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CAMBRIAN. Rhondda, Glamorganshire. 17th. May, 1965.

The Cambrian Colliery was in the no. 3 Area of the National Coal Board's South Western Division and was near the village of Clydach Vale in the Borough of Rhondda about 20 miles north west of Cardiff. There were four shafts at the colliery. The No.1 was downcast, 16 feet in diameter and sunk to the Five Feet Seam at a depth of 506 yards. The current winding level was at the Pentre Seam at an inset at 212 yards. The Maindy shaft at a former colliery of that name was elliptical 14 feet by 12 feet and served as the upcast from the Pentre Seam workings. Nos. 3 and 4 shafts were used for working the Five Feet, Lower Nine Feet and Bute Seams. The Maindy shaft was equipped with a radial flow fan which produced 103,000 cubic feet of air per minute at 4.8 inches water gauge.

The principle officials were the Area General Manager, Mr. G. Blackmore, the Area Production Manager, Mr. G. Hodkin, the Deputy Area Production Manager (Operations), Mr. W.J. Lewis, the Deputy Area Production Manager (Planning), Mr. W.J. Strong, the Group Manager, Mr. E. Pugh, the Manager, Mr. E. Breeze and the undermanager of the No.1 Pit, Mr. L. Williams. Both Mr. Breeze and Mr. Williams were killed in the explosion. The colliery employed 816 men at the time of the accident, 654 below ground and 162 on the surface and had a daily output of 700 tons from the Pentre Seam 300 tons and from the Lower Nine Feet and Bute Seams.

The colliery was, and always had been, a safety lamp mine and had a lamp room of the 'self Service' type and was equipped with 770 cap lamps, 129 flame safety lamps of which 59 were of the internal re-lighter type and eight automatic firedamp detectors.

The Pentre Seam was 240 yards deep at the shaft and three feet thick. It was overlain by the Pentre Rider Seam about 24 feet above with coal measure shales and sandstone separating the two seams. Forty one feet beneath the Pentre Seam, beds of sandstone, one 19 feet thick and mudstone separating these two seams. The P.26 District was about 3,000 yards from the No.1 Pit bottom and was a continuation of the P.25 district which had to be stopped as it approached the main return airway which was known as Maindy heading Return. It was formed by extending the P.25 Conveyor Road as a coal heading over the Maindy Heading Return while at the same time a short drift rising at a gradient of 1 in 2.4, parallel to the coal heading was driven from the Maindy Heading return to intersect the seam. The two roads were connected to form a face which came into full production in January 1965. at the time of the accident the face was 192 yards long and was advancing to the north on a rising gradient of 1 in 33 while the gradient cross the face was rising at 1 in 17 from the intake gate.

The face machinery consisted of a rapid plough worked in conjunction with an armoured face conveyor which were both driven by electricity. The intake gate which was the conveyor roadway was supported by 12 feet by 8 feet arched girders, had a coal rib on the right side and an eight yard wide pack on the left. The return gate was the supply roadway and was supported by 10 feet wide by 8 feet arch girders, and a coal rib on the left side and an eight yard wide pack on the right. Rippings for the roadways were taken in two sections just in advance of the face line and the main sections normally in line with the packs. The stables at each end of the face were 18 feet wide. Coal getting was carried out on the day and afternoon shifts on alternate weeks and the front sections of the rippings were taken on the night shift with the main sections on the other non-coaling shifts.

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The face was 'open caved and 'prop-free front' system of support was employed using hand set hydraulic props contained in pairs of frames set at five feet intervals. Each pair consisted of open frame with three props and the other with two. The frames in each pair were advanced alternately. The rest immediately in front of the gate side packs were supported by hydraulic props with metre long link bars and the roadheads by 11 feet long straight steel girders, each set to three props.

Coal from the face was delivered by an armoured conveyor on to a chain conveyor in the intake gate, which in turn, delivered on to a second chain conveyor and from there on to a 30 inch wide belt conveyor. At a loading point about 800 yards outbye the coal was transferred to 30 cwt. trams and taken by rope haulage to No.1 shaft bottom. Supplies for the district were brought from the No.2 Shaft along the main haulage road and then by way of a road called MacBains, into the Maindy Heading Return and from there into the district. Pulsed infusion shotfiring was practised in the stables while the rippings were brought down by Eq.S explosives.

The ventilation of the district was by a separate split from the main intake which crossed the Maindy Heading return at an air crossing, which was known as the air bridge. On leaving the face, the air passed down the return gate into the Maindy Heading Return under the air bridge and the to the Maindy upcast shaft. Near the outbye end of the split was a pair of ventilation doors. The last statutory measurements were taken on the 26th. April, 1965 while the face was in full production, showed that the air available and circulation outbye of the air bridge and round the face was 23,000 cubic feet of air per minute and 8,000 cubic feet respectively. An air sample taken at the same time about 10 yards from the face showed .38 per cent firedamp.

The air bridge had two openings in the floor one about nine feet square and covered with loose boards and the other about four feet square covered with a corrugated sheet. Apart from these openings the floor of the air bridge was covered with wood boards inserted into flanges of straight girders with the intervening space to the top of the girders being filled with small dirt. At the time of the explosion automatic firedamp detectors were not in use in the district.

The development went on without incident. There had been some difficulty arising from the fact that the props were too long for the working height of the face but the management decided to replace them and this was being done at the time of the disaster. When the face was started it was parallel to the Maindy Heading Return and so not at right angles to the intake and return gates. From the start the return end of the face had been advanced more rapidly than the intake end so as to bring it into line and at right angles with the roads and this had almost been achieved at the time of the explosion. The effect of this was to distort the line of the face and to create a situation whereby the return roadside pack did not always keep pace with the advance of the face. At the time of the disaster the pack was about eight yards behind and the air was leaving the face could not sweep into the fast end. In spite of the reduction in packing, support of the roof in this area by chocks and props appeared to be adequate.

It was said that the management were intending to complete the air bridge with a concrete floor but this had not been done. The access holes were intended to be temporary, pending the drivage of a proper connection between the intake gate and the Maindy Heading return. This had been started but other work with a higher priority was carried out and the drivage of the connection was discontinued.

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At the inquiry there was conflicting evidence about the state of the air holes but different witnesses passed the air crossing at different times and saw different conditions but the Inspector was left with the impression that the smaller of the two holes, which was equipped with a ladder, was open for most of the time. The larger of the two holes was used to pass bulky materials although on the day of the explosion it had not been opened often but the loose boards did not produce a good seal. There was also conflicting evidence about a pair of ventilating doors at the outbye end of the split. The Inspector thought that they were originally the connection with the ventilation from the P.25 face. When the face ceased production the doors were kept open except for a few occasions when it was necessary to deflect air into the P.25 district when salvage operations were going on there. They were simple regulators and in fact the air deflected into P.25 would have rejoined the main current outbye of the air bridge. Open or closed they could have had little effect on the accident.

On 7th. May, the intake end of the face made contact with the right hand roadhead of the old P.11 district. The confection was made at the end of the coaling shift and the deputy took immediate steps to close the small opening with brattice cloth. In succeeding shifts brattice sheets were erected in the old roadway and on Tuesday, six days before the explosion, T. Evans, a mason, began to construct a wood and cloth stopping with a door across the old roadway near to the holing. Because of a shortage of materials, the work was not completed by the weekend so on the Monday morning Evans, having acquired the necessary materials, went into close off the remaining area of about one square yard to the stopping. He completed the work by 11.15 a.m. and then left the district.

The last coaling shift before the explosion occurred was on the afternoon of Friday 14th. May. The deputy in charge, B. Pyne, who was a replacement for the regular deputy, said that the shift was normal and he did not detect any firedamp in the course of his inspections. He recalled that sometime during the shift the access holes in the air bridge were open for the passage of materials but he did not see any defects in the ventilation. The night shift of 16th.-17th. May with deputy C. Evans who had charge of a few men, were changing props on the face. Evans said that supplies were not brought into the district during the night and that the shift was normal in all respects.

The day shift of 17th. May went underground at the usual time and arrived in the district about 7.30 a.m. H. Pope was the district overman and T.E. Davies was the deputy in charge. Apart from the work on the face that morning, there was a considerable amount of other activity. Two major operations were in progress, the transport and erection of a belt conveyor in the intake gate to replace one of the existing chain conveyors and the extension of a rope haulage system in the return gate. As a result of this activity there were a larger number of men in the district than was usual.

Richards and P. Best, two repairers who spent the whole of the shift near the air bridge, were getting parts for the conveyor drive head up through the larger of the two holes from the Maindy Heading Return for D. Bessant and E.L.T. Jones, fitters who, with others were erecting the conveyor. They removed the boards over the large opening at about 8.30 a.m. but shortly afterwards, Pope, the overman, visited them and noted that, although the access hole was open, the materials to be passed through were not there. He gave instructions for the hole to be closed until the materials were there and the men replaced the boards while they went into the Maindy Heading Return to lead machinery parts into trams. This probably took about half to three quarters of an hour but it was clear that from the time the materials reached the air bridge until the explosion the large access hole remained open. According to Richards, the other access hole, the smaller

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one with a ladder, remained open throughout the shift and this was confirmed by other witnesses.

The day shift pit overman, G. Price, said that it was normal practice for the smaller of the two holes to be open during the coaling shift and he understood that the other access hole would have been open for at least half the shift that morning. The deputy, Davies, said he found the large hole open and the men raising machinery through it when he returned to the air bridge after the completion of his first inspection at 10.20 am. He was satisfied with the state of the ventilation throughout the whole of the shift.

The extension of the rope haulage in the return gate involved the transfer of a number of sheave wheels from one side of the gate to the other. R.C. Jones, sheavesman for the mine, who was supervising this work, was in the roadway for nearly three hours from 9.30 a.m. and thought the ventilation satisfactory. As he was coming out of the road at about 12.15 p.m., two electricians passed him going inbye the door and stopping at the end of P.11 connection was completed at 11.15 a.m.

Coaling commenced normally about it was interrupted at about 9 a.m. by the breaking of the plough chain which coincided with the failure of the face telephone circuit. The fault in the system either rectified itself or was repaired by some one unknown. There was contradictory evidence as to whether ploughing recommenced but if it did it could have been only for a few minutes because at about 12.15 p.m. an electrical fault developed at the return end plough motor. The overman telephoned K. Davies, the plough operator at the return end and told him that the electricians were working on the switches at the return gate with one panel open but that the fault had not been located. Price then gave instructions for the plough to be brought down the face by the motor at the intake end. This was done but attempts to plough back up the face were unsuccessful.

When the electrical fault developed the deputy made his way up the face towards the intake end and at about 12.40 p.m. when, about 40 yards from the intake gate he met the manager and the undermanager. They told him that Price, the overman, was attending the electrical fault, but after a few minutes the manager instructed the deputy to go and find out what was happening. Davies went to the telephone at the intake end of the face and spoke to the plough operator at the return end who said he would go and make inquiries. While the deputy was waiting at the telephone the explosion occurred.

As near as possible the time was 12.55 p.m. The deputy was struck by a violent blast which blew him backwards but he did not see any flame. Price was on his way to the telephone between the face and the air bridge was blown into the side of the road by the blast. He immediately went back to the face where he met the deputy and others but, because of the smoke and dust visibility was restricted. With the deputy he then went to the outbye telephone and raised the alarm. Shortly afterwards D. Jones at the loading point outbye was instructed to go to the P.23 District to fetch the men out from there to assist in rescue operations. This he did and then went along the P.26 intake gate passing through the ventilation doors which were closed and over the air bridge, where he noted that both access holes were open. Some time later Best, acting on instructions, propped open the ventilation doors.

The overman, deputy and a number of men who had been in the intake and survived the explosion, attempted rescue operations while waiting for the Rescue Brigade to arrive. They realised the impossibility of going on to the face from the intake end, they

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went down the ladder at the air bridge in to the Maindy Heading Return and along to the junction with the return gate from the face. The overman got into the return gate for about 10 yards but was persuaded to go no further. T. Rees, a rider, working in the Maindy Heading Return who had suffered serious injury was given first aid by the deputy.

The Porth Central Rescue Station was alerted at 1.05 p.m. and the Brigade arrived at the pit at 1.17 p.m. A team composed of Permanent Brigade members captained by L.C. Lewis and accompanied by the superintendent, J Perry went down the pit at 1.25 p.m. and arrived at the affected district at 2.10 p.m. They found the atmosphere smoky and dusty but it cleared slowly. Having been instructed to be back at base by 3 p.m., the team had soon to leave the face and return. Lewis then led the team into the face for second time and they reached the mid-point before turning back. There as still a great deal of dust in the atmosphere which duly cleared and the bodies were recovered.

Those who lost their lives-

Ronald Arnold aged 48 years, deputy.

Ernest John Breeze aged 38 years, manager.

Ernest William Burnett aged 46 years, chageman.

Peter Calvert aged 40 years, repairer.

James Channing aged 46 years, poster.

Albert William Colcombe aged 44 years, team captain.

Raymond John Daniels aged 34 years, stableman.

Gerrard Wayne Davies aged 24 years, assistant unit electrical engineer.

Kenneth Davies aged 26 years, plough operator.

David Evans aged 28 years, poster.

Ronald Flower aged 45 years, repairer.

Ronald Gregson aged 28 years, electrician.

David Alfred Griffiths aged 43 years, repairer.

Thomas Hann aged 42 years, transfer point attendant.

Richard William Hucker aged 32 years, poster.

Ivor Jacobs aged 45 years, poster.

Henry Lee aged 56 years, roadman.

Leonard May aged 33 years, poster.

Ivor Morgan aged 32 years, poster.

Arthur James Mewman aged 46 years, poster.

Vivian Nicholas aged 52 years, poster.

Harold David Pope aged 50 years, overman.

Donald Price aged 48 years, poster.

Evan Luther Rees aged 55 years, repairer.

Gwilym Thomas aged 33 years, poster.

William Isaac Williams aged 51 years, repairer.

Edmund William Williams aged 54 years, repairer.

Leslie James Williams aged 54 years, undermanager.

Sidney Williams aged 47 years, poster.

Trevor John Williams aged 27 years, poster.

Seriously injured-

Thomas Rees aged 62 years, rider.

The public inquiry into the causes of and the circumstances attending the explosion at the Cambrian Colliery, Glamorgan on 17th., May 1965, was conducted by H.S. Stephenson, B.Sc., M.I.Min.E, H.M. Inspector of Mines and Quarries in the Law Courts

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at Cardiff on 19th. July 1965, and lasted for four days. All interested parties were represented and the report was presented to the Right Honourable Frederick Lee, M.P., Minister of Power on 30th. September 1965.

With the recovery operations H.M. Inspectors of Mines and Quarries made detailed investigation of the explosion area to find the cause of the disaster and from the results of the examination it was concluded that the blast and flame had passed 325 yards along the face and associated roadway and about double this distance had been subjected to blast.

Much of the inquiry turned to the air bridge and experiments demonstrated that when the access holes in the bridge were covered, leakage occurred in to the Maindy Heading Return. The Inspector commented-

“Despite the air bridge leakage there was, still in my opinion, sufficient air to provide adequate ventilation for the face. But the poor construction of the air bridge and the way in which it was used were examples of deplorably bad practice, which should not have been tolerated by anyone having responsibilities for the safe working of the mine.

The evidence clearly established that, on the morning of the explosion, both access holes in the air bridge were open at the time of the explosion and had been for at least two and half hours. With such a prolonged interruption the ventilation of the district, everything points to the likelihood that by 12.55 p.m. that morning a situation very similar to that obtained by experiment had developed and that sufficient firedamp had accumulated in the return gate to sustain the ensuing explosion.”

The point of ignition was at the gate end switch controlling the return end plough motor. All the evidence pointed to the fact that the two electricians were trying to locate a fault which had stopped the motor and to do this they had opened the hinged cover. Tests proved that the removal of this could cause substantial arcing. Unfortunately this occurred when there was considerable firedamp in the atmosphere.

The Inspector concluded his report with the recommendations that-

1. “there should be a statutory provision requiring firedamp determinations to be made at the end of the face return roadways, as nearly as possible at the same time as the present statutory determination are made
2. a high degree of priority be accorded to the development of instruments and systems for the continuous monitoring of firedamp
3. in places where firedamp is a hazard, all gate-end switches should have integral testing facilities, but pending this every switch or bank of switches in such places and not equipped, should be provided with a test plug and
4. test instruments designed for tracing faults in control circuits external to switchgear should be developed.”

ABERFAN. Merthyr Tydfil, Glamorganshire. 21st. October, 1966.

The sister villages of Aberfan and Merthyr Vale are in the valley of the Taff about four miles to the south of Merthyr Tydfyl. The Merthyr Vale Colliery and part of the village were on the east bank and the village of Aberfan is on the west bank.the River Taff, where it flows through the village is about 42feet above sea level. At about 515 feet above sea level, there is an embankment of a disused railway line and below it and further to the west there is a ditch from 5 to 15 feet away, which was formerly a disused

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railway line. The spoil heaps on the mountain side lay between the 650 and 1,200-foot contours and the heights above the mountain side vary between 61 and 110 feet. The slope of the mountain side above the village averaged about 1 in 4 up to the 900 foot contour and steepen to 1 in 3 up to the 1,000 foot contour when it flatted out to the ridge summit. There was a colliery tramway which took the spoil to the tip.

Under the tip the strata inclined towards the valley and was of cracked sandstone which let water through fairly easily. When the water went through, it came to an impermeable layer and springs formed on the mountain side which flowed down varying in quantity depending on the seasonal rainfall. The rock on the upper slopes was covered to a depth of 5 to 10 feet by a layer known as the 'Heads' which overlay a deposit of boulder clay. A tongue of boulder clay extended up the mountain to about the 1900-foot contour and lay under the southern and eastern sides of the spoil heaps. Both the boulder clay and the Head had similar characteristics.

The two shafts at the Merthyr Vale Colliery were sunk between 1869 and 1875 and the first tips were started to the west of the river. Tipping began to the west of the canal during the 1914-18 War when Tip 1 was started. This rose to a height of 85 feet and was composed of mine rubbish and discarded coal from the preparation plant and boiler ash. It was estimated that it contained about 235,000 cubic yards of material. Tip 2 was started in 1918 and rose to 90 feet with an estimated contents of 574,000 cubic yards. Tip 3 was started in 1925 and was raised to 130 feet containing 210,000 cubic yards. Tip 4 was begun in 1933 and rose to 147 feet and was not used after November 1944 when a large part of the tip, slipped a considerable distance down the mountain. It was estimated to contain 572,000 cubic yards. Tip 5 was started early in 1945 and rose 171 feet by 1956 and was estimated to contain 706,000 cubic yards. Tip 6 started in 1956 was stopped in 1958 because of complaints from a farmer that the top was spilling onto his land. It rose 56 feet and contained about 67,000 cubic yards. Tip 7 was the tip that caused the disaster and was started at Easter 1958 and continued to be used up to the time of the disaster. It was estimated to be 111 feet high and to contain 297,000 cubic yards of waste including 30,000 cubic yards of material which was known as 'tailings' which the other tips did not contain.

The method of tipping at the No.7 Tip was old fashioned. The rubbish came either directly from the shaft, from the coal preparation plant or from the boilerhouse and was loaded into trams at the surface. When a journey was complete it was hauled by rope up a railway which climbed the side of the Merthyr Mountain. When the journey reached the engine house at the top of the incline it was stopped and the trams allowed to run by gravity, braked by a rope, to a parting and then to a point on the working tip where a crane stood. The crane was used to lift the tram and turn it upside down and the contents fell down the front or the sides of the tip according to the position of the jib of the crane. When this was done the tram was placed on the rails leading back to the operating. These operations were carried out by the crane driver and a gang of slingers who attached and detached the tubs. They were under the control of a chargehand. At the end of the working day it was the custom for the gang to bring the crane back from its working position at the front edge of the tip to a point as far back as the short length of track permitted.

At about 9.15 a.m. on Friday, 21st. October 1966, many thousands of tons of colliery waste swept with a jet like roar down the side of the Merthyr Mountain which formed the west flank of the village. The massive force overwhelmed two Hafod-Tanglwys-Uchaf farm cottages and killed their occupants. It crossed the disused canal and went over the railway embankment. It engulfed and destroyed a school and eighteen houses and damaged another school and dwellings in the village before the dreadful flow ceased.

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The day had begun windless and sunny except for a belt of mist which filled the lower parts of the valley and prevented people seeing the tips. The men working above the mist could see to top of the colliery stack. Lessons began at the junior school at 9 a.m. but at the senior school lessons did not begin until 9.30. so that while the younger children were already at lessons the older children were making their way to school. At about 9.25 a sound was heard being variously described as thunder or a low flying jet plane or loose trams running down an incline.

Howard Rees, a pupil at the senior school, was making his way up the Moy Road when he saw a big wave, much higher than the houses, heading straight towards him. He could see trees, boulders trams, slurry and water in the flow and it appeared to him to be "moving as fast as a car". This mass hurled itself against the two schools and the houses which stood between them. Outside those houses three of Howard's school friends were killed while sitting on a wall. He saw them buried, crushed and killed. Howard and other boys were more fortunate even though they were hit by flying material.

At the same time a hairdresser, Mr. George Lewis was making his way to his shop in Moy Road when he heard 'a noise like a jet plane' which he thought came from the tip. He could see nothing because of the fog but soon saw windows and doors of the houses on Moy Road crashing down like dominos. He was struck by flying material and would have been buried if it had not been for a piece of corrugated sheeting which acted as a shield until he was rescued by some Council workmen.

