air out

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1 with a pressure of, let's make it easy, 10 pounds per  
2 square inch, and you're losing one pound per square inch  
3 over every thousand meters of roadway, then you can  
4 realize at a certain point you've only got to go to  
5 10,000 meters and you've lost all potential for pushing  
6 air into that place. So that you do do pressure surveys  
7 at intervals to see what is happening and how you can  
8 move the air better.

9 Q. All right. And they are done on a --

10 A. They may be done at six-month intervals or according  
11 to the needs of the plant.

12 Q. All right. In addition to the ventilation surveys  
13 that are done periodically, what other steps should be  
14 taken to monitor what's happening with gas in the mine on  
15 an ongoing basis?

16 A. The only really effective way of monitoring the  
17 situation in the mine is by the people who are in the  
18 mine all the time themselves. And, generally speaking,  
19 this devolves upon the official, a foreman in these  
20 cases, overman, and under manager manager. So that  
21 whenever they are underground, they've got to be aware of  
22 the situation, be aware of how methane is produced, be  
23 aware that it may layer, be aware that it can form in  
24 cavities at the side of the road or in the roof, and for  
25 that reason they must be regularly, and on a continual

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1 basis, measuring the situation at all these points.

2 Q. Now what do you mean by "continual"? For example, a  
3 foreman.

4 A. A foreman will have to travel around the area which  
5 is under his care, and I would expect in a place of this  
6 description, such -- which is not an excessive area for  
7 him to cover, he'd be going around and around identifying  
8 where his potential trouble spots are and measuring these  
9 at intervals, depending on the situation he finds. If he  
10 finds cavities with no gas and that's regularly the  
11 situation, and conditions do not change, then, possibly  
12 two -- twice a shift. But in the headings themselves  
13 where there are fast ends, where there's auxiliary  
14 ventilation, it may be necessary to be going up and down  
15 there four or five times a shift, checking on the  
16 situation.

17 It's also a position in a number of the mines that  
18 the employees working in a development are issued with  
19 automatic fire damp detectors which can be located and  
20 suspended from the supports. This is an extremely good  
21 system, for you can actually hang the automatic fire  
22 detector on the last support which means you're as near  
23 the face that you get practically. And these fire --  
24 these detectors do give a warning in a bleeping system.

25 Q. All right. I take it from what you've told us that

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1 no matter how good and state of the art your main mine  
2 monitoring system may be, and no matter how regular your  
3 ventilation surveys may be, that the front line of your  
4 mine, if you will, your cavities, your overbreak and your  
5 working faces, the, perhaps not the only way, but the  
6 most effective way, the safest way to monitor methane in  
7 those areas is by this method of the officials using  
8 their instruments? For --

9 A. I'm afraid there's no alternative at the present  
10 time.

11 Q. For example, if we look at that photograph that we  
12 talked about yesterday where we see the sloped roof. And  
13 you've told us that there would be a tendency for methane  
14 to be -- to gravitate up toward that upper portion with  
15 the potential of layering. That wouldn't necessarily be  
16 detected by your main mine detection system, would it?

17 A. No. You see, you're moving all the time in that  
18 area. The -- it would be almost impossible to set a  
19 system that moved forward every time the continuous miner  
20 went into that area. And if you did, you'd be leaving a  
21 patch behind you every time you moved the sensing head  
22 up. So that, really, the only way is for, that's  
23 practical, is for the official or the workman, if he is  
24 so-qualified, to measure the situation in that particular  
25 corner.

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1 Q. And to do that, for example, in that corner, and  
2 using it purely as an example, you'd have to get the --  
3 your instrument right up in that area to see if you had  
4 gas layering in there.

5 A. Well, the instrument, you'll probably see later, is  
6 such that -- there are a number of types, but the type  
7 you require for that is one in which you can put a wand,  
8 which is a simple tube, so the man can hold his  
9 instrument at face level so he can read it and actually  
10 pass the tube up into that particular cavity which may  
11 be, in some cases, 10-15 feet high. If the roof falls  
12 out, of course, then you've got a real problem because  
13 you could be 20 or 30 feet high.

14 But you -- what you must remember is this that if he  
15 is examining for methane and he runs into any amount  
16 above one and a quarter per cent, he doesn't need to go  
17 any further. He knows there's a problem and he's got to  
18 get rid of it. So that, you know, to be talking about  
19 making -- looking for five per cent is not the answer; he  
20 looks for one and a quarter. And the bottom layer would  
21 be the one and a quarter per cent. Obviously, it could  
22 be getting more concentrated as the layer goes higher.

23 Q. Do you know -- have you seen anything that would  
24 tell you whether the Westray Mine had these wands or  
25 probes that could be attached the instrument?

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1 A. I just do not know the answer to that, I'm sorry.

2 Q. All right. In addition to the monitoring done by  
3 officials or others that would be equipped, what about  
4 other sensors and detection systems in the mine?

5 A. There is no legal requirement for any other sensing  
6 equipment. In fact, there's no legal requirement for the  
7 main monitoring system in the mine. But on the  
8 continuous miner the company who supply the miner also  
9 supply a sensing device with the miner.

10 The positioning of the sensing head on that machine  
11 is completely at the discretion of the management of the  
12 mine. So that when the machine is ordered, Joy will put  
13 that sensing head where it's required. I think we have  
14 to remember that the sensing head cannot go much nearer  
15 than, I would think -- I don't think it can go within six  
16 feet of the actual cutting head.

17 Q. Why is that?

18 A. Because of the configuration of the cutting head and  
19 the propensity for coal and material to drop on it and  
20 knock it off and cause trouble. You've always got to  
21 remember that these things are liable to damage and,  
22 therefore, it does stand some way from the actual cutting  
23 picks themselves. I'm open to comment on that from other  
24 people. I say six feet, I think that's about correct.

25 Q. All right.

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1       A.     So that the continuous miner did have a sensing  
2       device and does have that facility.  The device should be  
3       set up to give a warning.  In the case of Westray, if my  
4       memory serves, it was set to warn at .8 per cent and to  
5       cut off power to the cutting head, at 1.25 per cent which  
6       is the statutory level for cutting off electricity.  You  
7       may ask why only to the cutting head.  The reason for  
8       that is that if you did run into problems, say, due to an  
9       outburst or a gushing of gas, you don't want to be in a  
10      situation where that machine is left there.  You want to  
11      be able to track it back so that the facility was left  
12      that that you could actually pull that machine away from  
13      the position and take action.  So that was the reason the  
14      cutting heads were stopped.

15             The scoop tram, a diesel machine, was also fitted  
16      with a methanometer and sensing head.  And that piece of  
17      equipment also was designed to cut off the power at 1.25  
18      per cent, which is the norm that we apply for diesel.  
19      But, virtually, there's nothing in the Regulations,  
20      particularly, on the diesel equipment which was used at  
21      Westray Mine.  The location of that particular sensing  
22      head was between the bucket, the scoop bucket, and the  
23      main frame of the machine itself.  No other machines were  
24      equipped with methane methanometers or sensing heads.

25      Q.     Sorry.

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1 COMMISSIONER Just one question, Mr. Smales, to follow  
2 up on the previous point. You said that there's, in your  
3 estimation, about a six-foot gap between the sensing head  
4 for the methanometer and the cutting. Now does that mean  
5 that in the most active part of the mine, the working  
6 face which where you are generating methane as a result  
7 of cutting that it's actually without monitoring at that  
8 stage?

9 A. That is the situation, sir.

10 Q. Yeah. Okay, thank you.

11 MR. MERRICK Just on that point, Mr. Smales, and it's  
12 something that perhaps we could have dealt with a little  
13 earlier even. I take it from your description so far and  
14 everything that you've told us, that when you get into  
15 the last portion of a heading where you're actually  
16 cutting the coal, there is no roof support at that point?

17 A. Correct.

18 Q. And you've said that the continuous miner could go  
19 into a heading, wherever it would be, the very -- into  
20 the heading and it would be able to go in, I think you  
21 said about --

22 A. 18 feet.

23 Q. -- 18 feet.

24 A. Yes.

25 Q. Why does it only go in the 18 feet?

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1 A. The location of the driver's cab on the continuous  
2 miner --

3 Q. Yes?

4 A. -- is approximately 18 feet from the cutting head.

5 Q. Yeah.

6 A. And there's generally a requirement that no man  
7 passes beyond the last support. So if he is under the  
8 last support, then he'll actually cut to about 18 feet  
9 depth.

10 Q. So the intent is that wherever possible nobody's  
11 supposed to be in at the very end of that heading under  
12 unsupported roof until you've had a chance to bolt it or  
13 to whatever else?

14 A. Yes. Your system -- what happens is with the  
15 bolting process which was mentioned the machine puts up a  
16 temporary hydraulic support and then --

17 Q. And we see that when we look at the machine?

18 A. Yes.

19 Q. But that's a reality of coal mining today with the  
20 modern equipment, et cetera, that that last distance into  
21 the head is usually only mechanical?

22 A. Yes. Yes.

23 Q. All right. Were you aware of any other monitoring  
24 systems or techniques that were used at Westray other  
25 than what you've described to us now?

MR. SMALES, EXAM. BY MR. MERRICK

1 A. I know of none.

2 Q. Just to finish off this topic of gas and  
3 ventilation, I take it that in addition to the methane  
4 that is generally produced by the coal itself, the  
5 desorption, I guess, of it and the gas that would be  
6 coming out -- the free gas that would be coming out from  
7 the fissures and the cracks, et cetera, you talked about  
8 a burst of gas.

9 A. Yes.

10 Q. Tell me about that.

11 A. Well, occasionally when mining there are pockets of  
12 gas which are located in the seam or adjacent to the  
13 seam. And occasionally when cutting under those  
14 conditions, there can be a quick release of gas.

15 Q. Of quite a quantity of gas?

16 A. Can be quite a high quantity, yes. And this can  
17 last for seconds and can last for months. On occasions  
18 you can have the floor break open, crack. And methane  
19 can be released out of a crack of that description  
20 sometimes for a couple of days and sometimes for weeks,  
21 sometimes for months, just keeps on coming through. That  
22 is a situation that can happen.

23 Q. So in addition to the normal make of gas --

24 A. Yes.

25 Q. -- if I can use the word "make," you will every now

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1 and then get bursts or pulses of higher concentrations of  
2 gas --

3 A. I don't --

4 Q. -- higher quantities of gas?

5 A. I don't say you will get it. I say it may happen  
6 and happens at some mines. Some mines, they never have  
7 that situation.

8 Q. All right. One last point on this. We are talking  
9 about a mine explosion and many of us may believe that in  
10 a normal mine or in a well run mine that there will never  
11 ever be an ignition of that gas. What can you say as to  
12 whether occasionally you do get ignitions even in the  
13 best run mines?

14 A. Over the years that I've been working in mines I  
15 think it's fair to say that I must have investigated in  
16 the tens of ignitions.

17 Q. Where you've actually -- the gas has ignited?

18 A. Where gas has been ignited. And they have varied  
19 from short-period ignitions of methane to the order of  
20 10-45 seconds to continuous burning and repeated flashes  
21 of burning over a number of weeks.

22 Q. Describe to me, if you would, what one of these  
23 unpreventable or ignitions would look like. If you were  
24 in the heading working at the coal face, what would  
25 happen?

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1 A. I think the best one is to -- the best thing is to  
2 give a real example, I think, rather than talking in  
3 theory about this. I think, if you remember, I did  
4 mention that in the A Heading there was a Dosco road  
5 heading machine.

6 Q. That's in the North Mains, yes.

7 A. That's in the North Mains. I can remember  
8 investigating an ignition where the seam was dipping and  
9 I think our members from Cape Breton will know of this  
10 quite well, so that the potential for layering in that  
11 area was nil and, in fact, the methane would actually be  
12 going uphill away from the face of the heading. On this  
13 occasion the rotating head had been cutting in the seam  
14 and in the strata above, which was not particularly hard,  
15 but in cutting in the seam there developed a small  
16 ignition when a blue flame was seen which spread across  
17 the material on the floor from roughly halfway across the  
18 heading, across to the right-hand side of the heading.  
19 That blue flame persisted for something like about 45  
20 seconds.

21 Q. This would be a sort of a blue flickering flame like  
22 you would see on a propane burner?

23 A. It is exactly the same flame that you'll see now  
24 with natural gas which, of course, is methane and it's a  
25 similar kind of coloration. And as you say, it was just

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1 a few inches above the material which was lying on the  
2 floor. That is the type of thing. Now when I talk about  
3 the flame going on for weeks. What happened in that --  
4 in a particular case that I can recite, the short  
5 explosion had been fired to enlarge a roadway. This had  
6 ignited methane in the cracks and what happened is that  
7 that flame continued to burn and every so often there  
8 would be a puff as the methane increased, the flame would  
9 come out, and gradually that died down over a period of  
10 weeks. The application of water makes no difference to  
11 that situation.

12 Q. I take it in a case where methane had come out and  
13 was up the roof level --

14 A. Yes.

15 Q. -- if you have an ignition that you would get the  
16 same phenomena up there then. You would have that  
17 flickering blue flame running along the ceiling?

18 A. Yes. In a rising situation where you could have a  
19 roof layer and you have got sufficient concentration of  
20 methane to ignite or burn then, of course, it can act as  
21 a fuse and you can actually see the methane burning and  
22 travelling back to a point where either it explodes or  
23 there's insufficient methane or insufficient oxygen for  
24 the flame to continue.

25 Q. So that in one's career as a miner, I take it from

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1 your evidence that it would not be unusual for most  
2 miners to have, at some point, experienced some sort of  
3 an ignition?

4 A. With -- you may not experience that, depending on  
5 your job, but I would think that most miners who have  
6 spent more than five years underground are aware of this  
7 situation.

8 Q. It must be a very frightening experience?

9 A. I'm -- well, it is really because you're not in  
10 control. I mean, when you're not in control of a  
11 situation, then you get frightened.

12 Q. All right.

13 COMMISSIONER But why can't water assist?

14 A. Well, what happens is -- I wasn't thinking about in  
15 the one where -- which I first described. You can flush  
16 that with water and, generally speaking, you'll be okay.  
17 But in the one where -- the gas is in the breaks, you  
18 can't get your water into the breaks. They're probably  
19 only half inch wide and you've got the gas burning in  
20 these particular breaks, so you cannot -- if you flush  
21 water in, all you do is push the methane back and the  
22 burning back. And this is a great problem.

23 COMMISSIONER Okay, I see.

24 MR. MERRICK All right. Let me come to another topic  
25 if I can. Ventilation being one of the most important

MR. SMALES, EXAM. BY MR. MERRICK

1 aspects of being able to control for the safe operation  
2 of a mine, I would assume that the second equally  
3 important factor to control is ground control --

4 A. Yes, I agree --

5 Q. -- or strata control?

6 A. Yes.

7 Q. Can you tell me what the purpose of ground control  
8 methods and technologies are?

9 A. Well, there are two real main purposes in ground  
10 control. Number one, of course, is to prevent falls of  
11 roof or falls of side which can injure a person or damage  
12 the machinery. I think that seems to be a fundamental  
13 sensible approach. The permanent basis for ground  
14 control is that you ought to systemically exploit the  
15 resource, and you either want to allow for full support  
16 of the area when you've taken out what coal you want or  
17 need or you're going to look at caving the area. So  
18 you've got to make a ground control system that allows  
19 you to do one of those two things. Having put in your  
20 immediate support, you also want to try to ensure that  
21 you don't get some sudden failure of that roadway  
22 condition. So you want to prevent sudden collapse of  
23 your roadways and -- or a major collapse of the area that  
24 you're working in. And the third permanent reason for  
25 ground control that I bring to mind is the question of

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1 surface damage. And if you look at the Westray Mine,  
2 there were two major problems there, as I saw it. One  
3 was the Trans Canada Highway which could have had quite  
4 substantial bumps in if not examined properly. And the  
5 other one is they were going to work under the area of  
6 New Glasgow where there's housing there. and I think the  
7 hospital was involved as well so that what you didn't  
8 want to do is suddenly cause the hospital to break or  
9 crack. So it made you look at surface damage by way of  
10 substance.

11 Q. Yes. And in deciding what approach or what  
12 techniques to use in your mine, what factors do we have  
13 to keep in mind in considering the adequacy of ground  
14 control techniques?

15 A. Well, the first thing, of course, is the depth. The  
16 deeper you are, the more pressure, vertical pressure.  
17 There's the seam characteristics itself --

18 Q. Just before --

19 A. Sorry.

20 Q. -- you go on to that, you've told us the depth at  
21 which the districts were being worked at this stage in  
22 the mine life. What would you say as to whether this  
23 was, say, a deep mine, not an unusually deep mine? How  
24 are we to evaluate that?

25 A. The 300 meter depth is a relatively shallow mine.

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1 It's the kind of depth at which room-and-pillar is being  
2 worked pretty successfully. The deeper mines are usually  
3 from about 500 to 1,000 meters.

4 Q. All right. I cut you off, you were about to tell me  
5 the second factor that you take into account on ground  
6 control.

7 A. The seam characteristics are very important. The  
8 hardness of the coal and the general strength of the  
9 surroundings, the adjacent strata, whether the roof is  
10 strong, weak, whether you have massive sandstones,  
11 massive materials which will bridge over large areas.  
12 It's pretty obvious that geological disturbances such as  
13 faults, washouts will affect you quite considerably.

14 Q. What do you mean by a washout underground?

15 A. Ah, during the coalification period -- I think most  
16 people remember the carboniferous forest which falls and  
17 then gradually the coal is formed. During that period  
18 streams would run through those forests and tongues of  
19 the streams would run off. And in those areas would be  
20 deposited silts, sandstones and even in some cases  
21 limestones. And, of course, what you've got then is that  
22 piece of the carboniferous forest is washed out. So when  
23 the coal is formed completely, you have a section which  
24 may be washed out and is actually -- comprises shales or  
25 sandstones or even, as I say, limestones.

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1 Q. So these would be bands or courses, I guess, through  
2 the coal seam itself?

3 A. Yes, there could be lenticular pieces in the coal.  
4 There could be complete elimination of the coal. But  
5 they vary considerably.

6 Q. And I would assume they would constitute difficult  
7 ground or loose ground, not good ground for roof control?

8 A. They vary. As a matter of fact, some of these,  
9 particularly the finer grain sandstones can be extremely  
10 hard, and then, of course, as you say, they can go on to  
11 the very, very soft shales. It's a grade right through.

12 Q. All right. Anything else in the way of geological  
13 disturbances that we should be keeping in mind?

14 A. Well, the seams do thin in places so you've got  
15 problems there you've got to look at when you're doing  
16 your ground control. In situ stresses, that's the  
17 horizontal stresses that occur and I think I did mention  
18 those yesterday. They are usually at right angles. We  
19 measure two stresses, one which are a major stress in one  
20 direction and the other one at right angles to it. In  
21 many places there is no dominant stress in one direction.  
22 Orientation of the roadways, to exploit your reserve in  
23 this particular case at Westray, you've got to get to the  
24 North so you may have to design with a problem  
25 immediately.

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1 Q. What do you mean?

2 A. That the roadways going to the North may be such  
3 that with the conditions you have they may not finish up  
4 as good roadways. They may be subject to all kinds of  
5 stresses. So you have to really examine the situation,  
6 see what is needed according to those stresses. And  
7 quite often in those cases you don't find that you've got  
8 a problem until you actually drive in those roadways.  
9 Another thing is water. If you have, we'll say, water-  
10 bearing strata or even damp strata, this will cause quite  
11 a substantial difference in the calculations you make in  
12 determining roadway size and size of pillars. And last  
13 of all, of course, from the point of view of the rooms  
14 themselves, there's the configuration of the room,  
15 whether you have a rectangle, a trapezoid, an arch  
16 roadway, a circular roadway, elliptical roadway, these  
17 are things which you've got to consider all the time.

18 Q. I take it in this mine and I'm looking now at  
19 Exhibit 38, Tab 1, which is the sort of geological map  
20 that we looked at yesterday which shows us not only the  
21 dip of the seam but the faults that they were actually  
22 encountering in the working areas of the mine. Now I  
23 appreciate your evidence that you can predict your major  
24 faults but your minor ones sometimes you find only when  
25 you get there and you then have to accommodate them. But

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1 my impression of what you've told us and the information  
2 that we have is that this was a mine that, in the area  
3 where they began to do the mining itself, they first  
4 predicted they were going to have considerable fault  
5 difficulties. They also found additional faulting, very  
6 unsettled ground through that area, particularly through  
7 the Southwest 1 district and even through into the North  
8 district where they were mining. And I get the  
9 impression that this was a mine that hadn't gone to where  
10 really they were intending to develop. Its main  
11 development was to be to the North; the better coal was  
12 to be the North. And, therefore, this was a mine that  
13 sort of had ground control difficulties right at its  
14 doorstep that they had to work through to get to the rest  
15 of the mine and they would always have to be travelling  
16 back and forth through. Is that a fair assessment?

17 A. The Southwest area appears to be me as being opened  
18 out to obtain coal which was required for the power  
19 station. The major fault which ran -- which identified --  
20 - ran from the Allen Mine across to an area just below  
21 No. 10 Crosscut. If we look on this plan, it ran  
22 somewhere in that direction.

23 Q. Yes.

24 A. There's a major fault. And if you look on that  
25 geological plan and try to erase from your mind the

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1        faulting which is shown going towards the Northwest which  
2        was encountered by the roadways which were driven to the  
3        north of the Southeast -- Southwest area, there appears  
4        to be an area of coal between that fault and the  
5        Southwest. Now when they started to drive those North  
6        headings, they then encountered that minor faulting.

7        Q.    Yes.

8        A.    And that then is something where they have to take  
9        quick action because they just couldn't work in that  
10       area. This appears to be the situation. In developing  
11       to the north for the future, the main development plans,  
12       which I think Mr. Golbey will be talking about later, did  
13       show roadways going straight to the North. And these, if  
14       we examine this plan, had to pass through faulted areas.  
15       The way of dealing with that would be to reevaluate the  
16       support that you're putting into roadways and also  
17       reevaluate the dimensions and the shape of those roadways  
18       and that is something which must be ongoing with a  
19       development of that nature.

20       Q.    All right.

21       A.    I hope that answers what you were asking.

22       A.    Yes. Okay, now let's talk about having in mind the  
23       considerations or the criteria that we have to look at in  
24       deciding what kind of roof support to use. Let's look at  
25       the various kinds or ways to control your roof strata,

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1 control your ground in a mine. I take it that there are  
2 methods of support to be inserted in a mine. Do you want  
3 to take me through those?

