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MINISTRY OF POWER

FIRE AT MICHAEL COLLIERY FIFE

REPORT

On the causes of, and circumstances attending, the
fire which occurred at Michael Colliery, Fife,
on 9th September, 1967

by

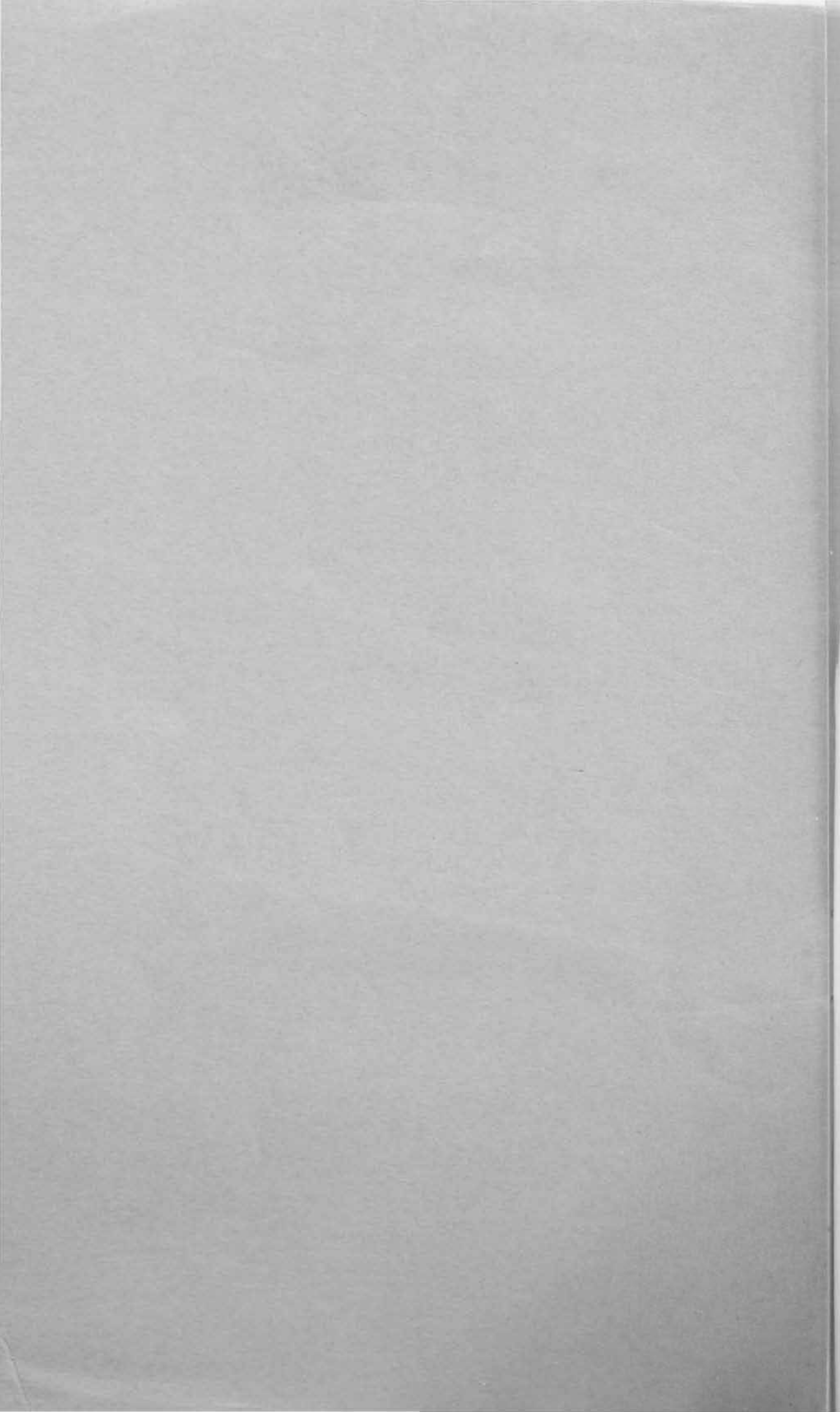
H. S. STEPHENSON, B.Sc., C.Eng., M.I.Min.E.
H.M. Chief Inspector of Mines and Quarries

*Presented to Parliament by the Minister of Power
by Command of Her Majesty
June 1968*

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ROYAL CANADIAN MOUNTED POLICE

THE ACT MICHAE GULLERY

1984

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Published by the
Department of Justice
Ottawa, Ontario

THE ACT TO PROTECT THE
MICHAE GULLERY

SBN 10 136570 5

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THE HISTORY OF THE CITY OF BOSTON

The first settlement in Boston was made in 1630 by a group of Puritan settlers from England. They came to the city in search of religious freedom and a place to practice their faith. The city was founded on a small island in the harbor, and the settlers built a fort to protect themselves from the Native Americans.

The city grew rapidly in the years following its founding. By 1640, the population had increased to over 1,000 people. The city was a center of trade and commerce, and its harbor was one of the busiest in the world. The city was also a center of education and culture, and it was here that many of the great minds of the American Revolution were born.

The city's history is filled with interesting events and people. From the founding of the city to the present day, Boston has been a city of great importance and influence. It has been a city of firsts, and it continues to be a city of great significance.

The city's history is a testament to the strength and resilience of the American people. It is a story of a city that has overcome many challenges and has emerged as a city of great success and achievement.

REPORT ON THE CAUSES OF, AND CIRCUMSTANCES
ATTENDING, THE FIRE WHICH OCCURRED AT MICHAEL
COLLIERY, FIFE, ON 9th SEPTEMBER, 1967

6th May, 1968.

The Right Honourable Raymond Gunter, M.P.,
Minister of Power.

Sir,

In accordance with the direction of your predecessor, I held a Public Inquiry with respect to the accident which occurred at Michael Colliery in the County of Fife on 9th September, 1967. The names, ages and occupations of the nine persons killed are given in Appendix I.

2. I opened the Inquiry in the Beveridge Hall, Kirkcaldy, on 11th December, 1967; it lasted five days and the names and occupations of the eighty-three persons who gave evidence are given in Appendix II.

3. The interested parties were

The Ministry of Power, by Mr. H. F. Wilson, H.M. Divisional Inspector of Mines and Quarries for the Scottish Division, with Mr. H. T. Ramsay, Director of the Safety in Mines Research Establishment, and Mr. G. D. Nussey, one of H.M. Deputy Chief Inspectors of Mines and Quarries.

The National Coal Board, by Dr. H. L. Willett, Deputy Director-General of Production, with Mr. D. J. Skidmore, Director of the Scottish North Area, Mr. W. Rowell, Deputy Director (Operations), and Mr. D. D. Shaw, Chief Mining Engineer.

The National Union of Mineworkers, Scottish Area, by Mr. M. McGahey, President, with Mr. L. Daly, General Secretary, Mr. G. Montgomery, Inspector, and Mr. W. McLean, District Secretary, Fife, Clackmannan and Stirlingshire Area.

The Scottish Colliery Enginemen, Boilermen and Tradesmen's Association, by Mr. W. Lamb, Assistant General Secretary.

The National Association of Colliery Overmen, Deputies and Shotfirers, by Mr. J. Hill, General Secretary of the Scottish Area, with Mr. W. McKibbon, Assistant Secretary, Mr. M. Hynds, Executive Council Member for the Fife Area, and Mr. W. Shaw, President of the Michael Colliery Branch.

The National Association of Colliery Managers and the British Association of Colliery Management, by Sir Andrew Bryan, Consulting Mining Engineer, with Mr. G. Duncan, General Manager, Michael Colliery, Mr. E. Lynn, Secretary of the Scottish Liaison Committee, and Mr. T. Barrie, Technical Investigator.

fault-free, but there is one major quartz dolerite transgressive sill running roughly north-east where the measures are thrown up about 50 fathoms to the north-west. At the time of the fire five seams were being worked, the Dysart Main and the Four Feet in No. 3 Pit and the Chemiss, Bowhouse and Branxton in No. 2 Pit.

Manpower and Output

10. The colliery employed 2,190 men, 1,874 underground and 316 on the surface. The average weekly output of 16,750 tons was produced from fully mechanised shearer loader faces, as follows:

Chemiss Seam	..	..	(No. 10 District)	..	..	4,055 tons
Four Feet Seam	..	..	(No. 31 District)	..	..	1,275 tons
Bowhouse Seam	..	..	(No. 40 District)	..	..	2,184 tons
Branxton Seam	..	..	(No. 22 District)	..	..	3,701 tons
Dysart Main Seam	..	..	(No. 1 District)	..	..	4,285 tons
Dysart Main Seam	..	..	(No. 3 District)	..	..	1,250 tons

The Checking System

11. The checking system in force at the colliery had remained unchanged for many years. A man reporting for work changed his clothes in the baths and then went to the lamp room to collect his lamp. He then went to the check office window, called out his personal number and collected two checks, one square and the other round, bearing this number. On going underground, he dropped the square check into a container at the pit bottom and retained the round one. When the last man underground had gone to his work, the container was brought up the pit and the square checks were put on the check board as an indication that the men concerned were underground. At the end of the shift, each man on coming to the surface dropped his round check into the check office window. The round check was then placed on the board with the corresponding square one indicating that the man was now above ground. A lamp number was allocated to a man when he first joined the colliery. There was no relationship between the lamp and the check numbers, but, each being related specifically to individuals, were complementary to each other and served as a double check.

12. As will be seen later in the Report, some confusion arose over the numbers of men still below ground at various stages in the incident. It is desirable that the National Coal Board and H.M. Inspectors should examine the possibility of improving checking systems.

Method of Ventilation and Working

13. Ventilation was provided by a Howden 1,000 horse-power radial flow fan situated at No. 2 Shaft and producing 310,000 cubic feet of air per minute at 3.5 inches water gauge. There was a standby fan, a two stage Aeroto 400 horse-power 100 inch diameter unit with a capacity of 225,000 cubic feet of air per minute at 2.5 inches water gauge. There were no underground booster fans.

14. Access to the Sections in the No. 2 Pit workings was by horizon mines and, in the No. 3 Pit workings, by roads in the seams. Plans Nos. 1 and 2, which cannot be scaled, are isometric drawings, which have been prepared to clarify, visually, the relationship of workings on different horizons. In order to appreciate the extent of the workings, it may be noted that a man going along the 430 fathoms mine from No. 2 Pit Bottom would travel 1,530 yards to the Coal More Turn, 2,530 yards to the Compressor House and 3,537 yards to the return roadhead of the Bowhouse No. 40 Section. A man starting from No. 3 Pit Bottom would reach the top of the Four Feet Dook in 870 yards and the intake roadhead of the No. 31 Section in 1,560 yards. On the Dysart Dip side of the colliery, the distance from No. 3 Pit Bottom through the intakes to the Dysart Dip No. 3 Section roadhead was 1,967 yards. The scale of Plan No. 2 can be visualized by noting that the distance along the Loco Level from the Dysart Turn to Bell's Heading was 320 yards.