At the moment when the disaster struck, Kenneth Davies acting-headmaster of the Senior School, the Pantglas County Secondary School was getting ready to receive staff and pupils for lessons which were to begin at 9.30 a.m.,. He was in the assembly hall when, in his own words-

"I heard a sound which appeared to be like a jet plane screaming low over the school in the fog. Immediately following there was a bang and the part of the school I was in shook, and some girls can running and screaming into the hall. When passing the needlework Room I noticed that the furthest corner had collapsed and the roof has started to collapse into the room as well. The Girl's entrance was approximately two thirds to three quarters full of rubble and waste material. I climbed onto the rubble in the doorway. I was still looking for this pane and when I look directly in front of me I saw the houses in Moy Road had vanished in a mass of waste tip material and that the Junior School gable ends or part of the roof, were sticking up out of the morass. I looked down to my right and I saw the the Moy Road houses had gone. Around the outer edge near the school where I was standing it would have been firm enough to stand on. I was standing on the outside edge."

Mr. Davies was in fact at the edge of the heap which was 20 to 30 feet high. With remarkable discipline and heroic absence of panic exhibited by staff and pupils alike, the school was evacuated and the pupils gathered in the front of the building for a roll call. This was prevented by a rush of very dirty water which brought more waste material with it. Through the swirling waters the teachers guided and sometimes carried the children away from the danger for sometime afterwards the water continued to pour down the mountain and also from two large water pipes owned by Cardiff Corporation and the Taff Fechan Water Board which had been laid in the bed of the disused canal and which were severed in the slide. These pipes came from the Brecon Beacons and

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although they were turned off it was not until 11.30 p.m. that water stopped coming from them.

The gang of men working at the top of the tip had arrived there shortly after 7.30 a.m. but their chargehand Mr. Leslie Davies was not with them at that time because it was Friday and he had to give his weekly report to the Unit Mechanical engineer, Mr. Vivian Thomas down at the colliery. when Mr. Gwyn Brown, the crane driver and Mr. David Jones, a slinger, arrived at the point of the tip they found that it had sunk by 9 to 10 feet and that two pairs of rails, forming part of the track on which the crane moved, had fallen into the hole that was left. Mr. David Jones set off down the mountain with a message and the telephone that had been at the top of the tip had been removed because the wire to it had repeatedly been stolen. While David Jones was on his way down, Mr. Glyn Brown used the crane to recover the tram landing plate from the hole and then with the help of others in the gang, he Moved the crane further back from the edge of the tip.

Mr. David Jones made his report to Mr. Leslie Davies and him in his turn to make a report to Vivian Thomas. Leslie Davies did just that and told Mr. Thomas of the ten foot hole. Mr. Thomas then sent men with an oxy-acetylene burner to cut the overhanging rails and gave directions for the crane to be pulled as far back as possible from the point of the tip and instructions were issued to top tipping on No.7. Mr. Thomas said at the time that he would go up he tip complex with a view to find a suitable place to start tipping in a fresh place. Leslie Davies and David Jones along with two men with cutting apparatus arrived at the top of the to about 9 a.m.. They found that the point of the tip had sunk another 10 feet so that at that time it was 20 feet below it's normal level.

The instructions to move the crane back were given but the men decided to have a cup of tea before doing this. It was very fortunate that they did this and retired to their cabin. Had they started work they would probably have gone down with the slide. Mr. Brown the crane driver stayed behind and while the rest were in the cabin, he gave the following account of what he saw.

"I was standing on the edge of the depression. I was looking down into it, and what I saw I couldn't believe my eyes. It was starting to come back up. It started to rise slowly at first. I still did not believe it, I thought I was seeing things. Then it rose up after pretty fast, at a tremendous speed. Then it sort of came up out of the depression and turned itself into a wave. That is the only way I can describe it, down towards the mountain, towards Aberfan village, into the mist."

Mr. Brown's shout brought the rest of the tipping gang out of the cabin, and the story was taken up by Leslie Davies who said-

"When he shouted, we all got to the top of the tip and all I can tell you it was going down at a hell of a speed in waves. I myself ran down the side of the No.3 tip all the way down towards No.2 and No.1 tip on the side. As I was running down, I heard another roar behind me and trees cracking and a tram passing me. I stopped, I fell down in fact. All I could see was waves of muck, slush and water. I still kept running. I kept going down shouting. I couldn't see, nobody could. And I heard a voice answer me and he shouted, "Come out of there, for God's sake". That man was Trevor Steed. I went with Trevor Steed down to the old railway line. By that time my mates had come down behind me. We went along the line as far as we could towards the school which we could see. All the houses were down. We could not pass that way because there was too much water running down. We could not go the way we wanted to go."

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Great efforts were speedily put into effect to attack the slimy mass that had engulfed the village. Essential services were quickly brought to the village and people came from far and wide to lend a hand and from the local collieries, officials hurried and strong experienced colliers arrived to use their strength and skill as never before. Despite the efforts, after 11 a.m on that day no one was rescued alive.

In the disaster one hundred and forty four men women and children lost their lives. One hundred and sixteen of the victims were children, most of them between the ages of 7 to 10. One hundred and nine of them died in the Junior School. Of the twenty eight adults who died five were teachers in that school. In addition twenty nine children and six adults were injured some of them seriously. Sixteen houses were damaged by the sludge and sixty houses had to be evacuated and other unavoidably damaged during the rescue operations.

EVANS Gareth 3 months
EVANS Catherine Elizabeth 3
EVANS Howell Lloyd 7
MINNETT Carl 7
FITZPATRICK Michael 7
HOPKINS Angela Vaughan 7
PROBERT Thomas 7
ROBERTS David Paul 7
SUMMERS Roger Colin 7
ANDREW Malcolm 8
ATSCOTT Dennis 8
DAVIES Brian 8
DAVIES Edwin 8
JONES Robert Orville 8
LEE Anne Catherine 8
MEREDEITH Susan 8
MORTIMER Cheryl 8
EVANS Maureen Mary 8
FUDGE Daphne May 8
GOUGH Gillian 8
HAINES Jennifer 8
HILL Anthony David 8
HODKINSON Linda 8
OWEN Valmai Mary 8
POWELL Jaqueline 8
PRICE Julie 8
WILKSHIRE Joseph 8
WILLIAM Angela 8
WILIAMS David William 8
WILLIAMS Graham 8
ANDERSON Carol 9
BARTLETT Edwina 9
CARPENTER Carol Ann 9
DAVIES David Morgan 9
DOUGALL Ian 9
GOUGH Brian Michael 9
GRAY Trevor Timothy 9
GRIFFITHS Dwynwen 9

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HARDING Lynn9
HAYES Roger Dyfrig 9
HODKINSON Royston 9
JONES Paul 9
JONES Robert Garfield 9
JONES Susan 9
KING John Anthony 9
LEWIS Sharon 9
LEYSON Sandra 9
MINNERY Barbara Eileen 9
MUMFORD Phillip9
PARFITT Jill Elizabeth 9
PROSSER Christine 9
PROSSER Howard David 9
REAKES Layton Kerrie 9
HOWELLS Maralyn Carol 9
HUGHES Annette 9
JAMES Necia 9
JONES Janet 9
JONES Kenin Thomas 9
REGAN Julie Jeannine9
RICHARDS Sylvia Frances 9
SHORT Martine Anne 9
SMITH Annette 9
SULLIVAN Avis Elizabeth9
WILLIAMS Keith 9
ANDERSON Linda 10
ANDREW Kelvin David 10
BARRETT Royston 10
BROWNS Kay 10
COLLINS Peter10
CROTTY Susan Mary 10
DAVIES Gareth10
DAVIES David Trefor 10
DAVIES Terence Malcolm 10
DONOVAN Sandra Pauline 10
GEORGE Christine 10
GOLDSWORTHY Richard Phillip 10
HEAMAN Pamela 10
BREEZE Robert 10
BROWN Jeanette Lynne 10
CARPENTER Desmond 10
COLLINS Michael 10
MINNETT Maralyn 10
MINNEY Robert George 10
MUNFORD Norma 10
NEEDS Geoffrey Derek10
REAKES Corwyn Thomas 10
RICHARDS Lorraine Rosa Isobel 10
ROBBINS Megan Olwen 10
SULLIVAN Anthony John 10
SYMONDS Victoria Marie 10
HOPKINS Stephen Vaughan 10

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JONES Eryl Mai 10
JONES John Islwyn 10
LAUNCHBURY Jean 10
TUDOR Randolph 10
WATKINS Anthony Joseph 10
WILLIAMS Carol 10
WILLIAMS June Margaret 10
WILLIAMS Peter 10
BARNARD Merril 11
DRAGE Yvonne 11
EVANS Jean Winifred 11
JONES Gillian Irene 11
MINFORD Edward Clive 11
PROBERT Patricia 12
FITZPATRICK Sheila 13
JONES Michael 13
PARFITT Vincent Clark 13
COFFEY Robert 14
COLLIONS Raymond John 14
REES Andrew 14

The Mayor of Merthyr Tydfil, Councillor Stanley Davies, set up The Aberfan Disaster Fund and the money flowed in from all over the world, charities, clubs, Trade Unions and Voluntary bodies. Many people sent gifts that could be sold to provide money for the Fund. The Appeal reached a total of one and three quarter million pounds and a Management Committee was set up with Stanley Davies as the Chairman. Financial help was given to the families of the victims and the site of the disaster cleaned up and money from the Fund financed many ventures in the village.

At the inquiry, it emerged that as early as 29th. July, 1959, the Town Clerk of Merthyr had written to The Area Estates Manager of the National Coal Board regarding the 'reference made to the potential danger of the tip at Aberfan' and on 17th. June, 1960, the Town Clerk wrote to the Coal Board that a deputation, 'wish to discuss with you the potential danger of the above Tip. Concern has been expressed that the Tip could slide after heavy rainfall.'

In 1963 there was a slide on the No.7 Tip and there was evidence that this had an effect on the surface after and drainage of the area but tipping did not stop. After hearing all the evidence, the Tribunal came to the following conclusions-

- 1) That the blame for the disaster rests upon the National Coal Board. the blame is shared, through varying degrees, among the National Coal Board Headquarters, the South Western Divisional Board and certain individuals.
- 2) There is a total absence of tipping policy and this was the basic cause of the disaster. In this respect, however, the National Coal Board were following in the footsteps of their predecessors. they were not guided either by Her Majesty's Inspectorate of Mines and Quarries or by legislation.
- 3) There is no legislation dealing with the safety of tips in force in this or any country, except in part of West Germany and in South Africa.
- 4) The legal liability of the National Coal Board to pay compensation for the personal injuries (fatal or otherwise) and damage to property is incontestable and uncontested.

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There were certain lessons to be learned and action needed to be taken to safeguard the future condition of the tips at Aberfan. Underground storage of rubbish was not regarded as a practical proposition. All tips should be regarded as potentially dangerous and should be treated as civil engineering structures. There was an obvious need for the communication system within the National Coal Board to be overhauled,

The Tribunal made the following recommendations-

- 1) A National Tip Safety Committee should be appointed to advise the Minister and to co-ordinate research into the problem of tip safety and of bulk disposal of industrial waste products.
- 2) The National Coal Board should continue to have prime responsibility in respect of all tips in its ownership.
- 3) A standard Code of Practice should be prepared for consideration by the National Tip Safety Committee with a view to its being issued publicly and applied to all tips, whether in the ownership of the National Coal Board or otherwise.
- 4) Her Majesty's Inspectorate, strengthened by the addition of qualified civil engineers and armed with statutory powers, should be made responsible for ensuring the discharge by the National Coal Board officials of their duties in relation to tip stability and control.
- 5) A local authority should have access to plans for tipping and reports on existing tips and, if not satisfied with them, should have the right to appeal to the Minister, who might appoint an independent expert to conduct an examination and make recommendations.
- 6) Men engaged in the daily management and control of tips should be trained for their responsibilities.
- 7) Managers and surveyors should as soon as possible be made aware of the rudiments of soil mechanics and ground-water conditions. The statutory qualifications of managers and surveyors should be amended to include awareness of the rudiments of soil mechanics and hydrogeology in addition to the geology already comprised in the syllabus.

Many of the Tribunal's recommendations were accepted and tips all over the country were examined. The Institution of Civil Engineers produced a paper that laid down their findings and gave guide lines for further tipping so that the disaster could never be again repeated.

The NCB cleared the seven tips overlooking the village but they sent the bill to the Disaster Fund. It was not until 1997 that the Government of the day reimbursed the money.

MICHAEL. Fife, Fifeshire. 9th. September, 1967.

The colliery was in the Scottish Northern Area of the National Coal Board and was on the north shore of the Firth of Forth, near the village of East Wemyss, between Kirkcaldy and Leven. The Coal Board Area Officials were Mr. J.D. Skidmore, director, Mr. W. Rothwell, deputy director (operations), Mr. D.D. Shaw, chief mining engineer and Mr. J.S. Wilson, production manager. The manager of the colliery was Mr. G. Duncan, Mr. A. Nichol was the deputy manager and Mr. D. Wilson, Mr. J. Simpson, Mr. A. Robertson and Mr. J. Soutar were the undermanagers.

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The Nos.1 and 2 shafts were begun in 1892 and both had a rectangular cross section. they reached the Chemiss Seam at 136 fathoms in 1898. the No.3 shaft, 24 feet in diameter, lined with concrete, reached 300 fathoms in 1928 and in 1944 the No.2 shaft was enlarged to 20 feet in diameter and lined with concrete to 430 fathoms. In 1944 the No.1 pit was completely filled and the two remaining shafts were used to wind coal, the No.3 serving as the downcast and the No.2 as the upcast.

The top seam that was worked at the colliery was the Pilkembare and the bottom Seam the Lower Dysart. There were 225 fathoms between these two seams and there were nineteen coal seams between them. The seams dipped south east towards the sea at gradients varying between one in three and one in two. The coalfield was remarkable fault free but there was one running roughly north east where the measures were thrown about 50 fathoms to the north east. At the time of the disaster, five seams were being worked, the Dysart Main, and the Four Feet in the No. 3 Pit and the Chemiss, Bowhouse and Branxton in the No.2 Pit.

The colliery employed 2,190 men. 1874 underground and 316 on the surface. the average weekly output was 16,750 tons and was produced on fully mechanised shearer loader faces.

The checking system at the colliery had not been changed for 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 his personal number, and collected two checks, one square and the other round, bearing his number. On going underground, he dropped the square check into a container at the pit bottom and retained the round one.

At the end of the shift, each man dropped his round check into the check office window. The round check was then placed on a board with the corresponding square one indication that the man was now above ground. A lamp number was allocated to each man when he joined the colliery and there was no relationship between the lamp numbers and the check numbers. This system gave rise to confusion over the numbers of men still below ground at various stages in the incident.

The colliery was ventilated by a Howden 1,000 horse power radial flow fan at the No.2 shaft which produced 310,000 cubic feet of air per minute at 3.5 inches water gauge.. There was a stand by fan, a two stage Aeroto 400 horse power 100 inch diameter with a capacity of 225,000 cubic feet per minute at 2.5 inches water gauge. There were no underground booster fans.

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

About an hour later Stirling returned to the undermanager's office, smelt smoke coming through the ventilation pipes from the Loco Level. He went out of the office to the Loco

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Level where he saw a blue haze. He then turned right into the Loco Level and walked as far as the No.3 heading which he found 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. There was no smoke but 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 20 yards from the entrance, he met Izatt coming out in very heavy smoke. Izatt had returned to his work in the Cable Belt Dook, and had been cleaning out the back of the loading point when he had suddenly been enveloped in thick black smoke. The conveyors had been stopped for some time but they had been running earlier in the shift.

Stirling sent Izatt up Bell's heading and told him to tell the onsetter at the 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 went to the telephone at the bottom of Bell's heading and tried to 'phone the Dysart Dip Sections. he got no answer and sent to the Coronation Dipping and sent P. Ritchie, a back brusher, to warn the men in the Dysart Dip No.1 Section. He again tried to 'phone Nos. 2 and 3 sections but could get no reply. He then spoke to T. Lister, deputy in charge of the surface control room and told him, 'There is a fire at the cable Belt Loader, get everybody concerned informed.'

Telephone calls were made and the alarm raised. At the time there were 311 men underground, 45 in the 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 was remarkable that all but nine escaped the dense smoke and it was undoubtedly due to the rapid action that informed the men of the danger.

At the surface, Lister's duty in the Control Room was to receive and pass on messages and information but he did not keep a complete log. Before he gave Stirling's message to C. Webster, the senior overman in charge of the shift, he received a routine call from J. Tait, the overman in the Four Feet Section. Lister told him that there was a fire in the Cable Belt Book and he thought the trouble was confined to the Dysart Dip side of the pit.

W.Semple jur., an overman in the Branxton No.22 Section, who had heard of the fire rang the Control Room for more information. At about 3.45 a.m. Lister spoke to Webster and told him to get all the men out. Soon after Watson called to say that as the conditions were worsening, the Rescue Brigades should be called. There was some discussion who was authorised to do this but Lister managed to contact Nichol, the deputy manager.

Nichol's first reaction was 'that it was one of those roadway heatings'. He left for the colliery immediately and, on arriving in the Control Room, he found that Lister could not give him any definite information of the situation underground. He was told that some men had been taken to hospital and he learned from men that had got out of the pit that there was a fire in the Loader Mine. He then thought, 'he had a belt fire on his hands' and at about 4.35 a.m. He went to his office to make an action plan.

He instructed the telephone operator to contact the Rescue Brigades but this call was delayed because of the number of incoming calls from the police and the hospital. He

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arranged for the undermanagers, Simpson and Wilson and the general manager, Mr. Duncan to be called to the pit.

He spoke to Stirling who was in Bell's Heading who told him he was putting up screens to fight the fire and was concerned about the safety of his men. Nichol decided to stop the fan but it was started a quarter of an hour later when Stirling sent a message that smoke was backing up Bell's Heading and hampering the fire fighting.

Mr. Duncan reached the colliery at about 5.15 a.m. and took charge of the operations. He was told that there were possibly 60 men in the Dysart Dip and 30 in the Four Feet Section with a considerable in the No. 2 Pit workings. He realised that the only way to improve their possibility of escape was to reverse the ventilation in the Loco Level. Reports 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 a.m. to open the doors in the No.2 Heading to draw the smoke into the Dysart Main Return. These doors were opened at 7.15 a.m. by a rescue brigade but the smoke continued to flow into the Sea Mine for a further two hours.

Following a meeting of all parties concerned it was agreed that it was unlikely that three men who had not been found could be rescued but efforts continued for another 24 hours and finished at 3. p.m. on the 10th. September.

While this was going on at the surface, underground McIntyre had seen Izart in a state of collapse at the No.3 Shaft Bottom and he went down Bell's Heading to get the men out of the New Pumphouse. He was stopped by the smoke at the Loco Level but he went another way and met B. White, the pumpman in Tilley's Alley. J. Duncan, the pump house 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 warned the inbye sections and the pumpman in the Chemiss Inset who he told to go to the surface.

A.S. Todd, the overman in charge of reconstruction, hurried back to the No.3 shaft when he saw the fire and told J. Field, the reconstruction deputy, to withdraw all the men to the pit bottom section. After making several telephone calls to Todd and K. Buckley, another overman, he opened the doors to Davidson's Mine in an attempt to drive the smoke from the Dysart Turn to the upcast shaft. After he had done this, he helped the men coming out of the Sea Mine. At about 5 a.m., the undermanagers, D. Wilson and J. Simpson arrived, 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 in safety.

In the Dysart Dip Section, after Stirling had sent Ritchie into the Dysart Dip No.1 section and spoken to Lister, he was able to speak to R.C.M. Frazer, a deputy in the Dysart Dip No.3 section and to J.H. Drummond, a deputy at the foot of the cable belt. He told them that all the men were to come through the return airway to the No.3 Dook. He spoke to J. Drummond, a shot firer, and J.M. Imrie, a development workman, and agreed with them that because of the dense smoke, it would be better for them to walk up the return rather than attempt to go up the intake on the manrider.

Stirling went with a deputy, D.C. Dryberg down the Dysart Dip No.2 Dook and opened the doors to the 1a dip connection. They found that this had little effect on the smoke and closed the doors again with some difficulty and went to the east Loco Level. Stirling was driven back when the fan stopped but he remained in his area throughout his shift and organised the men and the fire fighting. The manriding haulage driver, T. Barr lowered the train when he received a signal at 3.40 a.m. The journey took five minutes

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in each direction. On the way up, he stopped the train at the Dip No.1 and later heard some men get off at the top. He lowered it again and brought out J. McDonald, the pumpman. The train went down for a third time and while it was at the bottom the electric power went off. A. Robie, a foreman electrician, was with Barr, arranged the switches so that the train could be drawn up as far as possible.

Robie had come out of the smoke when the power went off up Bell's Heading when he met Stirling who asked him to get the fan restarted. He was not able to find a phone free and he reported to W.L. Wilson, the colliery electrical engineer, who was going to the automatic exchange to find the breakdown. After getting permission from Nicol, the fan was restarted.

Of the 64 men in the Dysart Dip workings all but two escaped. P. Thompson, a greaser was last seen at 3 a.m. near the motor house at the top of the No.1 Dook by J. Duncan who worked in the new pumphouse. the rescue brigade recovered his body from the Cable Belt Dook. J. McKay was also a greaser was with a number of men near the phone when J. Drummond was speaking to Stirling. The smoke was very thick and KcKay was not seen again.

Ritchie went in through the Dysart Dip No.1 Section where he found J. Culcross, the overman and J. Linden, the face deputy, at the roadhead. he returned with some men through the East Loco Level. Culcross phoned down the face and sent Linden out along the bottom gate where he met men coming out of other sections. He went with the last of these men to Bell's Heading. W. Armour, the roadways deputy, was told by the workmen at 3.45 a.m. that smoke was coming into the section. He sent his men out through the face and he went along the bottom road to the dooks. The smoke was light grey at first but later it turned black and smelt of burnt wood that caught at the back of his throat.