4 A. Yes, I think that's worthwhile. Do you have the  
5 identification of the --

6 Q. If you're looking --

7 Q. -- exhibit?

8 A. -- for a map, how about Tab 11 of Exhibit 38. Do  
9 you have Exhibit 38 up there?

10 A. Yes, sir.

11 COMMISSIONER Geotechnical map of the Southwest?

12 MR. MERRICK Yes.

13 COMMISSIONER Okay.

14 MR. MERRICK And the second one is of the North Mains.

15 COMMISSIONER Okay.

16 MR. MERRICK Is that what you're looking for, Mr.  
17 Smales?

18 A. I was more thinking of the photographs of the --

19 Q. Ah, okay.

20 A. -- behind there which gives you the temporary  
21 support type of method.

22 Q. All right. The next pages over then are a series of  
23 photographs.

24 A. Yes.

25 Q. Which one do you want to refer us to first?

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1 A. If we refer to the non-yielding arches which are  
2 the, in my exhibit book, are the first ones.

3 Q. Yes. And we've got two photographs there of non-  
4 yielding arches?

5 A. Yes. What we have here is what you might call the  
6 Westray which are a very practical showing of the arch,  
7 and the next one is a very -- well, one of the ideal  
8 settings that shows you the kind of standard which some  
9 mines do rise to, very few of them at that standard.

10 Q. Yeah.

11 A. The --

12 Q. The first photograph then is one up from --

13 A. The first photograph is the one I would like to  
14 speak to.

15 Q. And it's of Westray itself?

16 A. That is Westray, yes.

17 Q. All right.

18 A. And that is following the explosion. This is not  
19 prior to the explosion.

20 Q. So that's not necessarily the condition one would  
21 see prior to an explosion?

22 A. No.

23 Q. But it's being used for illustrative purposes only  
24 to describe the arches that we see in that photograph?

25 A. That is correct.

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1 Q. All right. Tell me about those arches.

2 A. The arch made of steel and is a passive support. As  
3 you notice it's been designed to fit a rectangular  
4 profile. Arches are also made to fit a -- complete a  
5 semi-circular profile which is, of course, a lot stronger  
6 as a design. The arch itself, when it is set, should be  
7 set as tightly to the roof and sides as practical and  
8 that is normally achieved by placing the corrugated  
9 sheets which you see on top of the arches over the top of  
10 the arches and then tightening the arch to the roof by  
11 wedge pieces, wooden wedge pieces.

12 Q. Wedging underneath the arches or on the top of the  
13 arches?

14 A. No, above. Above the corrugated --

15 Q. Yes, got it.

16 A. -- sheets on top.

17 Q. Okay.

18 A. And to do that effectively, you must span at least  
19 two of the arches. So if these are set at five feet  
20 apart, usually they're anything from three to five feet  
21 apart. You must have wooden pieces of six or seven feet  
22 long to span the two arches and then you're tying  
23 directly over the top of the wooden pieces so that you  
24 would make it your --

25 Now later on you'll -- in some of the discussion

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1 you'll find that arches were set following roof falls.  
2 When a roof falls occurs, it's almost vital that the arch  
3 is moved up into the opening. This is not understood by  
4 a lot of mining engineers and a lot of people, the reason  
5 being that if you put a substantial amount of chocking on  
6 top of that arch, you can actually exceed the strength of  
7 that arch by the shear load of the wood that you put on  
8 top. So that in setting these arches it's very important  
9 they are set correctly. And I'd like to point out that  
10 the object is to stop the movement of the ground with a  
11 non-yielding arch. So the tighter you get hold of it  
12 initially, the greater chance you have of stopping the  
13 roof from moving downwards.

14 Q. All right.

15 A. If you notice the arch itself, it has -- it is fish  
16 plated at two points.

17 Q. What do you mean by "fish plated?"

18 A. If you look at -- there's a camber across the top --

19 Q. Yes?

20 A. -- and just before the curve there's a plating which  
21 connects the top part to the side leg. It's very  
22 difficult to see on here.

23 Q. Yes.

24 A. There's a little bit of a blip on the second arch  
25 that you can see on the right-hand side.

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1 Q. All right.

2 A. The arches themselves have, for integrity, must be  
3 fastened together, which you call "strutting." And if  
4 you look you'll see there are metal pieces connected  
5 between the arches. And that is the only way they  
6 maintain integrity. And in the roof you can see the  
7 similar kind of thing down the roof going in the  
8 direction of the tunnel.

9 Q. Okay. And the second photograph, I take it, is just  
10 illustrative of basically the same thing?

11 A. It is the same thing but in that case you can  
12 actually see the fish plates on the -- they're the things  
13 with the bolts in.

14 COMMISSIONER Pardon me?

15 MR. MERRICK Oh, yes. Yes, I've got it.

16 A. The fish plates have the bolts on the left-hand side  
17 of that second --

18 Q. Just hold your photograph up and --

19 COMMISSIONER Oh, yeah. Okay. Yeah.

20 MR. MERRICK Okay?

21 COMMISSIONER I found them, yeah.

22 MR. MERRICK All right.

23 A. And I thought that that was just a little clearer  
24 picture of the arch for illustration purposes only.

25 Q. All right. Now I see reference to "yielding

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1 arches."

2 A. Yes.

3 Q. What's a "yielding" arch?

4 A. The rigid arch, or course, is designed or is put in  
5 place where you don't want movement and where you think  
6 you can stop all movement. The problem is that in many  
7 places in the mine, once you have removed coal, movement  
8 commences. The roof starts to lower or the sides start  
9 to come in or even the floor starts to lift. And in  
10 these cases it may be necessary to put in an arch which  
11 will move down with the roof rather than distort.

12 Q. This is moot, but I assume that it's of a somewhat  
13 limited nature, otherwise you're not going to be in there  
14 very long?

15 A. It can be limited and it can be quite, quite high a  
16 degree of movement. Where we -- where room-and-pillar is  
17 being worked, then the design must be for a very limited  
18 amount of movement. However --

19 Q. Why is that?

20 A. However, if you look at the next photograph which  
21 I've put in for example, you can see there there's been a  
22 tremendous amount of movement. That is the kind of  
23 movement you may have with a longwall face because in  
24 fact your design is totally different, and you will be  
25 moving out of there as quickly as possible.

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1 Q. So the first photograph we see of a --

2 A. Is Westray.

3 Q. Is Westray after the explosion?

4 A. Yes.

5 Q. And the second is of another mine where there has  
6 been considerable crush, if you will, put on the arches.

7 A. Yes.

8 Q. Now tell me what makes them a yielding arch.

9 A. I think the best thing is to do a quick sketch of  
10 this.

11 Q. Please, and then we'll break.

12 A. The profile of the arch itself is a "U". And of  
13 course that's a very strong profile, as you can imagine.  
14 There are three pieces to the arch, the crown piece, and  
15 two legs.

16 Q. Just a minor point, is that top one upside down?

17 A. No, that's the right layout.

18 Q. All right, keep going, I'll catch up. Somebody had  
19 to ask it. I thought it was my job. Keep going.

20 A. The inner piece slides down the outer piece, so you  
21 have--

22 Q. So we're looking down the leg in that top drawing?

23 A. That is a section across there.

24 COMMISSIONER That's a cross section?

25 A. Yes, a cross section there. These pieces are

MR. SMALES, EXAM. BY MR. MERRICK

1 clamped together, so after the pressure comes on, the  
2 clamping can slide down the legs.

3 MR. MERRICK Out of resistance?

4 A. The resistance is provided by these clamps.

5 Q. And theoretically, can you vary the amount of  
6 resistance or attempt to vary the amount of resistance?

7 A. Theoretically, you can do, but in practice, no. In  
8 practice, it's very difficult once you've tightened these  
9 clamps, the friction of the steel on steel tends to  
10 prevent any movement whatsoever. It becomes almost a  
11 rigid support. And what happens then in practice is that  
12 at intervals with a seven-pound or a fourteen-pound  
13 hammer, the miner will go around and give the legs a  
14 bump, and the steel does tend to move down then.

15 Q. So you hit the leg of the yielding arch, and it then  
16 settles, and the ground above your head settles a bit?

17 A. That's correct.

18 Q. All right, I'm not applying for that job.

19 A. Theoretically, that is not the thing, but that is a  
20 practical aspect of it.

21 Q. Now at some point, Mr. Smales, I would presume  
22 though that even a yielding arch is designed to, at some  
23 point, keep the roof from collapsing any more.

24 A. Well, I've just drawn this representative. This is  
25 not quite the arches. If you look on the diagram, the

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1 crown piece actually goes over the outside, over the  
2 legs.

3 Q. Now which photograph are we looking at?

4 A. I'm looking at the first photograph.

5 Q. Of Westray?

6 A. The Westray photograph. You'll notice that the  
7 crown piece goes over the legs.

8 Q. So if we look in that photograph, on the right-hand  
9 side we see that blue -- it looks almost like a stretcher  
10 or back --

11 A. Yes.

12 Q. Oh, it is a stretcher.

13 A. Yes.

14 Q. For the leg that goes up there just a short  
15 distance, a half an inch up on the photograph, is that  
16 where we're seeing the top piece coming down?

17 A. No, sir, you've got to go virtually -- go above the  
18 man's head in the blue helmet.

19 Q. Yeah.

20 A. Go to the right about an inch.

21 Q. Yes.

22 A. And that is the point at which you can see three  
23 clamps.

24 Q. Yes.

25 A. And that is the point at which the side leg goes up.

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1 Q. Okay.

2 A. If you look on the next picture, what has now  
3 happened is this whole material is tightening up. And at  
4 this stage, there is virtually no more potential for that  
5 to yield, other than by bending the legs.

6 Q. So as we look at that second photograph on the  
7 right-hand side as we come up the leg of those arches,  
8 the second one in, for example, just about an inch up, we  
9 see a bolt?

10 A. That's him.

11 Q. That's it?

12 A. Yes.

13 Q. So that's the top crown piece that's come down that  
14 far?

15 A. Come down that far.

16 Q. So that roof is pressed down to that extent in that  
17 mine?

18 A. Yes, in that particular mine, if you're examining  
19 that, the conveyor structure is probably about three feet  
20 high. You've got another two or three feet above, so  
21 you've got a maximum height in that room of six feet.  
22 That roadway would probably be something like about ten  
23 feet high initially. So you've had a convergence of  
24 something like four feet in that particular roadway.

25 Q. Just a minor point, but would one assume from that

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1 particular roadway that at some stage you're going to  
2 have to do -- probably abandon that one?

3 A. No, I would think that the settlement in that  
4 particular roadway has taken place.

5 Q. I see, all right.

6 COMMISSIONER Can you be sure?

7 A. I can't be sure of that at all. Looking over the  
8 picture though, it suggests that to me. What is  
9 suggested to me in that particular roadway is not the  
10 roof problem, but I think the floor would be the problem  
11 there. That would start to move up in that situation.

12 COMMISSIONER That's what you call being caught between  
13 a rock and hard place, isn't it?

14 A. Yes, yes.

15 MR. MERRICK Mr. Commissioner, would this be a  
16 convenient point to break?

17 COMMISSIONER Fine.

18 INQUIRY RECESSED (TIME: 11:06)

19 INQUIRY RESUMED (TIME: 11:28)

20 COMMISSIONER Okay, Mr. Merrick?

21 MR. MERRICK Okay, thank you. Mr. Smales, we were  
22 talking about yielding and non-yielding arches. Can you  
23 tell me under what circumstances and why you would use  
24 arches. Obviously you don't use them throughout the  
25 mine. When and where are they used?

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1 A. In some mines they are used throughout, actually,  
2 depending on the situation. But in a Westray-type  
3 operation, you would use them where you're finding that  
4 the preferred support, which was bolting, was not doing  
5 the job. They're normally put in as additional supports  
6 or where ground falls have occurred. And in a number of  
7 cases, you may even insert them where you are  
8 experiencing some type of ground movement. There is  
9 additional support for the existing bolting system that  
10 you've put in.

11 Q. So it's basically where you're having problems with  
12 your roof control?

13 A. That is the situation in a Westray-type of  
14 condition.

15 Q. What other methods are used in addition to yielding  
16 and non-yielding arches?

17 A. There are a number of other things, square set  
18 steel, which is really a preferred method, where the  
19 excavation is a rectangle.

20 Q. And do you have a photograph of that in the book?

21 A. There's a photograph.

22 Q. Next page over?

23 A. Entitled "square set." And it is arches, I'm sorry  
24 about that, a square set system.

25 Q. Yes.

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1 A. The structures are I beams.

2 Q. The two photographs that we're looking at just for a  
3 second so that I just know where they're from-- one is, I  
4 take it, the first one is, I take it, Westray post-  
5 explosion?

6 A. Yes, I'd like to take you through that picture, if  
7 you would like.

8 Q. All right, go ahead, you tell me the way you would  
9 like.

10 A. I'm just going to say that they are made of I beams,  
11 and the reason they're called "I beams" is because of the  
12 cross-sectional shape in the form of an "I".

13 Q. Yeah.

14 A. In the photograph which you see, Section 11, the  
15 roof has been secured by bolting initially.

16 Q. And do we see those bolts in that photograph?

17 A. Yes, if you look in the top right-hand corner,  
18 there's a projection.

19 Q. About a half an inch to the left from that corner?

20 A. That is correct, and that is a roof bolt end.

21 COMMISSIONER Are we looking at the pre-explosion or, I  
22 guess, the--

23 A. Yes, sir.

24 COMMISSIONER The post-explosion.

25 MR. MERRICK Post-explosion, the first photograph in

MR. SMALES, EXAM. BY MR. MERRICK

1 the square set.

2 COMMISSIONER Okay, fine.

3 MR. MERRICK Top right-hand corner, about a half inch  
4 over to the left from the right-hand corner.

5 A. I think it may be worthwhile just mentioning bolting  
6 before, I mean, I've gone to this photograph, if that's  
7 okay, and got out of context, Mr. Merrick?

8 Q. All right.

9 A. Could I do that?

10 Q. Let's talk about bolting first.

11 A. Bolting is a process of securing the roof strata as  
12 opposed to using a support to hold the strata up. It  
13 improves the situation with the strata itself. There are  
14 two basic concepts of roof bolting which I'll draw. I'm  
15 going to draw a horizontal seam because I think it's  
16 easier to understand what I'm talking about. The  
17 excavation is made 18 feet wide and 12 feet high up to a  
18 parting. Some five feet above the seam, and this is  
19 hypothetical, we have a fairly strong band of material.  
20 In this case, we can insert bolts by drilling a hole up  
21 into the band inserting a bolt with a shell. As we  
22 rotate the bolt, the shell expands and anchors into this  
23 very competent band of material. A plate is then placed  
24 on the bottom of the bolt and a nut is then put on and  
25 the plate is tightened up. These are placed across the

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1 room and so then I have this block of material held by  
2 the competency of the strata above. This is called  
3 "point anchoring of bolts."

4 COMMISSIONER They would be about four foot centers?

5 A. The intervals should be dictated by the requirements  
6 in this particular piece of material. It is fair to say  
7 that most people are operating only four feet centers or  
8 1.2 meters.

9 MR. MERRICK Mr. Smales, I can understand where if you  
10 have a strata here that is solid that you bolt into, but  
11 is it possible as well that if in this area you have,  
12 perhaps not as secure a strata system, layers of various  
13 things, that by bolting you can somehow create a beam  
14 effect?

15 A. Yes.

16 Q. Can you describe that for me, please?

17 A. We now have a strata that is laminated and,  
18 individually, these laminations have very little  
19 strength. They something like pages of a book.  
20 Individual pages, if you lift them up, they all tend to  
21 collapse. If now we drill a hole and insert resins and  
22 these are specially developed resins, we could now insert  
23 a bolt. We could put the resins in.

24 Q. And these resins come in tubes sort of like a  
25 sausage, a long sausage?

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1 A. Exactly like a sausage, a German sausage, you know,  
2 the length, and they're slightly less than the diameter  
3 of the hole. The bolt is inserted into the hole, pushed  
4 against the resin, and as the bolt is being inserted, put  
5 a plate on, it is rotated such that the hardener which is  
6 contained within the capsule is mixed with the resin.  
7 The rotations continue for a predetermined time.

8 Q. To mix the resin and the hardener?

9 A. To mix the resin and the hardener. The resins all  
10 come in two types, quick set and slow set. Quick set  
11 sets in about twenty-five seconds. The slow sets about a  
12 minute. And at that stage you have a very hard material,  
13 strong material.

14 Q. The bolt is then effectively glued in or anchored  
15 in?

16 A. So you've now anchored that and that, and there's  
17 resin all the way along. You've now finished up with  
18 this multi pages which are so much stronger. And the  
19 beam then has to be capable of supporting itself across  
20 the width.

21 Q. So these layers are compressed or pressures brought  
22 to bear on them which gives them the additional strength  
23 that they would not have individually?

24 A. Very little pressure, but mainly the fact that you  
25 actually are holding these together along that full

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1 length.

2 Q. I follow.

3 A. There is an amount of pressure.

4 COMMISSIONER It's almost like laminating?

5 A. It is, yes. You do this with roof beams. You can  
6 get three 9 x 3 planks together and you finish up with a  
7 26 wide, which is so much stronger than your individuals.

8 MR. MERRICK All right, just while we're talking about  
9 that for a moment, while you're inserting the roof bolt  
10 up in, you put the plate on?

11 A. Yes.

12 Q. And there's the nut that you've shown us there.

13 A. Yes.

14 Q. That nut is then spun?

15 A. No, in this particular case, that is pure and simply  
16 for the purpose of driving and twisting the bolt as it  
17 goes in. It is in the first case that the anchoring is  
18 done. The anchoring part is done and then that is put on  
19 as a separate item underneath.

20 Q. So in either case, you have the nut on the end of  
21 this bolt?

22 A. Yes.

23 Q. That will be up against the plate?

24 A. Yes.

25 Q. What do you say as to whether that can occasionally

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1 cause sparking?

2 A. That would not--by rubbing steel on steel, you will  
3 not produce sparking; you will produce heat which can be  
4 manifested if you can rotate it long enough. Usually you  
5 can't. You may get a dull red glow. I've never seen it  
6 myself. This is hearsay. I understand that can happen.  
7 But the roof bolting I've seen, I've never seen anything  
8 except the warming, heating of the plate.

9 Q. All right, that's the bolting thing?

10 A. That's bolting. And also side bolting is carried  
11 out. This is also done by using resin, and quite often  
12 the bolt which is put in here is purely and simply a  
13 wooden or a glass fiber piece of rod. That is rotated,  
14 of course, to make the resin seal, and virtually no  
15 pressure is put on that particular item. The reason wood  
16 and glass fiber is used here is when you come to your  
17 depillaring operation, you don't want to be rotating your  
18 cutting head into steel rods.

19 Q. So when you come back out depillaring, what you  
20 would be doing is taking the sides of that pillar right  
21 there.

22 A. Yes, cut straight into it.

23 Q. And you don't want any ignition or friction heat  
24 there?

25 A. Yes, or damage you can do by having that chopping

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1 steel there.

2 Q. All right.

3 COMMISSIONER Before you continue, are all resin fixed  
4 roof bolts done with the plate on when they're put in or  
5 are some, are the bolts driven in and then the plate put  
6 on?

7 A. You can actually do both, actually, yes.

8 COMMISSIONER Okay, yeah.

9 A. Yes, you can do both. What happens in many cases,  
10 obviously there's a chance for a piece of muck to drop  
11 out of these areas between the plates, so in that case,  
12 weld mesh, woven wire, which I'll identify on the  
13 photograph--

14 Q. In fact, we can see on that photograph of the -- as  
15 an example, either in the yielding arches, the first  
16 photograph of that or the square set arches, the first  
17 photograph, is that the kind of mesh you're talking  
18 about?

19 A. That's the mesh.

20 Q. You use that as well as bolting?

21 A. Over the top of the plates. That is put over the  
22 top of the plates up to the roof as tight as possible and  
23 also down the sides where there is potential for the  
24 sides to break off.

25 Q. That is primarily, I take it, to prevent injury from

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1 smaller falls, chunks of roof?

2 A. It is for the small materials, not for the major  
3 falls at all.

4 Q. All right, okay, that tells about roof bolting. Do  
5 you want to now take us back to the square sets?

6 A. Yes, I think if you look at this picture, it does in  
7 fact show the bolting. It shows you the mesh that was  
8 put up at the time of the bolting, and what can happen  
9 is, of course, the strata can start to move. Now where  
10 monitoring is taking place, usually a pre-determined  
11 amount of roof settlement or movement downwards is  
12 allowed. However, if that pre-determined amount is  
13 exceeded, then static supports normally have to be  
14 erected. In a rectangular roadway, the best support to  
15 erect is, of course, the one that conforms to that  
16 configuration. And that is why the square set is so  
17 beneficial in these conditions. It's a static support on  
18 a steel leg at each side, a horizontal beam, and once  
19 again, the beam has to be tightened up to the roof,  
20 otherwise it will be of no benefit. And on that  
21 particular photograph on the left-hand side above the  
22 beam, the horizontal beam --

23 Q. This is the first photograph of square set arches,  
24 yes.

25 A. You see that? You'll see there are a couple of

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1 pieces of wood. They look to me to be probably four to  
2 five feet in length, probably six inches square. That's  
3 the kind of thing that would be lodged across the two  
4 beams and tying up to the roof. The strength of that  
5 beam would be substantially more than the individual  
6 strength of an arch, of the arch that we saw in that  
7 first picture, the non-yielding arch. But due to its  
8 profile, in fact, it may not be as strong bearing the  
9 weight in the middle because in fact the shape of the  
10 arch, of course, being circular, is a benefit in  
11 transferring weight under resistance.

12           Once again, you've noticed that there are three  
13 struts sticking out of the horizontal beam.

14 Q. Yes.

15 A. There are the three items. And it is vital that  
16 strutting is completed between the horizontal beams and  
17 also the vertical legs. In fact you can see one strut on  
18 the left-hand side about a half way up the vertical leg.  
19 Don't forget, these square sets are slightly moved due to  
20 the explosion, I would think.

21 Q. And down on that left-hand leg, just a quarter of an  
22 inch up from the photograph, are those struts as well  
23 that we see?

24 A. They are struts. You can see one, two, three, four  
25 pretty clearly.

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1 Q. All right, so that --

2 A. Here again they may also, depending on the amount of  
3 space between the horizontal beam and the roof, insert  
4 corrugated sheets and then timber on the top.

5 Q. Now Mr. Smales, square sets and yielding and non-  
6 yielding arches looks like you can require a fair amount  
7 of steel if you're going to put much in. Is that a  
8 factor? Is this something that a mine operator would  
9 prefer to do or would prefer to avoid?