No. 2 Pit workings

15. From the 300 fathoms level at No. 3 Shaft bottom, the 360 fathom level was reached by three dooks (dipping roads) in the Dysart Main Seam and two in the Lower Dysart Seam. The 360 Lateral Level Mine followed the line of strike in a south-westerly direction with two level cross cuts (Nos. 1 and 2) driven through the seams along the line of full dip to give access to the large field of coal to the seaward side of the quartz dolerite sill. From the No. 2 Shaft bottom level at 430 fathoms, a level mine ran in a westerly direction with two cross cuts (Nos. 1 and 2) driven along the line of full dip to make contact with the coal seams. The cross cuts at the 360 fathom and 430 fathom levels were connected by roadways driven on the full dip of the various seams, and from these roadways the working sections advancing along the line of strike were developed. Air circulated from the No. 3 Shaft, down the Dysart Dooks, through the 360 fathom Lateral and the No. 1 and No. 2 Cross Cuts, into the working sections, returning through the 430 fathom cross cuts into the 430 fathom Lateral to the No. 2 Shaft.

No. 3 Pit workings

16. From the 300 fathom level at No. 3 Pit Bottom, roadways had been driven in the coal to the full dip and from them the various sections of the Dysart Main coal workings advanced along the line of strike. Also from No. 3 Pit Bottom a level mine, called the Sea Mine, had been driven in a south-easterly direction, cross cutting all the seams in the field. At the time of the fire, the Four Feet Seam was being worked from the Sea Mine, workings in the Barncraig, Chemiss, Bowhouse, Branxton and Boreland having been abandoned at various times between 1956 and 1960. The most recently abandoned section of the Sea Mine workings was in the Branxton Seam, but a pumping station was still maintained there. Air for the Four Feet workings entered along the Sea Mine and returned to the upcast shaft at the Bowhouse Inset by way of the Old Branxton and Bowhouse workings. The only open route to other collieries was a connection, driven in 1963, in the Lower Dysart Seam to Lochhead Colliery.

The Loader Mine and the Loco Level

17. The Loader Mine was supported throughout by 15 feet long straight steel girders set at three feet intervals, on seven feet steel props attached to the

girders by specially designed clamps. The sides of the roadway were lined with a mixture of treated fireboards and concrete slabs, in the estimated proportion of 20 per cent of the former to 80 per cent of the latter, set in the webs of the girders and props. Any small falls had been filled with untreated timber and there was also untreated timber over the tops of the roof girders.

18. The Loco Level was supported by 14 feet by 10 feet arched girders. The sides of the road were lined mainly with fireboards but there was some untreated timber above the arches and, as necessary, behind the fireboards.

19. The junction of the Loader Mine with the Loco Level was supported by straight steel girders resting on brick pillars at the centre and a brick wall around the junction. Runners were provided across the girders with fireboards between the webs. Untreated timber had been used to fill the space, estimated at 9 to 12 inches in thickness, above the girders.

20. Coal from the Dysart Dip workings was brought up to the Loader Mine on a cable belt conveyor. It was then carried down the Loader Mine to the Loco Level by a belt conveyor 36 inches wide, 200 feet long with a 15 feet jib extension, and driven by a 36 horse-power motor at a speed of 390 feet per minute. The belting was made of fire resistant anti-static P.V.C. manufactured to National Coal Board Specification 158/1960.

21. The electricity supply cables in the Loco Level were PVCDWA, P.V.C. sheathed at 550 volts and PILCDWA, P.V.C. sheathed at 3,300 volts.

The Telephone System

22. There were three internal telephone systems at the colliery. The first, an automatic system, was installed in 1957 and had facilities for up to 100 lines. It served, in addition to other places, the intake and return gates of every working district, and the loading points, junctions and bunker stations. Two extensions, serving the general manager and deputy manager, had priority call facilities which enabled either official to interrupt a conversation on any of the other lines. The second system, of the magneto-call type, had a manual exchange in the time office. The third was a system of local telephones, some of which had loudspeakers, for point to point communication underground.

Fire-Fighting Arrangements

23. The plan of the fire-fighting arrangements in the No. 3 Pit Bottom area at the time of the incident showed that eight hydrants were sited as follows:

four in the 300 fathoms Lateral, of which one was at the shaft bottom, one at the junction with the Sea Mine, one at the junction with the Lower Dysart Man Haulage Dook and one midway between the two latter points; and

four in the Loco Level, of which one was at the Dysart Turn, one near the junction with the Old Pumphouse, one at the junction near the stopped off No. 3 Heading and one at the junction with Bell's Heading.

Plans had been made for a ninth hydrant to be sited in the Loader Mine, but the pipeline from the shaft was not complete. Fifteen hoses with other fire-fighting gear were kept in a station near the Old Pumphouse and 14 hoses with other fire-fighting gear in stations at each end of the New Pumphouse. It was said in evidence that the fire-fighting plan was revised once a month, that there were 86 trained men at the colliery and that drills were held about three times a year.

RECENT HISTORY

24. The most significant events at the colliery in recent months having a bearing on the fire in September were a heating in the Loader Mine on 24th July, and a fire in the Dysart Dip No. 1 Section on 6th August, 1967.

The Heating of 24th July

Discovery

25. During the morning of 24th July, J. T. Brown, deputy engaged on special duties, looking up the Loader Mine from its junction with the Loco Level, saw smoke coming from a point on the right-hand side which later proved to be about 40 yards from the junction. He then investigated more closely and, finding smoke was issuing from the top of the girders, telephoned D. Wilson, the under-manager in charge of reconstruction, at the pit bottom. Wilson had actually passed through the Loader Mine three quarters of an hour earlier but had noticed nothing untoward.

Dealing with the July heating

26. D. Wilson who received the telephone call between 9.30 a.m. and 10.00 a.m. at once recognising the serious potential of the heating ordered the immediate withdrawal of all men likely to be affected by it and informed the manager. The conveyor belt in the roadway was withdrawn from the affected area and hoses run out from a hydrant in the Loco Level near the Old Pumphouse. This presented no difficulty because the hydrant was at the time on the intake side of the Loader Mine, the direction of ventilation being along the Loco Level from Tilson's Alley. That the air was moving in this direction was largely a matter of chance because this changed from time to time according to the temperature on the surface. After the reconstruction of the No. 3 Pit Bottom during the summer holidays of 1967, this variability ceased and there was a greater flow of air into the Four Feet Section with the result that the air in the Loco Level settled down to flow constantly from the Loader Mine towards Tilson's Alley.

27. The point where the fire had occurred was in an old fall area; when the fireboards between the RSJ webs were removed, three feet of packing timber and the coal above it were found to be burning. The burning material was dug out for quenching and the work continued during the remainder of the day and on into the succeeding night. Ultimately a cavity about eight feet high and ten feet long was excavated. The area was cooled down from about 150 degrees fahrenheit to about 70 degrees fahrenheit and Wilson was convinced that the fire was "definitely out" before packing of the cavity was commenced.

29. A. H. Barker, H.M. District Inspector of Mines and Quarries, visited the area soon after the incident was discovered and agreed with the immediate measures being taken to deal with the situation. He then travelled the return airways and detected carbon monoxide at the stopping on the high side of the No. 3 Heading, but found none in the return itself. D. Wilson also made an inspection of the return airway in the vicinity of the place where it crossed the Loader Mine. He neither saw nor smelt anything unusual, but he did notice that the concrete raft at the crossing had heaved up. He thereupon arranged for the cracks so disclosed to be filled in and this was done on the following day.

29. Later that day Barker attended a meeting of the management at which the general lines of removing the burning material and of sealing the cavity were agreed. The discussion also took in the need to eliminate any air leakage between intake and return airways in the triangular area bounded by the Loader Mine, No. 3 Heading and the Dysart Main Return. An essential feature of this reinforcement was to be the treatment of a length of the Loader Mine with polyurethane foam. Another was to breach the stopping in the return at the entrance to No. 3 Heading and to fill any voids found.

30. The cavity in the Loader Mine was filled with sandbags built up on the RSJ's with plaster puddled between the bags and the coal sides. Both the inbye and outbye sides of the cavity were treated in this way, leaving a narrow shaft up the middle and this was similarly treated using fireboards as supports for the sandbags. Temperature tests were taken throughout the filling operation and at no time did it exceed 70 degrees fahrenheit. D. Wilson was satisfied that "a sound and efficient job" had been made of the filling.

Treatment of the Loader Mine

Application of polyurethane foam

31. As soon as the immediate danger was passed, the management turned its attention to longer term measures. It was decided that the lining of the Loader Mine with polyurethane foam should extend over a length of some 150 feet between the Loco Level and the Cable Belt Road. Verbal arrangements were made immediately with the Caledonian Mining Company to carry out the work. On 28th July, colliery workers, under the general supervision of company representatives, started to prepare the site and on 30th July machinery and material required for applying the foam were taken underground. J. Simpson, an under-manager, exercised control over the work when he returned from holiday on 31st July. Preparation of the site included the making of four recesses each about four feet wide and two feet deep cut into the sides of the roadway to provide adequate sealing for the foam lining. Simpson found no signs of heating but decided to play safe and have the four recesses treated with polyurethane foam immediately. With the resumption of production at the colliery following the annual holiday, however, the actual work of spraying the foam had to be restricted to the night shift from 31st July, because the application of polyurethane foam constituted a hazard to health while spraying was in progress.

32. C. V. Peake, deputy managing director of the Caledonian Mining Company, explained that the work of foam application in the Loader Mine was carried out in accordance with the requirements of the National Coal Board Production Department Information Bulletin No. 65/253. The polyurethane used had been ordered from the manufacturers by reference to the Board's specification; this included a provision requiring a flame inhibitor to be incorporated in the polyurethane mix. The foam was applied in two coats, giving a total thickness of about one inch. In the first instance no mention was apparently made by any of those concerned about the need for the applied foam to be treated with a coating of a fire-retardant material as indicated in para. 5(ii)(c) of the Bulletin. On 3rd August, however, the management arranged with the Caledonian Mining Company for the coating to be applied

as soon as the foam work was complete. The material necessary for this was delivered to the colliery, but, for reasons which I shall explain later, it was never used.