In the Dysart Dip No.2 face, J. Drummond, a shotfirer, was firing shots at the bottom of two roads that were being driven to develop the Dysart No.2 face. He smelt smoke that was coming through the ventilation tubes and went to the phone near the pumphouse where he spoke to Stirling and warned McDonald. The black smoke was coming down the dooks when he joined the men from the development headings and J. McKay, the greaser. They went back to the return airway, thought the doors at the top of the no.2 section and and made their way outbye through the smoke in several parties. McDonald went to the bottom of the No.1 Dook and stopped the pumps and the made his way up the No.2 Dook, to the top of the road doors where he saw J. Watson and R. Bernard, both deputies and then went to the manriding train. He was hauled to the top and signalled the bogies down again to fetch Watson and Bernard.

Watson, Bernard and R.C.M. Frazer all deputies, were at the top of the No.3 Section when they got the message from Stirling that the men were to go through the No.3 Dook. Frazer went down the the face and met E. Moore, the overman, and they travelled along the bottom road together where they met J.H. Drummond and checked with him that all the men further inbye had been warned of the danger. Drummond went down the face keeping pace with the smoke, taking the workmen with him. This party travelled in the smoke up the No.3 Dook to the stairs at the top where visibility was down to ten feet. Several of them were distressed and required help.

By this time the smoke had travelled along the East Loco Level and the men had to get out by way of the Dysart Main Return. There were alternative routes from the top of the Coronation Dipping and the No.3 dook and J. Linden went back into the return at 4.30

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a.m. to guide any men that were trying to find a way out. They travelled in small parties and some, finding the smoke very thick at the doors in the No.2 Heading, came through roads which they did not know to the 300 fathoms lateral. Others came through the 1 in 1 Drift and Davidson's Mine. One group tried to come out through the Lochhead Level but were stopped by smoke. They went back to the return airway and eventually came through the overcast to the Lower Dysart Manriding Dook.

Many messages were sent to the Four Feet Workings to tell the men to get out but J.E. Nowak, a belt maintenance man, was standing near the Dysart Turn and saw the black smoke in the Sea Mine. He told Tait, the overman and J. Arthur a greaser to come out through the return. Eventually all the men except McArthur and J.C. McEneamy, a belt man, accompanied part of the way by A. Taylor, a deputy walked out by the shortest way, through the Sea Mine which was filled with black smoke before they entered it.

D. Hunter, the roadways deputy, received an urgent message and came out by sending his men ahead. He met a haze 150 yards from the face as he rode up the Four Feet Dook on the conveyors. At the top he phoned the 750 Branxton pumpman, H. Gallacher and stayed to keep the conveyors running for a few minutes. He then tried to get to the top of the 750 Branxton Cable Belt Dook where some of his men had been working but he could only go 40 yards because of the smoke. Fortunately, the men had already seen the smoke and escaped. He went along the Sea Mine to the Dysart Turn where he saw Buckley, McIntyre, Todd and others. He told them to start the conveyor and shout into the Sea Mine to see if there was any answer. After a while they heard a voice and in zero visibility, Hunter went into the smoke and found C. Cunningham, the pumpman lying on the ground. He carried him back to the Dysart Turn, a distance of 50 to 60 yards, with the help of some other men.

In the meantime, Tait had sent messages up the No. 31 Face to warn the men and he had telephoned 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. Thompson. They rode up the first of the two conveyors but when they reached the top of the second, Thompson 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. When Wilson found that Grieve had not followed them, he lifted him to his feet and helped him into the fresh air. Several of the men came out of the Sea Mine vomiting and most of them suffered dizziness, coughing and loss of movement to their legs. Of the 25 in the workings at the time, 18 were able to escape.

Immediately McArthur, who was at the top of the Four Feet Dook, received the message to escape through the return, the black smoke appeared. He phoned McEneamy at the bottom of the Dook and arranged to meet him at the top. They went through the doors to 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 down the return airway which was signposted. They turned left at the first junction for a rest at the ladder and they saw signs of smoke in the return.

Taylor had been alone at the top of the No.31 face and he did not know that his men had gone down to the bottom road. In spite of protestations from the other two men. Taylor decided to go back to make sure that they were all out, particularly, Gallacher, the pumpman. He arranged with the others, that if he was not back in a few minutes they should look for him and if they did not find him quickly they were to go on through the return following the signs. After about five minutes, they went back down the return

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but they could not see Taylor and went on. At the top of the ladder they turned right and following the signs to the 'Escape Pit', they came to the junction of Walker's Dook and Steven's Brae, up Steven's Brae to the inset n No.2 Shaft at the Bowhouse Level. By this time, the smoke was quite thick but it cleared towards the shaft and they stopped at a fence where there was 'no road' sign. They spent some time in the old workings to the north of the shafts and returned to the No.2 inset. McEneamy started to strike an old rusty bell plate with a brick and they shouted when they saw the cage go by. Later, a second cage with rescue men blowing hooters passed them.

When A.D.H. Smith, an overman, came up the shaft at about 7 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 went down the shaft but was unable to find the Bowhouse inset but L.M. Irvine, the workmen's inspector deduced that the voices must be coming from the inset and a rescue party under G. Pratt went down at 11.30 a.m. but because of signalling difficulties the attempt was unsuccessful. McArthur and McEneamy were eventually brought out of the No.3 shaft at 2.50 p.m.

C. Webster, the senior overman, was in the Bowhouse No.40 Section bottom road when he was told of the fire in the Cable Belt Dook at 3.45 a.m. He told T. Inglis, an overman, that he was going outbye to see about it but he made no mention of withdrawing the men from the No.2 Pit workings. He rode on a locomotive along the 360 fathom Lateral and found a blue haze at the Compressor House and smoke at the turn half way between Nos. 1 and 2 crosscuts. He came back and made arrangements to withdraw the men. He spoke to Nicol at the surface and got the impression that he was as much in the dark about events as he was.

In the inbye sections Nowak had spoken to W.K. Paterson, a deputy in charge of mechanisation, and advised him to send the men out through the Lower Dysart Manriding Dook. A. Watson, at the No.3 Pit Bottom had told some workmen in the 360 fathom Lateral to warn everyone to go to the No.2 Shaft by way of the 430 fathoms Mine. These messages were passed on and all the men in the No.2 Pit workings were safely withdrawn. The men from the inbye workings made their way to the Compressor House through 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 but the majority of the men walked u the Dook. Some required assistance on the steep gradient.

At the No.2 Pit Bottom 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 fire and that the men should withdraw. at 5.10 a.m, near the pit bottom M. Blankenstein, a deputy, told him had gone up the shaft and it was closed. After a delay Smith got through on the phone to Nicol and told him that he had a stretcher case to send up and that the atmosphere was getting hazy. By 5.40 a.m. all the men were out of the pit save about six and there were signs of carbon monoxide at the shaft bottom.

Smith went to the bottom of the Lower Dysart Manriding Dook to satisfy himself that all the me were out and he finally rode up the No.2 shaft at 7 a.m. leaving the acting onsetter and pumpman at the pit bottom to wait for their reliefs. There services were required and the pumps had to kept running and he kept in touch with them by phone. W. Cull, a deputy, went down the No.3 shaft at 8.50 a.m. with the day onsetter and pumpman. They walked down the Lower Dysart Manriding Dook an found thick smoke on the inbye side of the doors to the 430 Mine. After leaving the doors open for a while,
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it cleared and they went on to the No.2 shaft bottom. condition deteriorated and at 10.45 a.m. wearing short period breathing apparatus, they were brought up the No.2 shaft by a rescue brigade.

In the report Mr.. Stevenson commented-

“I can not 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 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. There was at times some confusion, is in the circumstances which obtained, quite remarkable. There was at no time the slightest degree of panic is remarkable. Had there been, the death role in this incident would have undoubtedly have been much higher.”

Those recovered 9th. September 1967-

Alexander Henderson aged 41 years, a power loader operator,
Johnstone Smith aged 36 years, a power loader operator,
James Tait aged 41 years, an overman,
Andrew Thomson aged 55 years, a power loader operator and
Philip Thompson aged 64 years, a greaser.

There were three bodies that were not found-

Hugh Gallacher aged 61 years, a pumpman,
James McKay aged 59 years, a greaser and
Andrew Taylor aged 43 years, a deputy.

The inquiry into the disaster was conducted by H.S. Stephenson, B.Sc., C. Eng., M.I.Min.E. H.M. Chief Inspector of Mines and Quarries and D.G. Wilde, a Principle Scientific Officer in the Safety in Mines Research Establishment of the Ministry of Power described a series of experiments that were carried out at the Establishment's Buxton Station. These experiments centred upon the behaviour of polyurethane foam when it was burnt. The hazards on the foam came to light. There was little doubt from the experimentally generated fired, that a P.V.C. belt within range of the fire would be consumed by it and it was found that the P.V.C. belting and the foam produced thick black smoke and poisonous gasses.

As to the cause of the fire, there was no evidence produced at the inquiry to show that it was from spontaneous heating and it was conjectural how sufficient air got behind the lining to sustain a heating. It was difficult to be more precise than to say that the heating occurred in the roof coal somewhere in the Loader Miner that was lined with polyurethane.

The Inspector recommended that-

- 1) (a). polyurethane foam as at present constituted, whether or not treated with fire-retardant coating, should not be used underground at any mine, or at the surface of any mine in such a situation that the products of it's 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 adequate fire-retardant coating and removed within 12 months.

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- (c). any foam which has been placed in a situation other than that in (b) above shall be given an adequate fire-retardant coating and be removed as soon as practicable or sealed off.
- 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 a Area emergency.
 - 3) The Board and H.M. Inspectors should examine the possibility of improving the checking systems.
 - 4) The methods of signposting all means of egress should be examined and a standard method instituted.
 - 5) Overmen and deputies shall at least once every month inspect and report on the state of every means of egress from the parts of the mine assigned to them.

The recommendations were submitted to all interested parties in February 1968.

CYNHEIDRE-PENTREMAWR. Llanelli, Carmarthenshire. 6th. April, 1971.

The colliery was in the West Wales Area of the National Coal Board and was five miles north of Llanelli on the western extremity of the coalfield. Cynheidre and Pentremawr Collieries were linked underground in 1966 and came under the same manager in 1970. The Pentremawr Colliery began production in 1875. The sinking of the shafts at the Cynheidre Colliery was started in 1954 and production began in 1960. At the time of the outburst the combined colliery produce about 20,000 tons gross each week and employed 1,178 men underground and 422 on the surface.

There were two downcast shafts, two upcast shafts and three intake drifts all within a radius of 1.5 miles. The No.1 downcast and the No.2 upcast shafts were 24 feet and 20 feet in diameter respectively and were both at Cynheidre. The No.3 upcast and No.4 downcast shafts each of 18 feet diameter were three miles to the north-east of Cynheidre, near Tumble. The No.2 upcast shaft was equipped with an electrically driven Davidson Sirocco fan extracting 370,000 cubic feet of air per minute at 8 inches water gauge.

Approved electric cap lamps were in general use and flame safety lamps were issued to officials and selected workmen as firedamp detectors. Methanometers were carried and used by the ventilation staff and certain senior officials. The colliery was divided into five main sections each of which had a separate ventilation circuit. The outburst occurred in the Cross Measure 2 Section of the mine.

The principle officials were the Area Director, Mr. D. Davies, the Deputy Director (Mining), Mr. R. Williams, chief Mining Engineer, Mr. G. Hodkin, deputy Chief Mining Engineer (Mining Services), Mr. C.J. Davies and the Deputy Chief Mining Engineer (Mining Planning and Surveying), Mr. T. Rosser. The colliery was managed by Mr. C.B. Jenkins with two deputy managers, Mr. W.J. Williams for the Cynheidre part and Mr. K.V. Jones for the Pentremawr. The undermanager in the Cross Measure 2 Section was Mr. P.K. Lewis. On the day of the disaster Mr. W.J. Williams was in charge of the colliery while the manager was away on official business in the West Midlands. Mr. Jenkins was called as soon as the incident occurred and arrived at the colliery in the early morning.

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All the seams worked at the colliery were of high grade anthracite and they were in descending order, Big, Ddugaled, Stanlyd, Braslyd, Gwendraeth and Pumpquart but since 1966 only the Big Seam had been worked. The roof in this seam varied from massive sandstone to shale and the floor was a weak fireclay, in general the workings were dry and throughout this part of the coalfield there is geological faulting and folding and there were areas where the coal was pulverised and powdery. Outbursts had been experienced in this part of the coalfield which ejected coal and firedamp. The amount of coal varied from a few tons to thousands of tons and the total quantity of firedamp bore a relationship to the tonnage of coal ejected.

An outburst usually lasted for a very short time and was usually preceded with a warning noise called '*pouncing*'. This noise was compared with that of a two-stroke motor cycle starting and accelerating. The firedamp was usually released with considerable violence and the coal ejected was invariably very finely powdered. Since the early years of the century, 192 incidents of this type had been recorded in the West Wales area and had occurred at nine mines in the Gwendraeth Valley. At the Pontheny Colliery, a drift mine on the outcrop about two miles to the north west of the Cynheidre Nos. 1 and 2 shafts there were a number of serious outbursts in the 1920's which caused loss of life and as a result of these accidents a code of Special Regulations was established under Section 87 of the Coal Mines Act, 1911. This mine ceased production in 1930 because of the difficulties in dealing with these outbursts. The problem returned to other collieries in West Wales, periodically, over the next twelve to fifteen years.

An increasing number of incidents resulted in the formation in 1945 of the Joint Advisory Committee on Outbursts on which the Mining Inspectorate, the Management and the Trade Unions were represented. This Committee produced Codes of Practice which recommended precautions to prevent outbursts and to minimise the consequences if they occurred. The code recommended a shot firing procedure designed to induce an outburst where conditions were suspect which was only practice when there were no people on the return side of the workings. This technique was known as volley or induced shotfiring. In the Cynheidre part of the colliery the first outburst of coal and gas occurred in October 1962 and since then there were 67 outbursts. In the Big Seam there were 37, 13 of which occurred spontaneously and the remainder were induced by shotfiring.

The Cross Measure 2 Section of the mine was developed from two main roadways driven from the 560 yards and 660 yards horizon laterals from the Nos.1 and 2 shafts respectively. When the Big Seam was reached a longwall face was opened out and advanced to the dip forming three roadways from which subsequent production faces were worked on both flanks. The development road was serviced by a centre intake, Road 2, with returns on the left side, Road 1 and on the right side, Road 3. In 1968 it ceased production because of geological difficulties and later the inbye portions of the roads became untravellable. Road 1 became closed inbye of Panel 11, Road 2 inbye of Panel 13 and Road 3 inbye of Panel 4. In the intervening period flank faces were worked and Panel 13 and Panel 2 were in production at the time of the outburst. In order to re-establish the ventilation in this forward development area two coal headings were started, one at the inbye end of the Road 2 and one re-opening Road 3. They were being driven by outside contractors.

Panel 13 was a longwall face 130 yards long, advancing slightly to the dip with a gradient on the face of 1 in 12 from the return to the intake. Coal was being produced
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on the day and the afternoon shifts using a 125 horse power ranging drum shearer loader which extracted the top seven feet six inches of the seam. The mudstone roof was supported by six-legged powered supports. The main conveyor gate was supported by 14 feet by 11 feet arched girders and had a coal rib on the right hand side and a five yard pack to the other. The return supply gate was 12 feet by 9 feet supported by arched girders with a four yard pack on the right hand side and skirting the partially closed roadway which served Panel 11. Production commenced on 8th. February 1971 and the face was soon advancing at a regular rate giving an output of up to 12,000 tons per week.

The Road 2 Cross-cut Drivage, in which the outburst occurred, started from the far side of Road 2 and was being driven roughly parallel to the old face line leaving a pillar about eight yards wide. It had been advanced for about 16 yards in the seam and was supported by 12 feet by 10 feet arches. The coal was won by explosives fired in large rounds between shifts in accordance with the Outburst Code and was filled on to a conveyor by a compressed air powered shovel loader. The heading was worked on three shifts and advanced about 4 feet per shift. The depth of cover at this point was 680 yards. Until shortly before the incident the conditions on the face were considered normal and there was no visible geological disturbance and the coal itself appeared strong.

The total quantity of air entering the main intake lateral to the Cross Measure 2 Section of the mine was 102,926 cubic feet per minute and when last measured, 32,436 cubic feet per minute reached the face of Panel 13. In the shifts before the outburst work on the Road 2 Cross-cut Drivage proceeded as usual on the day shift of 5th. April. The loose coal got out by the previous shift was filled out, the four feet advanced and an arch girder was set. The coal was bored in preparation for shotfiring between the day and the afternoon shifts. The shotfirer, D. Lydon Davies, was killed but records showed that he fired a volley round of 12 shots containing 18 pounds of Group P5 explosives. In accordance with the Code of Practice this operation was carried out with no men at all downwind in case the shock of the shots would cause an outburst but no outburst occurred.

When the afternoon shift of the 5th. April arrived at the face of Road 2 Cross-cut Drivage, they found that the shotfiring had produced an unusually large amount of loose coal and the work of filling went on throughout the shift. Because of the quantity of the coal the advance was not enough to permit an arch to be set. The coal had produced more dust than usual and much time was spent watering it with sprays to keep this down. The deputy in charge of the heading, Edgar John Evans, noted that the coal was falling off the face and sides, particularly on the left hand side so that the face at roof level was six to seven feet in advance of the last arch by the end of the shift and there were signs that the roof was beginning to raise slightly. He made tests with flame safety lamps but found no increase in the percentage of firedamp during the shift. Neither the deputies or the workmen heard any 'pouncing' and they attached no significance to the change in the conditions.

The workmen on the night shift of the 5-6th. April, continued filling the loose coal which was still falling from the face and sides and eventually were able to set another arch. The deputy in charge, Glyn Howell Jones, confirmed that the coal was dusty and friable and when he left the heading at 5.15 a.m., the face at the roof level was about 9 feet ahead of the most recently set arch. By this time an abnormality was clearly visible with the roof rising away sharply about 1 in 3. The falling coal on the left hand side had also produced a space of about 9 feet behind the arch at roof level. During the shift, the deputy did not detect any firedamp using a flame safety lamp. On reaching the surface

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at the end of the shift the deputy reported the conditions in Road 2 Cross-cut to P.K. Lewis, undermanager and W. Luther Davies, the day shift overman who was later killed in the accident and John Jones Rees, the oncoming deputy.

During the day shift of 6th. April normal operations proceeded on Panel 12 and Panel 2 and Road 3 Development. In Road 2 Cross-cut Drivage two contractors' workmen, A.G. Miller and H. Itzi, continued to fill loose coal at the face of the heading and to pack material behind the arches. In the course of the morning, the heading was inspected by P.K. Lewis, and John Jones Rees, W. Luther Davies, overman, D. Lyndon Davies, shotfirer, F. Knoedl, contractors engineer and J. Steinmann, contractors' shift supervisor. When John Jones Rees arrived at the face of Road 2 Cross-cut Drivage at about 8.30 a.m., he found conditions much the same as the night shift deputy and reported to him. The coal was soft and dusty and still falling from the side and face. The ventilation conditions were normal and he did not hear any 'pouncing'. He left the heading at about 9 a.m. to inspect other parts of his district, leaving the workmen to fill loose coal into bags and pack them behind the arches. He expected this work to occupy the whole shift and did not return before the outburst.

The same conditions were observed by J. Steinmann who entered the drivage at about 8.30 a.m. and remained until about 9.30 a.m. P.K. Lewis, undermanager and W. Luther Davies, the overman, arrived at the drivage at about 10 a.m. According to Lewis they found that the coal had fallen from the face for about 10 feet forward of the last arch at roof level and the roof curved upwards to a height of about 4 feet above the normal. Using a methanometer he found that the firedamp content near the face of the heading was normal at .20 percent. He told the workmen to get nine feet long, flat timbers and place them behind the arches to support the bags of coal dust. Lewis telephoned for the surveyor to record the disturbance of and spoke to D. Austin Thomas who was an expert on outbursts and asked him to make an inspection and give his opinion on the conditions. Neither of these men arrived before the outburst occurred. Lewis left the No.2 Cross-cut Drivage about 10.30 a.m. and summoned F. Knoedl and gave him instructions concerning the work to be done in the drivage. Knoedl had made three earlier visits to the drivage and after receiving the instructions from the undermanager, arrived at the face of the headings soon after 11 a.m. At that time, the workmen were cleaning up and using hand shovels in the final stages of preparing to set an arch on the instructions of the undermanager and the shovel loader was not in use. Shortly before leaving the place Knoedl saw a workman's flame safety lamp hanging near the face and noted that the flame was burning normally. When he left the drivage, two workmen, Miller and Itzi were near the face and A. Lyndon Davies, a shotfirer had come in. He was near the drive-head of the conveyor serving the drivage and it was then 11.50 a.m. about 10 minutes before the outburst occurred.

At about 12 noon the outburst of coal and firedamp occurred at the face of the Road 2 Crossing-cut Drivage. All the people working there were killed. These were D. Lyndon Davies, A.G. Miller and H. Itzi. The facts that their bodies were recovered some distance from the working face well clear of the outburst of coal, suggested that they had some warning and were trying to escape when they were overcome and asphyxiated.