10 A. The benefit of roof bolting is that it's relatively  
11 cheap compared with this system. In laying out a mine of  
12 this description, you would estimate that you could use  
13 roof bolting if that was practical. And you would put a  
14 cost against that particular aspect in terms of material  
15 cost and labour cost, because this takes more labour,  
16 takes more time. You would also probably put an estimate  
17 in if you were looking at roof bolting for what might be  
18 necessary in the way of additional support of this  
19 nature. And that would come into your overall economic  
20 assessment. If when you're operating, you found that you  
21 were having to put in a lot more of this steel, static  
22 support, than you originally estimated, then you could be  
23 reducing your economic potentiality. The Westray  
24 situation was that in the north area, this is inbye No.  
25 10 crosscut, sorry, there is No. 10 crosscut. This is

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1 the North area. There's approximately 1,900 or 2,000  
2 meters of roadway driven.

3 Q. In fact, maybe we could take a look at that. That's  
4 also in Exhibit 38, -- sorry, Exhibit 45, Tab 10, that  
5 particular map. It's entitled "Westray Mine Support  
6 Map." And it's also at tab 6 in Exhibit 38. I knew I  
7 saw it in there. So either reference will give it. Now  
8 just before we talk about what Westray did themselves, I  
9 take it then from your evidence that if you begin to --  
10 let me back up. In planning a mine, you would hope to be  
11 able to do it primarily with roof bolting or some less  
12 costly method such as that.

13 A. In planning a mine of the Westray type, yes.

14 Q. Yes, but you would have to build in some degree of  
15 anticipated factor for steel sets, steelwork. Any  
16 general rule of thumb as to what you might prudently sort  
17 of anticipate in the way of steelwork?

18 A. I've never had a rule of thumb for this, I'm sorry.  
19 I wouldn't be able to give you an estimate if it was ten  
20 percent or five percent. I'm sorry, I couldn't do that.

21 Q. But I take it that if an extensive use of steelwork  
22 is a significant cost factor?

23 A. Yes.

24 Q. Now let's take a look at the map and tell me to what  
25 extent Westray found themselves having to use steelwork.

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1 Show us or tell us what that map shows.

2 A. The Number 1 tunnel, if we look at the key, the dark  
3 blue horizontal lines -- actually it's the dark blue on  
4 your plan, shows the rigid arches to a set. The red on  
5 your plan shows the square set work. And the light blue  
6 is where the yielding arches were set.

7 Q. Yes.

8 A. As we go down No. 1 slope, we can see where, what I  
9 call "static supports" were set in addition to bolting.

10 Q. Just before we get in further down, Mr. Smales,  
11 there was one other question I meant to ask you as to the  
12 significance of doing extensive steelwork. In a room-  
13 and-pillar operation, particularly when you get into a  
14 room-and-pillar development area, what's the significance  
15 to the operator if they've had to put in a lot of  
16 steelwork? How does that affect or cause you problems in  
17 the development or depillaring in a room-and-pillar  
18 situation or in the maneuverability of your equipment?

19 A. If you have to erect static steel during the initial  
20 part of the development, then obviously the development  
21 of the rooms slows down. Assuming that you have erected  
22 those static supports somewhere behind the additional  
23 room development, then you have additional teams working  
24 in that area to put those static supports in. You now  
25 have a situation where you have steel along the sides of

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1 the roadway, which means it is alongside the pillar and  
2 therefore, you have no opportunity for removing coal from  
3 the pillars.

4 Q. So that when you come back out of your room-and-  
5 pillar system, you can't rob the pillars, as they call  
6 it?

7 A. No.

8 Q. It --

9 A. You could, but the cost of removing those supports  
10 prior to carrying that work out and then the risk of the  
11 roof falling when you're doing all those supports would  
12 make it something that you wouldn't even entertain.

13 Q. All right. And that second point I had. To what  
14 effect -- to what extent does the existence of steelwork,  
15 particularly in the vicinity of intersections, cause any  
16 difficulty when an operator is trying to use equipment  
17 such as continuous miners, shuttle cars, et cetera?

18 A. In quite a number of cases, the intersections would  
19 -- could have square works set on chocks. Because when  
20 you start to rob the pillars, you would then not cut in  
21 that area. That could be a piece of coal that's left  
22 which would collapse under the normal roof weight.

23 During the operation, the opening out operation,  
24 with the bolting, you would not put the square work in.  
25 That square work would be put in after you've moved

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1 forward, advance your room.

2 Q. All right. Okay. Let me take you back to the map.  
3 You were starting to tell us to what extent they were  
4 using steelwork and we were coming down the mains to the  
5 10 Crosscut.

6 A. The first part of the No. 1 Main was developed using  
7 point anchored roof bolts. In addition to that, cement  
8 was sprayed onto the side of the roadway which helped to  
9 seal the roadway from the environment because the  
10 moisture in the atmosphere does tend to cause the shales  
11 to flake off and destroys to some intent -- to some  
12 extent, the integrity of the support system. They did  
13 find it necessary to erect square work to the red area.  
14 And yielding arch -- sorry, rigid arches, if I remember  
15 rightly, in the area just below No. 1 Crosscut.

16 The rest of the No. 1 Main, right down to the curve  
17 and into the coal, which, if you remember, was entered  
18 somewhere below No. 5 Crosscut, seemed to go quite well.  
19 But by No. 7 Crosscut they were in trouble again. And  
20 square sets were put in. And if I remember rightly, the  
21 photograph of square sets is in that area.

22 Q. The one that we were looking at a few minutes ago?

23 A. In the book, yes. Right down to the -- below the  
24 intersection of No. -- I think that's No. 7. Then there  
25 were yielding arches inserted and more square sets. I

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1 don't propose to go through every one of these, I don't  
2 know --

3 Q. No, just --

4 A. -- if you want me to, but you can see the pattern of  
5 arching that went on in the Southwest. I think that what  
6 is significant is if you really look at the northern  
7 development area. Virtually --

8 COMMISSIONER Before we get into that, assuming, Mr.  
9 Smales, that part there between No. 7 and No. 8 Crosscut  
10 where there are all three varieties of roof support used.  
11 Why would one elect to vary the methods in such a short  
12 span?

13 A. Well, I don't think one would elect to vary them. I  
14 think, looking at the plan, that would almost be  
15 certainly supply and demand situation. They probably had  
16 a condition and they got certain steel so they used what  
17 they had. Quite a bit of the steel was shipped from  
18 British Steel in the UK. And I would imagine, and I  
19 think this is for someone else to answer, that they  
20 probably got certain material available which they used.

21 COMMISSIONER Would that affect its integrity within the  
22 mine?

23 A. Where they are in that part of the mine which is  
24 rectangular work, the square set, in my opinion, would be  
25 the better facility for holding that up. Assuming that

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1 the block had dropped out of the overbreak I showed  
2 initially -- originally. If it had dropped out of the  
3 church arch then, really, the benefit would have been  
4 with the arch section. And whenever you have this  
5 situation you have to make your mind up which is going to  
6 be the best, static support where it's going to be a  
7 square set material or an arch profile.

8 COMMISSIONER Thank you. Sorry.

9 A. If we look at the Northern area we see a limited  
10 amount of roadway which is not supported by  
11 static support.

12 MR. MERRICK I take it wherever we do not see colouring  
13 indicating steelwork that, generally, roof support was by  
14 bolting?

15 A. That is correct. I should have mentioned earlier,  
16 Mr. Commissioner, that there is another support which was  
17 used at the mine; that was called "trusses."

18 Q. Let me to come to that in a few minutes. Let's keep  
19 going where we are right now.

20 A. The non-coloured area was bolted. So that if we  
21 look at the whole picture of what was happening in the  
22 North area, we have a grand total of about 2,000 meters  
23 of drivage inbye No. 10 Crosscut.

24 Q. So if one were to measure those roadways inbye No.  
25 10 Crosscut, you've got about 2,000 meters of roadway?

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1 A. That is correct.

2 Q. All right.

3 A. And in there there's something like 960 meters of  
4 static steelwork representing something -- about 48 or 50  
5 per cent of the area.

6 Q. So 40 some -- I had 46 in my notes, but whatever it  
7 actually comes out to in math, somewhere that 50 per cent  
8 of those roadways were supported by steelwork?

9 A. In addition to the bolting that was done initially.

10 Q. And what does that -- what impact does that make on  
11 you as a mining person? Is that high, low?

12 A. Well, for -- as a roof-bolted mine, this is very  
13 high, in my opinion. I hate giving opinions, by the way,  
14 on this particular subject.

15 Q. But I take it that, assuming that is an unusually  
16 high amount of steelwork, that would also be a reflection  
17 of the problem -- the unusually high degree of problems  
18 that were being experienced?

19 A. This would show that.

20 Q. All right. What about in the Southwest District?

21 A. Now the Southwest, I think we've got to note there's  
22 a difference, and that we were developing for room-and-  
23 pillar working and pillar extraction. There's a total of  
24 3,000, just over -- about 3,200 meters of roadway  
25 developed in that Southwest area. And something like

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1 480-490 meters of that were supported by steelwork, which  
2 represents about 15 per cent.

3 I think the point must be made that they went in  
4 these places and came out pretty quickly so the  
5 requirement for steelwork which is required in this would  
6 not be as great. However, that doesn't alter the fact  
7 that there was a considerable amount of roadway  
8 deterioration in the North compared with the Southwest  
9 area.

10 Q. What about the mine as a whole? Are you able to  
11 give me any comparison figures as to --

12 A. Totalled?

13 Q. Yes.

14 A. No, I didn't do that because, generally speaking,  
15 with the slopes being cross measure the potential for the  
16 support in them is better. With using the shotcreting on  
17 those slopes as well, in addition to the roof bolting,  
18 they stood a much better chance of maintaining integrity  
19 of that support.

20 Q. All right. Thank you. Now let me take you back.  
21 We've talked about the steelwork, the kinds and the  
22 extent to which it was used in this mine, let's talk  
23 about some other methods of roof control that perhaps  
24 aren't quite as onerous, cost wise and labour wise, as  
25 steelwork. You were talking about trusses?

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1 A. Yes, sir.

2 Q. And if we can turn to Exhibit 38, tab 11, and flip  
3 past the plans and photographs that plans and photographs  
4 that are in that section. Well, perhaps not past. Just  
5 past the square set photographs that we left off on. And  
6 incidentally, just for clarification purposes, the second  
7 typical square set support photograph, the first one was  
8 Westray, the second was of another mine.

9 A. Yes, sir.

10 Q. That second photograph, the square sets, we're not  
11 suggesting that that's the way that a coal mine should  
12 look, I assume?

13 A. This was put in to show you the kind of square set  
14 work which you would put in the -- on the bottom,  
15 normally around a shaft, when you had a shaft entry,  
16 where you want no movement whatsoever of the strata.  
17 It's going to last you 25, 50, 100 years. And you'll see  
18 the tremendous bulk of those square sets in that  
19 condition.

20 In a mine of this description, you would not expect  
21 anything like that standard.

22 Q. All right. Okay. Turn over to the next page to a  
23 diagram entitled "Dywidag Truss Advantages." And what  
24 system of roof support is that showing us?

25 A. This support really worked on the basis that you, to

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1 some extent, lost the initial battle. And what happened  
2 in this case is that the -- I think I'd better draw for  
3 the people who haven't got pictures. Your roadway is  
4 driven and your initial support system is using the  
5 bolts.

6 Now what was identified was that this system of  
7 using bolts was not sufficient to prevent movement. With  
8 the truss system, remember, I drew where breaks would  
9 occur, you drill at an angle into the roof. And once  
10 again with resin, you secure the anchorage into the roof  
11 of a truss.

12 The horizontal on the truss is brought across to a  
13 connection which can be tightened. But as you can  
14 imagine, if you put a piece of material across there and  
15 tighten in this direction, the amount of pressure in this  
16 direction is nil. So these are really a very static  
17 situation where when the roof sags onto that truss, you  
18 now have the bolts trying to maintain the integrity of  
19 that particular lens and the truss supports underneath.

20 These trusses were introduced when they found that  
21 they were getting the lowering of the roof at the Westray  
22 Mine and then they were put in at similar intervals to  
23 the intervals between the bolting.

24 Trusses are used in many, many instances nowadays,  
25 particularly at intersections, because of the fact that

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1 you anchor them 10 or 12 feet into the solid material  
2 beyond the breaks which have been pre-formed.

3 Q. All right. Thank you. You mentioned a moment ago  
4 about a system of providing some support, of spraying  
5 concrete.

6 A. Yes.

7 Q. I'm just going to ask you to flip over to the next  
8 page and we see a photograph. Is that what you're  
9 referring to?

10 A. Yes. This is the system. The cementitious material  
11 contains some strengthening agents, these may be fibre or  
12 they may be even steel materials, and that is sprayed  
13 onto the surface of the rock, and over the bolts as well,  
14 to form a continuous skin. This does help prevent quite  
15 a bit of the small material falling, and it also, as I  
16 said, prevents the atmosphere from attacking the rock  
17 surrounding the excavation. And that's quite  
18 interesting, the amount of deterioration in roadways  
19 which occurs purely and simply from the ventilation  
20 passing along that roadway.

21 It has some limitations in that if there is water  
22 being produced behind the cement, then the cement can be  
23 lifted off and slab off itself at times.

24 Q. Incidentally, a somewhat more minor point, but what  
25 effect on ventilation would that type of application have

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1 in the areas where it's used?

2 A. As a matter of fact, in some roadways where problems  
3 occurred in the past, the roadways could be sprayed with  
4 cement to make it a smoother lining because the  
5 resistance of the roadway depends, obviously, on the  
6 frictional resistance of the roadway and the surface area  
7 of that frictional resistance. When you've got,  
8 particularly, static supports like arches, then you've  
9 got a highly resistant roadway. The roof bolted roadway  
10 would not be as resistant as the arch roadway.  
11 Cementitious material, of course, you're getting even  
12 less resistance.

13 Q. As we flip over two pages past that first one about  
14 concrete, I see a photograph of cement chocks, and then  
15 following that a photograph of wooden chocks. Can you  
16 just briefly tell me about when they are used.

17 A. When you have an area of roof exposed, sometimes  
18 it's too -- just too big, or the weight on it is too  
19 great to be supported by normal systems. In those cases,  
20 you would erect chocks. At the Westray Mine, at each of  
21 the intersections on the No. 2 Slope. These were quite  
22 large. The crosscuts onto the No. 2 Slope were anything  
23 over 20 feet wide.

24 Q. Incidentally, that photograph of the cement chocks,  
25 is that Westray?

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1 A. That is Westray. And that -- actually, on the  
2 bottom you see a lightish material?

3 Q. Yes.

4 A. That is identifying the -- that is the conveyor  
5 which is running in No. 2 Slope.

6 Q. Oh yes. Going horizontally across the photograph,  
7 just in the --

8 A. Yeah, slight incline. That's right.

9 Q. Yeah. So this photograph is taken in a crosscut  
10 looking at the return main?

11 A. Looking from the crosscut into No. 2.

12 Q. Yes.

13 A. Yes. And the conveyor, at the time, had been  
14 damaged badly. It was on the floor and "roughed up," if  
15 I may use that expression. At each of those  
16 intersections, a concrete chock, which as you can see, is  
17 a six feet square concrete erection between the floor and  
18 the roof. This, of course, then reduced the span from  
19 the coal to the block and from the block to the coal on  
20 the other side. These were substantial.

21 Having said that, I visited the mine on a number of  
22 occasions in the No. 2 Slope and this concrete chock  
23 actually protected the crosscut fairly well, but the  
24 intersection on No. 2 Slope, in quite a number of cases,  
25 the roof there was in a collapsed state.

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1 Q. Yes.

2 A. The wooden chock --

3 Q. And is that Westray again?

4 A. That is also at Westray. I'm sorry, I can't  
5 identify the position of that, but this was the type of  
6 chock which would be erected for two purposes. One may  
7 be at an intersection for the purposes of securing and  
8 holding a horizontal girder, and there would be two  
9 chocks, one to each side of the intersection, and the  
10 horizontal girder placed on top. It's a very substantial  
11 method of supporting. Or in a roadway where a collapse  
12 was feared and the type of support you had was not  
13 satisfactory, so you elect a chock. It's a judgment.

14 If you look in that roadway that is drawn, that's in  
15 the photograph, there's no chance of machinery travelling  
16 backwards and forwards on that roadway again, other than  
17 by up over the chocks. So that you've really got a state  
18 there where that roadway is abandoned except for the men  
19 travelling.

20 Q. All right. And are they main methods of roof  
21 support or ground control that --

22 A. They're the --

23 Q. -- have been utilized?

24 A. -- main methods of roof control. What we might call  
25 immediate and intermediate. But the main ground control

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1 features are the design of the pillars and the design of  
2 the rooms between them. The importance of those designs  
3 I think we've identified previously, but I'll repeat them  
4 again. If the pillars are not substantial, they will  
5 tend to start to fail and that failure will be  
6 transmitted into the room.

7 When you're retreating, you have two decisions to  
8 make, whether you're going to leave pillars which remain  
9 intact or pillars that may fail later, or if you're  
10 actually going to depillar. Having made those decisions  
11 which must fit in with the overall pattern that you're  
12 trying to design, then you can successfully work that  
13 area.

14 If you were working under very important properties,  
15 such as the hospital, there may have been a conscious  
16 decision that you do not want to lower the surface, in  
17 which case you may be leaving all the pillars.

18 Q. All right.

19 A. If you're working under the Trans Canada Highway,  
20 there may be a decision that you're prepared to allow the  
21 roof and the floor and, therefore, the surface of the  
22 mine to come together slowly. These are all ground  
23 control decisions which have to be made in the light of  
24 the limitations that have been placed on your work.

25 Q. But I take it from your evidence then that your

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1 primary -- how do I put it -- I guess the front line  
2 method of ground control is your design?

3 A. Is design.

4 Q. And then these other methods that we've talked  
5 about, the arches, et cetera, are basically the, sort of,  
6 secondary method of control?

7 A. They are secondary to that extent but they are  
8 obviously primary because they are the thing that  
9 prevents the men getting a bump on the head.

10 Q. All right. Now let me come to that for a moment and  
11 talk just for a few minutes about falls. And in  
12 particular, I want to have you just describe to me what  
13 your roof can look like after it has been cut out by the  
14 continuous miner. Now the miner cuts basically a  
15 rectangular shape, and assuming that you can get support  
16 in there fairly quickly, basically, you maintain the  
17 integrity of the roof. But there are falls that  
18 nevertheless occur --

19 A. Yeah.

20 Q. -- of one size or another. Can you tell me about  
21 those and the significance that they would have on  
22 ventilation?

23 A. If we examine the formation of the roadway ideally -  
24 - particularly on a -- one of the roadways which is on  
25 strike; that is, going level, we would have the seam

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1 going across. We would have an ideal road in this  
2 manner. However, as I explained, quite often this  
3 triangle of coal will fall out. Then at Westray they had  
4 a, what shall I say, a very difficult roof above the seam  
5 and they tend to get an overbreak, anything from .4 to  
6 one and a half meters, as quite a regular situation.

7 Q. That would be the depth of the overbreak?

8 A. The overbreak, yes. And we're talking about,  
9 really, from the roof of the normal height of the cutting  
10 into the roof of the seam and the strata above. And this  
11 was something that they did encounter on quite a regular  
12 basis.

13 Q. And do I -- can I assume -- can we assume from that  
14 that even in a case where you're mining on the dip, if  
15 you will, so that the roof that you're cutting out by the  
16 miner is parallel to or horizontal to the strata, to the  
17 seam and to the strata, you would still get overbreak?

18 A. You would -- you may get overbreak if you were, as  
19 you say, going exactly down dip. If you remember, the  
20 contours were like so. If you were mining exactly  
21 downhill in that manner, then you could have the seam  
22 like so. So you had a flat roof. However, none of the  
23 roadways go like that; they go across. So you've always  
24 got a little bit of coal as a triangular piece in all the  
25 roadways. Overbreak would occur in any of these places.

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1 Q. And by "overbreak" I assume you're meaning not only  
2 a piece of the roof that falls out at the depth that  
3 you've indicated, but it would be of a certain dimension.  
4 It would cause a cavity, if you will, in the roof.

5 A. Yes. And if you think in terms of -- these were  
6 anything from .4 to about one and a half meters, this  
7 means that as you look at -- there's the floor, which I  
8 hope looks relatively straight.

9 Q. Yes.

10 A. You can imagine you have the surface of the seam,  
11 top of the seam, horizontal as well, which you would like  
12 to be at. If you only break half a meter here and you  
13 break one a half meters there, the roof I've exaggerated  
14 to be that shape. So that if you have methane migrating,  
15 then it can actually migrate into these cavities, and so  
16 you can have a concentration of methane or even a layer  
17 running right through the whole lot.

18 Q. With concentrations of it at places through the roof  
19 heading --

20 A. With --

21 Q. -- roof?

22 A. Concentrations. And fair quantities of methane in  
23 cavities.

24 Q. If an ignition were to occur in a roadway with that  
25 phenomena existing; that is, a layer of methane that had

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1 layered with pockets of it, or concentrations of it in  
2 roof cavities, I would assume then that you might have an  
3 ignition that would almost run like a wick through that  
4 roadway.

5 A. Yes. I think when I mentioned the one I  
6 investigated where the coal actually was burning on the -  
7 - the methane was burning on the floor, I said it was a  
8 roadway going dipping. If we assume that that had been a  
9 roadway rising, and a heap of material on the floor and  
10 this was burning here, and if we got the situation where  
11 a roof layer just through there with all that area, then  
12 there is a potential for that flame that has shown that  
13 there is methane to crawl up the front of the face and  
14 then cause a burning here. Now the violence of that  
15 burning would obviously depend on the concentration of  
16 the methane. At this point, which is nearer the general  
17 body, it would almost certainly be a lesser concentration  
18 than up at the top here. So you now have the potential  
19 for the -- this to act, as you say as a fuse or wick,  
20 down which the flame can travel.

21 Q. And I would assume that even if in the cavities we  
22 had a higher concentration than 15 per cent methane, that  
23 a burning of the -- there will be an explosive range, or  
24 an ignition range, with that methane between the higher  
25 concentration and the general body of the air. That's

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1 your danger zone.

2 A. There's danger zone here. Because, as you say, if  
3 you've got 30 per cent in there and here you've got .5 --  
4 .8 percent, somewhere in between those you have between  
5 five and 15 per cent.

6 Q. And assuming for a moment that it's just along the  
7 layer that I'm indicating along the roof line in the  
8 diagram, that burning that occurs there does cause some  
9 degree of turbulence?

10 A. You get excessive turbulence in those areas.

11 Q. And the more turbulence you have, the more mix you  
12 have of the higher concentration into the general body,  
13 expanding your danger zone?

14 A. Yes. If you have the right concentration.  
15 Alternatively, if you've got a very low concentration in  
16 there, it would tend to mix and the flame would go out.