Subsequent inspections

33. The work of applying the foam was completed on the night shift of 5th-6th August. Shortly after this, Barker inspected the polyurethane foam lining and found it satisfactory; there were in fact one or two very small holes around some cable hangers but these he took to be of no consequence. A few days earlier he had travelled the return airway in the vicinity of the Loader Mine with J. S. Wilson, production manager. They inspected the stopping at the junction of the return airway and No. 3 Heading and found no carbon monoxide. At that time the stopping had not been breached with a view to filling any voids but some pipes and pumps had nevertheless been installed to facilitate the performance of this work as soon as it could be started. At about 1.30 p.m. on 8th September, M. R. Bottomley, H.M. Inspector of Mines and Quarries, in the course of an inspection for another purpose, travelled through the Loader Mine, had a quick look at the foam, passed his hand over parts of the surface and considered it to be satisfactory. He did not see, smell, or feel anything indicative of spontaneous combustion. There was no fire-retardant coating on the surface but it was his understanding that this was to be applied when other foam work in the Dysart Dip No. 1 Section, to which I shall refer later, had been completed.

Contract arrangements

34. The decision having been taken that the work of lining the Loader Mine with foam should be carried out quickly, the parties concerned—the management and the Caledonian Mining Company—agreed to dispense with the normal formalities of obtaining a quotation and drawing up formal contract documents. Instead, they agreed that the work should be carried out under a verbal contract based on the N.C.B. Information Bulletin mentioned above. Later there was an exchange of letters to this effect.
special duties, measured the work for payment on 17th August.

35. The parties to this verbal contract considered that the Information Bulletin did not specifically require the surface, to which the polyurethane foam was to be applied, should be treated with a lining of fire-retardant material. For this reason, it was explained that the work ordered to be done in the first instance was restricted simply to the application of foam. By omitting any reference to an application of fire-retardant material beneath the foam, the management had already settled by implication that this was not necessary, because the Loader Mine was already lined with concrete slabs and fire-resistant boards. It was arranged on the 3rd August that the work to be undertaken by the Caledonian Mining Company of applying a coating of fire-retardant material on the polyurethane when foam spraying of the latter was complete, should be the subject of another verbal contract.

The Fire in the Dysart Dip No. 1 Section

36. On 6th August, the day after the completion of the foam treatment of the Loader Mine, a fire occurred in the Dysart Dip No. 1 Section. The

management considered this to be a greater risk to the safety of the mine than the Loader Mine, which was now treated with polyurethane foam, and decided to have the Dysart Dip No. 1 Section main gate treated in the same way. They deferred the work of lining the foam in the Loader Mine in accordance with the arrangements which had been made three days before, concentrated their efforts and completed this early on the night shift of 8th-9th September.

The Night Shift of 8th-9th September

37. Following the fire in the Dysart Dip No. 1 Section, an increased number of air samples were taken daily under special arrangements designed to give information about the effectiveness of the fire-fighting measures taken there. On 8th September, a carbon monoxide analysing and recording device installed in the Section was tested satisfactorily and, as a result, the special arrangements for sampling were discontinued in favour of the normal sampling pattern. To avoid the misleading effects of carbon monoxide produced by shot firing, the usual practice was for samples to be taken daily at the end of the night shift. D. C. Dryburgh, a deputy engaged on special duties, was instructed to this effect and planned to collect his samples at about 5.00 a.m.

38. At about midnight, Dryburgh travelled along the Loco Level and went through the No. 6 Heading into the main return. Walking along the return, he passed the stopping to No. 3 Heading, and came out through the No. 2 Heading. He had some experience of spontaneous heating, but, in the course of his inspection in the vicinity of the Loader Mine, he neither smelt nor saw anything which gave him cause for concern.

THE EVENTS OF 9th SEPTEMBER

The Start of the Fire

39. In the early part of the night shift of 8th-9th September, at about midnight, J. Izatt, cable belt attendant, was cleaning up the Cable Belt Road near its junction with the Loader Mine. He heard several rumbling noises; he did not regard them as unusual, however, thinking they were due to normal movement of the strata. At about 2.30 a.m. he travelled down the Loader Mine and went into the under-manager's office on the low side of the Loco Level, where he saw A. Stirling, overman. He told Stirling that he had heard rumbling in the roof and that there had been one loud bang. As a result of this conversation, Stirling went up the Loader Mine a few minutes later to where Izatt was working. He noticed nothing unusual en route and concluded that the bang had resulted from the breaking of the sandstone roof.

40. About an hour later Stirling, having returned to the under-manager's office, smelt smoke coming through ventilation pipes from the Loco Level. He went out of the office to the Loco Level where he saw a blue haze. He then turned right into the Loco Level and walked as far as No. 3 Heading which he entered and found quite clear. He came back and looked up the Loader Mine and saw what he took to be burning coal falling from the roof about 20 to 25 yards away from him. There was no smoke. Amongst a small quantity of this material, he particularly noticed "one piece lying on the floor about six inches square and it was blazing; it was black but there were fumes coming

from it". He rushed along the Loco Level, up Bell's Heading and back down the top end of the Loader Mine where, about 15 or 20 yards from the entrance, he met Izatt coming out of very heavy smoke. Izatt had returned to his work in the Cable Belt Dook, and had been cleaning out at the back of the loading point when he had been suddenly enveloped in thick black smoke. The conveyors were stationary and had been so for some time, although they had been running normally earlier in the shift.

41. Stirling sent Izatt up Bell's Heading (Plan No. 2) and told him to inform the onsetter at No. 3 Shaft bottom about the fire. The onsetter, J. J. Teevan, sent for R. McIntyre, the pit bottom deputy, who saw Izatt in a state of collapse under the pit bottom clock at 3.50 a.m. Stirling himself went to the telephone at the bottom of Bell's Heading and tried to telephone the Dysart Dip Sections. Getting no answer, he went to the Coronation Dipping (Plan No. 1) and sent P. Ritchie, a backbrusher, to warn the men in the Dysart Dip No. 1 Section. After again trying unsuccessfully to telephone No. 2 and No. 3 Sections, he spoke to T. Lister, deputy, in charge of the surface Control Room, and told him "There is a fire at the Cable Belt Load, get everybody concerned informed."

42. Izatt's arrival at the No. 3 Shaft bottom and Stirling's message to Lister raised the alarm. Following this, a very large number of telephone calls were made and messages sent by men to warn others. At the time, there were 311 men below ground: 45 in No. 3 Pit Bottom, 64 in the Dysart Dip Sections, 25 in the Four Feet Section and 177 in the No. 2 Pit workings; it is remarkable, having regard to the denseness of the smoke and its irritant effect, that all but nine escaped. There is no doubt that, in large measure, this was due to the comprehensive and rapid manner in which messages were transmitted round the pit.

43. The following account of the warnings given to the men underground and their escape from the pit is based on the evidence of many of the witnesses. It must be borne in mind that very few of them looked at their watches to check the time and that the smoke was so thick that they were often unable to see their companions.

The Surface

Events between 3.30 a.m. and 5.15 a.m.

44. Lister's duty in the Control Room was to receive and pass on messages and information. He did not keep a complete log. Before he gave Stirling's message to C. Webster, the senior overman in charge of the night shift, he received a routine call from J. Tait, the overman in the Four Feet Section. Lister informed him that a fire in the Cable Belt Dook had been reported and that he thought that the trouble was confined to the Dysart Dip side of the pit. Next, W. Semple, Jnr., an overman in the Branxton No. 22 Section, who had received a message about the fire from A. Watson, an overman in No. 3 Pit Bottom, rang the Control Room for further information. Eventually, at about 3.45 a.m., Lister spoke to Webster and was instructed to withdraw all the men from the Dysart Dip Sections and to call A. Nicol, the deputy manager, and J. Simpson, the under-manager for the Dysart Dips. Soon afterwards, Watson telephoned to say that, as conditions were worsening, the Rescue Brigades

should be called out. There was some inconclusive discussion between Lister and the Time Office staff of it was that Lister persisted in his attempts to summon Nicol and J. Simpson and managed to speak to the former at 4.00 a.m. or shortly afterwards.

45. Nicol's first reaction on receiving the call from the colliery was that "it was one of those roadway heatings". He left for the colliery straight away and on arrival found that Lister could not give him any definite information about the situation underground. He was told that some men had already been taken to hospital and, seeing three or four men who had come up the pit, learned from them of the conditions that they had seen, including the fire in the Loader Mine. He deduced "I had a belt fire on my hands". At about 4.35 a.m. he went to his office to determine a plan of action. He instructed the telephone operator to get the Rescue Station for him but the call was frustrated by a number of incoming callers including the police and the hospital. He arranged for the general manager, G. Duncan, and the under-managers, J. Simpson and D. Wilson, to be sent for. He spoke to Stirling in Bell's Heading who told him that he was putting up screens to fight the fire and expressed concern about the chances of all his men to escape. The call to the Rescue Station was logged at 5.00 a.m. After a conversation with McIntyre, who like Stirling was concerned about the difficulties of men escaping through the smoke, Nicol decided to stop the fan. The evidence about the times is conflicting but it appears likely that it was stopped at about a quarter to five and restarted about half an hour later, after Stirling had sent a message that the smoke was backing up Bell's Heading and was hampering the fire-fighting.

Events after 5.15 a.m.

46. Duncan reached the colliery at about 5.15 a.m. and took charge of operations. He was told that there were possibly 60 men in the Dysart Dip Sections, 30 in the Four Feet Section and a considerable number in the No. 2 Pit workings. He realised that the only way of improving the prospect of their safe withdrawal was by reversing the ventilation in the Loco Level. When reports were received that the Dysart Dip and the No. 2 Pit Sections were clear of men, attention was concentrated on the Four Feet and a decision was taken at about 6.00 a.m. to open the doors in No. 2 Heading to draw the smoke into the Dysart Main Return (Plan No. 2). Although the doors were opened at 7.15 a.m. by a rescue brigade, the smoke continued to flow into the Sea Mine for a further two hours.

47. At about 7.00 a.m. W. Rowell, the deputy director (operations), reached the colliery and collaborated with Duncan in exercising overall control. During the afternoon, it was agreed at a meeting of representatives of all the parties concerned that it was unlikely that the three men who had not been found could be rescued but efforts 3.00 p.m. on 10th September.

No. 3 Pit Bottom

48. After McIntyre had seen Izatt in a collapsed state at No. 3 Shaft bottom, he went down Bell's Heading to withdraw his men from the New Pumphouse (Plan No. 2). He was stopped by smoke at the Loco Level but on going round the other way he met B. White, the pumpsman, in Tilson's Alley. Meanwhile,

J. Duncan, the pumphouse greaser, had informed A. Watson in the Overman's Office that smoke was going from the Loco Level into the Sea Mine. After seeing this for himself, Watson made a number of telephone calls to warn inbye sections and McIntyre telephoned to the pumpsman in the Chemiss Inset and told him to go up to the surface.