Denzil Rees, a transfer point attendant on Road 2 at the junction with Panel 13 Main gate, was working about 20 feet inbye the auxiliary fan which ventilated the No.2 Cross-cut drivage when he heard a fizzing sound as if something was passing through the fan duct and saw a cloud of dust coming towards him from the fan. He saw the flame in his lamp, rise and he extinguished it as he became aware of a sulphurous smell coming

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from the direction of the No.2 Cross-cut drivage. Rees and D. V. Callahan, supplies man, and Dewi D. Evans and R. Sandow, repairers, were working near Rees, realised that something serious was wrong and rushed outbye along the Road 2. They were joined by five electricians and four other workmen who were having a food break at the substation about 40 yards outbye of Panel 13 junctions. These 14 men managed, with some difficulty, to travel outbye and reach the fresh air intake. The firedamp from the outburst had backed up against the intake air current for 140 yards outbye of Panel 13 junction. One man in these group, Gordon M. Rowlands, an electrician, had the presnce of mind to continue further 200 yards beyond Panel 11 gate junction to a substation where he switched off the power supply to Panel 13 and Road 2 Cross-cut Drivage.

Firedamp from the outburst was carried along Panel 13 main gate towards the face. About 40 yards along this road there were two repairers, F.R. Ould and Thomas Li. Rees and a shotfirer, David J. Thomas. They noticed a bad smell and saw a cloud of dust coming towards them. They realised that something was wrong and struggled outbye through the cloud of dust to Panel 13 gate junction where they all remembered climbing over travelling bridge across the main conveyor belt. After that they lost consciousness for a short period of time but came round and travelled out along Road 2 as far as Panel 11 gate junction, keeping as close to the floor as possible. Here, they met a group of men who had fresh air from the return side of Panel 13 as well as those who had gone before them from Road 2. V. Lewis, a beltman, who was working about half way along Panel 13 main gate recalls seeing a cloud of dust before he became unconscious. When he came to some time later, he began to struggle out and remembered that there was a compressed air valve near the ripping gate and opened it to get fresh air. When he was sufficiently recovered he continued outbye.

In Panel 13 main gate there were about 25 men from about 40 yards outbye from the face to a point a few yards along the face. After a short period of warning smell, all these men lost consciousness. There was evidence that some of them had time to travel a few yards from the face into the gate but others appeared to have been overcome very quickly. Three of these men did not recover, W. Luther Davies, overman, I. Gareth Watkins, ripper and H. Garfield Roberts, measurer. The first to regain consciousness was Tom Lewis who was a few yards along the face. He saw several men unconscious around him and attempted to rouse them. Some of them came to and others did not. He went to the gate and telephoned direct to the surface First Aid Room and spoke to Noel Davies. This call was the first indication to the surface that there was something seriously wrong below ground. Soon after the call was made some of the men began to recover amongst them P. Lewis, the undermanager who realised that there had been an outburst. His first action was to speak on the district loudspeaker to warn everyone to get out to fresh air. He then telephoned the surface and spoke to W.J. Williams, the acting manager who put the emergency scheme into operation.

There were 18 men at the return end of the face near the return gate roadhead. The overman, Illtyd Beynon, was on the face nearby when he noticed a smell. He immediately checked the conditions with his methanometer which showed 5 per cent firedamp. He quickly got the men together and told them to get out of the return gate into the main intake as fast as they could. After checking for lights on the face, Beynon followed the group out to the main intake at Panel 11 junction. On the way he collected two repairers working in the old Panel 11 main gate.

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Two powered support operators, B. Griffiths and W.C. Davies were the only men between the groups at each end of the face. They were overtaken by a cloud of dust about one third of the way along the face. They realised that something serious had happened and went up the face and out by the return gate. They managed to reach the outbye end of the gate with great difficulty and from there they were assimilated into the Road 2 main intake.

Two contractors workmen S. Parry and B. Barskyj who were working at the face of Road 3 drivage heard a rumbling noise and retreated with alarm about 40 yards. They then realised that the auxiliary fan ventilation the drivage had stopped, and they went outbye to the nearest connection with Road 2. They met J. Steinmann who was their supervisor who told them there had been an outburst and instructed the men to warn two back rippers in Road 3 and the men in Panel 2. The back rippers in turn, warned L.R. Jones, overman and D. Deasy, deputy at the transfer point of Panel 2 gate. L.R. Jones the organised the withdrawl of all 16 men in Panel 2. Some of these men went to help in the rescue operations in Panel 13 gate.

Along the return airway from Panel 13 outbye to the locomotive terminus there were four engine houses for haulages handling supplies. Loudspeakers were installed near three of these haulage engines and seven men who were working there at the time of the outburst heard the warning given on the system and went through the cross heading which led to the main intake near the top of the 1 in 2 drift. They reached the intake air without suffering any adverse effects. At the fourth haulage engine house further inbye on Road 1, there was no loudspeaker and two supples men, A. Mount and D.T. Jones and a haulage driver, C. Evans, did not realise that there was an emergency and remained there until their deputy sent them to the intake. The last people to be involved in the incident were the locomotive driver and a guard in the No.7 Cross Measure. They were travelling inbye from the pit bottom with an empty diesel locomotive when the engine began to loose power. The driver stopped the engine and noticed a dust cloud passing them. The guard said that the flame traps on the exhaust had been smoking. They felt that the air was warm and there was a smell of mildew but at this stage they were not alarmed and were concerned with the breakdown of the locomotive. They walked out a junction and reported by telephone to the locomotive fitter. The fitter and driver returned to the locomotive but could not find the problem. They managed to start the engine and nursed it back to the garage which was in fresh air and the engine started to run normally. They then left the mine. About half an hour later 7 per cent firedamp showed at the outbye end of that return main roadway.

The men involved in the outburst made their own escape as best they could. After, those who were physically fit helped those who needed assistance. The group of 18 men at the return end of Panel 3 led by the deputy Illtyd Beynon were soon on fresh air and he used the loudspeaker system to broadcast a message instructing all the men to get out of the return airways. He tested for gas using his methanometer and found none and then went down Road 2 towards Panel 13 main age where he found 5 per cent of firedamp. He returned to the junction and telephoned the acting manager at the surface and reported to him. Beynon made a second attempt to go down Road 2 and found 4.5 percent firedamp but when he saw the lamps of F.R. Ould, D.J. Thomas and T.L. Rees coming towards him he realised that the air was breathable. With six men, he went inbye down Road 2 as far as the junction with Panel 13 main gate where he found 5 per cent and again reported by telephone to the acting manager who told him that P.K. Lewis, the undermanager, was at the inbye end of Panel 13 main gate with a large number of men who were in various stages of regaining consciousness.

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When Leslie Davies, the first survivor from the inbye end of Panel 13 main gate, reached Road 2, Beynon decided to lead his group of volunteers rescuers to the Panel 13 face. On their way they met survivors coming out and face what assistance they could to get the men to the fresh air in Road 2. Near the face Beynon met Lewis who had recovered and was supervising the rescue operations. He had crawled out into the main gate and helped the men as they recovered consciousness. As soon as everyone appeared fit enough he sent them outbye telling them to keep as close to the floor as possible.

Soon after Beynon and his group arrives, L.R. Jones, overman, and D. Deasy, a deputy came up from Panel 2 which had not been affected directly by the outburst. They were followed by first aid men from the surface carrying oxygen apparatus. It took about an hour to evacuate all the survivors from this area but despite long efforts with oxygen apparatus W. Luther Davies, H. Garfield Roberts and I. Gareth Watkins did not respond. The assisting workmen began to feel the effects of the gas and the undermanager decided that all should withdraw into fresh air.

While the evacuation from the Panel 13 main gate was going on, another group including F. Knoedl, J. Steinmann, G.M. Rowlands and Oscar Evans arrived at the outbye end of the gate and saw light not far away down the lower part of Road 2. They held their breath and kept as close to the ground as possible and working rapidly, they were able to bring out A. Miller and Lyndon Davies to the junction where they attempted to revive them but without success. They tried to go further down to recover H. Itzi but were prevented from doing so because of high concentrations of firedamp.

The acting manager had called the Loughor Rescue Station which was 10 miles away at 12.26 p.m. and the first team arrived at the colliery at 12.50 p.m. and went underground soon afterwards. They made a fresh air base in Road 2 at the junction with old Panel 11 gate. Soon after 2 p.m. another team arrived at the fresh air base and exploration of the affected air was started by men wearing breathing apparatus. By 2.15 p.m. the last of the survivors had been evacuated and all the men in the mine were accounted for. The rescue teams recovered the bodies from Panel 13 main gate and by 3.40 p.m. five of the bodies had been brought out into Road 2 and the fresh air base moved outbye of Panel 13 main gate junction. Soon afterwards the body of H. Itzi was brought out. The rescue teams then made inspections down Road 2 through the whole of the Panel 13 district and finally through the return from panel 13 to the upcast shaft.

Those killed-

Douglas Lydon Davies aged 54 years, shotfirer,
William Luther Davies aged 56 years, overman,
Henryk Itzi aged 45 years, contractor's workman,
Albert George Miller aged 35 years, contractor's workman,
Henry Garfield Roberts aged 61 years, measurer and
leuan Gareth Watkins aged 43 years, rippper.

Those who were injured-

James Edward Alderton aged 28 years, powered support operator.
Iltyd Benyon aged 34 years, overman.
Daniel Vivian Callahan aged 40 years, supplies man.
Leslie Davies aged 55 years, ripper.
Morley Rhys Davies aged 55 years, ripper.

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Thomas Howell Davies aged 53 years, supplies man.
William Aled Davies aged 33 years, assistant fitter.
William Cliff Davies aged 54 years, powered support operator.
William George Davies aged 56 years, beltman.
Vivian Denning aged 35 years, powered support operator.
Cyril Evans aged 52 years, haulage driver.
Derwyn Morris Evans aged 55 years, stableman.
Dewi Daniel Evans aged 41 years, repairer.
Eifion Morris Evans aged 21 years, electrician.
John Thomas Evans aged 54 years, shotfirer.
Kenneth John Evans aged 45 years, stableman.
Alun James Gibbeard aged 39 years, locomotive fitter.
Brinley Griffiths aged 48 years, powered support operator.
Ramsey Gordon Hughes aged 53 years, transfer point attendant.
Thomas William Hurley, aged 45 years, powered support operator.
Dewi John aged 50 years, repairer.
David Bryan Jones aged 32 years, supplies man.
David Gwilym Jones aged 34 years, shearer operator.
David Kenneth Jones aged 41 years, powered support operator.
David Thomas Jones aged 58 years, supplies man.
Dennis John Jones aged 39 years, ripper.
Emrys Jones aged 43 years, deputy.
Robert Jones aged 36 years, deputy.
Sidney Jones aged 42 years, stablemen.
Thomas Daniel Jones aged 44 years, stableman.
Verdun Jones aged 54 years, general worker.
Fritz Knoedl aged 40 years, contractor's engineer.
Ieuan Marvyn Lewis aged 35 years, ripper.
Phillip Kenneth Lewis aged 33 years, undermanager.
Tom Lewis aged 46 years, powered support maintenance man.

The Inquiry into the causes of and the circumstances attending the outburst of coal and firedamp which occurred at the Cynheidre-Pentremawr Colliery, Carmarthenshire on 6th. April 1971 by J.S. Marshall, B.Eng (Mining), C. Eng. F.I.M.E., H.M. Divisional Inspector of Mines and Quarries. The proceedings were held on 4th. June when Mr. J.E.G. Roberts, H.M. Coroner for the Three Commots District of Carmarthenshire sat with a jury of eight persons. In accordance of the medical evidence the men died from asphyxia following an outburst of methane gas from the Road 2 Cross-cut Drivage in the Cross Measure 2 Section of Workings in the Big Seam. The report was presented to The Right Honourable John Davies, M.B.E., M.P., Secretary of State for Trade and Industry on the 10th. September 1971.

The first task after the disaster and the bodies had been recovered was to clear the gas put of the mine, This was done and it was found that about 35 yards of the roadway was full of the outburst material. The outburst of coal was so powdery that it was necessary to fill it into sacks to transport t outbye on the conveyor. During the clearing, a stone seven feet by four feet by two feet was found. This had apparently cone from the roof at the face of the heading about 30 yards away. More stones were found as the work went on. Soon after filling was commenced it was noticed that the dust was hot.

When the recovery operations reached the inbye end of the Cross-cut Drivage it exposed a roll in the roof of the seam which rose steeply and flattened out after a
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vertical displacement of about 12 feet. The last steel arch support erected at the face had been buckled against its neighbour by the force of the outburst. As work went on material continued to slide down from the roof and a cavity 20 feet by 12 feet was formed. This cavity became further enlarged as the disturbed strata in the roof began to peel off. This was altering the character of the site and filling out was suspended on 19th. April 1971.

The mouth of a narrow cavity running over the top of the seam could be seen at the to left hand corner of this large cavity and because this appeared to be a typical outburst feature, further attempts were made to secure the cavity to permit closer inspection. This work proved too hazardous and was finally abandoned on 6th. May 1971 and the heading was abandoned and sealed off.

The inquiry came to the conclusion that a spontaneous outburst of coal and firedamp occurred on the geologically disturbed ground at the face of the No.2 Cross-cut Drivage. 400 tons of coal were ejected along with very large volumes of firedamp and went on to recommend that-

- 1) "where narrow headings in coal are driven every endeavour should be made to arrange the general layout and coursing of the ventilation so that in the event of an outburst in the heading, the gas would pass directly to the main return.
- 2) advance boring, sampling and determination if the desorption ratio of the coal should be adopted in all coal headings.
- 3) having regard to the fact that, in this case, all six persons died from shortage of oxygen, careful consideration should be given to the provision of breathing aids to sustain life of persons caught in the gas from an outburst. This might include the use of compressed air lines with frequent breathing points similar to those which are used in the Silkstone Seam at certain mines in Yorkshire. Consideration should be given to the development of specially designed breathing apparatus to be carried by the individual.
- 4) Loudspeaker communications should be installed throughout the workings of each main ventilation section. Any such communications system should have an independent power supply so that it will remain in operation if the colliery mains electricity supply had to be switched off. When satisfactory automatic firedamp alarms are developed they should be coupled to the system."

The Inspector concluded the report by recording that the Joint Advisory Committee on Outbursts of Coal and Firedamp had been enlarge to include additional members with the special scientific and engineering expertise and the inquiry recommended that the Committee should carry out a thorough review of inducer shotfiring techniques for use in both headings and an longwall faces and the the Code of Precautions should be revised as necessary. All times whilst working, and that it is not placed within two feet of the swing of the pick or other gear with which he may be working.

SOMETHING MISSING

67).Not to allow any door to be fastened or propped back on its hinges and to see that every door is so hung that it will fall to and close.

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68).The fireman in each district shall before quitting at th end of the day see that all men are out, and that everything is safe and in order, and enter the same in his report book.

ENGINEER.

69).The whole of the machinery with its appendages, and all erections on the surface and underground are in his charge, and he must keep them in thorough and efficient repair at all times, under the direction of the manager.

70).To inspect and direct the repairs of all engine, coal and other shafts. to at once remedy anything reported to him in his department as unsafe or defective, and to carry out General Rule 13.

71).After cleaning the boiler he shall examine it externally, also the mountings no boiler, unless

LOFTHOUSE. Wakefield, Yorkshire. 21st. March, 1973.

The Lofthouse Colliery was in the North Area of the National Coal Board and was about 2 miles to the north of Wakefield on the western fringe of the workable coalfield. Production began at the colliery in 1877 and at the time of the accident the colliery produce 18, 500 tons of saleable coal per week and employed 837 men below ground and 207 at the surface.

There were four shafts. The A was the downcast and was 18 feet 6 inches in diameter and the B, the upcast was 15 feet in diameter were at Lofthouse and the Silkstone which was am downcast and the Beeston which was upcast of 14 feet in diameter were at Wrenthorpe about one and three quarter miles to the south. The Silkstone shaft had winding equipment but there were no winding facilities at the Beeston shaft. At the top of the B shaft there were three Aerex fans in parallel which extracted 180,000 cubic feet of air per minute at 7 inches water gauge. A Keith Blackman centrifugal fan extracted 60,00 cubic feet per minute at 3.2 inches water gauge at the Beeston shaft at Wrenthorpe.

Electric cap lamps were in general use with flame safety lamps issued and firedamp detectors. Certain officials were also issued with methanometers. The officials holding statutory appointments at the time of the accident were, Mr. T, Wright, Acting Area Director, M.r G. Hayes, Deputy Director (Mining), Mr. W. Forrest, Chief Mining Engineer, Mr. R.P. Hollis Deputy Chief Mining Engineer (Mine Planning and Surveying), Mr. T. Donnelly, Production Manager and Mr. T. Mapplebeck, colliery manager.

The coal was won from longwall advancing mechanised faces and the seams that were worked in descending order were, the Flockton Thin which had three working faces, the Eleven Yards with one working face and the Beeston which had two working faces. Development was taking place in the Blocking Bed seam which lay between the Eleven Yards and the Beeston seams. Very little water was pumped from the mine. The main intake at the Lofthouse A and B shafts was from the old Haigh Moor workings and was between 160 and 230 gallons per minute depending on the season. At the Wrenthorpe shafts there was a well shaft 63 feet deep, from which 33 to 35 gallons of water per minute were pumped. The make of water in the main shafts at Wrenthorpe was only 15 gallons per minute pumped from the Silkstone pit bottom.

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The south 9B district was in the Flockton Thin seam to the west of the South 4 loader gate and the face was 5,600 yards from the Lofthouse pit bottom. The Flockton seam was 34 inches thick which included a dirt band three inches thick. The roof was of a medium grey shaley mudstone and the floor was also of mudstone. The face lay about 220 yards below the surface and two seams were worked above it 120 to 130 years before. They were the Gawthorpe, (Warren House) at a depth of 50 yards and the Top Haigh Moor at 120 yards. The Silkstone seam was about 80 yards below the Flockton Thin and was worked around 1914.

Access to the South 9B district from South 4 loader gate was gained by a cross measure intake drift dipping 1 in 6 through faults of 48 feet vertical displacement. A 216 yards long single unit conveyor face was formed in the seam, with the return airway connected by an overcast to a roadway leading to the Wrenthorpe shafts, a slit at the air crossing, with two wooden air lock doors, provided a connection between intake and return.

Production commenced in December 1971 and the coal was won on three shifts per day by a double ended conveyor mounted trepanner taking full thickness of the seam and 2 inches of dirt from the floor. The trepanner took a 26 inches web and the average weekly advance was 20 yards and the face had got to a rise at 1 in 24 for a total of 1,060 yards when the inrush occurred. At the main gate of the face an advancing heading 4 feet 6 inches high was taken 18 to 25 feet ahead of the general face line and a stable at the same height extended 12 feet along the face. At the tail gate there was an 8 feet long stable at seam height. Rigid bars and hydraulic props were used in the roadhead areas and powered supports throughout the face.

Both gates were formed by conventional ripping and packing, with the main gate supported by arch girders 10 feet wide and 8 feet high set at 3 feet intervals and the tail gate similarly supported by 8 feet wide by 7 feet high steel arches. The district was ventilated by a separate split giving 11,700 cubic feet of air per minute on the face. Methane drainage was installed from the tail gate with holes 120 feet long spaced at 120 feet intervals at right angles to the gate and inclined at 45 degrees over the waste. The methane content at the statutory measuring point was about 0.3 per cent. The amount of water in the district was small and systematic pumping was necessary. Although there was small fault on the face, 80 yards from the main gate and weighted breaks were evident from time to time, the roof was well controlled by five legged powered supports.

Work on the afternoon shift of 20th. March was normal and operations ceased as usual at 7.30 p.m. by which time the trepanner had taken two webs from the face and was in the tail gate. During the night shift of the 20/21st March, the district had 27 men working there. E. Finnegan was the deputy and he made his pre-shift inspection stating in the tail gate and reported to B. Oldroyd, the overman when they met in the main gate about midnight, that the face was normal. Work then commenced on coal filling, advancing the heading and stables and ripping both roadheads and proceeded without incident apart from the usual brief interruptions. With the men at work there were four ripper, two stable hole men and a shotfirer at the tail gate, four face men and the deputy who had returned from the main gate on the face near the machine and forty yards towards the tail gate there was an electrician. In the main gate roadhead area there were two men in the advance heading, a supports man in the stable, four rippers and a shotfirer near the ripping lip and an overman at the stage loader with a fitter, who had arrived there from the face. Along the conveyor roads there were four transfer point men, two in the South 9B district main gate and the other two further outbye.

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At about 2 a.m., the trepanner, which had cut to powered support No.60, approximately 70 yards from the main gate, was stopped together with the face conveyor because large stones were being broken at the main gate roadhead. The face conveyor never restarted. The inrush was sudden and violent and water flowed in both directions along the face. It was therefore impossible to set down briefly in correct chronological order the events which followed.

At approximately 2 a.m., T.Denton, the electrician was travelling along the face from the tail gate and was examining the power loader cable midway along the face when he heard a bang, looked up and saw water flowing towards him from the direction of the trepanner. He made his way immediately to the tail gate with the water at the height of the conveyor, about 7 inches, flowing alongside him. By this time it had become apparent to those at the tailgate roadhead that something was wrong and R. Barrett, the tail gate shotfirer, attempted to make contact by telephone with anyone who might be available but got no reply. At 2 a.m. B. Kus was in advance of the face near the main gate roadhead when he heard a rumbling noise, looked along the face and saw lights at what he estimated to be 30 yards. He then heard a loud crack and saw his workmates at the roadhead start to run outbye. He shouted a warning to C. Barnaby who was in the advance heading. As Kus made his way out past the ripping lip he was overtaken by a wave of water at the full height of the seam which knocked him against the side of the road. He dragged himself upright and ran outbye.