17 Q. Because --

18 A. You've got the two potentialities.

19 Q. -- you'd be below the five per cent at that point?

20 A. Yes.

21 Q. All right. Just one other point when we talk about  
22 those roof cavities. I assume whether you're on the dip  
23 or on the strike that somebody -- that the main mine  
24 ventilation monitoring system would be reading at  
25 whatever height the sensor had had, it would not be

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1 detecting those cavities?

2 A. No chance at all.

3 Q. Nor would you necessarily pick up those on a  
4 ventilation survey?

5 A. No.

6 Q. How would you actually be able to ventilate those  
7 cavities if they weren't already being ventilated by your  
8 main mine system? You told me that that you could detect  
9 it by your methanometer by having a probe and putting it  
10 right up in there.

11 A. That's correct, yes.

12 Q. How would you ventilate those cavities?

13 A. There are two practical ways of doing this without  
14 using auxiliary ventilation fans supplied to those. If  
15 we erect what is called a "hurdle sheet," which is an  
16 incline piece of plastic, across the roadway, it's laid  
17 on a continuous roadway with air going through and  
18 supported top and bottom, and the air coming in here will  
19 hit that plastic and be directed up into the roof. So  
20 disturbing this roof layer, breaking it up and diluting  
21 the gases. This hurdle cloth, normally, would be  
22 suspended across the roadway with rope, and usually you  
23 would take it, probably, three-quarters of the way  
24 across, preferably all the way across, but so that you  
25 leave adequate space at the bottom and don't restrict the

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1       airway to any extent. That is one method, very simple  
2       method, using the material which is available and using  
3       the air which is available.

4       Q.     But fixed in placed and appropriate only to the  
5       cavities right in the area?

6       A.     That's all. You'd have to -- if you've got a half  
7       dozen cavities along this roadway you may have to have  
8       half a dozen sheets.

9       Q.     All right.

10      A.     The other way is by using what is called a  
11      "compressed air venturi." The venturi works on this  
12      basis: You have a -- this is a steel contraption, very  
13      much like a megaphone. I forget what they call it in the  
14      mine. You'll probably remember --

15      Q.     I'm --

16      A.     You can't remember the name of it. They had a  
17      special name for it, but this is called -- this is a  
18      venturi. And you introduce compressed air into an  
19      annulus which blows the compressed air. This is a  
20      circular construction. So we're now blowing compressed  
21      air into this steel construction. As a result of that  
22      air being compressed, it induces air from outside in  
23      very, very much greater quantity than the compressed air  
24      which is going in. So the result is you have a big  
25      increase in air quantity available. This contraption is

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1 probably two feet in length. There are usually a couple  
2 of lugs on it so that, in fact, you could hang this and  
3 direct the airflow into the cavity. That's a more  
4 sophisticated method of removing the methane from  
5 cavities.

6 Q. And I take it that it's relatively mobile?

7 A. Oh yes. They're the kind of thing you can pick up  
8 in one hand and move along.

9 Q. And --

10 A. But you've got to have a compressed air facility and  
11 a hose.

12 Q. Was Westray using these pieces of equipment?

13 A. The men referred to them. Whether they were being  
14 used, I don't know. But men do refer to them in their  
15 comments.

16 Q. They appeared to have them?

17 A. They had them, yes. This was -- that is a  
18 manufactured type of device. Venturi device. You can  
19 very simply make these at the mine. And they worked  
20 totally effectively, by just having a rectangular box  
21 with a nozzle. The compressed air ejected from the  
22 nozzle and this will also induce air, not as efficient as  
23 the designed one, but this does work quite well. There  
24 is one thing that you must remember though, when using  
25 compressed air, you must actually earth the equipment

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1 otherwise you may get static energy, static electricity,  
2 which can produce a spark.

3 Q. Yes. All right. One last question on ground  
4 control. I take it, Mr. Smales, there are also methods  
5 that a mine can use to determine once they have cut the  
6 roadway, and even once they have supported it, albeit by  
7 roof bolting or arch or steelwork, whatever, there are  
8 methods by which they can measure whether that roof is  
9 beginning to sag?

10 A. Yes.

11 Q. And what is that method?

12 A. There are a number of methods that are adopted.

13 Q. Just give me quickly the theory of them and --

14 A. The -- what is done generally is that a hole is  
15 bored into the roof and sensors are put into the roof  
16 which identify the amount by which the strata is opening  
17 up at the different horizons in the roof. To make the  
18 amount by which the roof is sagging into the excavation,  
19 what happens then is you anchor a rope up in the roof and  
20 you allow the identification to be below the initial roof  
21 level. So you can have three two-inch bobbins at the  
22 bottom. As the roof moves down, it tends to cover the  
23 bobbins. So if there's two inches -- two-inch bobbins,  
24 you can see when two inches has been deflected.

25 Q. I understand.

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1 A. This is the system that you use.

2 Q. All right.

3 A. Another thing that's worthwhile just mentioning is  
4 that in doing this work you should be actually measuring  
5 load that is coming on. So load cells are also  
6 distributed along the roadways for determining just what  
7 kind of pressures are being distributed in the roadways.

8 Q. All right. Mr. Commissioner, this is an appropriate  
9 point to break if that's convenient.

10 COMMISSIONER Just one point, please. What you're  
11 describing there as measuring the slippage in the roof,  
12 is that what some refer to as an "extensometer"?

13 A. Yes. Yeah. They would refer to that.

14 COMMISSIONER Yeah, okay. Thank you.

15 MR. MERRICK All right. After lunch we'll talk about  
16 dust.

17 INQUIRY RECESSED (TIME: 12:31 p.m.)

18 INQUIRY RESUMED (TIME: 2:00 p.m.)

19 COMMISSIONER Now, Mr. Merrick?

20 MR. MERRICK Thank you, Mr. Commissioner. Mr. Smales,  
21 just before we do leave the ground control part of your  
22 presentation, I do want to finish off one point. And  
23 that is from the information that has been available to  
24 you through the inquiry and that's in the possession of  
25 the Inquiry, were you able to determine the extent to

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1 which they had had falls in the Westray mine?

2 A. Yes.

3 Q. And have they been plotted on some maps that we'll  
4 use with your evidence?

5 A. I have a map of the overall picture and then we have  
6 detail which we can show the areas in which falls which  
7 were reported occurred.

8 Q. All right. If you can turn to Exhibit 45, Tab 15.  
9 And in that section there are a series of maps, the first  
10 one being of the whole of the mine, entitled  
11 "Geotechnical Map." And then following that we've got  
12 two other maps of the Southwest and the North. In fact -  
13 - yes, of the North.

14 COMMISSIONER These are blow-ups of the main --

15 MR. MERRICK That's right. The main map is the first  
16 one and then the following two are blow-ups of the two  
17 districts. Taking me through that, Mr. Smales, can you  
18 tell me what the fall -- what the records show as being  
19 the recorded falls?

20 A. In the Southwest, just backing up a minute, these  
21 falls were recorded between the 28th of September, 1991,  
22 and the 24th of April, 1992 --

23 Q. Yes.

24 A. -- which is a relatively short period. And these  
25 are the falls which were required to be reported to the

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1 inspectorate and most of them were reported, actually.

2 Q. Yes?

3 A. The enlarged version of the Southwest has items  
4 which you can identify as "faulting in green." It has  
5 areas which you can see outlined in blue. And it has  
6 other places which you can see in red.

7 Q. Yes. In fact, on the legend that's beside us, in  
8 each of those colours means a different kind of roof  
9 problem?

10 A. The blue indicates the areas of overbreak. And if  
11 you have a magnifying glass, you may be able to identify  
12 the amount of overbreak which I said this morning varies  
13 from .4 to anything up to 1.5 meters.

14 Q. Yes.

15 A. The falls occur quite massively in the development  
16 of the rooms to the North.

17 Q. Now what would be the difference between -- we're  
18 seeing here a distinction between roof falls and  
19 overbreak. What's the distinction?

20 A. The distinction is that what is termed an  
21 "overbreak" would occur during the period that they had  
22 cut the coal out and before the roof bolting took  
23 place.

24 Q. Yes.

25 A. That would be looked on as overbreak. Having passed

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1 that position with the preliminary supporting system at  
2 some place behind where the development was taking place,  
3 a fall would occur which would include the bolts moving,  
4 the meshing moving, and the roof collapsing. This is  
5 quite distinctive. The falls varied from five feet, some  
6 as high -- were reported 20 and 30 feet high.

7 Q. In fact, if we look in the little box that's beside  
8 the legend at the top on our map and the ones in the  
9 exhibit book, it would be the one that shows the number  
10 of falls. That indicates that there were 16 falls in  
11 this -- reported falls in this district during that  
12 period of time?

13 A. 16 falls reported for the whole of that North and  
14 Southwest area; that's the total number.

15 Q. And that box gives us the date of the fall, plus the  
16 general measurements of the fall?

17 A. That is correct, it gives you the length and the  
18 height to which they collapsed.

19 Q. So that there were falls in there of relatively --  
20 well, ranging from about five - six meters to perhaps as  
21 much as 12 - 15 meters.

22 A. 15 meters. The falls themselves were identified on  
23 the enlarged scale map so that if you look in what is the  
24 Southwest No. 2 you will see a "1," a red "1" at the side  
25 of the fall and that "1" relates to the "1" on the

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1 information at the side which was up to a 12-meter height  
2 and 10 meters in length.

3 Q. So we're looking on the big one about where that --

4 A. The big one --

5 Q. -- pointer is?

6 A. -- we're looking just about there.

7 Q. Yes.

8 A. And you can then identify successively the different  
9 falls. Number 5, and you can then pick out the damage of  
10 that particular fall. They were generally something  
11 within the width of the roadway. The roadway was 18 feet  
12 wide. The fall itself would move inwards probably  
13 reducing in size.

14 COMMISSIONER That's the area that shows "1" and "2" and  
15 then "5" with a "D" and an "E" in the area also?

16 A. There's a "5"

17 COMMISSIONER Yeah.

18 A. -- and a "D" at the side of it.

19 COMMISSIONER Yeah.

20 A. There's a red "5" and a blue "D."

21 COMMISSIONER Okay, thanks. Just make --

22 A. That's correct.

23 COMMISSIONER -- sure I'm in the right place.

24 MR. MERRICK And the blue letters that are shown on the  
25 map, they would refer to your legend up in that top left-

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1 hand box?

2 A. Yes. If you identify in "A" Road here the first of  
3 the blue outlined areas, you may not be able to see it on  
4 you very small scale maps, but that shows an overbreak of  
5 one meter.

6 Q. I see. Because the measurements are actually  
7 printed in there if one has got a magnifying glass.

8 A. And the -- going along the roadway, the first one is  
9 .75 meters, the second one is one meter, the third one  
10 1.5, the fourth one 1.5, .25 --

11 Q. All right.

12 A. -- that is the situation.

13 Q. So that map gives us the reported dimensions of the  
14 overbreaks as well?

15 A. Overbreaks and the fall.

16 Q. Now --

17 A. What I think is interesting here is that we have  
18 quite a massive falls in the Southwest area mainly, if  
19 you notice, in the area that was developed and had to be  
20 abandoned because of the faulting. Three faults in the  
21 Southwest 1 development area.

22 Q. Three falls?

23 A. Three falls.

24 Q. All right.

25 A. But in that Southwest 1 area you can see

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1 considerable overbreak occurring.

2 Q. Now I notice that your letters -- or the legend  
3 refers to not only roof falls and overbreaks but also  
4 pillar slabbing. Explain that to me.

5 A. Along the side of the roadway the coal, under  
6 pressure, will tend to break off in places. And this is  
7 where the pillar slabs off and that automatically widens  
8 the roadway. So this could require more bolting in the  
9 roof as you've extended the beam from the last bolt to  
10 the side of the roadway.

11 Q. And the next symbol is cutter roof. What is "cutter  
12 roof?"

13 A. When the coal is extracted, there's a tendency for  
14 breaks to form in the roof. Now those breaks will be  
15 there but when they become defined so you can see them,  
16 they tend to be on one side of the roadway but that will  
17 be defined in the roof. This can be predominant on one  
18 side of the road. It usually is, particularly if there's  
19 a horizontal stress in a particular direction. They form  
20 under all kinds of conditions. Obviously, if the roof is  
21 heavy at one side, then you will get that kind of break  
22 on the roadway.

23 Q. So this is a break in the roof itself --

24 A. Break in the roof.

25 Q. -- it's not necessarily a fall at that point?

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1 A. No, it's a defined break in the roof.

2 Q. All right. And your next symbol is "slickenside?"

3 A. Slickensides. As the shales and materials are  
4 pushed together, they form a shiny surface which, of  
5 course, is not very competent, doesn't hold together very  
6 well. And that is slickensiding. And so when these  
7 areas were examined by the geotechnical engineer, he  
8 would look at the kind of material and look for these  
9 shiny surfaces which he called "slickensided" areas.

10 Q. All right.

11 COMMISSIONER Are there actual examples of those in this  
12 plan?

13 A. The letter "G" on your plan which I'm trying to  
14 pick up --

15 COMMISSIONER That's down the Southwest --

16 MR. MERRICK That's C-1 Road.

17 A. -- and you C-1 --

18 COMMISSIONER -- crosscut.

19 A. -- C-1 Road here.

20 COMMISSIONER Okay.

21 A. Slickensides are identified at that point.

22 MR. MERRICK No symbol for it though on the map?

23 A. By letter "G."

24 COMMISSIONER That's the cutter roof.

25 A. Sorry, am I right in that?

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1 MR. MERRICK That's the cutter roof.

2 A. Sorry. "F" is the area down Southwest 2 Main.

3 MR. MERRICK Well, if you look on the legend for the  
4 symbol that goes with "slickenside," it doesn't appear  
5 that that is entered anywhere on the map. I guess the  
6 short question is are you able to identify from symbols  
7 on the map any locations --

8 A. I can't on this, but I know -- I know that I  
9 identified "slickensides" in this by myself.

10 Q. Yes.

11 A. And I did identify them in the area of intersection  
12 of No. 10 and No. 1.

13 Q. All right.

14 A. They were present and on this map, I'm sorry, I just  
15 can't pull them out offhand.

16 Q. All right. And the last symbol that I want to ask  
17 you about is the one that's identified as "cleat  
18 separation."

19 A. Yes, the -- here again, on the major geotechnical  
20 maps these will have been identified by the corporation  
21 themselves to show where the cleat has been identified as  
22 being -- breaking out. Now "cleat" has not been defined  
23 so far and that is the -- in the coal there is a general  
24 orientation of the breaks which form in the coal. And  
25 these, in the northern hemisphere, generally came to be

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1 in a north northeasterly direction. And these, when the  
2 coal comes off, you'll find it comes off in slabs and  
3 this is against a cleat which forms in that particular  
4 direction.

5 Q. So a "cleat" is a break?

6 A. Is actually breaks in the coal and they're there in  
7 most coals. Some are well cleated where you can just put  
8 a pick in and pull the coal away. Others have very  
9 little cleat.

10 Q. All right. Anything else you want to tell us about  
11 what's shown?

12 COMMISSIONER I'm just wondering, is there any  
13 connection between that slickenside symbol and the green  
14 symbols like on Southwest 2, 1 Road or are they just  
15 faults? I shouldn't say "just," but --

16 A. They --

17 COMMISSIONER It looks like the same sort of symbol only  
18 it's a different colour.

19 A. These are plans which have been developed by the  
20 company, as you probably are aware, sir. The thing about  
21 slickensides is that in faulted areas, due to the fact  
22 that the material has moved relative to one piece to  
23 another, nearly always you do get slickensided materials  
24 in that areas. So that I would assume from these  
25 pictures that there would be slickensides where those

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1 faults are.

2 COMMISSIONER So up in those -- where those straight  
3 lines, like a half an arrow head --

4 A. Yes.

5 COMMISSIONER -- is slickensides?

6 A. I would say that they were slickensided, yes.

7 COMMISSIONER Okay, thank you.

8 A. But as I said, I have identified myself at No. 10  
9 Crosscut --

10 COMMISSIONER Uh huh.

11 A. -- with the main road, the strata itself showed  
12 slickensides.

13 COMMISSIONER Thank you.

14 MR. MERRICK Anything else you want to tell us about  
15 that district as far as the roof falls that they  
16 experienced?

17 A. I think that we should mention that when Southwest  
18 2, A and B Roads developed, pretty much all the way along  
19 we did have overbreak. And some of these overbreaks were  
20 in the region of 1.5 meters which, if you think of it, is  
21 quite a big cavity in the roof developing.

22 Q. So each time we have one of these overbreaks or  
23 falls, that creates then the problem of -- obviously you  
24 clear it away if it gets to the floor, that creates a  
25 problem then of a cavity in the roof?

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1 A. Yes, sir.

2 Q. So as we look on that map and we see the overbreaks  
3 that occurred all the way up Southwest 2, A and B Roads,  
4 we can presume that all the way up those two roads we've  
5 got a roof with a lot of cavities in it which cavities  
6 either have to be filled or ventilated?

7 A. That's correct.

8 Q. All right.

9 A. To fill is the only way to guarantee that you would  
10 not get accumulations of gas in these pockets.

11 Q. How do you fill them?

12 A. Generally speaking, nowadays, you would support with  
13 steel and then you would inject foam over the top. A  
14 very lightweight foam which would fill the cavity.

15 Q. All right. Do you know what Westray was doing to  
16 fill cavities?

17 A. There was no cavity filling, to my knowledge.

18 Q. Pardon me?

19 A. There was no cavity filling, to my knowledge. When  
20 supports were set under these, as far as I know, they  
21 were putting wooden chock pieces on top of the supports  
22 and these, of course, would leave still a substantial  
23 cavity in the roof.

24 Q. In fact --

25 COMMISSIONER You couldn't adjust the ventilation

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1 velocity sufficiently in an area of such severe  
2 overbreaks to carry off the methane, is that correct?

3 A. It would be extremely difficult.

4 COMMISSIONER Yeah.

5 A. You may be able to ventilate with high velocity a  
6 small overbreak, .2 meters.

7 COMMISSIONER Yeah.

8 A. But if you're getting up to 1.5 meters, it would be  
9 very difficult to make sure that the air was actually,  
10 under normal circumstances, ventilating the top of the  
11 cavity.

12 COMMISSIONER But you just couldn't create that much  
13 turbulence?

14 A. Not that much turbulence.

15 COMMISSIONER Yeah, okay.

16 A. Because you tend to get laminar flow on these  
17 roadways. And the air would tend to go straight across  
18 the gap --

19 COMMISSIONER And, of course, the downside of increasing  
20 the velocity would be stirring up the coal dust?

21 A. Oh, yeah.

22 COMMISSIONER Yeah.

23 A. Well, not really, sir. The coal dust, you don't  
24 pick up coal dust from -- which is settled until your  
25 velocity is up in the region of 1,000 feet a minute.

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1 COMMISSIONER That's what, typhoon --

2 A. It's pretty strong, I must admit.

3 MR. MERRICK Incidentally, Mr. Smales, you said that  
4 you were not aware of Westray doing any fill in the  
5 cavities. If you look at Exhibit 38 at your tab 11, they  
6 were the photographs we were looking at before the lunch  
7 break, if you look into that series of photographs, in  
8 particular the first one entitled "Photograph of Square  
9 Set Arches," that's a picture actually of the Westray  
10 Mine.

11 A. Number 11.

12 Q. Exhibit 38. That's 45. Tab 11. The first  
13 photograph of the square set arches.

14 COMMISSIONER That's a post-explosion photo?

15 MR. MERRICK That's a post-explosion --

16 COMMISSIONER Yeah.

17 MR. MERRICK -- photo. And just as an example, I'm not  
18 suggesting that this was here before explosion, but I  
19 assume that as we look above that first girder or beam,  
20 that's sort of the cavity or the irregular roof that you  
21 would see with -- that might have been caused by  
22 overbreak?

23 A. That could be the situation.

24 Q. And we don't see there, of course, any evidence of  
25 it being filled, but that's what should have been filled

MR. SMALES, EXAM. BY MR. MERRICK

1 to avoid methane concentration?

2 A. That would need to be filled if you wanted to ensure  
3 no methane was in that cavity.

4 Q. Yes, all right.

5 A. If you only chocked it over with a piece of six-inch  
6 square wood as in the picture, you would still have quite  
7 a substantial cavity there.

8 Q. Yes. All right, thank you. Now let's come back to  
9 the falls. We've looked at the Southwest district. Can  
10 we go over to the North Mains? And what are we aware of  
11 there from the recorded information as to roof falls?

12 A. The situation, of course, is that during driving of  
13 these roadways, I'm afraid, that what is not shown on  
14 here is the fact that which I was advised there was a  
15 considerable problem in the roadway here. And I say this  
16 is information I received which I -- obviously, will come  
17 out later in the evidence. The main falls --

18 Q. Now this is a roof control problem?

19 A. Roof control problem. Roof --

20 Q. Yes.

21 A. -- roof falls. But I think that should be mentioned  
22 by the people who worked in there.

23 Q. Yes.

24 A. And that would be the thing to do. The major fall,  
25 what occurred at this intersection --

MR. SMALES, EXAM. BY MR. MERRICK

1 Q. That's a fairly substantial one, is it not?

2 A. That is substantial. I think if we look at the  
3 number, Number 12 --

4 Q. 15 meters by 15 meters?

5 A. Yes. That's 15 meters high and 15 meters long.  
6 That's a very substantial fall. And this would present a  
7 great problem. If you set the type of lights they were  
8 setting and you set it on the floor, you've then got  
9 something like 45 feet above you back solid. So you've  
10 got a cavity there which is 15 meters high and 15 meters  
11 long. So the potentiality for methane being in there is  
12 great under all circumstances.

13 Q. Yes?

14 A. The only way you would deal with that, of course,  
15 would be to inject foam or some of the lightweight  
16 material which would completely fill the cavity.

17 Q. And again, some of the other falls that we -- we  
18 don't see as many falls, but it appears that some of  
19 them, at least, were fairly significant.

20 A. We have quite a big fall on the intersection of No.  
21 3 and 1 East.

22 Q. What number is that fall?

23 A. That is No. 14.

24 Q. Yes. In fact, I'm assuming that that indicates an  
25 overlap. It almost looks like two falls occurred in this

MR. SMALES, EXAM. BY MR. MERRICK

1 area?

2 A. Two falls occurred at that point. And I think  
3 you'll find there are dates on them. But two falls did  
4 occur there. Two falls occurred at the crosscut I'm  
5 identifying there.

6 Q. No. 3 on the map?

7 VOICE 13.

8 MR. MERRICK 13, sorry.

9 A. 13. 13.

10 Q. Yes?

11 A. There was a major weak area on No. 1 in the -- from  
12 No. 15 fall --

13 Q. Yes?

14 A. -- which witnesses have stated when they went into  
15 that area of the mine during the rescue operation, there  
16 was a considerable fall length there which they had to  
17 climb over and actually use ropes and ladders to get over  
18 that particular fall.