49. A. S. Todd, the overman in charge of reconstruction, after seeing the fire in the Loader Mine, hurried back to No. 3 Shaft and instructed J. Field, the reconstruction deputy, to withdraw all the men in the Pit Bottom Section. After making several telephone calls Todd with K. Buckley, another overman, opened the doors in Davidson's Mine in an attempt to direct the smoke from Dysart Turn to the upcast shaft. Thereafter they continued to assist the men coming out of the Sea Mine.

50. At about 5.00 a.m. the under-managers, D. Wilson and J. Simpson arrived, the one at the Sea Mine and the other at the Dysart Dip side. All the 45 men in the No. 3 Pit Bottom Section reached the surface safely.

Dysart Dip Sections

Dysart Dip Sections generally

51. After Stirling had sent Ritchie into the Dysart Dip No. 1 Section and had spoken to Lister, he was able to speak to R. C. M. Fraser, a deputy at the return roadhead in Dysart Dip No. 3 Section, and to J. H. Drummond, a deputy at the foot of the cable belt (Plan No. 1). He told them that all the men were to come out through the return airway, the No. 3 Dook. Amongst others, he also spoke to J. Drummond, the shot firer from the Dysart Dip No. 2 Development, and to J. M. Imrie, one of the development workmen, agreeing with them that, in view of the denseness of the smoke, it would be better for them to walk up the return rather than to attempt to go up the intake on the manriding train.

52. Stirling accompanied by D. C. Dryburgh, deputy, went down the Dysart Dip No. 2 Dook and opened the doors in the Dysart Dip 1A connection. Finding that this had little effect on the smoke, they closed them again and, with some difficulty, returned to the East Loco Level. Stirling was driven back up Bell's Heading by the smoke when the fan was stopped but he remained in the area throughout his shift organising the escape of the men and the fire-fighting.

53. T. Barr, the Dysart Dip manriding haulage driver, lowered the train on receipt of a signal at 3.40 a.m. The journey took five minutes in each direction. He stopped the train at Dip No. 1 on the way up, and later heard some men get off at the top; he lowered it again and brought up one man, J. McDonald, the pumpsman. He then lowered the train for the third time and, while it was at the bottom, the electric power went off. A. McRobie, the foreman electrician, who was with Barr, had defeated the top over-run switches so that the train could be drawn up as far as possible; when the power went off, he came up Bell's Heading through the smoke which was coming out of the Loader Mine and met Stirling who asked him to get the fan re-started. Being unable to find a free telephone, he went up the pit and reported to W. L. Wilson, the colliery electrical engineer, who was going into the automatic telephone

exchange to attend to a breakdown. After obtaining permission from Nicol, they re-started the fan.

54. Of the 64 men in the Dysart Dip workings, all but two escaped. P. Thomson, a greaser on the Cable Belt Dook, was last seen at about 3.00 a.m. near the motor house at the top of the No. 1 Dook by J. Duncan, who worked in the New Pumphouse. His body was recovered from the Cable Belt Dook by a rescue brigade (Plan No. 3). J. McKay, a greaser, was with a number of men near the telephone when J. Drummond was speaking to Stirling. The smoke at that time was very thick and McKay was not seen again.

Dysart Dip No. 1 Section

55. Ritchie went in through the Dysart Dip No. 1 Section top road and found J. Culross, the overman, and J. Linden, the face deputy, at the roadhead. He then returned with some of the men and came out through the East Loco Level (Plans Nos. 1 and 2). Culross telephoned down the face and sent Linden out along the bottom gate, where he met men coming up from other sections. He returned with the last of these men to Bell's Heading. W. Armour, the roadways deputy, was told by a workman at 3.45 a.m. by his watch, that smoke was coming into the section. He sent his men out through the face and went along the bottom road to the dooks. The smoke was light grey at first but it turned black later; it smelt of burnt wood and caught his throat.

Dysart Dip No. 2 Development

56. J. Drummond, a shot firer, who was firing shots in the bottom of the two roads being driven to develop the Dysart Dip No. 2 face (Plan No. 1) smelt smoke coming in through the ventilation tubes and went out to the telephone near the pumphouse where he spoke to Stirling and warned McDonald. Thick black smoke was coming down the dooks when he was joined by men from the development headings and J. McKay, the greaser. They went back to the No. 3 Dook, the return airway, through the doors at the top road of the Dysart No. 3 Section and made their way outbye through the smoke in several separate parties. McDonald, however, went down to the bottom of the No. 1 Dook, stopped the pumps, and made his way up the No. 2 Dook. He went to the No. 3 top road doors where he saw J. Watson and R. Bernard, deputies, but returned to the manriding train. After he had been hauled to the top, he signalled the bogies down again to fetch Watson and Bernard.

Dysart Dip No. 3 Section

57. J. Watson, R. Bernard and R. C. M. Fraser, deputies, were in the top roadhead of Dysart Dip No. 3 Section when they received a message from Stirling that all the men were to go out through the No. 3 Dook. Fraser went down the face where he met E. Moore, the overman, and travelled out along the bottom road with him. They met J. H. Drummond and checked with him that all the men further inbye had been warned. J. H. Drummond went on to the face keeping pace with the smoke and taking the workmen with him. Eventually all these officials and workmen travelled in smoke up the No. 3 Dook to the stairs at the top, where visibility was only about ten feet and several of them who were physically distressed had to be helped.

58. By this time, the smoke had backed along the East Loco Level and consequently the men had to travel out through the Dysart Main Return. Because there were alternative routes from the top of the Coronation Dipping and the No. 3 Dook, J. Linden went back into the return at about 4.30 a.m. to show any men coming up the best way out. They travelled in small parties; some, finding thick smoke at the doors in the No. 2 Heading, came out through roads with which they were unfamiliar to the 300 fathoms Lateral; others came through the 1 in 1 Drift and Davidson's Mine; one group, who tried to come out to the Lochhead Level but were stopped by smoke, went back to the return airway and others after attempting other routes eventually came out through the overcast to the Lower Dysart Manriding Dook.

Four Feet Section

Warnings and withdrawal of men

59. A great many telephone messages were sent to the Four Feet workings. In most cases they were simply to the effect that the men should come out, but J. E. Nowak, a belt maintenance man, standing near the Dysart Turn saw the black smoke going into the Sea Mine, and accordingly advised J. Tait, the Four Feet Section overman, and J. McArthur, a greaser, to come out through the return. Eventually all the men, except McArthur and J. C. McEneamy, a beltman, who were accompanied part of the way by A. Taylor, the deputy, No. 31 face, walked out by the shortest way, the one they were accustomed to travel, through the Sea Mine, which was filled with black smoke before any of them entered it.

60. D. Hunter, the roadways deputy, received an urgent message and came outbye sending his men on ahead. He met haze 150 yards from the face and smoke as he rode on the conveyors up the Four Feet Dook. At the top he telephoned to warn H. Gallacher, the 750 Branxton pumpsman (Plans Nos. 1 and 3) and then stayed a few minutes to keep the conveyors running. He next tried to get to the top of the 750 Branxton Cable Belt Dook where some of his men had been working but he managed to travel only about 40 yards in the dense smoke. (The men had already seen the smoke and escaped successfully). Hunter then went outbye along the Sea Mine to the Dysart Turn where he saw several men including Todd, Buckley and McIntyre. He told them to start the conveyor and to shout into the Sea Mine to see if they could get any answering calls. After a while he heard a voice and, with nil visibility, he went into the smoke and guided by shouts found C. Cunningham, pumpsman, lying on the ground. He carried Cunningham most of the 50/60 yards into fresh air receiving help from some men at the Dysart Turn (Plan No. 2).

61. Meanwhile, Tait had sent messages up No. 31 face to warn the men and had telephoned to Taylor who was at the face return roadhead. All the men except Taylor came down the face and walked out through the Sea Mine. D. Wilson, an apprentice fitter, set off from the face with J. Smith and A. Thomson, power loader operators. They rode up the first of the two conveyors in the Dook together but when they reached the top of the second one, Thomson was not with them. About 50 yards from the Dysart Turn, D. Wilson found A. Grieve, a maintenance man, lying on the floor and told

him to get up and keep walking. However, when Wilson found that Grieve was not following him, he lifted him on to his feet and assisted him to fresh air.

62. Several of the men who came out of the Sea Mine vomited and most of them suffered from dizziness, coughing and loss of power in their legs. Of the 25 in the workings at the time, 18 were able to escape.

Escape of men from the Bowhouse Inset

63. Immediately after McArthur at the top of the Four Feet Dook had received the telephone message advising escape through the return, the black smoke appeared. He telephoned to McEneamy, who was at the bottom of the Dook, and arranged to meet him at the top. They went through the doors into the No. 31 Section top road and saw Taylor coming towards them. After Taylor had been through the doors and seen how thick the smoke was in the intake, they set off up the return airway which was signposted. They turned left at the first junction and stopped for a rest at the ladder at the next junction (Plan No. 1). They saw the first signs of smoke in the return at this time. Taylor, who had been alone at the top of the No. 31 face, did not know that his men had gone down to the bottom road; in spite of protestations from McArthur and McEneamy, he decided to go back to make sure that they were all out, being particularly worried about Gallacher, the 750 Branxton pumpsman. He arranged with McArthur and McEneamy that if he did not return in a few minutes, they should look for him and, if they did not find him quickly, they were to go through the return, following the signs. After about five minutes, they went back down the return, but not seeing Taylor they set off outbye. At the top of the ladder, they turned right; continuing to turn right and following the signs to the "Escape Pit", they came to the junction of Walker's Dook and Steven's Brae. They went up Steven's Brae to the inset in No. 2 Shaft at the Bowhouse level. By this time, the smoke was quite thick but, on going towards No. 3 Shaft, it cleared and they stopped at a fence where there was a "no road" sign. They spent some time in old workings to the north of the shafts and eventually returned to the No. 2 Shaft Inset. McEneamy started to strike an old rusty bell-plate with a brick and they shouted when they saw a cage go by. Later, a second cage with rescue men blowing hooters passed them.

64. When A. D. H. Smith, overman, came up the No. 2 Shaft at about 7.00 a.m., he heard and saw nothing, but W. Shaw, acting as a rescue brigade captain, heard voices at 10.35 a.m. Shaw's brigade who returned down the shaft were unable to identify the inset but L. M. Irvine, the workmen's inspector, deduced that it must be at the Bowhouse level. A rescue brigade under G. Pratt, part-time rescue man, went down at 11.30 a.m. to attempt a rescue but, on account of signalling difficulties, they were unsuccessful. McArthur and McEneamy were eventually brought out through the No. 3 Shaft at about 2.50 p.m.