Oldroyd, the overman which was at the stage loader, heard a heavy rumbling noise and thought the ventilation had reversed. He saw the main gate men running towards him and heard someone shout that water had broken in. He then tried, without success, to contact the facemen over the loud hailer. The water was now at knee height in the main gate and he hurried outbye to the conveyor tandem point, where he tried to contact the surface by telephone but was unable to do so. Oldroyd then tried to ride out on the gate conveyor but this stopped almost immediately so he jumped off and ran. He passed C. Cotton, a main gate ripper, and made his way to the top of the 1 in 6 drift where he again tried to contact the surface. He eventually did so from the South 4 loader.

K. Stone, a fitter who had travelled along the face with the trepanner to No.60 powered support, was at the main gate roadhead when he was warned that water had broken in. He ran outbye and when he passed the 9C south development heading he looked in and saw no one. Stone switched off the electricity to the development and continued outbye passing and warning S. Wojeck, the attendant at the conveyor transfer point at the outbye end of the main gate. He continued outbye and switched off the electricity supply to the main gate at the transformer house at the overcast, then ran on to the top of the 1 in 6 drift, where he picked up the telephone and found Barrett the South 9B tail gate shotfirer on the lone. He told Barrett, who was still at the inbye end of the South 9B tail gate, what had happened and was advising him to withdraw his men when Willoughby the main gate shotfirer arrived, took the telephone and told Barrett to withdraw his men immediately.

Barrett's conversation with Stone and Willoughby took place some time after his earlier unsuccessful attempt to make contact by phone but in the interval, no men had come off the face. On replacing the phone he instructed Denton to cut off electrical supply to the face and after G.Firth, the tail gate stableman, had gone back and looked along the face but could see nothing, all the men at the tail gate roadhead made their way outbye. When this party of eight men arrived at the slit at the air crossing, Denton opened the first door and saw that the second was bulging towards him with dirty water seeping through it. He retreated to the return and the party then travelled over the air

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crossing through South 9A gate and ultimately to South 4 gate. Had they delayed a little longer this escape route would almost certainly have been blocked. Later a check was made by Willoughby on the number of men who had got out of the South 4 gate, At approximately 2.35 a.m. K. Furniss the night overman who was at the pit bottom, was told from the surface control room that water had broken in. He gave instructions for the manger, the assistant manager and Wakefield Rescue Station to be contacted. Furniss was later instructed by T. Mapplebeck, the manager, to return to the surface to check on the number of missing men. It was established that Frederick Armitage, Colin Barnaby, Frank Billingham, Sidney Brown, Charles Cotton, Alan Haigh and Edward Finnegan were missing. All, with the exception of Charles Cotton and Colin Barnaby, were known to be last working on the South 9B face line. Barnaby was in the advance heading when the inrush occurred and Cotton was last seen making his way outbye down the main gate.

The emergency procedure was instituted by the manager shortly after 2.35 a.m. and the call was received by the Wakefield Rescue Station at 2.45 a.m.. led by W. Cave of the permanent rescue brigade, the first team went below to the South 4 gate and then to the 1 in 6 drift where at 4.35 a.m. the water was seen blocking the roadway 60 yards from the drift top. The team travelled towards the South 9B district by means of the return airway where, at the junction with South 9A return the roadway was also blocked by water. The inspection proved that South 9B district was completely sealed off.

T. Wright, the acting Area Director and his senior officials were soon at the colliery and they were quickly joined by A. Harley, H.M. Senior District Inspector of Mines and Quarries and a member of his staff. Shortly afterwards N, Siddal of the National Coal Board's Member for Mining arrived. After an assessment of the situation it was decided to install pumps in the 1 in 6 drift to lower the water level and regain access to the district. It was also decided to install a submersible pump in the Silkstone shaft at Wrenthorpe as it was apparent that the water would drain to this point. Other methods of rescue were discussed and a decision was made to bore from the surface to contact South 9B tail gate. The borehole was intended to be about 6 inches in diameter when it reached the roadway was commenced at 11.15 p.m. about 21 hours after the inrush had occurred. This considerable operation which involved the dismantling, transporting and re-building of a large drilling rig, was carried out with great speed.

In the meantime a surface visit had been made to the Old Low Laithes Colliery where it was found that the Bye Pit was exposed and water could be heard falling from it. Before mid-day it was reported that the Engine pit and Bull Pit were exposed and that water could also be heard falling down them. There was little doubt that there was direct relationship between the inrush into the Lofthouse workings and this water pouring down the old shafts. A decision was made to fill and seal them. Hardcore, baled straw and clay were used to get a water tight seal near the bottom and the filling from the surface was completed by hardcore. This would required great care to avoid further loss of life was finished by 11.30 p.m. on 23rd. March as was the filling on of a large depression between the Engine Pit and the Bull Pit. after the filling had been commenced, the Bye Pit was plumbed and found to be 54 feet deep to the top of the filling. It was later calculated that the depth of the shaft was approximately 660 feet.

Late in the afternoon of the 21st. March, the pumping of water at Lofthouse was making very little progress and it was decided that the mines rescue team from Hednesford, Staffordshire, the members of which were trained frogmen, should make a trial dive for 25 yards. That evening the men went in but they found the water too fouled an opaque and so full of material that it was too dangerous to dive. On 23rd, March,
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after the level of the sludge had been lowered, frogmen were then used in the 1 in 6 drift, near the entrance to the air crossing while they were trying to locate the slit between the intake and the return, conditions were too dangerous and the attempts were abandoned.

Although several pumps coupled in various pipe ranges were in use but difficulties arose and progress was slow due to the high proportion of solid material that was coming through the pumps. On 24th. March, work began on a small 'piggy-back' roadway over the arches at the foot of the 1 in 6 drift to try to gain access to the slot and to the tail gate over the wooden doors. When this was done on 26th. March work was suspended on the surface borehole. At 10.20 a.m. on 26th. March, the Lofthouse colliery No.,2 rescue team started from the 1 in 6 drift to inspect the South 9B tail gate. Passing through the 'piggy-back' roadway, the team dropped in to about 4 feet of sludge and water, which persisted for about 30 yards, after which it was possible to travel up the tail gate without hindrance. At five yards beyond the No. 20 methane drainage hole there was a slit and rubble which reached to about 3 feet 6 inches from the roof. The team crawled on top of this for a further 44 yards to a point 1,067 yards from the air crossing where further progress became impossible. Air samples were taken by the team at 160 yards and 760 yards inbye of the air crossing. The first sample was found to contain 6 percent firedamp, 13 per cent oxygen and 4 per cent carbon dioxide and would not have supported life. J. Coxon, the Area Chief Scientist, said although the samples were small but they were accurate.

At 12.45 p.m. Glasshoughton Colliery rescue team attempted to explore the intake road beyond the slit but they found water and sludge to within a few feet of the top of the arches at the slit junction, and after a few yards the underlying sludge became very soft. The team sighted a body about 7 yards inbye before they withdrew. Later that day R. Williams, H.M. Inspector of Mines and Quarries, recovered the body which was identified as Charles Cotton.

At 10 a.m. on 28th. March, A. Rollinson, an assistant superintendent of the Rescue Station at Doncaster, made an assessment of the possibility of exploring along the intake gate inbye the slit junction. Although the water level was within 14 inches of the roof at the outbye end. He found that the condition inbye improved. At 11.33 a.m. the Ledston Luck Colliery rescue team carried out an exploration and after some difficulty at the transfer point, travelled 490 yards beyond. Very high methane content was found in the air samples that they brought back. Later the Savile Colliery rescue team made an inspection along the same route and found that the road was blocked with debris about 917 yards inbye to the South 9C development heading. No survivors were found on any of these explorations and after consideration of the air sample results and the reports of the team captains it was agreed by all that there was no further hopes of finding anyone left alive.

The victims of the disaster were-

Recovered 26th March 1973-

Charles Cotton aged 49 years, faceworker and those who were not found-

Frederick William Armitage aged 41 years, faceworker,

Colin Barnaby aged 36 years, faceworker,

Frank Billingham aged 48 years, faceworker,

Sydney Brown aged 36 years, faceworker,

Edward Finnegan aged 40 years, deputy and

Alan Haigh aged 30 years, faceworker.

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Work was then directed to recover the district and despite the arduous periods of duty and the disappointments which followed the valiant efforts of the rescue workers they persevered in conditions of extreme difficulty and discomfort. On the 19th, April, all interested parties inspected the district. Mr. Mapplebeck spoke of the violence of the inrush and said that the water was still seeping through the debris which blocked both roadways at the time of the inspection. He pointed out that the artificially low level of the surface water table and referred to the possibility that the natural restoration of the water in the strata and old workings would put pressure on the debris which blocked the South 9B face and the inbye end of the main gate and tail gate. The opening up of the Bye, Engine and Bull Pits to the surface would cause water to flow down these shafts and from the fact that old shaft lining had been found in the district after the disaster, there was little doubt that there was physical connection between the old shafts and the old workings in the Flockton Thin seam and the district. When everything was considered it was realised that the recovery of the bodies would necessitate the clearing of the debris from the gates and face and would invite the possibility of a further inrush. It was decided that the risk was too great.

The inquiry into the causes and circumstances attending the inrush which occurred at the Lofthouse Colliery, Yorkshire on 21st. March 1973, was conducted by J.W. Calder, C.B., O.B.E., B.Sc., C.Eng., F.I.Min.E., H.M. Inspector of Mines and Quarries, at No. 1 Crown Court, Wakefield on 30th, May 1973 and lasted for eight days. the report was presented to The Right Honourable Peter Walker, M.B.E., M.P., Secretary of State for Trade and Industry on 30th. August 1973. All interested parties were represented.

The Inspector said that many of the possibilities of an inrush could have been foreseen. There was water in South 9B district, water was found in the shotholes, there was smell in the 9B district, there had been subsidence at the Bull Pit in September 1972 and the plans and records were available. The inquiry concluded that-

- 1) "the disaster was caused by an inrush of water from old workings in the Flockton Thin seam into the South 9B face at a point between 30 and 70 yards from the main gate roadhead
- 2) the old uncharted workings probably originated from the Bye Pit, now known to have been sunk to the Flockton Thin seam, and the Engine Pit of the long abandoned Old Low Laithes Colliery
- 3) the magnitude and the violence of the inrush were due to the shafts and associated wastes in the Gawthorpe and Haigh Moor seams being water logged over a considerable area
- 4) the victims whose bodies were not recovered were probably killed instantly
- 5) important decisions relating to the safe working of the mine were taken at the planning stage by surveyors and were accepted by the manager and the Section 1 appointees who did not call for and examine the supporting information
- 6) the implications of the environmental changes which took place in the district in the weeks immediately prior to the inrush were not fully appreciated."

The inquiry recommended that

- 1) "in planning for the extraction of an area of coal all the available evidence should be listed and attached to the layout plan. Minutes should be taken of all discussions and the final decisions should be recorded and should be taken by a senior mining engineer carrying appropriate responsibilities under Section 1 of the Mines and Quarries Act 1954

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- 2) when an area of coal under consideration includes old shafts or workings prior to 1900, the utmost care should be taken during the preliminary investigation to ascertain their position and extent. In the absence of positive information the coal should not be worked
- 3) approaches to the Institute of Geological Sciences relating to areas of coal which are intended to be worked should be accompanied by a written request for information so that the full facilities of the Institute can be utilised
- 4) the National Coal Board and the Institute of Geological Sciences should set up a small working party to consider the feasibility of preparing a catalogue of old geological field note books and other documents to ensure that these sources of information are not overlooked
- 5) a national appeal should be launched by the Department of Trade and Industry for old mining plans held in private hands to be made available for copying
- 6) the development of equipment capable of handling fluids with a high solids content should be pursued.”

SEAFIELD. Kirkaldy, Fife. 10th. May, 1973.

The Seafield Colliery was situated on the southern outskirts of Kirkaldy and worked the measures beneath the Firth of Forth which dipped between 1 in 3.2 and 1 in 1.4 with workings in the Productive Coal Measures both above the Millstone Grit and the Limestone Coal Group. Two shafts were sunk at the colliery in 1954 and were 24 feet in diameter, lined with concrete. Insets were made at 170 fathoms and 300 fathoms and horizon mines were driven for two miles to the south cutting with all the seams under the Firth. A stone mine was driven for one and a quarter miles from the 170 fathoms horizon mine and for one mine from the 300 fathom horizon mine, to allow development of the No.2 Sub-Crosscut are. The mine was ventilated by a Howden Centrifugal fan at the top of the No.1 shaft which extracted 350,000 cubic feet of air per minute at eight inches water gauge.

At the time of the accident the National Coal Board areas were still operating in Scotland certain appointments for an amalgamation of one area were already effective and the principle officials at the Seafield Colliery were the Area Director, J.R. Cowan, the Area Chief Mining Engineer, Mr. G. Gillespie, the Area Deputy Chief Mining Engineer (Mining Services), Mr. A. Ludkin, Production Manager, Mr. J. Gibb and the Colliery Manager, Mr. D.T. Paterson. Mr. J.C. Fox, the Deputy Manager had statutory responsibility as undermanager for the colliery and there were six statutorily appointed undermanagers. The undermanager in charge of the D.22 district in the Dysart Seam was Mr. J. Simpson. It was here that an extensive fall of roof killed five men and injured and trapped others. All the undermanagers worked on the day shift and on the afternoon and night shifts senior overmen were in charge of the mine

Production began in 1965 and at the time of the accident the weekly output was an average of 26,000 tons with 2,100 men employed below ground and 300 on the surface. There were nine workable seams at the colliery with estimated total reserves of 85 million tons but apart from the first two faces, which were in the Five Foot Seam in the Limestone Coal Group, all the other faces had been in the Productive Coal Measures, the seams were, in descending order, the Barncraig, the Six Foot, The Bowhouse and the Dysart Main. At the time of the accident the output was from six fully mechanised faces, the Six Foot (S.02) longwall advance which produced 4,100 tons per week, the the Six Foot (S.03) longwall advance which produced 4,100 tons per

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week, the Bowhouse (W.04) longwall retreat which produced 2,000 tons per week, the Dysart Main (D.09) longwall retreat which produced 7,200 tons per week, the Dysart Main (D.10) longwall advance which produced 6,100 tons per week, the Dysart Main (D.22) longwall advance which produced 1,000 tons per week and the development roadways which produced 1,500 tons per week.

The D.22 face was the deepest of three faces that were intended to be worked to the south and after some difficulties that face commenced production on 24th. April 1973 but there was very little output before the accident because of problems with the powered supports and the grading of the face conveyor which had not been overcome when the accident occurred. Many of the supports were not pressurised against the roof. Small coal that was thrown over the shearer drums and spillage from the conveyor accumulated on the waste side of the conveyor to such an extent that the supports were sometimes set on a layer of small coal.

Changing of clevises appears to have continued on the afternoon shift of 10th. May but it was impossible to gain a clear picture of what was actually done. The work had been held up because pins for the D clevises were missing but it was established during the investigation that when the fall occurred supports 104, 106, 107, 117 to 122 inclusive and 127 and 130 were not connected to the conveyor. At about 6.30 p.m. D. Dickson, E. Downes and A. Guthrie were returning to the tail gate after taking planks down to the face to support 100, J. Comrie, R. Henderson and T. Kilpatrick were advancing supports, J. McCartney and J. Todd were working on the face side of the conveyor and J. Holmes was travelling up the face. J. Hay and W. McDuff were advancing supports and having difficulties with support 91. The bolt connecting the relay bar to the advancing ram broke and the support moved back slightly into the waste. They had to reset it where it was but were unable to pressurise the back legs, because the roof had fallen on it over the rear part of the canopy. At this time the waste began to fall and because of the noise and the amounts of dust produced, Hay went up the face to support 106 while McDuff retreated down the face. After a short time they returned to 91 but decided to go lower down the face for their 'piece' before resuming work.

McCartney working in the face track near support 126, had, earlier in the shift he noticed a hairline crack in the roof above him extending for 30 feet or more on either side and shortly after the roof began to fall into the waste, opposite Hay and McDuff at support 91. He was the crack open up to about nine inches to a foot with a depth of three or four inches. McCartney said that had two falls into the waste lower down, the roof over him just gave way in one large 'Bit'. His words were - *'the whole roof slid down the hill taking chocks and almost everything with it.'*

Dickson, who had just passed McCartney and was at support 132. He said.-

"The roof in the waste was bursting and I said to Eddie Downes, 'its taking its first break', I felt perfectly safe in the Gullick chock. we just proceeded two or three chock lines and I just saw the roof moving, I had seen the roof moving and the chocks beginning to topple over. I saw the roof above the Gullick chocks and I saw the Gullick chocks above men starting to topple over. I must have turned to hide myself that is the last thing I remember. I must have been knocked unconscious or something till I came to myself and was completely buried."

The fall was 6 to 8 feet high and extended from support 90, which remained upright and pressurised to the roof, to support 155 which also remained in the same position. All the supports between were toppled with the exception of 152, 153 and 154 which

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remained upright. the total length of the fall, which was the full width of the excavations was about 210 feet and with the exception of Hay and McDuff all of the men mentioned were trapped.

A. Bell, overman and R. Stewart, face overman were in the main gate when the fall occurred at about 6.45 p.m. and because the face telephone was knocked out by the fall, they had to inspect both sides before they could find the full extent of the fall. Shortly after 7 p.m., Bell reported to the surface control centre that there had been a heavy fall on D.22 face and that men were trapped. J.C. Fox the deputy manager, was contacted by telephone and after making sure that the manager had been informed, he went to the colliery. Here he met J. Simpson, the undermanager and they both went in by to D.22 collecting men on the way who could assist in the rescue work.

In the meantime, D.T. Paterson, the manager, arrived at the surface and put the emergency scheme into operation calling the rescue brigades and first aid workers. While Fox and Simpson were travelling in by, they met a stretcher party bringing McCartney out. He had survived and escaped unaided from the centre of the fall by walking through the waste behind the powered supports to the tail gate roadway. He gave the approximate location of the trapped men and confirmed that they were still alive.

Fox and Simpson found it impossible to pass along the face between supports 90 and 152. Simpson took charge of the operations on the top side of the fall while W. Kerr, an overman, took charge below it and attempts were made to reach the trapped men over the top of the fallen stones. Wood chocks were erected on the stones but this proved to be too difficult and dangerous because the foundation was too insecure and there were large overhanging stones on the side of the face.

Fox was joined by I.L. Davies, H.M. Inspector of Mines and Quarries and J. Gibb the production manager who had been alerted by telephone through the emergency scheme. shortly after 10 p.m. It was found possible to get to the top of the fall from the bottom side and an assessment was made of the situation. The unsupported roof of the cavity seemed smooth and strong over the entire area which was roughly 30 feet wide and 210 feet long. The fallen material was well laminated and there were massive slabs of stone mixed with stone fragments which made the floor uneven and because of the steep inclination, very dangerous to walk and work on.

By 10.40 p.m. the first body was found at support 115 and was identified as Comrie. Nearby Henderson was calling for help and was released from within the main structure of the support and placed on a stretcher at about 12.30 a.m. on 11th. May. oxygen was given from a reviving apparatus but he died almost immediately. Rescue attempts from the top side had to be suspended because material was sliding down on the men working at the bottom end. at support 123, Holmes and Todd were trapped by the structure of the support and while they were being released, Fox took a party up to support 135 where Dickson and Downes were released at 1.30 a.m. Guthrie was found dead in a position between the supports immediately above Downes and Dickson but his body could not be recovered at that time. Holmes died soon after being released.

No trace could be found of T. Kilpatrick who was presumed to be dead and buried under the massive stones at the lower end of the fall and because of the steep slope and the dangerous conditions the only hope of recovering his body was to work systematically down the face from the top end. The work was started almost immediately with steel arched girders erected close to the end of the coal face and

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spanning the face conveyor. Progress was slow as the girders had to be bolted to the roof and the solid ground over the face. at about 8 a.m. on Saturday 19th. May, Guthrie's body was recovered and taken to the surface not Kilpartick's body was not recovered until 3.30 p.m. on 6th. June. It was found 16 feet from the waste side of the conveyor near support 109.

The men that lost their lives-

James Comrie aged 49 years, assistant shearer operator,

Angus Guthrie aged 20 years, brusher,

Robert Henderson aged 59 years, chocker,

James Holmes aged 53 years, chocker and

Thomas Kilpatrick aged 38 years, leading man.

The injured-

David Dickson aged 48 years, brusher,

Edward Downs aged 57 years, brusher,

James McCartney aged 26 years, chocker and

James Todd aged 29 years, chocker.

The inquiry into the diaster was conducted at the Technical College, Kirkaldy, Fife on 8th. August 1973 and lasted for seven days.it was conducted by Mr. J.W. Calder, C.B., O.B.E.,B.Sc.,C.Eng., F.I.Min.E., H.M. Chief Inspector of Mines and Quarries and the report was presented to The Right Honourable Peter Walker, M.B.E., M.P., The Secretary of State for Trade and Industry on the 19th. November 1973.

In the weeks following the disaster a full examination of all the factors contributing to it was made and a full and extensive testing program was carried out on all equipment and working in steep seams. In his report, Mr.Calder came to the following conclusions-

- 1) "An extensive a fall of roof occurred on D.22 face in the Dysart Main seam extending for a distance of about 210 feet and displacing 61 powered supports.
- 2) The fall started near powered support No.90 when the roof beds in the waste broke down heavily and over-ran several powered supports on the face line at a point where there were natural slips in the roof. Bed separation of the immediate roof strata had already taken place at a well defined smooth parting 6Å to 8 feet above the seam, and the effect of the first fall was to release the detached roof which broke over the coalhead and collapsed so that large blocks of roof stone slid down and reeled out the supports, pushing then downhill and backwards into the waste. There followed a progressive collapse of the roof on the rise side.
- 3) The supports were set on a irregular floor with varying thickness of spillage coal underneath them and many were not fully pressurised to the roof. In addition, 12 were not connected to the conveyor, because of this they were not sufficiently stable for the inclinations on which they were in use.
- 4) Much of the trouble arose because the horizon control difficulties with the power loaders but the development of the face heading to a height in excess of the maximum extended height of the powered supports was unsatisfactory. The supports could not be fully pressurised to the roof and this allowed bed separation to occur as the face moved away.
- 5) The development of the face at an angle lead of 17 degrees produced a steep inclination in the line of advance and this contributed to the instability of the supports and the ease with which they were pushed back into the waste.