19 Q. All right.

20 A. There, again, I'm sure that will come out with the  
21 witnesses' statements.

22 Q. Yes. Okay, anything else that you wanted to tell us  
23 about the North Mains from their experiences with falls?

24 A. I think the other interesting thing to see is that  
25 there's overbreak pretty well all the way up No. 1 and up

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1 No. 2. No. 3 doesn't seem to have suffered the same  
2 amount of overbreak. This may give rise to the  
3 suggestion that you could work in the shadow of the  
4 advancing roadways and thereby take some of the pressure  
5 off the roads which were following up.

6 Q. All right. We'll hear evidence about what all that  
7 means --

8 A. From the --

9 Q. -- later on.

10 A. -- experts on the subject. The other thing I think  
11 is worth mentioning is if you notice A and B Roads, you  
12 immediately start off virtually with overbreak  
13 continuously.

14 Q. All right.

15 A. There may be some explanation from your technical  
16 experts on that subject.

17 COMMISSIONER Getting back to your evidence yesterday,  
18 Mr. Smales, on the faulting. Now these green lines  
19 cutting through the Mains there at various locations,  
20 those are the faults you referred to yesterday at times?

21 A. Yes, sir. Yes.

22 COMMISSIONER Now would those faults show up in  
23 boreholes or would they not be -- would they not be known  
24 until they were actually in there putting the drives in?

25 A. The faults on here, generally, they didn't record

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1 the displacements. All I have from their plans is the  
2 fact there was a fault there. Now that may have been  
3 anything from two feet or one foot, upwards. Generally  
4 speaking, I would suggest that they did identify this  
5 major faulting that ran here.

6 COMMISSIONER Yes, okay.

7 A. But almost certainly they would not have identified  
8 these smaller faults which occurred during the drivage.

9 COMMISSIONER Okay, thank you.

10 MR. MERRICK And just, Mr. Smales, so I can understand  
11 that point, when you say that they could identify the  
12 major fault --

13 A. Yes.

14 Q. -- you could do that by boreholes even though the  
15 boreholes were not in the immediate area of the fault.  
16 The boreholes could be at some distance away --

17 A. Yes.

18 Q. -- but when you were correlating the data from them,  
19 you would realize that you had a fault somewhere in  
20 between?

21 A. That is correct.

22 Q. Because your elevation lines would not match?

23 A. You get a 350 line coming into to a 500 line.

24 Q. Yes. So you know that somewhere in between those  
25 two holes that seam had dropped?

MR. SMALES, EXAM. BY MR. MERRICK

1 A. Yes.

2 Q. Okay.

3 A. The other thing is that with the seismic work, you  
4 also can pick out where these formations are and where  
5 there is a blur on the seismic data.

6 Q. All right, thank you. Now I think that completes  
7 our discussion about ground control and falls. And if  
8 that's so, can I take you to the topic of coal dust?  
9 That is another major factor that has to be accommodated  
10 for a safely operating mine. Tell me how coal dust is  
11 generated in a mine? Obviously, it's generated as you  
12 cut the coal, but there are other ways as well?

13 A. Yes, the major source, of course, is during the  
14 cutting operation. And, of course, whenever you break  
15 coal, the dust you produce is all sizes from probably .2  
16 micron or, in normal figures, that's a 1000th of a  
17 millimeter, right up to quite large lumps.

18 COMMISSIONER Could you relate the micron to something  
19 that I'd be familiar with, like sounds like sugar or --

20 A. Oh, dear. A .2 micron would be about the  
21 consistency of ladies' face powder.

22 COMMISSIONER Like talcum or something that?

23 A. Yes.

24 COMMISSIONER Oh, yeah. Okay.

25 A. It's as fine as that.

MR. SMALES, EXAM. BY MR. MERRICK

1 COMMISSIONER Okay. And it goes --

2 A. And you have --

3 COMMISSIONER And it goes up from there to?

4 A. Up from there to lumps, of course. You know, the  
5 1/4-inch lump.

6 COMMISSIONER Yeah, they wouldn't float though?

7 A. No.

8 COMMISSIONER No.

9 A. The normal test for dust which is raised in the  
10 atmosphere would be at about 250 microns which is, what,  
11 something like about -- you're talking about something  
12 less a millimeter.

13 COMMISSIONER Okay, thank you.

14 MR. MERRICK All right.

15 A. So, pardon me, dust of all size is produced. And  
16 this can get into the atmosphere, of course.

17 The other way of producing dust is that in this  
18 particular mine, in Westray, the vehicles were running on  
19 a coal floor, on a seam floor. And, of course, as they  
20 ran, they did churn up the floor and produce dust from  
21 that situation.

22 Q. Would this be equally true of rubber-tired vehicles  
23 as well as tracked vehicles?

24 A. Yes, the track vehicles and the rubber-tired  
25 vehicles will produce dust.

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1 Q. And is that exacerbated or made worse if you're  
2 having to turn crosscut corners on an incline and that  
3 sort of thing?

4 A. It's much worse and particularly bad when you steer  
5 without movement, forward movement. I think you do this  
6 particularly driving motor cars, you see people standing  
7 still and they spin the wheel and the front wheels turn.  
8 And if you do that underground on a coal floor, you  
9 immediately break the floor up and produce dust.

10 Q. All right.

11 A. So it's most important for the shuttle car operators  
12 to be actually moving as they steer.

13 Q. Yes. All right.

14 A. The third way in which you produce quite a  
15 considerable amount of dust is when you transfer the  
16 coal. The system is that you transfer from the  
17 continuous miner into a shuttle car which means the coal  
18 drops a distance, probably five or six feet. You  
19 transfer from the shuttle car onto a stage loader, again  
20 another drop of the coal. You then break it up again in  
21 the feeder with rotating picks and drop it onto the  
22 conveyor and at each transfer point the coal moves  
23 downwards and dust is produced.

24 In addition to that, once the belt, the conveyor  
25 belt, turns over and comes back, you then have the

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1 situation where it hits the bottom rollers and the dust  
2 which is already adhering to the belt, which may be wet,  
3 dries out and drops off as it hits the bottom idlers on  
4 the conveyor.

5 Q. So --

6 A. These are the main -- collecting dust.

7 Q. So what you're telling us is that you will have  
8 collection points, if you will, or points in a mine where  
9 you will have greater concentrations of dust. For  
10 example, at the face, certainly at the Stamler, or the  
11 feeder at the end of the conveyor belt, and at each of  
12 the junction points.

13 A. Each transfer point. And particularly on the bottom  
14 belt. You get a very fine deposit of coal at each of the  
15 bottom idlers. I'll be referring to the belt -- the  
16 conveyors -- I don't know whether we looked at them the  
17 other day.

18 Q. We will be.

19 A. And we'll be looking at those. And the bottom  
20 idlers are normally spaced, something like, nine meter --  
21 nine feet apart. And from the bottom belt you do get --  
22 by this continuous bumping of the bottom belt, you get  
23 dust produced in each of the idlers.

24 Q. So that your return roadway is also throughout its  
25 whole length a point where you've got considerable dust

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1 buildup?

2 A. Yes.

3 Q. Or creation. And in the Westray Mine the return  
4 conveyor, at least in the mains, was in the No. 2 Road.  
5 And I take it it occupied basically the road which meant  
6 that you couldn't move equipment in there that you would  
7 normally use to remove coal dust?

8 A. That's a fact. The No. 2 Roadway was used by the  
9 conveyor alone. Machinery did not travel down there.

10 Q. All right. Tell me how you control dust in a mine.

11 A. The main method of controlling the dust in a mine  
12 is, obviously, at source. And the first thing that  
13 should be done it to ensure that the cutting picks are in  
14 a true condition. I do have a pick here. The picks  
15 normally are of a high-grade steel with a tungsten  
16 carbide tip. Now the main thing is to ensure that the  
17 point on the tip is kept in good condition and that will  
18 tend to break out the coal better than hammering it with  
19 a flat head. That's pretty obvious. And that will  
20 reduce the amount of dust you produce as you actually cut  
21 the coal.

22 Q. Now --

23 A. Another thing you want to do with a pick is to make  
24 sure it actually digs into the coal as far as practical.  
25 Obviously, if you're only taking half an inch of a bite

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1 at a time you're going to produce a lot more dust than if  
2 you're going to bang off six inches. So, obviously, you  
3 want as deep a penetration with that pick as you can  
4 have.

5 Q. But from what you're saying then, one of the  
6 maintenance measures to minimize your coal make at the  
7 cutting face itself is a regular maintenance and  
8 replacement of those picks?

9 A. This is important.

10 Q. And how frequently should they be replaced?

11 A. No pick should run, number one, without any tungsten  
12 carbide. I can mention that to you in relation to  
13 ignitions later, or I think possibly Malcolm McPherson  
14 may talk of that. The -- number two, as soon as this  
15 pick adopted a complete firm nose, then that should be  
16 replaced. You do want a, as much as possible, a point on  
17 the pick.

18 Q. All right.

19 A. No matter what you do you're going to produce dust  
20 from the operation of that pick into the coal. So, at  
21 source, the general tendency is to attempt to drench that  
22 area with water and prevent the dust from becoming  
23 airborne.

24 Q. Yes?

25 A. Now here we have a bit of a conflict because the

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1 objective must be to try to put ventilation at that point  
2 to dilute methane that's produced, but at the same time  
3 you don't want to be blowing the dust about. You want to  
4 be able to keep it under control with water. That's the  
5 water -- pick point and -- well, I'll mention that now.  
6 In relation to the continuous miner, there are two  
7 methods of applying that water. One is to apply it  
8 adjacent to the pick by having jets coming out near the  
9 pick. The other one is to produce an area of water which  
10 goes around the cutting head of the machine.

11 At the continuous miner, you can also apply an  
12 extraction system for removing dust. And the particular  
13 machine that was in use had what was known as a "wet bed  
14 dust extraction filtration system," which exhausted seven  
15 -- could exhaust, as much as 7,000 cubic feet of air per  
16 minute from the region of the cutting head.

17 This sucked 7,000 cubic feet of air plus the dust  
18 that was entrained therein, passed it through a wet bed  
19 filter, and then passed the air out to go out into the  
20 general ventilation system.

21 Q. All right. So other than cutting down your make of  
22 dust at the cutting heads themselves, what else do you do  
23 to remove or control dust?

24 A. The -- I'm talking about Westray now, but the  
25 general picture you can develop is by using very good

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1 exhaust ventilation, either by single exhaust or by an  
2 overlap exhaust system, you can, in fact, remove the dust  
3 from that area around the head end, not around the  
4 cutting end because this now has gone into the atmosphere  
5 and then filter the dust out through approved type of  
6 dust filtration systems which may either be wet or dry  
7 systems. The wet systems, obviously, are better. If you  
8 have a dry system, you've still got to get rid of the  
9 dust which is in the dry system.

10 Q. All right. What about removal of dust itself?

11 A. Can I just continue --

12 Q. Sure.

13 A. -- mentioning the control of the dust? There are  
14 other things, that -- to remember. People will say when  
15 the dust is on the floor, why not wet it. Well, of  
16 course, this is possible, but unfortunately, to use the  
17 word, coal dust is hydrophobic. Water tends to run off  
18 the top of the dust or dust will just form on top of the  
19 pools of water, and that dust can be raised into the  
20 atmosphere. You can actually wet it using a wetting  
21 agent and that, obviously, will dry out and this has to  
22 be a repeated operation. To wet the dust.

23 There is a method of maintaining the roadway dust in  
24 a state where it will not be lifted and that would be to  
25 use a substance which takes in water, calcium chloride

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1 being an appropriate material. And you'd wet the whole  
2 of the area down, apply calcium chloride which  
3 continuously draws in water, moisture from the air, and  
4 keeps the ground hard -- well, damp, sufficient that the  
5 dust doesn't rise. There again, it's a continuous  
6 operation. You have to keep adding more and more calcium  
7 chloride and it's not really suitable for what -- the  
8 room-and-pillar area, but would be imminently suitable  
9 for such things as the No. 1 Tunnel where your machinery  
10 is going to travel up and down and also parts of No. 2  
11 Tunnel.

12 Q. Do you know if Westray was doing that?

13 A. No, they were not doing that.

14 Q. All right.

15 A. These are the control methods for keeping the dust  
16 under control.

17 Q. Now having done that --

18 A. Cleanup.

19 Q. -- cleanup -- all right.

20 A. Cleanup. This is extremely difficult. I think  
21 we've already mentioned, there's something like about  
22 5,000 meters of roadway in this mine, pretty much all of  
23 which will have coal dust, rock dust, in there as well.

24 To clean it up with a scoop-type tram, you still  
25 leave quite a layer of coal dust on the floor. I think

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1 we've seen that with snow cleaners and everything;  
2 there's still quite a lot of material left. Very thin  
3 layers of coal dust can be raised into the atmosphere and  
4 produce an explosive mixture.

5 Cleanup has to be precise. It has to be, normally,  
6 cleaned up into a container. If we take the conveying  
7 system which you mentioned, if you look at the feeder, if  
8 you just clean up around the feeder with a shovel and  
9 throw the dust from the floor into the feeder, then that  
10 will be transferred at each point and will just be blown  
11 back again into the general atmosphere.

12 Q. Is that a method that some mines use? You dump it  
13 on the conveyor?

14 A. That is used in many places, but it's a very  
15 fruitless method. You get a very small percentage, maybe  
16 60-70 percent, returning back to where you've already  
17 cleaned up. So that the cleanup is very difficult. The  
18 law requires you clean it up as it's made. The law does  
19 not tell you how to do it. And this is one of the great  
20 problems, with the cleaning up.

21 Q. So you either have to transport it out or put it on  
22 a conveyor. Transporting it out is very impractical and  
23 putting it on the conveyor isn't very effective.

24 A. No. The -- what happens in quite a number of mines  
25 is that when cleanup is carried out of this description,

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1 they do put it into packages, bags, which can then be  
2 tied and dumped on the conveyor and transported out so  
3 that the dust that they cleaned up does actually go out  
4 of the mine as opposed to being blown off elsewhere.

5 Q. Do you know if Westray was doing that?

6 A. No. I don't know if it was doing it, sorry. I'm  
7 not saying no, they didn't do it.

8 Q. Yes, all right. So is that basically how you try to  
9 control dust?

10 A. That is the -- well, the control and the cleanup  
11 side of it.

12 Q. Now let's talk about keeping dust from becoming a  
13 danger in the mine apart from just an environmental  
14 hazard. You said, and we'll have evidence as to how coal  
15 dust can itself become part of an explosion, either the  
16 ignition source being something else, such as methane, or  
17 itself becoming the primary ignition for an explosion.  
18 How do you prevent dust from becoming part of an  
19 explosion?

20 A. The general method of prevention is to add a non-  
21 flammable material. In this case, stone dust, limestone  
22 dust, and mix it thoroughly with the dust which is being  
23 produced on the floor, the roof, and the sides of the  
24 roadways in which the dust is formed.

25 Q. And very simply, that is effective because of why?

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1 A. The heat energy that is required to continue an  
2 explosion is dampened by the absorption of the energy by  
3 the non-flammable material. I think it's important to  
4 say here that the Nova Scotia Coal Mines Regulation Act  
5 required not less than 65 per cent of non-flammable  
6 material, stone dust, with the coal dust. That is a very  
7 low percentage, and in many cases the amount of stone  
8 dust required to prevent coal dust from igniting is in  
9 the region of 80 per cent or more.

10 Q. We'll have evidence on this, Mr. Smales, a little  
11 later, but I take it that it also depends to some extent  
12 on the nature of your coal and also the size of the dust?

13 A. Yes. The tests which are carried out, normally  
14 carried out, on two or three size of coal, and by "size  
15 of coal" we talk about the mean diameter of the coal.  
16 Usually they're carried out at something like about 30  
17 micron and 250 micron size. So that you've got the, you  
18 know, two ends of the scale of the size of coal.

19 They are also usually tested on pure coal which is  
20 not quite the same in a seam which has dirt round. So  
21 that what you might see is that you do identify what  
22 would be the worst condition. And those tests are  
23 carried out to see what percentage of limestone dust is  
24 required to prevent the material exploding.

25 Q. So when we see in the legislation, or we hear, that

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1 somebody should see that the coal dust is mixed so that  
2 there is a 65 per cent volume, percentage of the volume,  
3 being limestone or stone dusting, that doesn't  
4 necessarily mean you now have a safe mixture of coal  
5 dust?

6 A. No. As a matter of fact, normally, that requirement  
7 is also tied in with the -- a second step which is to  
8 identify the amount of methane which may also be in the  
9 air. Because as the amount of methane in the air  
10 increases, then it's required to increase the amount of  
11 stone dust to prevent the ignition occurring.

12 Q. So that even if you have a mixture of methane in the  
13 general body of the air at a percentage that is lower  
14 than its ignition point, it may still be a factor in a  
15 coal dust explosion?

16 A. That is a fact. If we take a figure which is  
17 acceptable by law of one per cent methane, one and a  
18 quarter per cent is the point at which you switch off  
19 electricity so you can have your mine with one per cent,  
20 then Regulation or Act normally would require that the  
21 percentage of stone dust would be increased by five or 10  
22 per cent above the minimum levels.

23 Q. How is this stone dusting or limestone distributed  
24 through a mine generally? Or usually.

25 A. Two ways. One is mechanically and the other one is

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1 by hand.

2 Q. What do you mean "mechanically"?

3 A. Mechanically is in the form of a hopper into which  
4 you would put, probably, 100 pounds of limestone, and  
5 then you would use compressed air to blow the stone dust  
6 into the mine so it can actually direct it or -- in the  
7 airstream. Then it then settles out along the roadway.  
8 Now that's okay for the roadway, probably part of the  
9 sides of the roadway. But when you think of this  
10 particular roadway which it may be 18, 20 feet high where  
11 coal dust can settle, then you've got to really take some  
12 action to ensure that the dust does get up into that  
13 area.

14 Q. And by hand how is this done?

15 A. That is done simply by hand. Often enough the right  
16 way is you would use a shovel and the standard method is  
17 to fling it up as high as you can, up into the roof, on  
18 the basis provided you throw it up, there will be enough  
19 will fall on the floor. But the main thing is to get it  
20 up into the roof and onto the sides of the roadway. It's  
21 a labour-intensive job which has to be carried out on a  
22 regular basis.

23 Q. And if you have to inert the coal dust, if you have  
24 to put at least -- if you have to bring it to a volume,  
25 with stone dust, of a 65 per cent ratio of stone dust or

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1 more, then, as a general rule of thumb, what you're  
2 saying is you've got to take into that mine and spread  
3 around almost twice as much stone dust as you have coal  
4 dust that's being made in the mine.

5 A. Well, it's probably more than that. If you think of  
6 the real figure, 60 and 40, you're talking about two and  
7 a half times, you know, and three times as much. This is  
8 the situation.

9 A rule of thumb which is used for the amount of  
10 stone dust used is something like about five pounds per  
11 tonne of coal produced. That figure can be as -- you  
12 know, down to two and up to 10, but that is when you're  
13 doing your initial calculations, you would work on about  
14 five pounds per tonne.

15 Q. So if the mine is properly being stone dusted, we  
16 should see evidence of a tremendous of stone dust being  
17 taken into that mine and distributed?

18 A. Yes. Yes. I would say as well that although  
19 regulation doesn't require in most places, for the area,  
20 the section adjacent to where the room is being worked to  
21 be stone dusted, probably the last 10 meters, I think  
22 it's always wise to be stone dusting as near to the  
23 machine as possible in these rooms. And that would have  
24 to be done by hand.

25 Q. Now the methods that you've described, I can see

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1 where they could be done in any of the roadways that did  
2 not have the conveyor system in them because you could  
3 get your mechanical means in there.

4 A. Yes.

5 Q. But we have a conveyor system that's in most of  
6 these roadways, or in almost half of them, I guess. Are  
7 you able -- was Westray able to use mechanical means in  
8 the roadways where the conveyor was located?

9 A. There's a great difficulty in this, of course,  
10 because they can't actually run from the main entrance  
11 down No. 2. You then have to access No. 2 through the  
12 crosscuts. And this could be one of the reasons why the  
13 crosscuts are fairly close together down No. 1 and No. 2.

14 What you would have to do is transport the stone  
15 dusting machine down the hill, through the crosscut,  
16 through the door, set it up in the return airway and then  
17 blow the dust uphill. Because don't forget, your  
18 ventilation is going up that hill.

19 Q. Because you can't get the machine up through there?

20 A. You couldn't take your machine up.

21 Q. Yes?

22 A. You'd then drop down to the next crosscut and blow  
23 the dust up the hill again. This is going to be quite an  
24 arduous occupation. And that would have to be done  
25 consistently right through that return airway.

MR. SMALES, EXAM. BY MR. MERRICK

1 Q. In a mine that is being properly maintained and run,  
2 how frequently and with what sort of regularity is a  
3 stone dusting program -- is the stone dusting activity  
4 actually carried out?

5 A. I'm afraid that stone dusting is difficult in  
6 certain positions --

7 Q. And it must be --

8 A. -- and

9 Q. -- messy?

10 A. It is a messy job. And it's very difficult to  
11 organize. And you can go to some mines where when you go  
12 along the roadways, conveyor roadways, particularly those  
13 which have track alongside, the roadways can be white  
14 with the stone dust. And you can go, equally, to many,  
15 many mines where you will walk along the conveyor roadway  
16 and it's black. Now I'm not saying what the condition is  
17 because colours can be deceiving. You can have a very  
18 grey looking material which still doesn't have a lot of  
19 combustible material in it. So all I'm saying is that  
20 you've got a tremendous variation point in what I call  
21 the "best mines" to the worst mines.

22 Q. But is it something that should be made as part of a  
23 regular shift? Is it something that should be done as  
24 part of a regular shift?

25 A. The only way to spread limestone dust is on a

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1 regular basis, continual basis, because even the small  
2 layer of coal dust on top of stone dust can be lifted up  
3 and produce a dust in the atmosphere which will explode.

4 Q. Let me make sure I've understood that. So that if  
5 at some point in time there is a layer of stone dusting  
6 put down that may, in fact, be in sufficient quantities  
7 to act as a dampener, coal dust can then settle on that.

8 A. Yes.

9 Q. And the mere fact that there's a quantity of stone  
10 dusting on the road underneath will not prevent that --

11 A. No.

12 Q. -- top layer of coal dust from being part of an  
13 explosion?

14 A. No. The essence is that it must be mixed.

15 Q. And continually mixed?

16 A. And continually mixed.

17 Q. All right. Tell me about -- other than stone  
18 dusting, what other methods are there to minimize or  
19 prevent or limit the effects of an explosion?