No. 2 Pit Workings

Warning messages

65. C. Webster, the senior overman, was in the Bowhouse No. 40 Section bottom road when he was told at about 3.45 a.m. that there was a fire in the Cable Belt Dook (Plan No. 1). He told T. Inglis, an overman, that he was going outbye to see about it but made no mention of withdrawing the men from

the No. 2 Pit workings. He rode on a locomotive out along the 360 fathoms Lateral, finding blue haze at the Compressor House and smoke at the turn half way between Nos. 1 and 2 Cross Cuts. He came back inbye, made arrangements about withdrawing the men and then walked down through the 360 fathoms No. 2 Cross Cut to the Compressor House in the 430 fathoms Lateral where he spoke to Nicol at the surface. He got the impression that Nicol had just arrived at the colliery and was as much in the dark about the fire as he was.

Inbye sections

66. Meanwhile Nowak had spoken to W. K. Paterson, a deputy in charge of mechanisation, at the Coal More Turn and advised him to send the men out through the Lower Dysart Manriding Dook. A. Watson at No. 3 Pit Bottom had told some workmen in the 360 fathoms Lateral to warn everyone to go to the No. 2 Shaft via the 430 fathoms Mine. These messages were passed on and, in the event, all the men in the No. 2 Pit workings were safely withdrawn.

67. The men from the inbye workings made their way to the Compressor House via the 430 fathoms Lateral, where they were checked out by their deputies. Some of them were taken out on locomotive trains to the bottom of the Lower Dysart Manriding Dook. The majority of the men walked up the Dook; some required assistance on account of the steep gradient.

No. 2 Pit Bottom

68. A. D. H. Smith left the Coal More Turn at about 4.40 a.m. and walked along the 430 Mine towards the shaft. He was passed by two fitters who told him that there was a fire and that the men should withdraw. Near the pit bottom at about 5.10 a.m. M. Blankenstein, a deputy, told him that the onsetter had gone up the shaft and that it was closed. After some delay in getting through on the telephone, Smith spoke to Nicol and told him that he had a stretcher case to send up and that the atmosphere was getting hazy. All the men except about half a dozen were sent up by 5.40 a.m. Readings taken with a P.S. carbon monoxide tube showed a trace at the pit bottom and a little more in the 430 Mine. Smith went to the bottom of the Lower Dysart Manriding Dook to satisfy himself that all the men from inbye were out and finally rode up the No. 2 Shaft at 7.00 a.m. leaving the acting onsetter and the pumpsman at the pit bottom to await their day shift reliefs; their services were required as the pumps had to be run continuously. He kept in touch with them from the surface by telephone.

69. W. Cull, a deputy, went down the No.3 Shaft at 8.50 a.m. with the day shift onsetter and pumpsman. They walked down the Lower Dysart Manriding Dook and found thick smoke on the inbye side of the doors to the 430 Mine. After leaving the doors open for a while, it cleared and they went on to the No. 2 Shaft bottom. Conditions deteriorated and at 10.45 a.m. wearing short period breathing apparatus, they were brought up the No. 2 Shaft by a rescue brigade.

70. I cannot conclude this necessarily brief account of the escape of the men from the mine without referring to their general behaviour. That the evacuation was completed in extremely difficult conditions in such a commendably short

time is in itself a tribute to the very high standard of self-discipline exercised by all. Under-officials displayed their concern for the safety of the men in their charge and the men an equal concern for the welfare of their workmates. That there was at times some confusion is, in the circumstances which obtained, quite understandable. That there was at no time the slightest degree of panic is remarkable. Had there been, the death role in this incident would undoubtedly have been very much higher.

Rescue Brigade Operations

71. As I have said earlier the Cowdenbeath Rescue Station was called at 5.00 a.m.; the first van left in a matter of minutes and arrived at the colliery, some 15 miles away, at 5.35 a.m. The first brigade went underground at 5.55 a.m. quickly followed by a second brigade from Cowdenbeath and by a brigade from the colliery. Coatbridge Rescue Station was alerted at 5.10 a.m. and were called out at 5.50 a.m. They had a brigade underground by 7.20 a.m.

72. As an initial task, the rescue brigades sought to penetrate the Sea Mine, but attempts had to be suspended at 6.45 a.m. because the smoke had become so dense. In order to reduce this, it was decided to send a rescue brigade, under W. Shaw, the colliery fire officer, to open the three doors in the No. 2 Heading (Plan No. 2). They attempted to do this from the intake side but were driven back by heat and smoke. They then travelled 450 yards in a smoke laden atmosphere to reach the doors from the return side. The first two doors were successfully opened but, on opening the third, they were subjected to a blast of intense heat, which singed them and stung their eyes. Visibility was considerably reduced. Some of the brigade were blown over by the blast and their ultimate return to base was only achieved with great difficulty. At about the same time, the body of P. Thomson, greaser, was located in the Cable Belt Dook and a rescue brigade under W. A. Kennedy, rescue man, recovered it at about 8.30 a.m. (Plan No. 3).

73. At about 9.15 a.m., the atmosphere in the Sea Mine improved and a brigade under J. S. Moyes, rescue man, went in there again. On coming out at 9.35 a.m., they reported having seen four bodies along the Sea Mine inbye the Redd Road. Further brigades were then sent in and the bodies of J. Smith, A. Henderson, A. Thomson and H. Morrison, power loader operators, and J. Tait, overman, were recovered between 9.40 a.m. and 10.25 a.m. Thereafter a brigade, captained by W. Aitken, rescue man, commenced a reconnaissance of the Four Feet area in a search for McArthur, McEneamy, Taylor and Gallacher, all of whom were still missing, but found no signs of them. Conditions were fair at first but they worsened, so much so that a second brigade, under J. McG. Malcolm, was sent in to recall the first brigade. The brigades failed to make contact with each other but the first returned to base at about 11.00 a.m. and the second at about 1.00 p.m. by which time conditions had deteriorated considerably.

Development of the Fire

Conditions in the Loader Mine

74. As we have seen, in investigating the fire he had observed, Stirling hurried round from one end of the Loader Mine, where the atmosphere was

clear, to the other end, where he found Izatt coming out of thick smoke. The distance was less than 200 yards and the journey time probably no more than two minutes. Yet in this short time, an apparently clear atmosphere had changed to one laden with dense smoke. A few minutes later, Barr, the Dysart manriding haulage driver, was standing with Stirling at the junction with the Bell's Heading and saw flames, which he thought were at the junction with the Cable Belt Dook: the flames appeared to be coming down from the roof and striking the floor. Some ten minutes later, McRobie went down the upper length of the Loader Mine and saw dense smoke and two or three piles of burning material in the mine inbye of the cable belt junction, while McIntyre, from a short distance into the Loader Mine, particularly noticed an intense fire which appeared to be somewhere near the junction of the Loader Mine and the Cable Belt Dook. At about the same time, Todd and Buckley saw smoke coming from between the boards in the webs of the girders; they reckoned they were about 20 yards from the cable belt transfer point.

75. Soon after the fan had been restarted, J. Simpson was able to go down Bell's Heading as far as the East Loco Level. Looking down the Loader Mine, as he passed the junction, he saw extremely dense smoke. On his way back, at about 5.35 a.m., he and Webster penetrated the Loader Mine as far as the return end of the conveyor. About six yards ahead of them they could see flame creeping up from the floor on the left-hand side of the roadway. Some time later, fire-fighters were able to get below the return end of the conveyor and they saw glowing material in a pile some 30 yards from the cable belt transfer point; the heat overhead was intense. When the smoke abated, G. C. Cowie, developer, was able, from the transfer point, to see two fires, one quite small, about three or four feet across on the belt some ten yards down and the other, much larger, some twenty yards farther on, burning fiercely across the full width of the mine and three or four feet above the level of the belt.

Examination of the Loader Mine

76. By 7.00 a.m., the fire had been reduced to a small one on the belt about seven yards below the junction of the Loader Mine and the Cable Belt Dook and a much larger one at a point about 25 yards below the junction. A few minutes before 7.00 a.m. J. Simpson was again in the Loader Mine when he observed that, whilst the cable belt was whole at the return drum, the top belt was gradually charring towards the louvre plate until it disappeared into powder; the bottom belt was fused to the rollers. At the start of the stretch of road treated with polyurethane foam, the roof and right-hand side were covered with black charred blisters. There were some places from which the foam had been completely burned exposing the fire-resistant boards and concrete slabs. At about the same time Shaw scratched the burnt foam surface with a nail and one inch or so of "black stuff" came away to reveal a chalky brown colour beneath.

77. Much later, at about 6.00 p.m. A. H. Barker, H.M. District Inspector, went five yards beyond the cable belt transfer point. He saw burning material on the floor twenty yards beyond him and observed that the conveyor belt had melted and was hanging in shreds around the return drum. Where he was

standing, he found the foam surface had been charred black to a depth of a sixteenth of an inch but the foam beneath was sound.

Spread of smoke in the Loader Mine

78. The smoke spread from the fire rapidly up and down the Loader Mine into both the Cable Belt Dook and the Loco Level. It split both ways along the Loco Level, to the Dysart Nos. 1 and 2 Dooks in one direction and to the Sea Mine and the Lochhead Level in the other. The consensus of opinion among the witnesses who gave evidence was that the smoke was first smelt, then seen as a white, grey or blue haze and then as very dense and black. The nearer the witnesses were to the Loader Mine the quicker was the change from haze to dense black smoke. There was evidence that the smoke had reached the Dysart Dip No. 1 Section and the Four Feet No. 31 Section by about 3.45 a.m., and the 360 Lateral by 4.00 a.m.

Opening doors and stopping the fan

79. The first priority in dealing with the emergency was to give the men an opportunity of getting out of the pit. The next was to make it possible for the rescue brigades to search for those not accounted for and, if not found alive, to bring out the bodies. The intakes had been contaminated by smoke right from the start. Reversing the ventilating currents might be thought to have been a course affording some relief. In fact it would have taken a considerable time to take effect and, in any event, would not have been a sensible action because the returns would have been more quickly affected by smoke than in fact they were. Stirling and Dryburgh attempted a local short-circuit of air by opening the doors in the Dysart Dip 1A Connection with a view to minimising the spread of smoke into the inbye Dysart Dip Sections, but this was ineffective. With more success, Todd and Buckley opened the doors in Davidson's Mine to afford relief to the Sea Mine. Nicol's action in stopping the surface fan seems to have had no effect at the Sea Mine side and it aggravated conditions on the Dysart Dip side. He therefore decided to restart the fan but it was not until 9.15 a.m. that the smoke began to clear at the Sea Mine entrance. The most likely reason for this development was that the surface fan doors had by then been slightly opened and the fan slowed down, rather than stopped. The relief was of short duration, however, for conditions were as bad as ever by 1.00 p.m.