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- 6) Planning arrangements did not ensure that the most stable supports available in the area were reserved for use in D.22 face.
- 7) The supervision in the district was not up to the standards required for modern methods of working and in particular, consultations between district officials did not ensure that urgent unfinished tasks, such as the changing of clevises, received the necessary amount of attention necessary for prompt completion. An improvement might well be achieved by the adoption of shift working by under managers as provided for in Section 2 of The Mines Management Act. 1971.”

The Chief Inspector also made the following recommendations-

- 1) The Committee formed to study all aspects of the working of steep seams in coal mines should give priority to the design and development of a purpose built powered support for use on steep faces.
- 2) The National Coal Board should examine critically its planning arrangements to ensure that the most suitable type of support is selected for steep faces.
- 3) The arrangements for the approval of powered supports under Regulation 16(2) of the Coal Mines and Other Mines (Support) Regulations 1966 should be revised to ensure that all supports used on faces in steep seams are subjected to additional tests which simulate the conditions under which they will operate.
- 4) All power loading machines used on steep faces should be fitted with steering under frames and consideration should be given to their automatic operation.
- 5) The research to improve the design, loading characteristics and shielding of shearer drums should be given a higher degree of priority.
- 6) The arrangements for supervision by underground officials at modern highly mechanised mines should be reviewed to ensure that consultation at change of shift is adequate and that an official, statutorily appointed as an undermanager is on duty on all production shifts.
- 7) Provision should be made for special training facilities for men who are to be employed on steep faces.”

MARKHAM. Chesterfield, Derbyshire. 30th. July, 1973.

At the time of the accident the Markham Colliery was one of 14 producing mines in the North Derbyshire Area of the National Coal Board. It was near the village of Dickmanton about 5 miles to the north east of Chesterfield. It produced about 30,000 tons per week of saleable coal and employed 1,870 men below ground and 425 on the surface. There were four shafts at the colliery arranged in pairs with No.1, a downcast and No.4 upcast near the general offices and No. 2 downcast and No. 3 upcast about 300 yards to the south. Coal winding was confined to Nos. 1 and 2 while Nos 3 and 4 were used for winding men and materials. At the top of the No.3 shaft there was an Aerex radial flow fan which extracted 238,000 cubic feet of air per minute at 9.8 inches water gauge.

The principle officials who held statutory appointments at the colliery including the winding equipment at the No. 3 shaft were Mr, R.B. Dunn, Area Director, Mr., J, H. Northard, Deputy Director (Mining), Mr. T.W. Peters, Area Chief Mining Engineer, Mr. G. Godfrey, Area Chief Engineer, Mr. J. Rodgers, Colliery General Manager, Mr. W.

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Fox, Colliery Mechanical engineer and Mr. C.C. Levers, Colliery Electrical engineer. There were two deputy Managers and each held statutory responsibility as Undermanager for a part of the colliery. Mr. D. Hotchkiss was the Senior Deputy Manager who was responsible for the surface and No. 3 shaft. The other officials who had responsibility including the winding equipment at the No. 3 shaft were Mr. A.G. Hartley, Area Mechanical Engineer, Mr. M. Blythe, Area Electrical Engineer and Mr. J.A. Plant, Colliery Chief Engineer.

The No.3 shaft was sunk to the Deep Soft seam in 1886 at a depth of 1,626 feet. Later 189 feet of the pit bottom was filled in which made the shaft 1,407 feet deep which was the Ell Coal seam level. The shaft was 15 feet in diameter and was brick lined throughout. There were two double-deck cages each of which was capable of carrying 16 people per deck and the cage was attached to a one and one eighth inches diameter locked coil winding rope which was guided down the shaft by four one and half inch diameter half locked coil ropes on the side nearest the shaft wall. There were two rubbing ropes between the cages and these together with the guide ropes were suspended from white metal swivel glands in the headframe and tensioned by weights in the shaft sump. In the pit bottom the cages landed on wooden baulks set into the shaft walls. On the north side a platform gave access to the top deck so that simultaneous loading or unloading of men could take place. At the top of the shaft a circular brick tower formed an air lock and supported the steel frame from the detaching bells and the headgear which had back stays to ground level. Steel tie rods from the frame to the brick tower gave additional stability. Access to an overwound cage suspended from the detaching bell was provided but there was no headframe catches to support a cage in that position. Either cage could ascend 15 feet 9 inches above the normal decking before it was detached from the winding rope.

The winding engine was a 440 h.p. Ward Leonard supplied by the British Houston Company Limited of Rugby. The mechanical parts were designed and manufactured by Markham and Company Limited of Chesterfield. The engine was installed at the Do Well Colliery which was owned by the Staveley Coal and Iron Company Limited in 1921 and transferred to the Markham No. 2 shaft about 1830. In 1945 a cylindrical drum was fitted with a centre ring and in 1949 a replacement automatic contrivance of the torque controller type was installed and commissioned by Tudor Auto Services Limited which at the time of the accident was called Blacks Equipment Limited. In 1952 the original deadweight brake was replaced by a servo-spring brake unit which was in use at the time of the accident. At the same time a Lockheed hydraulic impulse brake tripping system was installed but this was replaced in 1960 a Blacks high pressure oil tripping system. In the same year the 30 hertz alternating current apparatus was converted to operate from a 50 hertz power supply. In 1961 the number of men permitted to ride in the cage was increased from 24 to 32. Thicker barrel plates and a new centre ring were fitted to the drum in 1963 and the cast iron brake shoes and fulcrum brackets were replaced by mild steel parts the following year.

The engine was used to wind only men, materials and limited quantities of stone and as this did not require a constant winding cycle, it was left to the enginemen to regulate the speed and rates of acceleration. The ropes were attached to the drum by means of white metal sword capels which were bolted to the drum sides next to brake paths and were double layered when they were fully wound on. A new rope had about 11 'dead' coils to allow for recapping. The drum was connected by a slid coupling to a direct current winder motor which had separately excited field windings and an open loop control system. The armature was supplied by the generator of a Ward Leonard motor generator set which was driven by an alternating current slip-ring induction motor

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housed with the associated control equipment in a separate building adjacent to the winding engine house.

The speed and the direction of rotation of the winder motor were controlled by the engineman's control lever within a quadrant which had a middle 'off' position. Forward or backward movement of this level operated electrical contacts which determined the polarity of the generator field and thus the direction of rotation of the winder motor. The lever also operated a rheostat which varied the generator field strength and hence the output voltage of the generator. Except at low speeds the winder motor speed was proportional to the voltage for a particular load but for each change in the load these proportionally altered.

One of the winding enginemen described a normal wind with equal number of men in each cage said that after receiving the necessary signals, he moved the control level in the appropriate direction from the 'off' position, gradually applying power to the winder motor and slowly releasing the mechanical brake. The voltage applied to the motor was increased to accelerate the winding drum until the voltage reached 300 to 320 which gave a drum speed of about 20 feet per second (13.6 miles per hour). This speed was maintained until the position of the cages in the shaft corresponded to about 10 drum revolutions (283 feet) from the end of the wind when the generator voltage was gradually reduced by moving the control level towards the 'off' position to increase braking. This regenerative braking was available to reduce speed during a wind and if there was a descending out-of-balance load, to maintain a selected speed. During this regenerative braking, the winder motor, which was then being driven by the load, became a generator with an output voltage higher than that of the Ward Leonard generator. This caused the generator to drive the alternating current motor which in turn became an induction generator feeding power back into the colliery supply system which thus produced a braking effect on the winding engine. The engineman continued this braking as the wind continued by progressively reducing the voltage to about 200 at 6 drum revolutions (184 feet) from the end of the wind, when a warning bell rang. He continued to decrease the voltage and the speed of the cages by gradually bringing the level to the 'off' position. At about four revolutions (113 feet) from the end of the wind he progressively applied the mechanical brake until the cages came to rest. With a heavy out-of-balance load descending, the engine was controlled in a similar manner but the mechanical brake was applied earlier.

The engineman estimated the loads in the cages from readings of the winder motor current on a centre zero ammeter which was connected in the main direct current loop. When loads in the two cages were similar the starting current was about 800 amps. and this reduced to zero as the cages approached mid-point of the shaft. As the weight of the descending ropes became predominant, the motor current automatically reversed to produce the regenerative braking. The value of the current was indicated on the opposite side of the ammeter scale. With a minimum out-of-balance load descending the starting current was lower, regenerative braking developed earlier and the magnitude of the braking current was greater than that obtained with equal loads in the cages. Although the regenerative braking provided an efficient means of reducing the speed of the Ward Leonard winding engine, it was available in the No. 3 winding engine only when the electrical systems were operating normally. There was no regenerative braking if the power supply failed, if any of the safety devices operated or if the emergency stop button was pressed.

At the time of the disaster a Burns Cradle type brake was in use. It consisted of a pair of Ferodo lined brake shoes applied to the underside of the brake paths by the action

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of a compressed spring nest operating through a system of levers. The brake was released by using compressed air to counteract the force of the spring nest and move the brake shoes away from the drum brake path. During normal braking the winding engineman's brake lever operated an Iversen type valve which controlled the flow of compressed air to a servo-cylinder. The force from the spring nest was transmitted to the main level of the brake system by a 2 inch diameter steel rod 8 feet 11 inches long which was located in the centre of the nest, constrained by a plate at the top and connected by a crosshead trunnion to the main lever at the bottom. The piston of the servo-cylinder was connected to the free end of the main lever and when compressed air was admitted to the cylinder this lever was forced down and the brake released.

If the emergency power supply failed or any of the safety devices operated, or the emergency button was pressed, the emergency brake solenoid was de-energised and the 'un-grabbing' gear immediately disengaged the engineman's brake control level from the Iversen valve and caused the mechanical brake to be applied. The 'un-grabbing' gear could not be reset until the brake control level was returned to the 'brakes on' position and the safety circuits energised.

The automatic safety equipment was a Black's controller driven from the drum shaft through a system of gears which also drove a vertical pillar type depth indicator which showed the position of the cages in the shaft. It was designed to cut off the power supply to the winder motor and cause the mechanical brake to be applied to prevent the cages, reaching an excessive speed in the acceleration, constant speed of retardation zones, being landed on the baulks at a speed exceeding five feet per second and travelling beyond a predetermined position above the highest landing. The controller had a centrifugal governor, dial mounted cams and overspeed and overwind switches which operated in conjunction with back-out switches and two electrical safety circuits.

One of the circuits, which included the brake solenoid and all the protective features provided by the automatic safety equipment was interlocked with the pilot safety circuit which had two contactors in parallel. These contactors could be tripped by various safety devices including the winding engineman's emergency stop button, and overwind switch on the depth indicator, the Ward Leonard overcurrent relay and the slack rope and brake wear switches. The pilot safety connectors had contacts in series with two parallel connected main safety contactors which controlled the supply of electricity to the winder motor and the brake solenoid. Visual indicators in the engineman's cabin showed correct or incorrect operation of the pilot and main safety contactors.

Before the winding engineman operated a lever which, through a linkage, altered the position of one of the cams on the automatic safety contrivance to enforce lower winding speeds. A switch on the lever gave a visual indication to the banksman, onsetter and the winding engine man that the lever was set for 'man winding' but did not positively prove the position of the cam on the automatic contrivance. A rope speed indicator was installed in the engineman's cabin next to the ammeter about 13 years before but the associated tach-generator was not fitted and the indicator never operated.

At about 5.335 a.m. on Monday 30th. July 1973, the day shift winding engine man R.W. Kennan, arrived at the No.3 winding engine house as the last of the night shift men were being wound to the surface. Some 20 minutes later Kennan operated the winding engine to wind the first day shift men into the mine and by about 6.20 a.m. 105 person

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had been lowered. The overlap rope cage on the Bolsover side was then loaded at the surface with 15 men on the top deck and 14 on the bottom. The underlap cage on the Roadway side was empty. The wind proceeded normally until the cages had passed the mid point of the shaft when Kennan began to retard the engine and out of the corner of his eye saw sparks under the brake cylinder and heard a bang. He immediately moved the control level towards the 'off' position to increase the breaking effect and simultaneously pulled the brake lever towards the 'on' position. The operation of the brake level felt the same as 'picking up a pen' and had no effect on the speed of the winding drum. Kennan continued moving the control lever towards the 'off' position but it appeared to him that this had little effect on the drum speed so he pressed the emergency 'stop' button. He expected to see the drum brought to a sudden stop but nothing happened and as a last resort he switched off the motor for the hydraulic pump which supplied the 'ungrabbing' gear. This had no effect on the winding engine and the next thing Kennan remembered was bricks falling around him.

The ascending cage was detached from the underlap rope by the operation of the detaching hook in the headframe bell but continued to ascend until it struck the roof girders of the airlock structure where it broke the surrounding concrete and brickwork. As there were no shaft catches in the headframe the cage dropped back until it was hanging by its suspension chains from the detaching hook. The descending cage carrying the men crashed into on the pit bottom with such force that it fractured nine of the 17 wooden landing baulks. Although the power had been cut off before the crash, the momentum of the winding system unwound spare coils of overlap rope and the sword capel with part of the drum side and brake path was torn away. The rope and capel were pulled over the headgear pulley and then it fell down the shaft on top and alongside the cage containing the men. The drum continued to rotate and the flailing capel of the underlap rope seriously damaged the winding engine house and an adjoining workshop.

It was immediately obvious to the men at the bottom of the shaft that a serious accident had occurred and the onsetter entered his cabin to telephone the surface the winding rope was still falling down the shaft. He was unable to obtain an answer to his emergency call on the automatic telephone but spoke to the surface operator on a magneto phone. The mine emergency organisations was brought into operation with a control centre at the surface.

On the north side of the pit bottom some of the tangled winding rope had to be moved and there was difficulty in opening the cage gates because their vertical rods had been distorted in the crash but once the gate were open, the removal of the casualties proceeded quickly. Morphia injections were given to the very seriously injured as they lay in the pit bottom before they were transported to the surface. Some were brought out through the nearby No.2 shaft and to minimise the delay others were carried out down a steep drift to No.4 shaft about 700 yards away. The last casualties arrived at the medical centre about two hours after the accident.

In the early stages of the recovery there was some delay in getting the injured to hospital but the situation improved as the County Authority sent more ambulances. The mobile emergency winding engine from the Mansfield Rescue Station was in position alongside the No.3 shaft about 80 minutes after the disaster. During the rescue operations, one of the workers was badly injured. J. Maxwell who had started work at the pit only that morning was the pit bottom at the time of the accident and was seriously injured when he fell from the top deck platform while assisting in the recovery.

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Those who died-

Joseph Birkin aged 60 years, faceworker.,
Clarence Briggs aged 52 years, deputy,
Joseph William Brocklehurst aged 58 years, deputy,
Clifford Brooks aged 58 years, deputy,
Henry Chapman aged 48 years, deputy,
George Richard Cooper aged 30 years development worker,
George Eyre aged 60 years, gearhead attendant,
Michael Kilroy aged 53 years, development worker,
Jan Kiminsky aged 58 years, development worker,
Lucjam Plewinsky aged 59 years, general worker,
Frederick Reddish aged 52 years, development worker,
Wilfred Rodgers aged 59 years, face worker,
Charles Leonard Sissons aged 43 years, road repairer,
Frank Stone aged 53 years road, repairer,
Charles Richard Turner aged 60 years, deputy,
Albert Tyler aged 64 years, back repairer,
Alfred White aged 57 years, deputy and
William Yates aged 62 years. development worker.

Those who were seriously injured-

Dennis Brothwell aged 44 years, development worker,
Frank Cowley aged 43 years, development worker,
Malcolm Joseph Cowley aged 29 years development worker,
James Reddish aged 25 years, development worker,
Graham Richardson aged 34 years, heavy supplies worker,
George Dennis Stone aged 41 years, overman,
Harry Taylor aged 47 years, development worker,
Terence Thornley aged 18 years, face trainee,
Terence Graham Vaughn aged 38 years, development worker,
William Henry Watson aged 47 years, face worker and
Richard Wrobels aged 44 years, faceworker.

Seriously injured in the rescue operation-

John Maxwell aged 35 years, reserve face worker.

The inquiry into the cause of and the circumstances attending the overwinding accident that occurred at Markham Colliery. Derbyshire on 30th. July 1973, was held by J.W. Calder, C.B., O.B.E., B.Sc., C. Eng., F.I.Min.E., H.M. Chief Inspector of Mines and Quarries, at Chesterfield Town Hall on 10th. October, 1973 and lasted for six days. All interested parties were represented and the report was presented on the 6th. March 1974, to The Right Honourable Eric Graham Varley, M.P., Secretary of State for Energy.

There was full investigation of all the winding system at the colliery. The indications were that there had been a complete failure of the winding engine brake and it was found that the centre rod in the spring nest had broken. A short length of this rod was found under the brake engine. The bottom deck of the cage which had landed on the baulks was severely distorted but there was little damage to the top deck. The speed of impact was established to be 27 miles per hour. The top of the airlock was damaged did not affect the ventilation of the mine and and inspection of the shaft by hoppet revealed no serious damage to the shaft. The repairs were made to the shaft and the engine house before the investigation could proceed.

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In the early stages of the investigation the broken centre rod was removed from the spring nest and sent to the Mines Safety Research Establishment for metallurgical examination. It was found that it had failed through fatigue. After completing the investigation the winding engine was reassembled with nest spring applied caliper type brakes and a high pressure hydraulic system with duplicated brake solenoids all supplied from Blacks Equipment Limited. The drum sides were replaced, barrel plates renewed and a tacho-generator installed to operate the rope speed indicator. A reconditioned automatic contrivance was installed with an independent drive. Commissioning tests were carried out for the previous winding duties and in addition it was demonstrated that the winding system could be brought safely to rest by braking on only one brake path. The representatives of all interested parties agreed that normal winding could be resumed on 1st. October 1973.

The inquiry urged immediate action that the centre rods in all spring nests similar to the one involved in the accident be changed and the National Coal Board carried out non-destructive tests on winding engine brake components and examined all winding apparatus to identify all 'single line' components and assess the stress in brake components. In addition schedules of mechanical and electrical examinations were being reviewed and action taken to ensure compliance with instruction PI 1965/10.

During the inquiry it became evident that there was an urgent need for a committee of engineers to consider all safety aspects of manriding in shafts and unwalkable outlets. Immediately after the inquiry Mr. Calder met representatives of all interested parties who agreed that a committee should be formed and the National Coal Board agreed to implement any interim decisions of the committee as the work proceeded.

The inquiry came to the following conclusions-

- 1) "The disaster was caused by the complete failure of the mechanical brake of the winding engine because the spring nest centre rod which was a 'single line' component broke. The design of the trunnion did not take account of the high pressures due to the spring nest, and the main level could not rotate freely about the trunnion axle which had no practicable means of lubrication. Consequently, operation of the brake produced bending forces and induced fluctuating stresses in the rod which could not sustain. Cracks developed in the rod and one of them extended until failure occurred.
- 2) The cracks which were present in the rod could have been detected before it broke by the magnetic particle method on non-destructive testing.
- 3) There can be no criticism of R.W. Kennan, the winding engineman who, as a last resort, attempted to stop the engine by pressing the emergency stop button provided for that purpose.
- 4) It was always necessary to apply the mechanical brake to stop the engine but had regenerative braking been available after the emergency stop button was pressed, there is little doubt that the speed of the cages at the end of the wind would have been significantly reduced.
- 5) The fatal or serious injuries received by the men in the descending cage were caused by it crashing on to the wooden baulks at the bottom of the shaft. The accident would not have been so serious if, instead of landing baulks, an arresting device had been installed below the lowest landing."

The inspector went on to make the following recommendations-

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- 1) "All winding engines be examined and modified as necessary to ensure that the mechanical brakes should always be capable of bringing them safely to rest.
- 2) Where possible the operation of winding systems should not rely on 'single line' components. If this cannot be achieved the systems should be modified to ensure that 'single line' components are designed, operated and maintained to prevent danger.
- 3) All winding engine brake components essential for safety be non-destructively tested as necessary and the tests should be repeated at approximate intervals.
- 4) A design analysis be made of all winding engine brakes components essential for safety to ensure that all the working stresses can be sustained and to establish definitive life. This analysis should take account of the fluctuation of stress irrespective of the conventional static factors of safety. The use of screwed components should be avoided when ever possible.
- 5) The control systems of electric winding engines be reviewed with the object of making electrical braking available after the initiation of an emergency or automatic trip at least until the application of the mechanical brake has been proved.
- 6) All solid landings in shafts be replaced by suitable arresting devices below the lowest winding level as soon as possible.
- 7) An operating manual be prepared for each winding engine and the training and examination of winding enginemen be reviewed.
- 8) Every winding engine which can attain a speed in excess of seven feet per second be provided with a rope speed indicator.
- 9) The Coal and Other Mines (Shafts, Outlets and Roads) Regulations 1960 be revised to include additional statutory requirements for the safe winding of persons through shafts and unwalkable outlets."

HOUGHTON MAIN. Barnsley, Yorkshire. 12th June, 1975.