20 A. Once an explosion has happened, in the -- Europe and  
21 in the -- certain other mines, the object is to minimize  
22 the effect of the explosion. If the roadways are stone  
23 dusted effectively, then they will be no fuel for a coal  
24 dust explosion to continue. However, knowing the  
25 limitations that there are and the problems with

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1 intimately mixing with stone dust, over the years there's  
2 been developed a system of using what are known as "stone  
3 dust barriers" or "water barriers" or "triggered  
4 barriers."

5 Now the stone dust barrier is a series of shelves on  
6 which stone dust is placed and the series of shelves is  
7 placed at a point near to the potential source of  
8 ignition.

9 When the explosion occurs, or an ignition occurs,  
10 there is what is known as a "pressure wave" which  
11 everyone knows about, have heard about people being blown  
12 across the road. And the pressure wave moves faster than  
13 the flame front. Obviously, in the initial ignition, the  
14 flame and the pressure wave are at the same point. As  
15 the pressure wave moves out faster than the flame front,  
16 it has the ability to hit the stone dust barrier shelves  
17 which are balanced rather finely, knock the shelves off,  
18 to produce a cloud of stone dust in the atmosphere so as  
19 that when the flame front reaches the stone dust barrier,  
20 or this cloud, then the energy is dissipated and the  
21 flame cannot continue to ignite more and more coal dust  
22 and move that way.

23 That is the first, what is called usually a "light  
24 barrier," placed as near to the source as possible but  
25 with that design in mind, that you want to have the

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1 pressure wave hit the stone dust barrier before the flame  
2 front. If the pressure wave hits it too soon or not --  
3 too soon, then the dust could have gone and the flame  
4 pass through. If it hits it too late then, of course,  
5 the flame has already passed through. And these are the  
6 situations you've got.

7 Now in Europe they have a second defence called a  
8 "heavy barrier" or a "medium" or a "heavy barrier" where  
9 they put a substantially bigger quantity of stone dust  
10 over a greater length of roadway which, again, is  
11 triggered by the pressure wave advancing in front of the  
12 flame wave.

13 We have to accept that once an explosion has  
14 occurred in a place, we can't do much about that spot.  
15 But the objective must always be to prevent the explosion  
16 from moving into other areas and so protect other  
17 persons.

18 Water barriers are exactly the same thing. Tanks of  
19 water are suspended in the roof and these also can be  
20 knocked over by the pressure wave forming droplets which,  
21 again, absorb the energy.

22 The modern sophisticated system is to have what is  
23 known as "triggered barriers" which once again operate  
24 the pressure wave, activates a pressure switch, which  
25 then can cause either an explosive, light explosive, to

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1 distribute stone dust or an inerting gas.

2 Q. All right. Just briefly, what sort of monitoring  
3 system or follow-up system should you have to ensure that  
4 you have, in fact, correctly stone dusted or that there  
5 is adequate stone dusting in a mine?

6 A. There's only one way to attempt to ensure that your  
7 roadways are stone dusted adequately and that is by doing  
8 a sampling procedure which gives you a statistically  
9 correct result. And that procedure is laid out in  
10 regulations, different regulations. The normal system is  
11 that you divide your return airways up in something like  
12 lengths of 150 meters. You divide that 150 meters into  
13 three so there are 50 meter lengths and you then take  
14 strip samples of the dust. Two samples in each section.  
15 One from the floor, one from what represents the roof and  
16 sides of the roadway, and you take it to a depth of  
17 something like about half an inch. Because as I've  
18 already said, it's that top thin layer which can create  
19 the trouble.

20 You obtain the sample. The sample itself, you take  
21 one sample one month. You move to the next 50 meters the  
22 next month, the next 50 meters the next month, so that,  
23 in fact, you're actually covering the whole of the mine  
24 in three months sampling.

25 The intakes, you may go to probably 300 meters

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1 divided into three sections to cover.

2 And by taking those samples you then sieve them at a  
3 certain standard mesh.

4 Q. All right. I don't need at this time how you do the  
5 analysis. But taking the sampling itself, how frequently  
6 should they be sampling? Taking samples.

7 A. The samples of any roadway should be taken at least  
8 once a month.

9 Q. All right. And I take it, Mr. Smales, that the  
10 purpose of stone dusting or stone dust barriers, is to  
11 hopefully prevent, but if not prevent, dampen or limit  
12 the effects of an explosion. So that a mine may well  
13 have an ignition and an explosion in one area, but if  
14 there is adequate barriers and stone dusting, it may  
15 prevent that explosion from spreading to another area.

16 A. That's the true objective.

17 Q. So that while it may not itself save the lives of  
18 the men caught in the initial ignition area, it would  
19 save the lives of men in other places in the mine?

20 A. That's the object.

21 Q. All right. Now let me move on to some of the  
22 quicker topics that I just want to canvass with you very  
23 rapidly. Tell me very quickly about the Westray Mine  
24 facilities on the surface. And if you want to look at  
25 Exhibit 38, tab four, that gives us a fast layout. Just

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1 very --

2 COMMISSIONER Mr. Merrick, would it be appropriate at  
3 this time just to cover off that last section to ask Mr.  
4 Smales if he personally knows of any installation of  
5 stone dust barriers or water barriers in the Westray  
6 Mine?

7 A. Not in the Westray, no. I know of no installations.

8 COMMISSIONER Thank you.

9 MR. MERRICK All right. And we'll hear evidence later  
10 as to the extent to which stone dusting was actually  
11 taking place in the mine prior to the explosion.

12 All right. Very rapidly and perhaps with that pen  
13 that you have, can you use exhibit -- tab four, Exhibit  
14 38, as well as that photograph that's on the wall over  
15 there, to give us a quick tour of the surface facilities  
16 and what they are.

17 A. The mine entrance is by the road up to the car park  
18 which is identified quite clearly. The miner would leave  
19 his car in the car park, walk in through the doors in  
20 front of the main building. That building houses the  
21 offices. The mine dry, or the pit head baths. There is  
22 a lamp room in which the men would pick up their lamps.  
23 On the -- almost where I'm pointing now there was a  
24 first-aid station just behind which was a rescue room in  
25 which were kept the draeger self-contained breathing

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1 apparatus and the testing apparatus that was necessary  
2 for the draeger team to use. Behind the pit head baths  
3 and the admin. building, there's quite a substantial area  
4 there in which the maintenance, mechanical, electrical  
5 was carried out and also the warehouse, the covered  
6 warehouse was contained.

7 From the mine now going through the baths and  
8 picking up a lamp he would get on a tractor and drive out  
9 on the roadway, round, and behind that building the  
10 actual portals of the mine went underground in a position  
11 I'm indicating at the present time.

12 Q. Mr. Smales, just while you're on that, when the  
13 miner would go into the lamp room and was picking up his  
14 equipment, what system usually would you have and was  
15 Westray intending to have that would monitor and keep  
16 track of who was underground? Tell me about tag boards.

17 A. There should be two systems operating in mines. In  
18 the deployment centre, which was adjacent to the lamp  
19 room, there was a big tag board on which the miner could  
20 put a check which said "In" and, of course, when he came  
21 out he put it on the "Out" side as well. I think you  
22 have an exhibit of that particular board.

23 Q. Yes, and we'll deal with that a little later.

24 A. Yeah.

25 Q. All right.

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1 A. Also at that time the man should be talking to the  
2 foreman under whom he would be working and that man would  
3 identify him by marking him in a register. Back to the  
4 surface arrangements, the --

5 Q. Before you leave that, I assume that one of the  
6 reasons for careful control of this and keeping track of  
7 tags and marking in a register is, I suppose, in the  
8 unfortunate event that you do have a disaster underground  
9 so that you will know who is where, who is supposed to be  
10 underground and where they're supposed to be?

11 A. You've got both points. That is the important  
12 point, if something goes wrong, but equally so you can  
13 have a situation where a man faints underground and  
14 there's no major disaster except to him. And you want to  
15 know where these people are. He may be working in a  
16 return airway alone and collapse and then you can quickly  
17 identify where that man is.

18 Q. So that in a properly run mine if an event should  
19 occur underground, there shouldn't be much confusion as  
20 to who is down underground?

21 A. There should not be -- it's much easier to control  
22 that where you have shafts, vertical shafts. But in a  
23 case of slope entries, it's very easy for people to go in  
24 and out, unless there's a very, very tight system of  
25 control of people doing that.

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1 Q. Well, a miner working in the Southwest district, for  
2 example, is not likely to go walking out of there and up  
3 that slope?

4 A. No, but people could wander down the hill. And if  
5 you have a reasonable conveyor system in the No. 2  
6 return, it's not been unknown for people to ride up on  
7 the conveyor belt as a way out rather than walking up  
8 that steep hill.

9 Q. All right.

10 A. So there is a potential.

11 Q. All right. Continue your tour for me.

12 A. The No. 1 Slope and No. 2 Slope are adjacent in the  
13 area where I'm -- I'm sorry, I'm flashing the thing.

14 Q. That's okay.

15 A. The No. 2 Slope is just behind where I'm pointing  
16 now and the conveyor came out -- a little side conveyor,  
17 which you can see there, delivered onto a main coal  
18 stockpile. The stockpile itself was then transferred  
19 into the coal preparation plant here via a conveyor. And  
20 this conveyor ran underground and took the coal from that  
21 stockpile into the coal preparation plant. I'm not going  
22 to describe what was in the plant because I don't think  
23 it's relevant at all. From the plant, the finished  
24 products -- and there were two products made at this  
25 mine; one was a rather inferior quality coal and the

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1 other one was a better quality. They were transferred  
2 from the coal preparation plant into the two big silos,  
3 which are now -- can be seen if you go down to the mine,  
4 and the then the coal from the silos were taken out  
5 according to whichever product was required and loaded  
6 onto the railway which you see in this position.

7 There are other items around here. The outside  
8 warehouse, stock ground was located in the area here  
9 where as you can see, equipment which was for repair  
10 tended to be kept outside the maintenance sheds in the  
11 area demonstrated there. Such things as slurry ponds and  
12 thickening pools are really irrelevant to what we're  
13 talking about.

14 Q. All right, thank you. Now, Mr. Smales, I'm going to  
15 very quickly have you also give us a description of the  
16 major pieces of equipment that we would be -- that you've  
17 already talked about so that we can have a better idea of  
18 what they are. Can you turn to Exhibit 38.

19 COMMISSIONER Mr. Merrick, could I just ask the witness  
20 a brief question again on identification of the miners as  
21 they went into the mine. It was my understanding in some  
22 mines where both the self-contained rebreathing apparatus  
23 and the helmet and light are signed out to a specific  
24 miner and it's sort of prima facie of him in the mine if  
25 those things were missing off the rack. Is that --

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1 A. Yes, in many mines a man would have his own numbered  
2 electric safety lamp. In the U.K. the self-rescuer,  
3 which is distinct from the self-contained breathing  
4 apparatus, the self-rescuer would be issued as well and  
5 have that man's number.

6 COMMISSIONER A canister?

7 A. That is a canister, yes. So that you could identify  
8 the situation from those two things. But usually in that  
9 kind of mine also the man is required to carry a brass  
10 token with his number on as well. So that you've really  
11 got three means of identification. The reason for that  
12 brass token is that he will pick that up himself. He  
13 knows that's his. Occasionally with the self-rescuer and  
14 the lamp, someone may, either inadvertently or by choice,  
15 pick his lamp up and then you may be looking for a man  
16 who you shouldn't be looking for in any case. So the --  
17 really, the best way is to have men pick up their own  
18 token and carry that with them.

19 COMMISSIONER What do you say as to the existence of any  
20 of those three systems at Westray?

21 A. I think, sir, that you're going to have to question  
22 the people who work there as to how their systems worked.

23 COMMISSIONER Okay, thank you.

24 MR. MERRICK But I understand, Mr. Smales, and correct  
25 me if I'm wrong, that there were at least the facilities

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1 for maintaining a tag system. In fact, there were tag  
2 boards at Westray.

3 A. Yes, there was a tag board in the deployment room.

4 Q. Yes. We'll have to hear from the witnesses as to  
5 how effectively they were maintaining that system.

6 A. Yes.

7 Q. All right.

8 A. I can only say that from the time when I went  
9 underground, we didn't use a tag board in the deployment  
10 center. We used a tag board which was located at the  
11 entrance to No. 1 Tunnel.

12 Q. You're talking about Westray now?

13 A. At Westray, yes.

14 Q. So that there were two tag boards?

15 A. There were two tag boards at the time I was there.

16 Q. Yes. And we'll have evidence on that later on. Mr.  
17 Commissioner, you may want to take the mid-afternoon  
18 break at this point?

19 COMMISSIONER We'll take 10 minutes, sure.

20 MR. MERRICK All right.

21 INQUIRY RECESSED (TIME: 3:11 p.m.)

22 INQUIRY RESUMED (TIME: 3:21 p.m.)

23 COMMISSIONER Carry on.

24 MR. MERRICK Thank you. Mr. Smales, thank heavens for  
25 breaks. It allows me to remember the things I forgot to

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1 ask you. Under Exhibit 38, Tab 14, that's a photograph  
2 of one of the tag boards at the Westray Mine, is it not?

3 A. That's the one in the -- is that it? That's the one  
4 in the control room of the deployment centre adjacent to  
5 the lamp room.

6 Q. And so what --

7 COMMISSIONER Is this a handwritten list? Tab 14?

8 MR. MERRICK It's at the back of Tab 14.

9 COMMISSIONER Oh, I'm sorry.

10 MR. MERRICK The very last -- it's a photograph.

11 COMMISSIONER Okay. Fine, got it.

12 MR. MERRICK So that the tag would be moved from one  
13 side of the board to the other as the man is underground?

14 A. I would reckon that should be the system, that each  
15 man has his own identification disk, and when he went  
16 into the mine he would put it on inside and outside  
17 accordingly.

18 Q. Okay, thank you. Now back on track, we were talking  
19 some of the major equipment. Tab 9 of that exhibit. And  
20 I'm going to very quickly take you through this. We've  
21 heard some evidence already about each of these pieces of  
22 equipment. The first item there which is a blue and  
23 white painted piece of equipment is what?

24 A. This is the Dosco roadheader which was located in  
25 the A Road at the North.

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1 Q. And, indeed, that's probably the machine that is  
2 down there now, is it?

3 A. As far as I know, that was still in there when the  
4 men went in to the rescue operation.

5 Q. All right. And so that cutter head can move in  
6 almost any direction?

7 A. That can cut a circle; it could cut a rectangle. It  
8 is the kind of equipment which is used for travelling  
9 through harder ground than the coal.

10 COMMISSIONER What are you calling it, roadheader?

11 A. This is called a roadheading machine.

12 COMMISSIONER Roadheader --

13 A. Yes.

14 COMMISSIONER Okay.

15 MR. MERRICK And it's used primarily when you're in  
16 your development stage, you're driving your roads,  
17 initially?

18 A. It would be used there, preferably when you're going  
19 through a faulting and in hard conditions.

20 Q. All right.

21 A. The -- where you're going in coal, you would use  
22 your continuous miner.

23 Q. I notice that it's got two little arms on the  
24 front --

25 A. Yes.

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1 Q. -- that are sort of on a circular pivot and what  
2 looks to be a track going up through the middle of the  
3 front of it underneath the cutter heads.

4 A. Yes.

5 Q. I assume that's to gather the coal into that track,  
6 conveys it back to the back of the machine. And, in  
7 fact, behind the heads of the men that we see there, that  
8 would be the end of the conveyor?

9 A. End of the conveyor, yes.

10 Q. And that would dump the coal on a shuttle car?

11 A. Maybe on a shuttle car. Quite often with this  
12 particular piece of machinery it stays in the heading and  
13 you would run a conveyor right up to the back of that  
14 machine and dump onto a conveyor.

15 Q. All right.

16 A. But it can dump into a shuttle car as well and it  
17 was doing so at Westray Mine.

18 Q. Okay. Let's flip over to the next page. In fact,  
19 the next two --

20 A. Just looking at those picks --

21 Q. Yeah.

22 A. -- if you can remember the one I showed you, that's  
23 exactly the same type of pick --

24 Q. Yes.

25 A. -- in the cutter head.

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1 Q. All right. Next two photographs are continuous  
2 miner. The second photograph perhaps is more graphic?

3 A. Yes.

4 Q. We see where the driver's compartment is about 18  
5 feet back so that he will, hopefully, always be under  
6 supported ground?

7 A. Correct.

8 Q. And this -- can you describe the method of cutting  
9 of this head because this will be relevant to us later  
10 when we come to hear evidence about the continuous miner  
11 in the Southwest 2 district.

12 A. The driver would drive into the right-hand side of  
13 the heading which he comes up against a blank face of  
14 coal. The machine is running on tracks which you can  
15 see. And different drivers have different methods, but  
16 one method would be to start the picks up before he runs  
17 into the coal and he would drive in what is called  
18 "sumping" possibly in the middle, half way up the seam,  
19 and sump in to something like about 18 inches or two  
20 feet. The picks, as you note, will be turning to -- into  
21 the coal and pull the coal away at the bottom.

22 Q. And again the collector arms would gather it and  
23 there would be a conveyor system through the middle of  
24 the machine?

25 A. Conveyor system out to the shuttle car.

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1 Q. Yes.

2 A. Then the heads would be raised by the two hydraulic  
3 cylinders which you can see quite clearly, the cylin.  
4 shapes, up to the predetermined 12-foot height. And then  
5 you would probably drop and clean the bottom out, the  
6 piece that he's left at the bottom, right down to the  
7 floor. Having done that, he sumps in again, another 18  
8 inches, until he's done the full 18 feet by repeating the  
9 process. He cleans up as much material as he can, but,  
10 obviously, if you look at the gathering arms and they  
11 rotate in a system so, he will not clear out right to the  
12 sides of the roadway. So there's a need to clean up  
13 after him. Having sumped in 18 feet on one side, the  
14 cutting head is roughly 10 feet wide, he then would move  
15 across and cut the other eight feet out on the left-hand  
16 side by doing the same process. The machine would then  
17 flit from that position and go into another room.

18 Q. I take it it's basically the operator's option  
19 though as to whether he starts on the left and right and  
20 whether he sumps in in the middle or above or below?

21 A. Yes. Usually, once you have established a system  
22 and with the driver being on the right-hand side, the  
23 tendency would be to actually sump in on the right-hand  
24 side.

25 There are certain features on here that you can

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1 notice. On the second photograph which you're looking  
2 at, the dust extraction system is located on the side at  
3 the back of that photograph to the right-hand in the  
4 lower portion of it, just below the conveyor.

5 Q. Yes, all right. Just behind the tracks.

6 A. Just behind the tracks.

7 Q. Yes.

8 COMMISSIONER Is that the thing with like three little  
9 windows in it?

10 A. That's the thing, yes, right there. Yeah.

11 COMMISSIONER Okay. Dust extraction, eh?

12 A. The machine itself has all kinds of safeguards.  
13 There are emergency stop buttons. As we've mentioned,  
14 quite a number of other things. There's the wet cutting  
15 system which was drenching. And if you -- I actually  
16 should be looking at the first picture. That comes from  
17 an area just behind those cutting wheels. You can see --  
18 you can actually see the jets.

19 MR. MERRICK Oh, I see. Just back up. We see that  
20 flat piece of frame or metal behind the cutting heads --

21 A. That's right.

22 Q. -- and then it looks like triangular -- is that what  
23 you're looking at?

24 A. I'm -- yes, I'm looking in the area right behind the  
25 cutting head.

MR. SMALES, EXAM. BY MR. MERRICK

1 COMMISSIONER Here?

2 A. No, right behind. Just --

3 Q. Oh, yes. They look like small cutting heads.

4 A. They're actually -- if you look on the picture,  
5 there's a light area, three light areas right behind the  
6 three separate section of the cutting head.

7 Q. Yes.

8 A. They're very narrow.

9 Q. Yes.

10 A. And the jets, the water jets, would be in those  
11 particular blocks.

12 Q. Understood.

13 A. The thing that's worth mentioning about this cutting  
14 head is that the pick speed, that is, the speed at which  
15 the pick was moving was 690 feet a minute. The relevance  
16 of that is that where pick speeds are less than 450 feet  
17 a minute, even in quartzitic materials, the propensity to  
18 produce a spark of sufficient incendivity to ignite  
19 methane is very, very low indeed.

20 Q. How do we know these cutting heads were moving at  
21 that speed?

22 A. That is the manufacturer's specification of this  
23 particular cutting head that they supplied.

24 Q. That's the next page after the photographs?

25 A. Yes. And you will see that --

MR. SMALES, EXAM. BY MR. MERRICK

1 Q. "Cutter speed," about halfway down the page?

2 A. Yes. It says --

3 Q. "60 rpm."

4 A. No, bit tip speed.

5 Q. Got it.

6 A. That is the speed at which the bit tip was moving.

7 Q. So that's -- sorry, if they had -- I take it it  
8 would be for the company to decide what bit tip speed  
9 they would want on their machine?

10 A. Well, these machines are designed -- that's the  
11 standard, 690, but the company do also provide a slower  
12 speed rotating head.

13 Q. All right. And that slower speed one decreases the  
14 likelihood of sparking at the tips sufficient to cause an  
15 ignition?

16 A. Yes.

17 Q. Understood.

18 A. It is worth noting that in all these machines the  
19 speed of the tip of the pick is quite important.

20 Q. All right. I assume that the faster speed cuts more  
21 coal?

22 A. It would be useful where the coal is harder because,  
23 of course, you're rotating faster. And sometimes it is  
24 necessary.

25 Q. All right. Let's turn over to the next page. We

MR. SMALES, EXAM. BY MR. MERRICK

1 see a couple of photographs of a shuttle car.

2 A. Well, the shuttle car, basically, is just a moving  
3 conveyor with a container on top. But what is important  
4 about these shuttle cars is that they were electrically  
5 driven. Oh, let me back up a little bit. The Dosco and  
6 the continuous miner were flame-proof machines certified  
7 by the certifying body for Canada.

8 Q. And they were electrically driven?

9 A. Electrically driven.

10 Q. Yes, all right. So the --

11 A. The shuttle car is also electrically driven. This,  
12 again, is a flame-proof machine certified by the  
13 certifying agency.

14 Q. And flame proof certification means that it is  
15 useful in environments or atmospheres that may be  
16 inflammable?

17 A. Yeah. Well, there's a definition in your definition  
18 book which I think is worth reading, sir, out of the  
19 definition book but --

20 Q. All right.

21 A. -- you know, people could read that. What it really  
22 means is that it's an enclosure where if an explosion of  
23 methane takes place inside that enclosure, the products  
24 passing out will not explode -- they will not ignite  
25 methane outside that enclosure --

MR. SMALES, EXAM. BY MR. MERRICK

1 Q. All right.

2 A. -- and vice versa, of course. Now --

3 COMMISSIONER Is the testing agency you referred to, is  
4 that a department or a branch of CANMET?

5 A. Yes, that is CANMET.

6 COMMISSIONER Okay, thank you.

7 A. The thing to note about the shuttle car which is  
8 important is that it does have an electric cable.

9 MR. MERRICK And we see that in the second set of  
10 photographs?

11 A. Yes.

12 Q. Yeah?

13 A. And in the upper photograph, that cable is going  
14 into the reeling mechanism because, obviously, as the  
15 shuttle car moves away from the source of electricity,  
16 the cable has to be wound out, and when it comes back, it  
17 has to wind in. And, of course, you've always got a  
18 potential of running over your own cable.