Spread of fire from the Loader Mine

80. The fire had spread into the Loco Level well before 7.00 a.m. and flame was seen in the roof at the Old Pumphouse entrance at about 7.30 a.m.; a little further towards the Loader Mine burning coal was falling from the roof. The fire spread slowly towards the Sea Mine and by 4.00 p.m. had reached Tilson's Alley. At 10.00 a.m. flame was seen in the main return at the 1-in-1 Mine and much later at 6.00 p.m. fire was burning fiercely at the junction of Bell's Heading and the Loco Level.

Fire-Fighting

Attempts to control the fire

81. As soon as men could be assembled after the discovery of the fire, arrangements were made for a screen to be erected in the Loader Mine near

the Bell's Heading junction. Hoses were brought to the Loader Mine but, as the nearest hydrant was in smoke in the Loco Level, they could not be used. There was insufficient hose available to use the hydrant at the bottom of No. 3 Shaft, the nearest in fresh air, so the hydrant was itself transferred to Bell's Heading. The fitting of this hydrant took some time and it was not until two hours after the outbreak of fire that water was first applied to it. When the newly-sited hydrant was brought into use, it was successful in isolating the burning material on the floor of the Loader Mine but the fire was by then virtually out of control. The heat was intense and prevented any advance by fire-fighters towards the Loco Level; indeed, they soon had to be withdrawn to the transfer point. Smoke frustrated an attack on the fire through Bell's Heading and the Loco Level. At about 7.30 a.m. D. Wilson, under-manager, saw fire in the Loco Level from the Old Pumphouse entrance. There was some delay in obtaining hoses: sometime after 8.30 a.m., however, fire-fighters started to play water on the fire, although a roof fall restricted their activity. After about half an hour, they had to withdraw leaving their hoses to play on the fire. Fire-fighting in this part of the pit bottom continued until about 1.00 p.m. when the supply of electricity and water both failed.

82. Apart from the use of water, screens were erected, doors opened, the fan stopped and started and later slowed down, all as measures designed to control the fire and the movement of smoke.

Effect of measures

83. The effect of opening the doors in Davidson's Mine was to increase the quantity of air, and thus smoke, passing along the Loco Level towards the Sea Mine and so to reduce the quantity going towards Bell's Heading. Notwithstanding this, after an initial clear period, smoke in considerable quantity passed along the Loco Level and down Nos. 1 and 2 Dysart Dooks. Smoke moving towards Tilson's Alley was diluted at the Alley and again at the Dysart Turn, where it split three ways. Nevertheless considerable quantities of black smoke still passed into the Sea Mine, one of the three splits. The opening of the No. 2 Heading doors, probably because the doors at Davidson's Mine were open at the same time, seems to have had no marked effect on the fire or smoke movement, but, as I have mentioned earlier, the slowing down of the surface fan and the partial opening of the fan doors was probably responsible for a temporary clearance of smoke from the Sea Mine.

Extent to which measures failed

84. At about 6.00 a.m. it became apparent that eleven men were missing. By 11.00 a.m. six bodies had been recovered. Two men were rescued from the Bowhouse Inset at 2.30 p.m. J. McKay, last seen in Dysart Dip No. 3 Section, A. Taylor, who went back in along Four Feet return and H. Gallacher, the 750 Branxton pumper, were still missing. Efforts were made to fight the fire in such a way that it might be possible to find the three men but by 3.00 p.m. on 10th September, conditions had so deteriorated that it was decided that too many men were being placed at risk and stoppings would have to be put on, thus sealing in the bodies. On the evidence brought before me, I am satisfied that this was the right decision.

SCIENTIFIC EXPERIMENTS

85. At the Inquiry D. G. Wilde, a Principal Scientific Officer in the Safety in Mines Research Establishment of the Ministry of Power, described a series of experiments which had been carried out at the Establishment's Buxton Station to obtain information about the behaviour of polyurethane foam when subjected to igniting agents of different intensity.

The Locus of the Experiments

86. The experiments were carried out in an arched roadway, 240 yards long, seven feet high and seven feet wide, ventilated by a fan which was so adjusted that the airspeed in the roadway was 200 feet per minute. In the first three experiments, the roof and sides of the roadway were lined with a two inch layer of polyurethane foam for a distance of 23 yards; the area so covered was 134 square yards. The thickness of two inches was chosen because at that time the information was that this had been the thickness of the foam lining in the Loader Mine although subsequent evidence indicated that the lining was only one inch thick. In the fourth experiment the foam was applied to the inside surfaces of a steel duct 75 feet long, four feet high and four feet wide. The fifth experiment was a variation of the first three in that the foam in the roadway was coated with a fire-retardant material.

The Experiments

The first experiment

87. The purpose of this experiment was to test the inflammability and combustibility of the foam lining when it was ignited at the upwind end and to compare the result with that observed in an earlier series of experiments in which timber lining was used. The igniting agent was a stack of timber and a roadway lining of untreated timber which together weighed about 860 pounds. This timber was sited in the roadway just upwind of the foam; the igniting agent occupied a five yard length of the roadway and had a peak output of four megawatts, and an average of two megawatts over one hour.

88. Within two minutes of ignition flame developed over the whole area of the roadway and large volumes of dense black smoke, having temperatures in excess of 1,000 degrees centigrade, were produced. The initial rate of flame-spread across the foam was observed as being between 120 and 150 feet per minute; burning of the foam lasted for 90 seconds at any given point. This rate of propagation compared with a rate of one foot per minute observed in other experiments in which the roadway was lined only with untreated timber. Although instrumentation was made difficult by heavy deposits of solids, it was found that the oxygen content of the atmosphere fell to seven per cent, the carbon dioxide concentration rose to 13 per cent, and the carbon monoxide concentration exceeded one per cent. The rate of evolution and colour of the fumes emitted were of a kind never experienced in timber fires. Examination of the roadway showed that virtually all the foam had been burned away and that the fire had increased in intensity as it moved away from the igniter.

The second experiment

89. This experiment was designed to test the inflammability and combustibility of the foam lining when ignited at the centre of the lined area, to obtain

information on the risk of the burning foam igniting fire-retardant treated timber downwind, and to observe to what extent flame would propagate against the ventilation. The igniter on this occasion was capable of developing 2.4 megawatts and of lasting six minutes. The timber downwind was composed of 150 treated boards weighing about 850 pounds forming a roadway lining.

90. Within 90 seconds of ignition, flame spread with the ventilation at 78 feet per minute and against it at 90 feet per minute. Smoke travelled with the ventilation at about 230 feet per minute and backed up against it at 160 feet per minute. The general character of the smoke was similar to that observed in the first experiment. Examination of the roadway after the fire showed that all the foam downwind of the midpoint had been consumed, but upwind patches of partly burned foam remained. The treated timber downwind had been charred to a depth of about ten per cent of its thickness. Other work at the Establishment suggested that untreated timber, subjected to the heat developed by the polyurethane foam, would have burned fiercely producing very hot fumes containing almost no oxygen and high concentrations of carbon dioxide and carbon monoxide.

The third experiment

91. The purpose of this experiment was to determine the order of the power required to ignite a foam lining. The capacity of the igniting agent was stepped up in stages from a small paraffin wick developing 40 watts to an oil burning igniter of 2,000 watts (in all of which cases there was no sign of general ignition) and, finally, to an igniter which burned three-quarter ounce of mineral hydraulic oil per minute providing an output of 20 kilowatts. In all cases, the igniters were so placed that the flames from them made contact with the foam lining. The 20 kilowatt igniter was placed at floor level eight yards from the downwind end of the foam lining. Immediately after the igniter was fired, flames spread up the roadway wall to a height of about five feet and 70 seconds after ignition a cloud of vapour was suddenly generated on the crown of the roadway. This cloud ignited and a violent fire ensued. Within nine minutes the fire was over and the smoke had cleared away. While alight, the fire seemed to fluctuate and this suggests that in some conditions the foam will burn in such a way as to consume most of the available oxygen; the flame is therefore temporarily quenched until fresh supplies of oxygen are available when the conflagration is resumed.

The fourth experiment

92. This experiment with foam applied to the inner surface of a steel duct, was set up to determine whether a fire could be propagated in the foam lining by a mass of glowing and flaming solid fuel falling into the duct. The igniter in this case consisted of a 2:1 coke/coal mixture contained in a steel box sited centrally over the top of the duct. The mixture and the siting of the igniter and the lining of the duct with foam was intended to simulate the situation which might occur when hot burning coal from a gob fire is discharged into a foam lined roadway. The fire was given its own air supply and when it was judged to be sufficiently developed the burning coke/coal mixture was discharged into the duct by way of an opening in the top.

93. Examination of the duct after the fire had gone out showed that all the foam had been consumed and, although the experiment was on a smaller scale

than the others and the airspeed higher, the fire in the duct had features very much in common with those in the earlier experiments.

The fifth experiment

94. This experiment was designed to test the effect of applying an igniter to foam which had been coated. The igniter was of the type used in the first experiment and was sited at the centre of the lined area. Downwind of the foam, five yards of the roadway was lined with timber treated with a fire-retardant. When the fire was ignited, it burned more fiercely than had been expected, developing a power of seven megawatts and the roadway lining was subjected to a fire of great intensity, greater indeed than had been used against the uncoated foam in earlier experiments. There was no indication of flame other than from the igniter and the experiment was stopped after an hour. The oxygen concentration never fell below 14 per cent and was usually above 18 per cent.

95. Visual inspection of the roadway afterwards disclosed that none of the lining had been burned or affected with the exception of a small area which had been scorched. The fire-retardant coating had separated from the foam in places, the separation in some instances being in the form of bulges. Cracks had appeared in some of the bulges and the mechanical strength of the coating appeared to have been reduced by the fire. The lining timber downwind was not even charred, although the surface had become rather brittle and some resinous substance had exuded.

An Appreciation of the Experiments

96. Wilde advanced the view that the experiments demonstrated the hazards of uncoated foam in conditions which were designed to resemble, but not exactly reproduce, those which obtained in the Loader Mine. He saw no reason to suppose that a fire in the Loader Mine would not have had the same general characteristics as the fire experimentally produced at Buxton. He would have expected all the polyurethane lining the Loader Mine, with the exception of patches, to have been burnt in the same way as was found to be the case in the fourth experiment. He accepted that the lining in the Loader Mine was thinner than that used in the experiments but he thought that the difference in the behaviour of the fire would have been significant only in regard to its duration.

97. It was his opinion that foam uncoated with a fire-retardant material was highly inflammable material with a low fire resistance; provided flames from the source of ignition made contact with foam, the heat output of the source itself need not be large to start a fire. If a fire behind a lining of foam heated the foam to a temperature of between 150 and 200 degrees centigrade, the fire would break through. Before the break-through, however, the foam lining masked the heat behind and prevented the issue of the gaseous products of combustion, and the smell therefrom. Once the foam was burning neither the speed of the air in the vicinity nor the thickness of the lining would have much influence on the rate of spread of flame.