At the time of the accident the Houghton Main Colliery was one of eighteen mines in the Barnsley Area of the National Coal Board five miles from Barnsley. a total of 1361 men were employed at the Colliery, 1191 of whom worked underground and 170 on the surface. The colliery produced about 15, tons of coal per week and of this 700 tons was produced from the Upper Measures, the Meltonfield and the Beamshaw Seams. The remainder came from the Lower Seams, the Parkgate and the Silkstone Seams. There was development work proceeding on the Newhill and the Thorncliffe Seams.

There were three shafts at the colliery. The No.1 and No.2 were downcast each with a diameter of 14 feet, and the No.3 shaft was the upcast with a diameter of 20 feet. The shafts were originally sunk to the Barnsley Seam and later Nos. 2 and 3 were deepened to the Thorncliffe seam at 816 yards. The shaft were used to wind men and materials and for ventilation but some coal was raised at the No.2 shaft, about 150 tons a day. In the Beamshaw and Parkgate Seams coal was transported by roadways connecting with the neighbouring Grimethorpe Colliery where the combined output of both collieries was wound to the surface.

An Aerex single inlet radial flow fan, 153.5 inches in diameter extracted 354,000 cubic feet of air per minute at 7.8 inches water gauge from the No.3 shaft. Firedamp drainage from roof and floor holes was practised extensively at the colliery but not in the Meltonfield and Newhill seams.

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J.B. Keirs was the Area Director, A.W. Tuke, the Deputy Director (Mining), C. Shepherd, Area Chief Mining Engineer, H. Widdowson, Colliery General Manager and R. Cant, Colliery Surveyor. L. Fox was the deputy manager and senior undermanager for the colliery and there were four undermanagers, B.D. Bradley, A.N. Lloyd, A. Mellor and R. Sidebottom. Bradley was in charge of the Meltonfield and Newhill Seams which included B 02's, B 04's, B 05's and E 21's districts.

The Meltonfield seam was 50 inches thick on average with a fireclay floor and a shale roof. Access to the seam was by a cross measure and a road driven in the seam from existing workings in the Beamshaw horizon. Two longwall advancing faces B 01's and B 02's had been worked between September 1972 and October 1974. These faces were to have ceased production on 13th. June 1975, when they had met a fault and the face had been reduced in length to 94 yards. The face was to be replaced by E 21's district in the Newhill Sea, and salvage operations were in progress on B 20's district where rails were being recovered from the main gate by way of scourings driven through the ribside of B 04's tailgate. The B.04's district was a longwall advancing single unit equipped with powered supports. Coal was mined by a ranging drum shearer and a tailgate elimination shearer. The main gate was formed as an advancing heading some 10 to 15 yards ahead of the face line by blasting and mechanical loading of the debris.

The B 05's development district had two headings which were extensions of the Meltonfield main intake and return airways and both the headings were in solid coal and stone supported by arched girders 13 feet wide and 9 feet high lagged with corrugated steel sheets. The main intake heading had been driven 51 yards beyond B 04's main gate and was not positively ventilated. It was intended to start this heading soon afterwards. A road heading machine had been used to drive B.05's return heading 410 yards and the heading had been stopped for three weeks before the accident. It had been driven through a faulted area of the left flank of B.04's main gate. At 170 yards from B.04's junction B.05's tailgate had been driven a distance of 220 yards from B.05's return heading. This heading had been sealed with a concrete block wall and had not been ventilated.

The Newhill seam was 6 feet 6 inches thick and lay about 98 feet above the Meltonfield seam. Access to the seam was gained by driving a pair of 1 in 5 rising drifts off the Meltonfield main airways and the workings in the Newhill seam had been developed from these drifts. A longwall advancing powered support face, 145 yards long and fully mechanised had been opened up and equipped. This had had some problems with bad roof conditions with water breaking into the main gate roadhead where a large cavity had formed. Repair work was in progress and preparations were made to fill the cavity with fly ash. There was some evidence that there was difficulty in testing for firedamp at the top of the cavity because there was no suitable equipment in the district. It was intended that the face should commence production on Monday 16th. June 1975 to replace the B.04's face in the Meltonfield seam. Before the accident, four shears had been taken from the face which was advanced 5 feet 6 inches. This had been done to advance the face into competent strata.

Both the Meltonfield and the Newhill seams were ventilated by a main air current from the shafts and twin intake and return airways were provided over part of the ventilation circuit. The ventilation of the B 04's district had the air flow in the opposite direction to the coal flow and an exhaust fan had been provided for the B 05's return heading as auxiliary ventilation up to short time before the accident. The fan, coupled to a dust

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extractor, as placed on B 04's main gate about 15 feet inbye of B 05's junction. A bypass system of ventilation exhausted directly into the Meltonfield return was available to ventilate B 05's return heading during weekend shifts when the auxiliary fan was not in use.

The E 21's district of the Newhill seam was ventilated by air from the Meltonfield main intake which rejoined the intake after ventilation the E 21's face. There was some controversy as to whether E 21's district should have been put on a separate ventilation spilt from the time the connection was made.

In the B 04's district in the Meltonfield seam, work had proceeded normally on the day shift of 12th. June 1975 and the last shearers were being taken off the face in preparation for salvage work. There had been some difficulty with the stage loader conveyor chain which was fast at the end of the shift. The fifteen men of the afternoon shift went down at 12 noon and there were four tailgate rippers, the tailgate shearer operator and his assistant, six men employed on face timbering, two fitters and a fitter's mate. At the start of the shift the two fitters, Drury and Austin, repaired the stage loader and Austin then started to dismantle the loading shovel in the maingate advancing heading while Drury worked on the face removing powered support relay bars.

At the start of the early afternoon shift at 11 a.m., Norman, a gate end supervisor, was in charge of the district until the arrival of Williamson the district deputy who started his shift at 2 p.m.. The early afternoon shift left the district at about 5.30 p.m. and Norman left Williamson at the maingate roadhead and travelled outbye along the maingate. He arrived at the pit bottom at about 6.30 p.m. when he spoke on the telephone to Williamson who he assumed to be at B 04's maingate roadhead.

In the E 21's district in the Newhill seam the face was affected by water, particularly in the maingate roadhead area, and as a result, the face conveyor motor at the end had failed. During the day shift of 12th. June, work had started to replace the motor. There was some degree of urgency as it was planned to continue working during the afternoon shift. The district deputy, Lakin, went underground at 2 p.m. and travelled to the district. At 5 p.m. a late afternoon shift of Copperwheat and Baker, both electricians, Upperdine, a fitter, Woodcock and Bannister, both facemen went down the pit. They were all working changing the face conveyor motor except Bannister who was to be the pumpsman at the maingate. These men travelled inbye on the manriding conveyor as far as E 21's alighting platform. Pull lifts were required to install the new conveyor motor and there was a discussion as to where these could be obtained because Upperdine had unsuccessfully attempted to get some at the pit bottom. Buckley, Woodcock and Bannister went on to the district by the conveyor drift, leaving Lakin and Upperdine at the tandem point where they were later joined by Copperwheat and Baker.. After Upperdine had failed to get the lifts in the return airway, it was agreed that Copperwheat and Baker would go inbye as it was thought that there was a set in the B 05's return heading. Wilkinson, the transfer point attendant from B 04's main gate heard this proposal and spoke to some men on his way outbye. He warned them not to go into the B 05's heading because he knew that it was fenced off and thought to be in a dangerous condition.

Lee, a spare deputy on the 5 p.m. shift, also knew that the pull lifts were required for E 21's went underground at 5.30 p.m. and waited at the pit bottom for almost an hour for these to be sent down but they did not arrive so he left the pit bottom on the manrider at 6.35 p.m. After leaving his coat at the inbye end of the raid, he walked to the conveyor boarding point and travelled inbye. It was about this time that Upperdine

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received the call from Copperwheat to say that he could not find a set of lifts in the B 05's return heading. After a while Upperdine received a second call from Copperwheat to say that the deputy's light had been put out twice and they were going to do something about it. Shortly afterwards Lakin left Upperdine and walked inbye along the Meltonfield intake towards the bottom of E 21's conveyor drift. Upperdine started to eat a sandwich and he thought that 5 or 10 minutes had elapsed after Copperwheat had last spoken to him when the explosion occurred.

At 6.49 p.m. Pearson, the guard, signalled the manriding train from 42's station. It had travelled about 6 yards when there was a thump accompanied by a rush of air outbye, then inbye and the train stopped. The air was thick with dust and Pearson was unable to see anyone. He looked at his watch before starting the train and established the time of the explosion.

Lee, the deputy, was travelling on the manriding belt towards the Newhill seam when he was blown backwards by a violent rush of air. He was very confused but after collecting himself, he managed to make his way inbye on foot by following the conveyor. Although he was unaware of it, there was a possibility that Lee suffered the effects of carbon monoxide poisoning and this could account for the discrepancy in the time it took for him to travel to the Newhill cross-slit, which was short distance, and the other survivors who travelled the whole of the E 21's district.

Buckley, Woodcock and Bannister had walked inbye to E 21's maingate roadhead, reviewed the work they had to do and then walked outbye a short distance to the stage loader gearhead where they were waiting for Upperdine to bring the lifts. Suddenly they were blown off their feet by a blast of air which came inbye along the main gate. The air was so thick with dust that it was impossible for them to see each other. In close contact and with Buckley in the lead they made their way outbye along the maingate until they arrived at the top of the 1 in 5 conveyor drift. Here they smelled burning and decided to go back along the maingate and through the face. They donned their self-rescuers at this point but felt unable to wear them. They turned round and started to travel inbye along the maingate and Buckley changed places with Woodcock because the latter had lost his helmet and was concerned about injuring his head.

About this time Buckley and Woodcock lost contact with Bannister and they made their way through the E 21's face along the tailgate and down the 1 in 5 supply drift. Buckley led the way and found his way by means of the haulage signal wires. at the bottom of the drift, Buckley went towards the Meltonfield return but considered the conditions there to be worse, he was attempting to find his way put when he heard Lee shouting. They made contact in the cross-slit and Lee escorted the two men away from the district through the Meltonfield intake airway.

On their way out they had attempted to raise the alarm but the loud speaking telephone system had been put out of action by the explosion. When they arrived at the 42's a man rider road end they boarded the conveyor and rode outbye until they reached the fitting shop where Lee was able to contact the surface control room by telephone. He informed Johnson, the deputy in charge, that there had been an explosion. Johnson received this call about 7.10 p.m. and immediately told Askin, the seam overman, who was with him in the control room speaking to Bradley the undermanger who was told of the disaster. Johnson telephoned Fox the deputy manager and Askin had difficulty in ringing Doncaster Rescue Station but after a short delay was connected to Wright the Rescue Station Superintendent. Fox arrived at the mine shortly afterwards and after satisfying himself that the rescue service had been summoned decided to withdraw all persons from the mine and he instituted the emergency procedure. In the meantime at

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7.33 p.m. on the 12th June, Wright at the Doncaster Station, having ascertained that the call from the colliery was genuine, turned out the rescue brigade and informed the standby station at Wakefield.

The permanent corps rescue team under the charge of Fee, the Assistant Superintendent arrived at the colliery at 7.50 p.m. and were ready to go below ground at 8.08 p.m. It was initially thought that the explosion had occurred in the Newhill seam and it was known that there were men working there but Askin, the seam overman, accompanied the team as a guide as far as the first cross-slit to the return on the Meltonfield intake inbye of 42's man rider road.

The second team from Wakefield Rescue Station went below ground at 8.20. p.m. and they took with them a rough sketch map prepared by a fitter. After establishing a fresh air base, Fee, accompanied by Wilks the team captain, travelled along the first cross-slit towards the main return airway and near the junction they saw alight. They retreated to the fresh air base and instructed the team to couple up and go into the return where Bannister was located in a crouched position with his opened self rescuer hanging round his neck although the mouthpiece was not in his mouth. Bannister was carried by stretcher to the fresh air base where a reviver, mouth to mouth resuscitation and cardiac massage were applied but no avail.

The team then continued their exploration along the Meltonfield intake and about 50 to 60 yards inbye of the second cross-slit, they located Upperdine who was badly burned and severely injured. He was brought to the fresh air base where he was treated and then sent out of the mine. Shortly afterwards the Wakefield permanent corps team located and recovered the badly mutilated body of Lakin a short distance outbye of the junction of E 21's conveyor drift. The teams who were subsequently deployed made detailed searches of E 21's district through the conveyor drift where it was blocked by an extensive fall. No survivors or victims were found in the Newhill seam workings.

The teams then turned their attention to a systematic search of the Meltonfield seam workings inbye the Newhill drifts by successive seams. At 5.30 a.m. on the 13th. June, the body of Copperwheat was located in the Meltonfield return some 25 feet from B 04's maingate junction. The next team left the fresh air base at 6.20 a.m. and it found the bodies of Williamson and Baker in B 04's maingate about 25 feet from the junction of the main return airway. the bodies were recovered later by other rescue teams.

The men who died were-

Leonard Baker aged 53 years, electrician,
Richard Bannister aged 312 years, pumpman,
Raymond Copperwheat aged 42 years, electrician,
Irvin Lakin aged 55 years, deputy,
Frederick Arnold Williamson aged 59 years, deputy and
Kenneth Upperdine aged 48 years, fitter was seriously injured.

When all the victims had been recovered, rescue teams were deployed in the mine to obtain air samples at selected points in the affected workings and they indicated that there was a continuing fire in the area. this possibility together with an observed deterioration of the b 01's junction which had collapsed in the Meltonfield return. The rescue teams had to pass through this area and it made the operations hazardous. With the agreement of all parties it was decided that the affected workings should be sealed off. This was done and subsequent inspections by the rescue brigade and all

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interested parties were made while normal working was resumed in the unaffected parts of the Houghton Main Colliery and the interconnected Grimethorpe Colliery.

The inquiry into the disaster opened at the Town Hall Barnsley on the 26th. August 1975 and lasted for nine days under the direction of Mr. J. Carver, H.M. Chief Inspector of Mines and reported to Mr. W. Simpson, Chairman of the Health and Safety Commission on the 18th. November 1975. All interested parties were present and evidence was heard from 81 witnesses.

Because the district was sealed off it was impossible to carry out an underground investigation but large numbers of samples were collected and analysed. The personal effects of the victims that were recovered, two samples of cables and tests on a Carter Howden radial flow fan of the same manufacturing batch as the one on B 05's return were thoroughly tested. The ventilation system was thoroughly investigated.

The evidence indicated that the way in which some of the overmen and deputies carried out their duties were criticised and the inquiry thought that the management and control at this level left much to be desired. When the B 05's return heading a fan broke down on the 3rd. June it was first attended to by Cieslik, an electrician and his inspection revealed that the motor foot bolts had sheared but the motor was in good electrical order. He disconnected the fan cable and removed the retaining plug from the socket but he did not put a personal padlock on the switch isolator. Cieslik very properly reported the defect on his daily report sheet. Bush, a shift charge electrical engineer read the report but did not transfer the details to the statutory report as he considered the defect to be mechanical and not electrical. On the afternoon shift of 3rd. June, a foreman fitter, Barton, was informed of the breakdown and went to rectify the breakdown but found that the task was beyond him with the equipment he had. he did not make a written report but told K, Adams, the shift charge electrician that a fitter and an electrician were needed to do the repair. This was not brought to the attention of the night shift man. He saw the book but took no action. The afternoon charge shift engineer did not report the defect to Scott the mechanical engineer and did not record it in the report book. The afternoon shift charge engineer claimed that he mentioned the matter to Martin, the night shift overman, but the overman emphatically denied this.

The design and development of the Carter Howden fan was thoroughly investigated. In the late 1960's the National Coal Board made a critical review of fans available for the ventilation of long drivages. The introductions of heading machines had increased dust concentrations on the faces of the drivages and to contain this there was a change from forcing to exhausting systems of auxiliary ventilation. In december 1971, following discussions with the N.C.B., an in line radial flow fan for underground use was designed by James Howden and Company Limited of Glasgow. The first prototype was tested at the N.C.B's Research and Development establishment in March 1972. The inquiry stated that-

"The designers, manufacturers and suppliers of equipment used below ground should recognise their responsibility under the Health and Safety at Work act 1974 (Section 6): a responsibility which was not mandatory during the development of the Carter Howden auxiliary fan."

The site of the explosion was hard to pin down as the seam was sealed but it appeared to be concentrated along the Meltonfield intake. Mr. Carver stated in the report-

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“I consider of significance that all the separating doors between the intake and return airways were blown out as far as the Newhill cross-slit. The conveyor belting along the inbye length of the intake airway had disappeared and two large falls had occurred along the intake airway. A further large fall had taken place in the B 01’s maingate junction.”

As to the source of ignition there was no evidence of a fire, contraband or from any of the lamps. The inspector came to the conclusion that it was unlikely that the spark came from electricity and the weight of evidence led him to the conclusion that the firedamp was ignited by a frictional spark produced by the auxiliary fan.

Mr. Carver concluded that-

- 1) “the explosion resulted from the ignition of an accumulation of firedamp in B 05’s return development heading which had been unventilated for a period of nine days prior to the explosion.
- 2) it is not possible to determine whether coal dust formed part of the fuel for this explosion but if its violence was caused by firedamp alone it highlights the severity of the problem and the need to provide constant ventilation in narrow drivages as required by Section 55 of the Mines and Quarries act 1954.
- 3) the most likely source of ignition was frictional sparking from the impeller and casing of the Carter Howden auxiliary fan. The National Coal Board submitted that the ignition may have occurred in the Meltonfield return outbye B 04’s return gate. After close examination of all the evidence, I reject that submission.”

Mr. Carver recommended that-

1. “There should be amendments to the following statutory provisions:
 - a) The Mines and Quarries act 1954: Section 10 The person appointed to read reports on behalf of the manager should be a holder of a first or second class certificate of competency.
 - b). The Coal and Other Mines (Managers and Officials) Regulations 1956:
 2. The provisions of Regulation 6A relating to the appointment of a competent person to read reports of behalf of and undermanger should be revoked.

A statutory shift report should be introduced for officials superior to deputies but subordinate to undermanagers.

3. The Coal and Other Mines (Surveyors and Plans) Regulations 1956. The manager should ensure that any information that is necessary for recording on the plans and sections which are required to be kept at the mine is accurate and should certify this by counter-signing all such plans an sections prepared by or under the supervision of the appointed surveyor of the mine.
4. The Coal Mines (Precautions against Inflammable Dust) Regulations 1956. regulation 10A should be amended to include the recording on a plan the position of all the stone dust barriers specified in the manager’s scheme by virtue of the Regulation.
5. The Coal and Other Mines (Ventilation) Regulations 1956. These regulations should be amended to include the following provisions:
 - i) Rules should be made for the insulation and operation of auxiliary fans.

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- ii) Narrow drivages which require at any time to be ventilated by auxiliary means are, thereafter, constantly ventilated by positive means.
 - iii) The manager should specify the construction of any fence erected to prevent access to an unventilated part of the mine and should ensure that it is maintained constantly in an effective condition.
- 6.
- i). The Coal and Other Mines (Fires and Rescue) Regulations 1956: Regulation 27 should prescribe standards for the size, equipment and facilities of rescue rooms. The room should be maintained solely for rescue work.
 - ii). Regulations should be made to cover the approval, carrying and training in the use of self-rescuers.
- 7. The National Coal Board should implement as they arise any interim findings of the National Committee.
 - 8. The National Coal Board Committee studying the design of self rescuers should be reconvened as soon as possible. The membership and terms of reference should be reviewed.
 - 9. The National Coal Board should ensure that wherever possible its specifications for auxiliary fans are completed during the time this new equipment is in the prototype stage. Such prototype equipment should be used only in closely controlled conditions. The test and assessment requirements for new equipment of this type should include standards of construction, performance and ease of maintenance underground.
 - 10. When a plan for the ventilation of a development in a mine had been prepared and signed no change should be made without the agreement of all signatories of the said plan.
 - 11. Any change made in a ventilation circuit should be recorded forthwith on the rescue and ventilation plans. Furthermore, a joint working party should be set up to review the frequency of updating all statutory plans and the available methods of plan reproduction also as to reduce the time between survey and issue.
 - 12. The equipment to enable deputies to detect flammable gas in extensive roof cavities should be readily available where needed. Such cavities should be positively ventilated or filled.
 - 13. At large collieries consideration should be given to the appointment of a chief engineer to coordinate the activities of the electrical and mechanical engineering departments. Where there is no chief engineer, arrangements should be made to ensure that, in respect of matters likely to affect safety. There is a daily exchange of information between the mechanical and electrical engineers of the mine.
 - 14. The National Coal Board should provide effective means for the mobilisation of apparatus which may be dangerous by reason of some mechanical or electrical defect or abnormality.
 - 15. The National Coal Board should review the appointment of managers and safety engineers at collieries. The provision of Section 1 of the Mines Management Act 1971 should be more widely applied in this respect.

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16. The duties of safety officers, ventilation officers, roadway dust samplers, and stone dust water barrier supervisors should be specified in writing by the colliery manager.
17. The format of M & Q Forms No.231 and No.232 relating to deputies inspections should be reviewed to take account of current mining practice.”

BENTLEY. Doncaster, Yorkshire. 21st. November, 1978.

The Bentley Colliery was one of ten collieries in the Doncaster Area of the National Coal Board and was about three miles north of Doncaster. At the time of the accident the output was 14,00 tons per week of saleable coal with 920 men employed underground and 280 on the surface.

There were two shafts sunk in 1908 to a depth of 624 yards to the Barnsley Seam and later deepened to the Dunsil Seam at a depth of 642 yards. Production from the Barnsley Seam started in 1909 when the coal was transported along the haulage in tubs hauled by ponies, then along the endless rope haulages to the pit bottom. By 1943 belt conveyors had been introduced to transport the coal from the faces to the tub loading stations and endless rope haulages continued in use from there to the shafts. Diesel locomotives had been used there since 1939 for the movement of men, and in 1945 extended for coal haulage and supplies which eliminated the use of the endless rope haulages.