19 Q. All right. And I notice that in that page -- the  
20 second page of the shuttle car, we see what seems to be a  
21 driver's compartment --

22 A. Yes.

23 Q. -- to the right of the piece of equipment. I take  
24 it there's a similar compartment over on the opposite  
25 corner --

MR. SMALES, EXAM. BY MR. MERRICK

1 A. No. No, there's only one driving compartment and  
2 that is located on the side that you can see.

3 Q. All right.

4 A. There are two seats, so that when the shuttle car  
5 driver is driving in the one direction, obviously, he  
6 sits in one seat, and when he goes the other way -- what  
7 you can identify from that photograph there is the fact  
8 that he cannot see the far corner of the car. And we're  
9 talking about quite a long car here, 30 feet in length.  
10 So that when he's travelling around corners, quite often  
11 he will brush the coal on the sides. And, of course,  
12 he's got to be very, very much aware of what he's doing.  
13 If any cable is in the way, he's liable to catch cables.  
14 He can't see where the far wheels are, so, you know, his  
15 cables are there, he may run over them.

16 This is -- the housekeeping in a room-and-pillar  
17 area is very important because of this problem of really  
18 seeing where you're going with the machine.

19 Q. So when we hear later evidence about damage to  
20 electrical cables and electrical cables being possible  
21 sources of ignition because of that damage, this is one  
22 of the causes and maybe one of the reasons why they get  
23 damaged by a shuttle car. We've got a very long piece of  
24 equipment that has to be maneuvered around tight corners  
25 in places --

MR. SMALES, EXAM. BY MR. MERRICK

1 A. That is correct.

2 Q. -- where there are cables, either its own cable or  
3 other cables in the area?

4 A. That's correct.

5 Q. All right. Thank you.

6 COMMISSIONER This may sound kind of naive but who  
7 checks the cable when he's backing up?

8 A. When he's backing up, the reel should be taking in  
9 the spare all the time. This is an automatic reel,  
10 electrically powered.

11 COMMISSIONER On this machine?

12 A. On the shuttle car itself.

13 COMMISSIONER Oh, I see, okay. So it's always under  
14 tension as it goes forward and when it comes back, it  
15 winds itself?

16 A. It winds itself in, yes.

17 COMMISSIONER Okay, thank you.

18 MR. MERRICK Is that what we see, in fact, in the  
19 second set of photographs, the top photograph where we  
20 see the end of the cable which would be the plug, I  
21 assume, that would plug into a gate end?

22 A. Yes.

23 Q. And then we see it going up into that opening on the  
24 left-hand side. That's the reel mechanism in there?

25 A. The reel mechanism would be contained in there.

MR. SMALES, EXAM. BY MR. MERRICK

1 Q. Okay. And the driver's compartment is just on the  
2 other side?

3 A. Yes.

4 Q. And then the following several pages are the  
5 specifications for the shuttle cars used at Westray?

6 A. Yes, sir.

7 Q. All right.

8 A. I think that these are a general specification done  
9 by the Joy company. I think they probably say that they  
10 are 15 tonne shuttle cars in that specification. And my  
11 recollection is that they were 10 tonne shuttle cars.  
12 These are only details though that don't affect the  
13 general picture.

14 Q. All right. Flip to the next page which is a  
15 photograph of Stamler feeder. This is the piece of  
16 equipment that you station at the end of the conveyor  
17 into which the shuttle car deposits its load.

18 A. Correct.

19 Q. And I take it that in that first photograph, the  
20 only photograph, we're looking at the end, in which the  
21 shuttle car would deposit its load?

22 A. That's the end.

23 Q. And as we look in there, we see a track starting  
24 from that end, it looks like a conveyor system, or a  
25 ladder, or a track along the bottom.

MR. SMALES, EXAM. BY MR. MERRICK

1 A. That is a conveyor.

2 Q. That would be moving and it would bring the coal in  
3 toward those grinders that we see back there?

4 A. Yeah, the rotating head which is a break -- coal  
5 breaker.

6 Q. So that would break the coal up into a size that it  
7 could be conveniently conveyed on the conveyor?

8 A. That is -- yes.

9 Q. That would also be a tremendous generation of dust  
10 point?

11 A. Yes. At that point you would normally would have  
12 sprays. And, in fact, sprays were in use at the mine.

13 Q. All right.

14 COMMISSIONER So this is really a Stamler breaker  
15 feeder, isn't it?

16 A. Yes.

17 COMMISSIONER Yeah.

18 A. Yes, that's correct.

19 COMMISSIONER I learned something from yesterday.

20 A. After having passed through the breaker, the coal is  
21 raised on a conveyor -- on the conveyor and then  
22 deposited on the tail end of the belt conveyor.

23 MR. MERRICK All right. I have it. Now the next few  
24 pages are entitled "Underground Conveyor Control System,"  
25 and I'm not going to direct you to anything in the text

MR. SMALES, EXAM. BY MR. MERRICK

1       there other than its general background and the overview.  
2       We see a couple of pages, two pages, of general  
3       photographs of a conveyor system. That's not the exact  
4       conveyor that was in Westray --

5       A.    No, sir.

6       Q.    -- that conveyor is now destroyed.

7       A.    Yes.

8       Q.    But this gives us the general idea, I take it?

9       A.    This was just to use a picture to show people a  
10       conveyor as such. The ones in Westray in No. 2 return  
11       were actually suspended from the roof, not as this one is  
12       on the floor. Similar kind of structure, what we call an  
13       "open structure." And I think that apropos the questions  
14       you asked regarding dust, I think that you can see that  
15       below that belt it's quite black.

16       Q.    Yes.

17       A.    This is the material which has fallen off the bottom  
18       belt. If you look at the carrying side which has the  
19       coal on on the top belt, when that goes round, the top  
20       becomes the bottom. So any coal dust which has been  
21       adhering to that top surface drops off as it passes the  
22       bottom idlers and gets bumped at each point. And that's  
23       why you see this dark coal dust in the floor. And this  
24       looks to be a very, very good place where you've still  
25       got coal dust on the floor in this area.

MR. SMALES, EXAM. BY MR. MERRICK

1 Q. All right. The next photograph which also shows a  
2 conveyor system, the purpose of putting this in is just  
3 to give an indication of the junction point of the  
4 conveyor?

5 A. This is what is -- this is a drive area.

6 Q. Drive area, yes.

7 A. Where you've got your electric motors, your gear  
8 boxes, and the device for tension in the conveyor to make  
9 it drive. This is -- it covers quite a long length, as  
10 you can see, something probably about 150 feet. The  
11 delivery point can be a substantial distance from this  
12 particular drive. It may be 50 meters; it could be 100  
13 meters.

14 Q. All right.

15 A. What I think is interesting here is that if you look  
16 on the floor in the first diagram, you see the dark  
17 character under the belt. If you look at the area around  
18 the drive, there's been substantial stone dusting here.

19 Q. And, again, around that part of the drive would be a  
20 dust collection or generation point?

21 A. Yes. Because, of course, every roll that you go  
22 around tends to knock a little bit of dust off the belt.

23 Q. Okay, the next series of photographs, the next two  
24 photographs, one is entitled "Fletcher Dual Head Roof  
25 Bolter" and is not necessarily exactly -- it isn't the

MR. SMALES, EXAM. BY MR. MERRICK

1 exact same kind of roof bolter in Westray, but the next  
2 photograph of a blue piece of equipment is a Westray  
3 bolter, is it?

4 A. Yes. That is the one -- a photograph taken at  
5 Westray itself.

6 Q. Just tell us quickly what we're looking at.

7 A. I think the better one to describe is the one in the  
8 orange colour which is the Fletcher design, similar to  
9 the one at Westray. You have a T-piece in front, that  
10 is, the temporary roof support which is hydraulically  
11 set, under normal conditions, up the roof to protect the  
12 area and hold the roof intact while bolting is carried  
13 out.

14 Q. We see there that the men are, in effect, working  
15 under unsupported roof. They haven't yet moved in, and I  
16 take it at the very end of that roadway is where the  
17 miner would have just cut?

18 A. Yes.

19 Q. And if we look at the roof, there is nothing  
20 supporting it in that area.

21 A. This area is supported --

22 Q. Well --

23 A. -- by the temporary roof support, that hydraulic  
24 roof support.

25 Q. So that it provides its own support over the men?

MR. SMALES, EXAM. BY MR. MERRICK

1 A. Yes.

2 Q. All right.

3 A. The men themselves are on platforms, if you notice,  
4 with the drilling equipment which drove the holes in the  
5 roof in the predetermined positions. Having drilled the  
6 holes, the resin is placed in the hole and then the roof  
7 bolt is screwed into the hole using exactly the same  
8 chucks and the drilling equipment that are on those  
9 platforms.

10 Each man individually has a canopy over his head  
11 protecting him. If you look at the blue picture, the men  
12 can actually mount onto the roof bolter from the rear end  
13 which is under completely supported ground, travel  
14 through the centre of the machinery. On either side of  
15 that there are storage places for his roll mesh, for the  
16 roof bolts, for the resin, so he doesn't need to be  
17 getting on and off the machine. All is controlled with  
18 hydraulic and they're all fail-safe; that is, that to  
19 operate them they must hold those controls in position.  
20 When he releases the controls, they spring back into the  
21 neutral position. This, again, is a flameproof piece of  
22 equipment, electro-hydraulic, and once again, is  
23 certified by CANMET.

24 Q. All right. Thank you. Just a second now. Let me  
25 come to the next photograph. That's a scoop tram?

MR. SMALES, EXAM. BY MR. MERRICK

1 A. Yes, sir.

2 Q. That's a diesel piece of equipment?

3 A. Yes. Diesel.

4 Q. And that's basically a utility vehicle; it does a  
5 variety of functions in the mine?

6 A. Yes, the design of this particular scoop tram allows  
7 for the bucket to be taken off, forks to be put on, or a  
8 flat bed to be put on, so that it can actually service a  
9 number of jobs. Lifting, cleaning, and transporting  
10 materials. This particular machine is a certified piece  
11 of diesel equipment --

12 Q. And again --

13 A. -- with all the necessary flame traps and  
14 conditioner boxes.

15 Q. And, again, it's one of the pieces of equipment  
16 actually used by Westray?

17 A. This was used by Westray, yes.

18 Q. Did it have a sniffer on it?

19 A. This has a sniffer.

20 Q. Can you show us where the sniffer is?

21 A. If you look at the next photograph, the man there is  
22 pointing to the sniffer head which you can see is located  
23 between the bucket itself and the front wheels of the  
24 machine.

25 Q. All right. And, again, we've got the

MR. SMALES, EXAM. BY MR. MERRICK

1 specifications?

2 A. Yes.

3 Q. The two pages. And then the next two photographs  
4 are of the tractors used at Westray?

5 A. These are the non-certified pieces of diesel  
6 equipment which are subject to approval by the Nova  
7 Scotia Labour Department.

8 COMMISSIONER Did you say "uncertified"?

9 A. Non-certified.

10 COMMISSIONER Non-certified. Okay.

11 MR. MERRICK And these are basically a farm tractor  
12 type of piece of equipment with some staging built on it  
13 for transportation?

14 A. Yes. There are two shown. One was the one used,  
15 normally, for just transporting the men and the second  
16 one you see was designed to accept a stretcher and act as  
17 an ambulance carriage.

18 MR. MERRICK So that the shifts as they would go down  
19 the mine, would ride down on this tractor and ride back  
20 out again --

21 A. Yes.

22 MR. MERRICK -- I guess?

23 A. Yes.

24 COMMISSIONER Aside from the superstructure on that, is  
25 there anything to distinguish it from, as Mr. Merrick

MR. SMALES, EXAM. BY MR. MERRICK

1        termed it, as a "farm tractor"? Does it have any special  
2        anti-flame devices or anti-sparking devices or anything  
3        like that?

4        A.    I'd much rather let the experts on the subject speak  
5        to that --

6        COMMISSIONER    Okay.

7        A.    -- particular subject, if I could.

8        COMMISSIONER    Okay. Thank you.

9        MR. MERRICK     We have Mr. Bossert who will be able to  
10       talk about the tractors in detail. All right. We do see  
11       they've got two fire extinguishers strapped to it.

12       A.    Yes.

13       Q.    All right. Those are the tractors. In addition,  
14       and we don't have any demonstrative evidence, or  
15       photographs of this, there was also boom trucks used in  
16       the mine?

17       A.    Yes, sir.

18       Q.    And that would be generally a boom truck --

19       A.    I think the thing we can see -- is on the  
20       photographs over there, the boom truck.

21       Q.    That's post-explosion?

22       A.    Yes. These -- they were the photographs taken by --  
23       when the re-entry took place.

24       Q.    All right. And let me just find the one that shows  
25       the boom truck. Twenty-seven? Yeah. And that is

MR. SMALES, EXAM. BY MR. MERRICK

1 basically a truck with a boom on it?

2 A. Yes. The boom truck really is just a front-end  
3 driven machine with a flatbed behind.

4 Q. And it's diesel?

5 A. And that was diesel as well. And that was non-  
6 certified.

7 Q. And we'll hear more evidence about that. Turn to  
8 tab 13 in Exhibit 38 and very quickly, you can -- those  
9 are pieces of equipment that were actually used at  
10 Westray for rock dusting? Or stone dusting.

11 A. These were pieces of equipment which were  
12 photographed at Westray. Examining those photographs it  
13 appears to me that the stone dusting machine on the  
14 second page --

15 COMMISSIONER Where are we?

16 MR. MERRICK Exhibit 38, tab 13.

17 COMMISSIONER Thirteen. Okay. Oh, the little -- like a  
18 big fire extinguisher there?

19 A. Yes. There's a big fire extinguisher --

20 COMMISSIONER U-30 -- U-300.

21 A. Yes. That's a photograph of rock dusting equipment.  
22 On the next page there are two rock dusting machines and  
23 it would appear to me that the one at the top has been  
24 used. As for the others, the NSA machine is in the  
25 warehouse.

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1 MR. MERRICK Still is?

2 A. Was still in when I was over there. And the U-300,  
3 I cannot specify whether that has been used or not. It  
4 doesn't look as though it has been used to me.

5 COMMISSIONER What would be the capacity of that hopper  
6 on the blue machine there in the top photo?

7 A. That would hold something probably about 25  
8 kilograms. 50 pounds.

9 COMMISSIONER And that's -- that would be taken in, I  
10 presume, in a tractor with bags of stone dust?

11 A. Yes, yes.

12 COMMISSIONER I see. Okay.

13 A. They keep loading the stone dust in and blowing the  
14 air through and directing the nozzle.

15 MR. MERRICK All right. So that gives us a  
16 appreciation of what some of these pieces of equipment  
17 look like that we've heard evidence about and we'll hear  
18 much more evidence about.

19 COMMISSIONER But that wouldn't be state of the art,  
20 would it? Rock dusting equipment.

21 A. That is state of the art.

22 MR. MERRICK All right.

23 COMMISSIONER They need a better artist.

24 MR. MERRICK Now, Mr. Smales, you referred to a lot of  
25 this equipment being electrical that's in the mine. The

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1 continuous miner, the shuttle car, the Stamler, et  
2 cetera. Can you turn to Exhibit 38, tab 10, and very  
3 briefly, and we have a blow-up of this on the wall -- or  
4 on the pegboard. Just tell me quickly how the  
5 electricity was distributed in the mine. This will be of  
6 relevance because we will hear evidence about gate-end  
7 boxes and cables and that sort of thing.

8 A. The main feeder from Nova Scotia Power was at 69  
9 kilovolts. 69,000 volts. That power was taken to a  
10 substation on the surface somewhere to the back of the  
11 mine in that direction.

12 Q. Behind the portals --

13 A. Yes.

14 Q. -- right.

15 A. And transformed down to 7.2 kilovolts. The 7.2  
16 kilovolts cable then passed down No. 2 Slope. At No. 5  
17 Crosscut there was a section switch and energy was put  
18 into the No. 5 Crosscut at 1,000 volts to feed the  
19 conveyor, which was No. 2 conveyor drive, and through the  
20 non-flameproof transformer. So the transformer there  
21 transformed the energy from 7.2 -- that's 7,200 volts, to  
22 1,100 volts.

23 There was a continuation down the No. 1 Slope and  
24 just outbye No. 2 -- No. 9 Crosscut were three section  
25 switches. I'll speak about section switches in a minute.

MR. SMALES, EXAM. BY MR. MERRICK

1 One was the main section switch which stopped the power  
2 to the whole of the inbye section. One of those section  
3 switches fed the North; the other one fed the Southwest  
4 area.

5 To cut down on the detail which I don't think is  
6 really relevant, from the section switch, the power is  
7 goes along into the section of the mine which is being  
8 worked area, to a trans-switch unit, which is a  
9 transformer with switches at each end. These  
10 transformers were 1,000 KVA, which is quite a substantial  
11 transformer, and there the power, 7.2 kilovolts, was  
12 transformed again down to 1,100 kilovolts. So on the  
13 outbye side of the transformer you've got 7.2 kilovolts;  
14 on the inbye, 1.1.

15 From the transformer, cable passed to what is known  
16 as a "gate-end box." The gate-end box is really the  
17 control unit for the individual piece of machinery. In  
18 addition to the gate-end boxes which were used for the  
19 machinery, there were also lighting panels which  
20 transformed the 1,100 down to 120 or 240 volts so that  
21 lighting or minor machinery could be operated from that  
22 voltage.

23 This was the situation both in the Southwest area  
24 and in the North area. There were these transformers and  
25 systems operating.

MR. SMALES, EXAM. BY MR. MERRICK

1 Q. Now just -- this would be by cables that would  
2 running down the side of the roadway?

3 A. This was by cables. And we could see them quite  
4 clearly on the support plans that we -- photograph we  
5 looked at. And there are cables which can be seen on the  
6 photographs on the wall.

7 Q. Just -- let's take a look at that support photograph  
8 that you were talking about. How high up on the walls  
9 would those cables be?

10 COMMISSIONER Let's have some numbers --

11 A. I can't give you the numbers.

12 COMMISSIONER -- Mr. Merrick, please.

13 MR. MERRICK I'm just looking while I'm ad-libbing  
14 here. Tab number 11, the first photograph of non-  
15 yielding arches.

16 COMMISSIONER And that's --

17 MR. MERRICK Exhibit 38, tab 11.

18 COMMISSIONER Tab 11.

19 MR. MERRICK Is that what you mean?

20 A. That's a very good example of the cables which are  
21 passing down No. 1 Slope. They are supported on the  
22 right-hand side, as you can see. I should mention while  
23 you're looking at that photograph that on the left-hand  
24 side there are pipes as well which are supported. And I  
25 don't think it's wrong to mention that those pipes, there

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1 was compressed air. There was water for fire-fighting  
2 and for drenching coal, and there was also a pumping  
3 range.

4 Q. All right. So the --

5 A. The cables themselves, there's a specification for  
6 those which Mr. Bossert will talk to much more  
7 effectively than I would.

8 Q. But in any event, when we hear evidence about cables  
9 and where they are, that's, generally, sort of how they  
10 are strung --

11 A. Down --

12 Q. -- along the sides?

13 A. Down the No. 1 Tunnel. They would possibly be hung  
14 up in a similar position along the B and C Roads and the  
15 A and B Roads going into Southwest 2, but once you get  
16 into the room area, a lot of these cables automatically  
17 go onto the floor. And in the photographs that you can  
18 see on the wall, there are quite a number of cables on  
19 the floor.

20 Q. So some of those would have -- that would have been  
21 their position before the explosion?

22 A. Before the explosion and, you know, during the  
23 working of the operation.

24 Q. All right. And just quickly, under tab 10 of that  
25 same Exhibit 38, after that map, we see a couple of

MR. SMALES, EXAM. BY MR. MERRICK

1 photographs of pieces of electrical equipment that give  
2 us an idea as to what we're talking about. The first  
3 photograph of an actual Westray piece of equipment is  
4 what? Tab --

5 A. Can I see the one you've got because I have a --  
6 yes. That is a -- what we call a "trans-switch unit."  
7 It's a transformer. That's the one that transforms from  
8 7.2 kilovolts down to 1,100. And where the man is  
9 standing and covering up, there's a switch there. One  
10 end of that switch is high voltage switching at 7.2. And  
11 at the other end there's a switch as well and that would  
12 be the 1,100 volt end.

13 Q. All right. And the next --

14 A. This is a flameproof transformer.

15 Q. All right. And the next two diagrams are of --  
16 photographs, catalogue photographs, are of what kinds of  
17 pieces of equipment?

18 A. The lighting transformer I mentioned. I think the  
19 better one is to go to the second photograph which is a  
20 gate-end box.

21 Q. Yes.

22 A. From the transformer, the 1,100 volt supply would  
23 enter through the brass attachment at the top of the  
24 gate-end box. The gate-end box contains the buzz bars  
25 and you can actually couple together a batch of these

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1 gate-end boxes. So you may half a dozen of them all  
2 coupled together. The power would continue to go right  
3 through those boxes assuming that the power was switched  
4 on from the transformer. The protective circuits of the  
5 gate-end boxes are contained in the cubic section below  
6 the buzz bars.

7 Q. All right.

8 A. There's protection in the gate-end box for overload  
9 current, earth leakage. That is where one phase of the  
10 cable has a leakage of power to earth. There's an  
11 intrinsically safe circuit there at seven and a half  
12 volts which is designed so that when the power is  
13 switched on at the machine which is in the face of the  
14 heading, the power there is switched on at seven and a  
15 half volts. Intrinsically safe. And the main connecting  
16 power is 1,100 volts, where the big flash occurs, is  
17 actually in the gate-end box. So there's quite a lot of  
18 protection in here. There's also --

19 COMMISSIONER And that gate-end box is what you call  
20 "intrinsically safe"?

21 A. No, the gate-end box is flameproof.

22 COMMISSIONER Flameproof. Okay. So that means if  
23 anything -- if there's a little explosion in the box, it  
24 won't export itself.

25 A. That's right. So that when your 1,100 volt flash

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1 goes, which would ignite methane, if there was there  
2 methane in there, there would be no chance of it igniting  
3 anything outside. The intrinsically safe circuit is the  
4 one which is contained -- which is dealt with in the  
5 gate-end box. But the intrinsically safe circuit is the  
6 one that allows power to be switched on at the operating  
7 machine at seven and a half volts, but allows for the  
8 main contact, which is 1,100 volts, to take place within  
9 the gate-end box.