98. There seemed little doubt, given the intensity of the fires generated experimentally, that a P.V.C. belt within the range of the fire would have been consumed by it. Both foam and P.V.C. belting produce thick black smoke,

the particulate content of which is fundamentally carbon, and fumes which contain carbon dioxide and carbon monoxide. In addition, the polyurethane would produce other and more complex gases, and the P.V.C. would produce gases containing chlorine. Wilde was, however, unable to explain why black smoke persisted for so long in the fire at the colliery; he could not say whether temperatures of the order of 1,000 degrees centigrade would have penetrated cracks between fireboards and concrete lining slabs and ignited coal and wood behind them.

99. Pressed to give some indication on likely concentrations of gases from the fire which would have been produced at various times and places, such as the Sea Mine, Wilde explained that, although he had considered the matter, he had been unable to reach a reliable conclusion.

THE CAUSE OF THE FIRE

100. While detailed examination of the area was not possible after the fire, there was no evidence produced at the Inquiry which would suggest that it was initiated by any means other than the spontaneous heating of coal in the roof of the Loader Mine. It must, of course, be conjectural how sufficient air got behind the lining to initiate and sustain a heating. W. Rowell, the deputy director (operations), suggested that there must have been intake to intake leakage but this view is only valid if one accepts that the seals into the sides of the Loader Mine or those along the sides at floor level were defective. There was no evidence to this effect. It is difficult to be more precise than to say that the heating occurred in the roof coal somewhere in that reach of the Loader Mine which had been lined with polyurethane foam. But it is, I think, probable that the source of air leakage which caused this was in the direct connection with the No. 3 Heading between the Loco Level and Dysart Main Return between which there was a difference in water gauge of $1\frac{1}{2}$ inches. In considering just how the fire developed two facts are, I think, of outstanding importance. First, there was in a very short period of time the production of large volumes of thick smoke and, second, that such carbon monoxide as was produced was diluted to less than lethal concentration. In this latter connection it is important to note that, although all the six men whose bodies were recovered showed some signs of carbon monoxide poisoning, there was no marked degree of this in any of the large number of people who escaped.

101. It is known that concrete slabs can become cracked or broken when subject to high temperatures and that heated coal loses its inherent strength as combustion progresses. It is probable that the falling of burning material observed by Stirling was continued as a larger fall developed when the burning coal, bereft of its inherent strength, became a dead weight on the concrete slabs and the foam lining. And it may be that the burning of this larger fall accounts for the sudden issue of smoke which apparently occurred in the minute or two which it took Stirling to hurry round to the other end of the Loader Mine. However, the experiment I witnessed at Buxton showed that the burning seen by Stirling would have sufficed to ignite the foam and so bring about a polyurethane fire, which would have produced the same sudden issue of heavy smoke. What happened after this is again a matter for conjecture but the absence of high concentrations of carbon monoxide in the diluted products suggests that the rate of ventilation through the Loader Mine

was reduced by the fire. The evidence of the Buxton experiments leads one to think that the fire fluctuated in intensity both up and downwind in the Loader Mine. Here again, the burning of the P.V.C. belting would, I think, be involved in much the same way. That is to say it did not burn uniformly, but in patches as it became subject to higher temperatures produced by burning foam. This, and a reduced rate of ventilation, would account for the continued production of large volumes of smoke and fumes containing relatively small quantities of carbon monoxide, but dangerous quantities of other toxic gases. Once sufficient heat had been generated by the initial fire there were of course other materials, such as coal and untreated timber, available to it.

102. Both Sir Andrew Bryan and Mr. Hill drew attention to the virtual absence of warning of the initial heating. Laboratory experiments, however, have shown that the foam is such a good sealant in that it not only keeps out air but effectively masks any temperature changes, noxious gas emissions and the smell associated with heatings. Thus all the signs by which colliery personnel might have detected a heating were absent. This would explain why Dryburgh, some time after midnight, noticed nothing untoward. Moreover when Izatt reported to Stirling that he heard rumbling noises—these could well have been strata movements or even the cracking of concrete lining blocks—Stirling made an inspection of the Loader Mine; this took place less than an hour before the fire broke out but he noticed nothing unusual.

103. That a fire-retardant coating had not been applied to the foam in the Loader Mine was not disputed. The management explained that application of the coating had to be deferred while another fire in the Dysart Dip No. 1 Section was dealt with. This may well be so but I feel sure that had they recognised just how inflammable polyurethane foam is—and I take their evidence as meaning that until they saw the Buxton experiments they did not—they would have proceeded with the placing of the coating notwithstanding the demand for men to deal with the other fire. This is not to say that a retardant coating would necessarily have prevented the fire. Indeed, I recognise the possibility that burning coal breaking through the foam lining could well have left a hole with a ragged edge and the then exposed foam would have been susceptible to ignition either by coal burning on the floor or by fire in the cavity.

104. I consider that polyurethane foam as at present constituted is an unacceptable risk and that its use in, and near the entrances to, all mines should be discontinued. I understand that almost a mile of roadways have been treated with polyurethane foam but, notwithstanding the difficulties involved, I am sure that the fire hazard warrants its complete removal or sealing off as soon as practicable.

RELATED MATTERS

The Calling of the Rescue Brigade

105. Within minutes of discovering the fire, Stirling was warning the surface. Lister reacted with responsibility to the situation—as witness the messages and information he passed underground—and clearly the question of calling out the Rescue Brigade exercised his mind as part of the larger issue of declaring an emergency. He obviously regarded himself as unqualified to call out the Brigade and decided to leave it to Nicol. Nicol's first reaction when he reached the colliery about 4.15 a.m. was that the Rescue Brigade should be summoned

and he asked for them to be called on the telephone. As a result of telephone delays and other distractions, the Brigade was not called until 5.00 a.m., some 90 minutes after the fire had been discovered. This is not the first report in recent times on a mining accident where reference has had to be made to delay in calling the Rescue Brigade. It is true that, as events turned out, the delay on this occasion in no way contributed to the loss of life. Even if the Brigade had been called at the earliest possible moment, at, say 3.45 a.m. they could not have established their underground bases much before 5.00 a.m. by which time the smoke was so dense that their operations would have been impossible. Nevertheless, the situation might well have been different. Here was a clear case of emergency underground; yet the Brigade remained unsummoned for 90 minutes.

The Emergency Organisation

106. Clearly there was uncertainty among those officials immediately concerned with the events of the early morning about the exercise of authority to declare a formal state of emergency at the colliery. Lister, upon whom fell the brunt of having to deal with the emergency when it was first reported to him, certainly did not regard himself as authorised to initiate the full emergency procedure. Webster, who was at a remote point underground and who was not really in a position to judge how serious matters were, referred Lister to Simpson, an under-manager, or Nicol, the deputy manager. Even Nicol hesitated to take the positive step of declaring an emergency and it was not until 5.30 a.m., some two hours after the finding of the fire, that a general emergency was in fact declared on the instructions of J. S. Wilson, production manager. It is true that many of the emergency measures required by the Emergency Organisation had already been taken as a result of the sheer pressure of events but such an essential one as the setting up of an Incident Room was not achieved until 6.00 a.m. The Emergency Organisation was thoroughly comprehensive in the range of action it required, but it seems to have been associated in the minds of some with the action to be taken on the occurrence of a fatal or serious personal injury accident. Moreover, the presentation of the organisation chart lacked the clarity which I regard as absolutely essential. The merit of a carefully devised emergency scheme is that it removes from the individual the need to remember a great many things which have to be done quickly and effectively and to take decisions about priorities. The declaration of an emergency immediately results in the appointment of men to carry out specific tasks until they can be relieved on the arrival of more senior officials.

107. There was no evidence to suggest that any authority to institute the Emergency Organisation had been specifically delegated to anyone either by name or by appointment. Indeed, I think I am right in saying that the manager held the view that it was the responsibility of any competent official to use his initiative and institute the procedure if he thought the circumstances justified it. I have some sympathy with this, but the absence of timely action at the colliery on the morning of the fire merely supports the opposing view that too much reliance should not be placed on the readiness of persons to take the initiative in an emergency situation, when they are unsure of their authority to act. It is not so much a reluctance to take a decision which deters persons from acting in such circumstances as a fear of being accused of having acted hastily if, in the event, there is no emergency.

108. It is imperative that the emergency procedure, including the posted charts, should be clearly understood by all officials and particularly that there should be no doubt in their minds as to their powers to declare an emergency. The National Coal Board should review their present procedures in this regard and give specific instructions to managers that the senior official at the mine available at the time of an incident should be authorised, without prejudice, to call on the Rescue Station services and to declare an Area emergency.

The Checking System

109. Some two hours after the start of the fire it was reported that all men had been withdrawn from the Dysart Dip Sections; this unfortunately proved to be false in that two men who had been working in that part of the mine were in fact still missing. As a result of this, the effectiveness of the checking system was called into question at the Inquiry. To my mind the system at the colliery was quite satisfactory. I recognise that it disclosed imperfections but it must be remembered that any system has to rely on the complete co-operation of the individual and that this is always the limiting factor. As Mr. Wilson, for the Ministry of Power, said, the perfect checking system has yet to be devised; nevertheless the possibility of improving existing systems should be examined. In this respect, the suggestion offered by Mr. McGahey, for the National Union of Mineworkers, that a man's tokens and cap lamp should bear the same number, is well worthy of further consideration.

The Marking of Second Ways Out

110. There was a considerable amount of evidence at the Inquiry about the signposting of the airways and the second means of egress from the working sections to the surface. The routes were marked with chalk on boards, painted letters on boards and by luminous signs of letters three inches high with an arrow. In the returns, some of the signs directed men to the 'Return Airway' and in others to the 'Escape Pit'. It was not, however, clear if the 'Escape Pit' was the Michael No. 2 Shaft or Lochhead Colliery.

111. A particular case of the confusion about the marking of the means of egress arose in connection with the escape of McArthur and McEneamy from the Four Feet Seam workings in the Sea Mine area to the inset in the No. 2 Shaft. They had neither of them travelled the route before and they missed the way to the second means of egress when they went up the return airway instead of down through Walker's Dook to the Lochhead Level. In the event, it was probably lucky that they did so as the Lochhead Level was full of thick smoke. Having missed the escape route they were nevertheless able to find the No. 2 Shaft, an indication that some of the signs were effective. However, when they got to the shaft, they found their way on into old workings, which were not regularly inspected and should therefore have been fenced off. They were prevented from reaching the No. 3 Shaft because of a fence and a 'no road' sign which were not really necessary.

112. In order to ensure that men can find their way, sometimes in smoke, through roads with which they are unfamiliar, the direction signs should be easily recognised and unambiguous. I consider that managements should review the methods of marking routes and adopt a standard type of sign. Officials in charge of the men in the various parts of the pit should not only be

conversant with all the means of egress but should ensure that they are safe for travelling and that the direction signs are properly maintained. I consider that officials should inspect every means of egress from the part of the mine assigned to them at least once a month and report on their condition.