10 COMMISSIONER Okay.

11 A. I think Mr. Bossert might be able to explain it  
12 to --

13 COMMISSIONER Well, I --

14 A. -- you even better. The lighting transformer,  
15 you'll see, lighting unit, also can bolt onto the gate-  
16 end box. So that you've got a facility in that area for  
17 operating machinery from there, for doing lighting and  
18 any other job that you want to do at 120 volts. I don't  
19 know whether we've actually distributed the section  
20 switch.

21 MR. MERRICK If not, we have it available.

22 A. It is available. And this, again, this unit, if you  
23 remember, I mentioned there were three located just  
24 outbye No. 9 Crosscut. These section switches are  
25 designed with all the features like overload protection,

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1 earth leakage protection, under current protection.

2 Everything modern. And these were the latest designs

3 and, really, they're the Rolls Royce of the job.

4 Q. You're talking about the ones that were actually  
5 installed in Westray?

6 A. The ones in Westray, yes.

7 Q. Yes. All right. Okay. Enough talk about  
8 electrical. Let me deal very briefly with the personal  
9 equipment that each miner would have going underground.  
10 There would, of course, be the mining helmet and lamp.

11 A. I'm searching for my notes. I'm sorry. I think if  
12 I start at the head I can go down -- I remember the  
13 equipment. The miner himself would wear a helmet. And  
14 these are to Canadian standards.

15 Q. In fact, at tab 15 of Exhibit 38 is some of the  
16 printed material concerning this.

17 A. He would wear a flame safety lamp. Sorry, an  
18 electric safety lamp. Now this lamp has a burning time  
19 of approximately 13 hours. It also has an output, light  
20 output, initially of 36 lumen. But I must refer back.  
21 After 10 hours, that light output is only roughly two-  
22 thirds of what it was originally. It's down to something  
23 like about 20 lumen. 22 lumen.

24 Q. All right.

25 A. I think it's important to remember that for items

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1 which may come up later.

2 COMMISSIONER What's a "lumen"?

3 A. It's a measurement of the amount of light which is  
4 emitted and picked up on a screen. It's the --

5 COMMISSIONER Can it be roughly related to a --

6 A. It's -- be the old candle --

7 COMMISSIONER -- wattage or something?

8 A. The old candle power, but nowadays instead of  
9 measuring candle power, the measurements are done in the  
10 amount of light falling on a unit surface.

11 COMMISSIONER Okay.

12 A. And this reduces as time goes on, as the battery  
13 gets -- goes down. And so that it starts off initially  
14 at 36 lumen, or if we said 36 candle power, and reduces  
15 to 22 candle power.

16 COMMISSIONER Yeah, okay.

17 A. That type of thing.

18 MR. MERRICK All right. In addition -- sorry.

19 A. Sorry, can I go?

20 Q. Go ahead. The next thing he may be wearing on his  
21 helmet, he could have ear protection; that is, the muff  
22 type of hearing protection or he may have the inserts  
23 which he puts in his ears to wear.

24 He would have a coverall, a belt. He would have a -  
25 - on his belt he would have the battery for his electric

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1 cap lamp and also his self-rescuer.

2 Q. Now I want to spend just a few minutes with the  
3 self-rescuer because we're going to hear evidence later  
4 on as to attempts that were made by the miners in the  
5 Southwest District to get that self-rescuer out and on.  
6 What I would like you to do is, and I take it we have one  
7 that is similar to the kind that was being used at  
8 Westray.

9 A. This is identical to the type that was used at  
10 Westray. The self-rescuer itself is for use in  
11 atmospheres containing not more than one per cent carbon  
12 monoxide. The way in which it operates is that the  
13 breath pulls in the air through a mixture which removes  
14 the moisture and then converts the carbon monoxide to  
15 carbon dioxide. In use, it becomes very hot because, of  
16 course, there's a chemical action taking place. The  
17 rescuer itself is designed to work for about one hour.  
18 And it's most essential when you're using this that you  
19 move steadily and slowly. If you rush, you increase your  
20 breathing rate, it gets hotter and hotter and you've  
21 really got to control what is going on.

22 Q. When you say it's hotter, it's actually hotter in  
23 the mouthpiece?

24 A. The mouth dries out completely. And during my  
25 training with this, which I had to go through every year,

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1 we used to wear these for something like half and hour  
2 and, on the surface this was, going up and down ladders,  
3 through corridors, bending, and stretching, and crawling,  
4 and it did get very, very warm in half an hour even under  
5 what I call good conditions.

6 Q. And the danger is that the miner will take it out of  
7 his mouth?

8 A. If he took it out then, of course, within seconds he  
9 could be down, depending on the concentration of carbon  
10 monoxide.

11 Q. All right.

12 A. I think I mentioned that .1 percent, half an hour  
13 could result in death.

14 Q. Now --

15 COMMISSIONER These come with a nose clip too, don't  
16 they?

17 A. Yes.

18 COMMISSIONER Yes.

19 A. I have a demonstration model here.

20 COMMISSIONER Okay.

21 A. And I'm going to subject myself to all kinds of  
22 abuse because I'm going to try to show you how this works  
23 and how it goes on.

24 MR. MERRICK I'm very interested in that because,  
25 personally, I don't think they are that easy to get off.

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1 But we're going to hear evidence as to the attempts that  
2 were made to get them off and use them and how long a  
3 time it takes to do that. And I want to understand just  
4 what that mechanism is.

5 COMMISSIONER Do they also have to have a -- does there  
6 also have to be a certain percentage of oxygen in the  
7 ambient air before they'll function?

8 A. Oh, yes. These do not provide oxygen --

9 COMMISSIONER No. No, I realize that.

10 A. -- at all. And, therefore, to operate you must have  
11 the minimum of about 19 percent oxygen for this to work  
12 efficient -- really, at all.

13 COMMISSIONER Minimum of 19 percent.

14 A. 19 percent.

15 COMMISSIONER And the norm in breathable air?

16 A. 21 percent.

17 MR. MERRICK So if you're in an environment in which  
18 there has been tremendous combustion that has exhausted  
19 all of the oxygen, that's not going to save you?

20 A. This will not save you.

21 Q. All right.

22 A. As you see, the difference is -- it's exactly the  
23 same shape, et cetera. I'm going to try to put it on my  
24 belt. I didn't bring a proper belt for this job. I  
25 should have done. And it's nearly five years since I

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1 actually opened one of these and put one on. The method  
2 of operation is that on top we have a lever --

3 Q. Better show the Commissioner. He's the one that has  
4 to write the report.

5 A. Sorry, -- a lever and that is held down by a small  
6 strip.

7 COMMISSIONER I've worn two of them already but I would  
8 like to see it.

9 A. What we intend to do is to lift that lever, break  
10 the strip, and, at that stage, the bottom part should  
11 fall off into my hand. That contains the whole of the  
12 self-rescuer. I then have to place the rubber  
13 mouthpiece, drag the self-rescuer out of the container.  
14 If it doesn't come out easily, I can actually wear the  
15 equipment with the bottom container still on and it will  
16 function. So I have to grab the head pieces, pull the  
17 self-rescuer from the container, put the mouthpiece in my  
18 mouth and put the nose clips on and then adjust the head  
19 straps. Obviously, if I'm down in the mine, I shall take  
20 my helmet off first. So I don't know whether you want to  
21 time me, Mr. Merrick, but I'm going to flip the top.

22 MR. MERRICK All right, we are running.

23 A. All right. Lift that back up, release the  
24 mechanism. I throw that on the floor. I then hold the  
25 straps and pull.

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1 Q. This would be typical, I take it?

2 A. This would be typical. But if I was underground I  
3 wouldn't pull it out. I then threw that away. I sink my  
4 teeth around the -- [witness has self-rescuer on his  
5 face] --

6 Q. All this time you would have to ensure that you  
7 weren't breathing? All right. And the more that you  
8 would breathe, the more rapidly you would breathe, the  
9 hotter that mouthpiece would get?

10 A. Yeah.

11 Q. All right, thank you.

12 A. How long did it take?

13 Q. About a minute and a half.

14 A. I would not have actually pulled it out underground  
15 if I had been doing this. Once I felt resistance, I  
16 would immediately applied my mouth to the -- and put the  
17 nose clip on.

18 Q. That's if you're thinking coolly and calmly?

19 A. That was my training that I did that.

20 Q. All right.

21 A. The reason I pulled it out was to show you just,  
22 really, what the thing is. You can imagine that you must  
23 get the head piece on well because there's quite a weight  
24 there which you couldn't support with your teeth,  
25 gripping the two back rubbers and with your mouth around

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1 the outside.

2 Q. All right.

3 A. When I was practicing this, I could do it in about  
4 25 seconds, actually.

5 Q. All right. That is the standard piece of life-  
6 saving equipment that each miner would be carrying?

7 A. Yes.

8 Q. And when we hear evidence later about self-rescue  
9 units being found up in the Southwest district, it is  
10 identically that piece of equipment that we're talking  
11 about?

12 A. Yes. Yes.

13 Q. All right.

14 A. It has the silver out coating, not the red one.

15 Q. Yes. And the specifications and descriptive  
16 information about it, plus a self-breathing apparatus,  
17 are at the back of Tab 15 of Exhibit 38 for general  
18 information.

19 A. No, sir. I don't think we've got it.

20 Q. Well, self-contained self-rescuer? Maybe not.

21 A. No. No, sir, we haven't got that in.

22 Q. Sorry.

23 A. What we have in is another line of protection  
24 related to it which is the photograph, I think, which  
25 you're looking, which is called the "Oxy 60."

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1 Q. Yes?

2 A. Located --

3 COMMISSIONER That's the next step, isn't it?

4 A. Yes. Located -- the -- I must put on my spectacles  
5 so I can see what I'm showing you. At the intersection  
6 where the boom truck was, that is B Road and Southwest 2,  
7 No. 1 Road, according to the rescue teams who went in  
8 there, there were a number of Oxy 60 apparatus at that  
9 point. I think it was six or seven. I can't remember  
10 which. These are actually oxygen-producing pieces of  
11 equipment. And so we have what you might call the  
12 potential for two levels of protection. One is  
13 immediately to stick on your self-rescuer which requires  
14 oxygen. The Oxy 60 is something which is located in  
15 benches far too heavy to carry around. It tells you the  
16 weight in here somewhere. It must be 20 or 30 pounds at  
17 least. And these are usually located at points to which  
18 people can get in reasonable time, whatever "reasonable"  
19 is in the circumstance. The lid of that particular  
20 apparatus is taken off and, in fact, oxygen is produced  
21 so that you can actually move through an irrespirable  
22 atmosphere and really any level of carbon monoxide. The  
23 problem is, of course, always getting to that before the  
24 carbon monoxide got to you.

25 Q. Yes.

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1 A. And this is a great difficulty. But this level of  
2 protection is now being provided at most of the mines,  
3 usually on the return airway and on the intake airway.

4 COMMISSIONER Would they be placed as close as possible  
5 to the working face?

6 A. That is the objective all the time. In the case of  
7 the room-and-pillar, you move them up as close to the men  
8 operating as possible. And, generally speaking, it's  
9 worthwhile, you know, providing some facility for either  
10 racking them or hanging them and keeping moving that  
11 particular thing forward.

12 Q. All right. Thank you. And that's essentially the  
13 equipment that each miner would have with him at the  
14 time --

15 A. He would have that with him.

16 Q. -- in the mine?

17 A. And in addition to that he would be wearing  
18 protective boots or rubber boots. He may even be wearing  
19 gloves, of course, to protect his hands.

20 Q. All right. Now just before I move on, there was one  
21 topic or one item that I failed to cover with you when we  
22 were talking about the electrical equipment in the mine  
23 and the equipment itself, and that's the fans themselves.  
24 And we've heard a lot of evidence about fans. Can you  
25 turn to Exhibit 38, Tab 12. And you'll see there some

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1 specifications on fans and then some photographs  
2 themselves. One page of photographs of the two fans.  
3 These are the auxiliary ventilation fans that we've heard  
4 evidence about?

5 A. That's correct, yes.

6 Q. And are these actual pieces of equipment that were  
7 used at Westray?

8 A. These were actual pieces. And, in fact, the  
9 bifurcated fan which is here, the top photograph, they're  
10 actually photographs taken underground. That is the  
11 bifurcated fan.

12 Q. Yes.

13 A. And that's identical to the one that you see in the  
14 photograph in your exhibits.

15 Q. Yes.

16 A. The yellow -- the fan is the white part. The yellow  
17 pieces are silencers which are attached to either end of  
18 the fan and the tubing then would go from one of those  
19 silencers, depending on whether you're using this an  
20 exhausting or a forcing fan.

21 Q. And it would be exhausting or forcing depending on  
22 which way you had turned it?

23 A. Yes, that's correct.

24 Q. All right. And the bottom photograph is what?

25 A. This -- there are two types of fans; one is an in-

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1 line fan and the other one is a radial fan. They both do  
2 exactly the same thing. In one case the air is dragged  
3 straight through the middle; in the other case the vanes  
4 rotate and the air is taken on the sides.

5 Q. All right.

6 A. But the function exactly the same from the point of  
7 ventilation.

8 Q. And these are electrical as well and would have to  
9 be connected to your main electrical system?

10 A. These are electrical. These are also certifiable  
11 flame proof.

12 Q. All right. Let me come to just about my second last  
13 topic with you, Mr. Smales. Very briefly about  
14 certification. In a mine organization there are  
15 requirements for certification. Can you tell me very  
16 briefly what they are?

17 A. The Coal Mines Regulation Act requires the Minister  
18 of Mines to appoint a board whose responsibility it is to  
19 advise him on the certification of persons, certain  
20 persons, specified persons, who work in a mine and  
21 underground at mine. The people who are required to have  
22 certificates are the mine manager, underground manager,  
23 overmen. And they have what are designated First Class,  
24 Second Class, and Third Class certification. The mine  
25 surveyor requires certification. The mine electrician

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1 requires certification. In the Act there's a person  
2 called a stationary engineer which is an old term, but  
3 now we use that term for the mechanical engineer at the  
4 mine, and he has to have a certification. The original  
5 certification of stationary engineer were First, Second  
6 and Third Class certificates. But these were in the days  
7 when there were big boiler systems on the surface, and it  
8 really relates to a time gone past. The qualifications -  
9 - the Board of Examiners have adjusted their terms of  
10 reference nowadays and there's Mechanic, Class One; and  
11 Mechanic, Class Two. The mine examiner [racket?]  
12 shotfirer has to have certification. The coal miner has  
13 to have certification. And to be a rescue person you  
14 have to have rescue and first aid certificate.

15 Q. So practically everybody involved in the underground  
16 operation of that mine has to hold one degree of  
17 certification or another?

18 A. The people who do not require certification are  
19 really those who don't work at the face so that a  
20 material transport worker, a labourer cleaning up on the  
21 roadways, he would not need a coal miner's certificate.  
22 But, virtually, at a place like Westray where there are  
23 teams of men who work at the face and teams of men who  
24 work outbye, but the men who work outbye are quite often  
25 called on to replace workers who haven't come to work.

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1 Then you'll need most of your people to be certified as  
2 coal miners.

3 Q. All right.

4 A. The Act itself lays out the work experience that is  
5 required for qualification and certification. The work  
6 experience and training that a man receives is then the  
7 responsibility of the employer to see that that is  
8 obtained. The educational qualifications are also laid  
9 down in the Act. And the Board of Examiners set the  
10 questions which are asked of the -- for certification by  
11 the individuals. And they mark the papers and the  
12 results of their examination of the candidates and their  
13 identification of the fact that the experience and  
14 training has been carried out, they then recommend to the  
15 Minister that certificates are issued.

16 Q. And this is intended, I take it, to be a completely  
17 independent function by this Board of Examiners?  
18 Independent of the mine operator themselves?

19 A. Yes.

20 Q. All right. Let me come to the mine organization  
21 very briefly. Can you give me just a fast description of  
22 how Westray was actually organized, as you understand it,  
23 based on the information we have available to date?

24 A. Would you like me to put it on a --

25 Q. On a flip chart? Real fast.

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1 A. -- flip chart? The person in charge of the whole  
2 mine, of course, is the mine manager. Taking the  
3 underground, he has an underground manager. The  
4 underground manager had two overmen. These worked on the  
5 two 12-hour shifts. The overmen were responsible for the  
6 whole of the mine and the under the under manager. I  
7 don't want to discuss the statutory implication of this  
8 because I think they're a bit difficult at the present  
9 time. The overmen then had one, two, or possibly three  
10 foremen, one for the Southwest, one for the North and  
11 occasionally they had one in the Southeast or on the day  
12 shift they may have an overman looking after the  
13 conveyors on work outbye.

14 The teams which were doing the room-and-pillar  
15 drivage then were subject to supervision by the foreman.  
16 So we've got the Southwest team, the North team, and the  
17 conveyor, cleaning and materials team.

18 Now the second line, of course, was a manger and,  
19 under him, he had a chief of maintenance who had a chief  
20 mechanic and electrician. These are both certified  
21 positions. That is not requiring certification under the  
22 CMRA.

23 The chief mechanics then had mechanics and usually  
24 on any shift there would be a mechanic in the Southwest  
25 and a mechanic in the North. This the general situation.

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1 Two mechanics, sorry, two mechanics -- that's right, two.

2 At the same time there would be an electrician in  
3 the Southwest and an electrician allocated to the North.  
4 And these, of course, did the general maintenance, the  
5 examinations and the planned maintenance.

6 Obviously, there were other people here such as the  
7 administrative officers and finance people who all came  
8 under the manager.

9 Q. Now we know that some of them worked 12-hour shifts  
10 and some worked 8-hour shifts. What do you understand to  
11 have been the situation there?

12 A. The people who were actually employed in getting the  
13 coal, mining the coal, as the room-and-pillar people,  
14 they're working 12-hour shifts, 8:00 - 8:00, on a four-  
15 day on/four-day off basis. There were a number of other  
16 people who were working 8-hour shifts which started at  
17 8:00 a.m. and they worked until the 2 -- what is that,  
18 4:00 o'clock in the afternoon. I understand that they  
19 working on a five-day week basis. But, of course, they  
20 may have been called out to make up teams that we used as  
21 what I would have called "market system."

22 Q. All right. And we will have evidence later as to  
23 exactly who was on which team, et cetera, but that was  
24 your understanding as to how they operated this mine and  
25 its general organizational structure?

MR. SMALES, EXAM. BY MR. MERRICK

1 A. Yes, there were four teams to run the -- four  
2 on/four off. A, B, C and D they were termed. And,  
3 unfortunately, as you I think are well aware, the B team  
4 that were operating on the night shift of the 9th of --  
5 8th -- 9th of May.

6 Q. All right. The last topic I want to canvas with  
7 you, Mr. Smales, is the reporting system both required  
8 and that was in use at Westray for regular reports,  
9 written reports. What regular written reports were being  
10 maintained and by whom?

11 A. The only really regular reports that I have  
12 identified were those by the foremen. They provided a  
13 pre-shift inspection report. And by that, they had to  
14 examine the area in which they were supervising within a  
15 period of four hours before the commencement of the  
16 oncoming shift. This was so they could write a report  
17 which said if there were any problems, any unsafe areas,  
18 any problems with ventilation and really identify the  
19 situation as being safe for men to enter that area. Or,  
20 if it was unsafe, the actions that were required to make  
21 it so men could enter. That is what is called a "pre-  
22 shift inspection report."

23 COMMISSIONER Mr. Smales, wasn't this a 24-hour  
24 operation?

25 A. Yes.

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1 COMMISSIONER So the foreman would go in during the  
2 working of the previous shift --

3 A. No.

4 Q. -- to do a mine inspection?

5 A. No. The person who was on that shift would do the  
6 inspection for the shift coming on.

7 COMMISSIONER Oh, so it wasn't another body introduced  
8 into the system?

9 A. No, he was already there.

10 COMMISSIONER Okay. Yeah.

11 A. And he would do that inspection. He produced a  
12 report which anyone could examine --

13 COMMISSIONER Okay.

14 A. -- and should have examined to see that it was all  
15 right for them to enter that area.

16 COMMISSIONER Okay, thank you.

17 A. The foreman also did what was called a "shift  
18 report" as to what had been accomplished during that  
19 shift which normally took the form of continuous miner  
20 operated in No. 1 Head, No. 3 Head, cut 20 feet, cut 20  
21 feet. Was in No. 4 Head, cut 12 feet. Roof bolted No. 1  
22 and 2 --

23 MR. MERRICK Yes.

24 A. -- which was a description of the activity that had  
25 taken place. And also --

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1 Q. This was a separate report?

2 A. That was a separate report. So the two reports  
3 supplied by the foremen. The mechanics and electricians  
4 also made reports at the end of the shift relating to  
5 both the work that they had been doing during the shift.  
6 And they also would fill in what is what is known as a  
7 "planned maintenance report" where they had actually done  
8 examinations during the shift in relation to the planned  
9 maintenance requirements.

10 Other reports were made. I think I've mentioned  
11 that the ventilation officer did report his ventilation  
12 findings.

13 Q. This would be the ventilation surveys you've told us  
14 about?

15 A. That is correct.

16 Q. Yes?

17 A. There were intermittent reports by other people such  
18 as the under manger may have written notes out. The  
19 chief electrician and chief mechanics did some noting.  
20 But what -- on what you might call a continuous daily  
21 basis I didn't find any other persons than the foremen  
22 and the mechanics and electricians doing that regularly.

23 Q. So for a written record through a reporting system  
24 of the daily events of that mine, we have to look to the  
25 pre-shift reports or we can look to the pre-shift

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1 reports, the shift reports by the foremen, and the  
2 mechanics' and electricians' reports?

3 A. That's correct.

4 Q. All right.

5 A. And we pick up bits from all kinds of other reports  
6 but not in a systematic way --

7 Q. All right. Thank you, Mr. Smales. That's all I've  
8 got of you at this time.

9 COMMISSIONER I guess it's a little bit late to get into  
10 cross-examination. Indeed, if there is any plan?

11 MR. LARKIN I have a few, one or two questions, Mr.  
12 Commissioner.

13 COMMISSIONER Well, we'll adjourn until the morning and  
14 deal with it then.

15 MR. MERRICK I have Mr. Golbey next.

16 INQUIRY ADJOURNED (TIME: 4:34 p.m.)

17

## REPORTER'S CERTIFICATE

I, Margaret E. Graham, Court Reporter, certify that the foregoing is a true and accurate transcript of the evidence taken by way of recording and reduced to typewritten copy.

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Margaret E. Graham

DATED this 7th day of November, 1995, at Dartmouth, Nova Scotia.