The Telephone System

113. There were critical comments in evidence about the alleged inadequacy of the telephone system. These really stemmed, I think, from the fact that the automatic system became blocked just after 5.00 a.m. but some witnesses suggested that the telephone system was generally unreliable. I am satisfied that in general the internal telephone systems were adequate and I accept the evidence of management and officials that, apart from the normal breakdowns, the systems were reliable. It is readily apparent that a considerable number of emergency messages were passed within a comparatively brief period from about 3.30 a.m. onwards. The evidence suggests that the blocking of the automatic system on the morning of the fire was brought about by a main telephone cable or junction box being put out of commission by the fire. The fault so caused would have simulated the effect of all ten circuits, which the automatic exchange provided, being occupied by calls. When an engineer disconnected the faulty circuits, the automatic exchange operated normally.

114. I have said that the internal telephone service was adequate; nevertheless, there is scope for some improvement in one particular respect. As I understand it, the automatic telephones in the manager's and deputy manager's offices had over-riding facilities. In my view, automatic telephone installations would be better equipped for use in an emergency if over-riding facilities were also provided at a strictly limited number of underground extensions, as for instance at pit bottoms and perhaps one in each working district. The provision of such facilities would have to be accompanied by a strict injunction that they should be used only in an emergency. A considerable amount of telephoning and, consequently, time, could have been saved had the underground workings been equipped with a system of alarms operated from a central point on the surface. I am aware that such systems, either in the form of separate installations or associated with the telephone system, are available. The general provision of equipment of this kind should be considered as an early warning aid.

115. Finally in this context, I would refer to communications between the colliery and the outside world. There is no doubt that the outside telephone facilities, adequate in every respect for ordinary day-to-day needs, were woefully inadequate during the emergency. As it became known that there was trouble at the colliery, there was a flood of incoming calls which seem to have occupied the limited switchboard facilities to the exclusion of outgoing calls. There is no doubt in my mind that much of the delay experienced by Nicol in making his call to the Rescue Station was caused by a blocked private branch exchange; in his evidence he recounted his frustration when police and hospital calls came in while he was waiting to make his call. Managements should review their external telephone arrangements and consult the telephone authorities with a view to alternative arrangements if there is any doubt that the present provisions might prove inadequate in an emergency.

Self-Rescuers

116. The question of self-rescuers was not raised in evidence but I took

note of a submission made on behalf of the National Coal Board that the Board had now decided in principle that self-rescuers should be provided for all underground workmen as soon as an acceptable model could be produced. Mr. McGahey pledged the full co-operation of his Union in advancing the date of the introduction of this vital safety device into service underground. Within a very short time after the Inquiry, the National Coal Board set up a Working Party to "co-ordinate the procurement and introduction of self-rescuers and to consider whether the Board should themselves undertake manufacture". Mr. H. T. Ramsay, the Director of the Safety in Mines Research Establishment, and I are members of it.

Fire-Fighting Hydrants

117. As has been indicated in the description of the colliery, there were eight fire hydrants in the No. 3 Pit Bottom, of which four were in the 300 fathoms Lateral and four in the Loco Level. There is no doubt that this disposition of hydrants can be faulted on two counts. First, they were confined to two roads and a fire occurring in some situations in either road could render half the hydrants unusable. The hydrants in the other road would then be equally useless because they would be too far away. Second there was no hydrant in the Loader Mine or in Bell's Heading; with the ventilation travelling along the Loco Level towards Tilson's Alley, this meant that a fire in the Loader Mine could only be dealt with by fire-fighters operating in smoke. The installation of a hydrant on the inbye side of the Loader Mine, in Bell's Heading, was planned but the work was far from complete when the incident occurred.

RECOMMENDATIONS

118. I recommend that:

- (1) (a) polyurethane foam as at present constituted, whether or not treated with a fire-retardant coating, should not be used underground at any coal mine, or at the surface of any mine in such a situation that the products of its combustion would be likely to enter the mine;
 - (b) any foam which has been placed in moving ground or in a situation where there is a spontaneous combustion hazard shall be removed immediately, or sealed off, or be given an adequate fire-retardant coating and removed within 12 months;
 - (c) any foam which has been placed in a situation other than in (b) above shall be given an adequate fire-retardant coating and be removed as soon as practicable or sealed off. (Para. 104).
- (2) The National Coal Board should review the present procedures for implementation of the Emergency Organisation (including charts posted in offices) and give specific instructions to managers that the senior official at the mine available at the time of an incident should be authorised, without prejudice, to call on the Rescue Station services and to declare an Area emergency. (Para. 108).
 - (3) The Board and H.M. Inspectors should examine the possibility of improving the checking systems. (Paras. 12 and 109).

(4) The methods of signposting all means of egress should be examined and a standard method instituted. (Para. 112).

(5) Overmen and deputies shall at least once in every month inspect and report on the state of every means of egress from the parts of the mine assigned to them. (Para. 112).

119. In order that action should be taken without delay on the above recommendations, your predecessor agreed that I should submit them to the interested parties and this was done in February, 1968.

ACKNOWLEDGMENTS

120. I should like to record my extreme indebtedness to the representatives of the parties appearing at the Inquiry, who, by their courtesy and complete co-operation, facilitated the course of the proceedings, and to the many witnesses who gave their evidence so ably and clearly. I am also most grateful to those who were concerned with the investigations prior to, and preparations for, the Inquiry: the staff of the National Coal Board, and in particular, Mr. W. H. Irvine, the colliery surveyor, for his excellent plans and for his assistance at the proceedings; representatives of mining officials and workpeople; and members of the Safety in Mines Research Establishment and H.M. Inspectorate. My thanks are also due to the Burgh Council of Kirkcaldy, to the Town Clerk, Mr. C. D. Chapman, and his staff and to Superintendent Stirrat of the Fifeshire Constabulary for all their help and assistance before and during the proceedings. Finally I would like to record my appreciation of the help given to me by Mr. G. D. Nussey and Mr. A. R. D. Murray at the Inquiry and in the preparation of this Report, and to Mr. R. Hudspith, Clerk of the Court.

I have the honour to be, Sir,

Your obedient Servant,

H. S. STEPHENSON.

APPENDIX I

Names of the Deceased

<i>Name</i>	<i>Age</i>	<i>Occupation</i>
<i>1. Recovered on 9th September, 1967</i>		
Alexander Henderson	41	Power loader operator
Henry Morrison	36	Power loader operator
Johnston Smith	60	Power loader operator
James Tait	41	Overman
Andrew Thomson	55	Power loader operator
Philip Thomson	64	Greaser
<i>2. Not found</i>		
Hugh Gallacher	61	Pumper
James McKay	59	Greaser
Andrew Taylor	43	Deputy

APPENDIX II

List of Witnesses

<i>Name</i>	<i>Occupation</i>
Aitken, W.	Permanent Rescue Brigade man
Armour, W.	Deputy
Barker, A. H.	H.M. District Inspector of Mines and Quarries
Barr, T.	Haulage motorman
Birrell, T.	Deputy
Bottomley, M. R.	H.M. Inspector of Mines and Quarries
Brown, J. T.	Deputy
Cairns, A.	Area Mining Engineer (Special Duties)
Chrystal, J.	Developer
Cowie, G. C.	Developer
Coyle, H.	Face worker
Cull, W.	Deputy
Culross, J.	Overman
Daly, H.	Backbrusher
Dewar, G.	Overman
Drummond, J.	Shot firer
Drummond, J. H.	Deputy
Dryburgh, D. C.	Deputy
Duncan, G.	Colliery General Manager
Duncan, J.	Greaser
Fraser, R. C. M.	Deputy
Fry, G. T.	Senior Scientific Technical Officer, National Coal Board
Grieve, A.	Maintenance man
Herriot, G. S. B.	Rescue Station Instructor
Hunter, D.	Deputy
Hunter, J. M.	Backbrusher
Hynes, M.	Colliery Safety Officer
Imrie, J. M.	Developer
Irvine, L. M.	Workmen's Inspector
Irvine, W. H.	Colliery Surveyor
Izatt, J.	Cable belt attendant
Kennedy, W. A.	Overman (part-time rescue man)

<i>Name</i>	<i>Occupation</i>
Laing, R.	Overman
Linden, J.	Deputy
Lister, T. . .	Deputy (in charge of Surface Control Room)
Logie, D. K.	Time Office clerk
Lyle, J.	Backbrusher
MacBride, W. R.	Deputy
Malcolm, J. McG.	Deputy (part-time rescue man)
McArthur, J.	Greaser
McDonald, J.	Pumpsman
McEneamy, J. C.	Beltman
McIntyre, R.	Deputy
McKinnon, Dr. D.	Area Medical Officer
McLaren, W.	Foreman fitter
McLean, A.	Chargehand electrician
McRobie, A.	Foreman electrician
Meharry, M.	Assistant Personnel Manager
Moyes, J. S.	Bricklayer (part-time rescue man)
Nicol, A. . .	Colliery Deputy Manager
Nowak, J. E.	Belt maintenance man
Orr, J.	Backbrusher
Paterson, W. K.	Deputy
Peake, C. V.	Deputy Managing Director of Caledonian Mining Company
Pratt, G.	Face worker (part-time rescue man)
Ritchie, P.	Backbrusher
Robertson, A.	Colliery Under-manager
Rowell, W.	Deputy Director (Operations), North Scotland Area
Savage, I.	Rescue Station Instructor
Semple, W. (Jnr.)	Overman
Sharkey, C.	Rescue Station Instructor
Sharp, F.	Overman
Shaw, W.	Colliery fire officer
Simon, M.	Deputy
Simpson, J.	Colliery Under-manager
Simpson, J. P.	Electrician
Smith, A. D. H.	Overman
Stirling, A.	Overman

<i>Name</i>				<i>Occupation</i>
Teevan, J. J.	..	..	..	Onsetter
Thomson, J. M.	..	..	..	Chain maintenance man
Thomson, W.	..	..	..	Rescue Station Superintendent
Todd, A. S.	..	..	..	Overman
Todd, R.	..	..	..	Supports Economy Officer
Wallace, R. M.	..	..	..	Colliery Mechanical Engineer
Watson, A.	..	..	..	Overman
Watson, J.	..	..	..	Deputy
Webster, C.	..	..	..	Overman
Wight, J.	..	..	..	Developer
Wilde, D. G.	..	..	..	Principal Scientific Officer
Wilson, Daniel	..	..	..	Apprentice fitter
Wilson, David	Colliery Under-manager
Wilson, J. S.	Production Manager
Wilson, W. L.	Colliery Electrical Engineer

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