Diesel locomotives were used up to 1968 for hauling men and materials when trunk conveyor belts were introduced to transport minerals from the workings directly to the skip winding installation at No. 2 shaft. Locomotives were then retained for hauling men and materials only.

At the time of the accident coal was produced from three mechanised faces in the Dunsil Seam, the D34's in the northern part of the mine, together with D10's and D14's in the north eastern section. Manriding to these sections was by diesel locomotives hauling Wickham manriding carriages along the East Travelling Road as far as D04/D06 junction which was about 2 miles from the shafts. At this point trains travelling to D34's turned left along D06's road. Manriding trains for D10's and D14's districts continued along D04's roadway which rose inbye at an average gradient of 1 in 16. The manriding terminus '5's Paddy Station' was approximately 800 feet up D04's gate but locomotives hauling supply trains continued beyond this point, through 5's cross slit and into the respective districts.

A fleet of 12 locomotives were used and they varied in age from 22 to 33 years. They had been manufactured by Hunslet Limited and all were fitted with single cabs. Four of them were 50 H.P. and the remaining eight were 65 H.P. models. Seven had only mechanical brakes and were restricted to moving only materials and the other five had both mechanical and air brake systems and were used for manriding. Two speed gearboxes were fitted to all the locomotives which had a top speed of 4.42 m.p.h. and 9.15 m.p.h.. They were regularly serviced in a garage near the pit bottom.

Locomotives were normally operated on a single track system with a rail gauge of two feet three and half inches. The East Travelling Road was a common length of roadway used for all faces in the Dunsil Seam from the pit bottom as far as D04's/D06's junction. As a consequence, a control point was set up at the diesel garage and manned by a traffic controller. The East Travelling Road from the garage to D04's/D06's junction was

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divided into six equal zones of 500 yards, and each zone was given a different colour. Marker boards were hung in the roadway to denote the change from one colour zone to another. Each of the five manriding locomotives was equipped with a system of radio communication to the control point and the drivers were instructed to call the controller when they passed a colour zone notice. Their positions were logged on a colour board by the controller so that adjacent trains could maintain at least one colour zone between them. When the locomotives passed inbye passed D04's/D06's junction, their movements were controlled by telephones at the junction and at the Paddy Station. On occasions when the radio was defective, communication was entirely by telephone.

Wickham carriages were used for manriding and each was divided into four compartments. Each compartment could hold six men but a local agreement limited this to five making a maximum capacity of 20 men per carriage. The Manager's Transport Rules stipulated a maximum load of four carriages each containing 20 men. Normally there were four carriages. At the beginning of each shift, one train travelled to each of D34's and 5's Paddy Station followed by a third train with two carries which transported any surplus men to one of the other districts as was required.

The carriages were coupled to each other by a horizontally placed figure "8" rigid steel link with a vertical pin through the eye. The carriages were also provided with twin air breaking systems which were capable of being operated in the service mode, emergency mode direct from the locomotive and in emergency mode from two carriages. Each carriage was provided with a wheel which operated a mechanical hand brake for parking and as a further safeguard, safety chains were between adjacent carriages and the locomotives.

There had been development work to find a suitable friction type, energy absorbing arrestor for a number of years and in April, 1977, a Godwin Warren type of arrestor was installed near the bottom of the D04 incline to stop runaway vehicles. The device consisted of an impact head, mounted on auxiliary rails, arranged to engage 12 successive pairs of friction clamps. the auxiliary rails were secured between the main rails. The operation head protruded above the rail level so that it could make contact with runaway vehicles. It had an operating lever which had to be held in the down position to lower the impact head below rail level and allow vehicles to pass slowly under controlled conditions. The impact head was counterbalanced so that when the operating lever was released, the head rose and went into its arresting position. a quadrant plate had been fitted dint this device at the colliery with holes drilled in it to correspond with the holes in the lever. It also had red and green lights which indicated to the drivers, the position of the impact head. Many arrestors of this type had been installed in mines throughout the country and there was ample evidence to show that they worked well.

On the night shift of Monday 20th. November, 1978, one hundred and fifty two men descended the mine at 10.15 p.m. to commence normal work. Some stayed at the pit bottom area but 42 boarded the D34 manriding train and were taken to the district and 87 boarded two trains and were taken up the D04 gate to 5's Paddy Station.

Drivers of the trains usually worked with their regular conductors. Of the two trains going to 5's Paddy Station, the first was hauled by No.13 Locomotive driven by R.L. Wade with his regular conductor, H.A. Wells. The train consisted of four carriages, the following train of two was hauled by No.18 Locomotive was driven by G. Shone but his regular conductor did not come o work and his place for that shift was taken by S. Allott. The pit bottom deputy looked at the notice board in the diesel garage where

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there was a list of names posted of authorised conductors and nominated Allott as conductor. He confused Allott with another conductor names Aylott. Allott was not trained for the work.

These journeys were satisfactorily completed in a normal manner. For much of the remainder of the shift, the locomotives were used to transport materials up and down the D04's incline. At about 4 a.m., three locomotives left the diesel garage to go inbye ready for manriding at the end of the shift. No.13 was the first one driven by Wade hauled two carriages which had been repaired during the shift. Wells was his conductor. Repairs had been carried out to the left-hand brake on carriage No. 1660 and a new leaf spring had been fitted to carriage No. 1401. These two carriages were to become the first and second carriages in the accident train.

The first locomotive to go inbye stopped at the arrestor. Wells, the conductor, lowered the impact head and inserted a pin in the handle to hold it in the lowered position. He remounted the empty rain and continued up the incline leaving the arrestor in the lowered position as he saw the headlight of a following locomotive, and assumed that this locomotive would follow him up the incline. In the event, this locomotive did not follow him but turned left to D43 District before reaching the arrestor.

Shone was driving no. 18 Locomotive inbye as a light engine approached the arrestor and on seeing it to be retracted, he drove over it without stopping. He decided to leave the arrestor in the pinned down position and continued to the top of the incline.

On reaching the top of the incline, Wade, diving No, 13 Locomotive and hauling the repaired carriages, stopped at No.5's Paddy Station and applied the parking brakes to the carriages which were boarded by workmen waiting to travel out. Shone arrived at the top of the incline where his locomotive was coupled at the two carriages already containing workmen. As it was the custom for the first train to consist of four carriages, he shunted these two carriages further up the incline to collect two of the four carriages which had been parked throughout the shift. These carriages also contained a number of workmen. Wade and his conductor, Wells, assisted in the coupling of these carriages and locomotive as they were aware that Allott, the substitute conductor, was not fully conversant with the operations.

It was intended to form a four carriage train leaving the spare locomotive, No. 13, to follow behind with the remaining two carriages with the remaining workmen, Allott was told by the regular drivers and conductor to sit at the rear of the last carriage which was the customary position of the conductor, so he went to the last carriage, No. 6, and was left behind.

When Wells had completed the coupling of the carriages to make a four carriage train, he signalled with is cap lamp to Shone, the driver of No. 18 Locomotive to pull the train a short distance forward so that No.13 Locomotive could be brought out of 5's cross slit and be coupled to the two remaining carriages to form the second train. According to the official timetable, manriding was not due to commence until 5.40 a.m, and as it was only 4.50 a.m. there was enough tome to complete this operation. Shone said that he engaged second gear, released his brakes and stated to move down the roadway.

There had not been enough time to make a full completion of each specific joint. The driver understood the signal and instead of setting off properly in first gear he set off in second with the intention of stopping after 30 feet . He believed he the tried to stop using the mechanical brake and went into a skid. He then used the service brake

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several times applying sand, which was the usual technique to get out of a skid. As he neared the Godwin Warren Retarder, he realised that he was not going to be unable to stop and then decided to try to drive on and round the turn, hoping that there would not be a derailment.

Meanwhile, nobody out of the 65 men on the train, had attempted to use the emergency brake system but two men had tried to wind on the hand parking brakes. Most of the men on board ducked with their heads between their knees after they passed the Retarder. Locomotive No.18 and the first carriage passed round the curve but there was an impact at the connection between the first and second carriages which were pulled violently at the weld mesh canopy of the second carriage. The joint between the carriages was broken and carriage two, three and four were derailed and left behind. The locomotive and the first carriage came to rest 67 feet further on when the severely shocked driver managed to select neutral and apply the mechanical brake.

Deputies T. Rush, T. McAlister and A. Kenny were riding in the third carriage with overman W. Payne and apart from being shocked, they were unhurt and started emergency recovery operations. Other men on the train rendered first aid and gave comfort to the injured. Men who were waiting at 5's Paddy Station for the second train realised that an accident had occurred and ran down to help with the recovery operations. Soon afterwards a third manriding train returning with men from D34's arrived at the junction and these men also assisted. Deputy T. Rush ran back to the junction and alerted the controller that there had been a serious accident and medical assistance was required.

McAlister, the deputy, got off the train and ran back into the working district to collect supplies of morphia. In doing so he passed the arrestor and saw that the operating handle was pinned down by a bolt. Shortly afterwards, N. Smithard, a fitter, also observed this.

At the scene of the accident men were pinned between the last three carriages and the roadside. Carriages 2, 3 and 4 were disconnected from each other and sided over in order to release the men.

Night shift senior overman, R. McGuire, who was already at the surface, went down accompanied by a doctor and a nursing sister. They travelled in by a quickly assembled manriding train which was later used to transport the stretcher cases while those who were able walked out to the pit bottom.

All the injured men were brought to the surface within two hours and 18 men sent to hospital for further medical treatment of whom four were temporarily detained. A further 40 were treated for shock at the colliery medical centre. The seven who died were brought to the surface by 9 a.m.

The report for the Yorkshire National Union of Mineworkers stated-

"After the accident the workmen, management and officials joined forces in an exemplary manner and applied themselves unflinchingly to the task of recovering and releasing the dead and injured. The Area doctor and nursing sister arrived on the scene and about 9 a.m. all the casualties were on the surface."

Those who lost their lives were-

Robert Aitchenson aged 54 years, face worker,

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Donald Box aged 39 years, faceworker,
Kenneth Green aged 38 years, faceworker,
David R. Hall, aged 21 years, face trainee,
Geoffrey Henderson aged 39 years, face worker,
Michael E. Hickman, aged 18 years, face trainee and
James Mitchell, aged 55 years, face worker.

The men who were seriously injured were-
Thomas J. Rush aged 26 years, supply man,
Paul Thompson aged 26 years, ripper and
J. Butcher aged 57 years, shift charge engineer.

The investigation was begun and one of the first at the scene was Arthur Scargill, the President of the Yorkshire N.U.M., the General Secretary, O. Briscoe, the Financial Secretary, R. Horbury and members of the Branch Committee. Three Inspectors and the management also made detailed examinations of the scene of the disaster. A detailed inspection of the rails over the whole section showed no defects. There were no skid marks and some dampness was found. The gradient of eight pairs of rails were steeper than the statutory limit of 1in15 although the average gradient was 1 in 16.1. Locomotive No.18 was undamaged and the engine easily restarted after it was placed on the rails.. All three braking systems were found to be functioning and further tests were carried out on it at the bottom when each of the braking systems were found to be capable of stopping the train within the recommended stopping distance. There was a 166m length of track available and it was decided to carry out tests at a gradient of 1in15.2 using locomotive No.18 in the condition it was found after the accident plus its 4 Wickham carriages with a simulated load of 65 men. The tests proved that the train could be stopped with the available braking.

The damage to the carriages was then examined and it was found that some coupling pins had not been connected and there was no screw in the coupling pin retaining devices between the first and second carriages. It was established that there had been previous accidents on this section of track. In August 1978, a train loaded with manriding carriages ran back out of control into the Retarder after passing to the rise side of it and on 7th. November, 1987, just two weeks prior to this accident, a train of men had run out of control down the gradient and passed over the pegged down Retarder and negotiated the curve without a derailment but the incidents were not properly reported.

There was a large volume of evidence stating that the red and green warning light system on the side of the Retarder was frequently out of order and yet no official reports had been received by the Colliery Electrical Engineer and there had been only two such reports to the Colliery Manager in the 18 months of its operation. It was clear that there was no single act or collection of acts by any particular person who was solely to blame for the accident and recommendations were made aimed at avoiding an occurrence.

The recommendations-

1. "Despite the braking capabilities of locomotive manriding systems do not afford automatic overspeed protection as do other manriding systems and safe operations are dependent upon the skill of the driver and directly related to the gradient. It is therefore recommended that the maximum gradient on which these locomotives are allowed to operate be reviewed and reduced
2. Full operation of the braking systems of locomotive manriding trains is dependent on correct coupling and testing by driver and conductor and upon

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application wheel locking and skidding may result It is recommended that automatic speed sensitive track brakes are developed

3. Drivers and conductors of locomotive manriding trains should not be confronted with the difficulties posed by marshalling, coupling, brake testing and moving off gradients. It is recommended that terminal manriding stations be established to provide level conditions or their equivalent
4. The design of curves in roadways where locomotive manriding occurs and where there is a possibility of derailment should be examined. All means possible in terms of super elevation of the track and provision of check rails should be taken to reduce the risk of derailment. In addition a smooth sided finish to the roadway should be provided and any obstacle removed which would either impact with or tear the side of any manriding carriage
5. The design concepts of manriding carriages should be revised to ensure the shape and strength of the body affords maximum protection to passengers
6. The design of carriage coupling pins and safety chains should ensure ease and certainty of coupling and remove the possibility of uncoupling by accident
7. Advantage must be taken of modern information systems so that the possibility of errors in deployment and are eliminated
8. The use of friction type arrestors should be expanded and their operation conditioned to fully control approaching locomotives and to automatically reset after locomotives had passed over
9. Locomotive drivers and conductors in manriding situations carry a heavy responsibility and their training and authorisation needs to be reviewed in terms of its duration, compatibility of equipment employed, status and discipline of instructions and its relationship to the particular track and its problems where they are eventually to work
10. Manriding trains should be provided with direct and efficient means of signalling between conductor and driver
11. No person should ride in a manriding train without the knowledge of its emergency stopping procedure and equipment
12. Locomotive brake testing procedures should be reviewed to ensure the most onerous braking requirements are covered
13. Management should be resolute in taking whatever steps are necessary to achieve high standards of discipline and adherence to Transport Rules and Trade Unions should give full co-operation.

GOLBORNE. Golborne, Lancashire. 18th. March, 1979.

An explosion of firedamp occurred in the Plodder Seam at the colliery when ten men died and one was seriously injured. The official report on the disaster was made by Mr. L.D. Rhydderch, H.M. Chief Inspector of Mines and Quarries.

At the time of the accident the Golborne Colliery was one of twenty two producing coal in the Western area of the National Coal Board and was in Golborne within the Metropolitan Borough of Wigan, mid-way between Warrington and Wigan.

The colliery employed 870 men, 766 of which worked underground and 104 on the surface and produced 9000 tonnes of saleable coal per week from four seams. These were the Crombuke, the Ince Six Feet, the Higher Florida and the Plodder seams.

The colliery was first sunk in the 1860's and was served by two shafts, the No.2 Upcast and the No.3 Downcast. No.2 was 4.2 meters in diameter and sunk to 545 meters and

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was used for manriding. The No.3 shaft was 5.4 meters in diameter and sunk to the same depth and was used for men and materials.

In August 1975 an underground connection to the Bickershaw colliery was made and in April 1977 all coal winding operations at the Golborne Colliery were stopped and the coal was wound at Bickershaw. Parsonage Colliery in Leigh was also connected to the Bickershaw colliery but that fact that there were three collieries connected had no bearing on the explosions.

The mine was ventilated by a 653 kW single inlet radial flow fan and firedamp drainage was in operation from all the longwall districts. This was extracted to the surface where it was exhausted to the atmosphere.

The men at the colliery holding statutory appointments were ,MR. J.R. Hunter the Area Director, Mr. P.J. Griffiths Deputy Director (mining), Mr. J.W. Evans, Area Chief Mining Engineer, Mr. F.P. Reid, Colliery manager, Mr. W. Magrath Colliery Surveyor. Mr. G. Eaves was appointed as Senior Undermanager and there were two other undermanagers, Mr. G. Blackburn and Mr. M.A. Claber. The undermanager in charge of the Plodder Seam was Mr. Blackburn and the manager had appointed Mr. B. Jones as the colliery electrical engineer and Mr. P. Allred as the colliery mechanical engineer.

At about 11.15 a.m. on the 18th. March, eleven men were working in the Plodder Seam development district at the colliery when the explosion occurred. Three men died instantly and seven died later in hospital.

On the afternoon shift of the 17th. March, a deputy ,Mr. C. McGuire, inspected the whole of the Plodder Seam and paid particular to the auxiliary fans. The manager had said that these fans were to be inspected at intervals not exceeding four hours. The first inspection commenced at 14.30 and nothing unusual was found in the roads but there was firedamp in the face. All the auxiliary fans were in good order and the amount of gas did not appear to be different from those shown on the statutory records. A second inspection was made at 19.45 and no change in the conditions as detected. At the end of the shift Mr. McGuire reported to the deputy Mr. W. Scholes who was in charge of the mine and completed his written report.

On the night shift of Saturday 17/18th March, a deputy Mr. A. Molyneaux, began the inspection of the Plodder Seam developments and found that the conditions in the drivage and the Dip Return were normal. continuing his inspection he realised that the fan ventilating the Return Drivage had stopped. On investigation he found that the fan was suspended by only one chain and that the inbye end of the fan had separated from the steel ducting. He also saw signs that the cable had been damaged. He traced the cable back to the fan switch, turned it off and took out the plug.

He realised that he could not restore the ventilation and fenced off the entrance to the Return Drivage. He went on and found that the Intake Drivage fans had also stopped. He tried to start them but without success. On investigation he found that the circuit breaker on the transformer supplying the switches had tripped and would not re-close. He telephoned the information to the surface where the official in charge of the mine Mr. D. Hall a deputy took the call and at 00.45 to the electrician in charge Mr. J. Marsh.

From the conversation with Hall and Marsh thought that the stoppage might have been caused by the planned movement of electrical apparatus which was scheduled for the weekend but Molyneaux was not fully convinced. He tried again to close the circuit-

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breaker but again failed and he continued his inspection to the top of the Plodder Dip Intake. He again telephoned the deputy at the surface who advised him to fence off the Intake Drivage.

He did this accompanied by a locomotive driver Mr. K. Wareing and before He erected the fence he tested for gas with his flame safety lamp but detected none. he left the area at 05.00 and wrote up his report. He spoke to Mr. Hall who had already included the problem in the colliery log book. M.r Molyneaux left the mine at 06.00

On the day shift on Sunday 18th. March an overman, Mr. J. Crooks, who was in charge of the whole mine arrived at 06.30 and conferred with Mr. Bolton and noted from the report books that the fans were not running and that Molyneaux had fenced off the entrances to both the places.

He was concerned and asked the deputy Mr. J. McKenna who was responsible for the day shift on the Plodder Seam development district. McKenna went underground at 07.00 and at about 08.00 he telephoned Crooks to confirm that he had examined the Return Drivage fan and found it damaged. He also added that the fan had dropped at one end, that the fan blades were damaged and that the guide vane cowl had become detached and was 45 meters along the inside of the air ducting. He saw that the cable entry gland was torn out and the connecting bolts between the fan and it's steel ducts was broken. Mr. McKenna was then instructed by Crooks to transport the fan from the Plodder Dip Intake to replace the damaged fan.

The planned work for the day shift electricians included a planned stoppage of the Intake Drivage fans. This necessitated a de-gassing of the Intake Drivage. To do this a member of the colliery ventilation staff, Mr W. McPherson was underground to attend to these operations.

The three electricians who were to do the work were absent and Overman Crooks had re-deployed an electrician, Mr. B. Sherman at 07.45 from another seam to the Plodder district. The electrician in charge of the Sunday day shift was Mr. T. Peet, who was on the surface and arranged for Mr. C. Dallimore to be called from home. He arrived at the colliery at 07.50 and was sent to work with an apprentice, Mr. B. Rawsthorne after they had received work permits and job description from Mr. Peet.

Mr. Crooks went underground at 09.00 to supervise the work in the Ince Six Foot seam. he was satisfied that McKenna was competent to deal with the situation in the Plodder seam. At 09.30 the underground manager Mr. M.A. Claber arrived at the colliery and spoke to Crooks on the phone to familiarise himself with the state of the mine. He was satisfied with the arrangements that had been made for the work in the Plodder seam.

The electrical work consisted of moving one section which controlled two fans from the Intake Drivage, from the sub-station opposite the entrance to the Intake Drivage onto a metal platform above the conveyor Dip Intake Conveyor. Two additional switches had been previously transported to the site and were already on the platform leaving room for the other two gate end switches and the section switch.

At 9.30 Dallimore reported to Peet that the busbar connection required for coupling the two additional switches was not available and because of the time required to provide the interconnecting trunk would extend the period during which the fans would be stopped. Peet instructed Dallimore to restore power to the three original switches, with the view of coupling the additional switches the following weekend.

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At about 11.20 Mr, McGuire was near the locomotive garage on the Main Intake near the bottom of the downcast shaft. Mr. F. Smith who was a deputy was at the terminal of the Ince Six Foot seam manrider. Both realised that something unusual had occurred. Mr. McGuire heard two muffled thuds, sensed a momentary reversal of the air, saw clouds of dust and felt a popping of his ears. Mr. Smith heard a bang, noted that the ventilation doors had opened and that there was excessive dust in the atmosphere. he immediately telephoned the overman, Mr. Crooks who was in the Ince Six Foot district.

Both McGuire and Crooks telephoned in turn to the surface to raise the alarm and inform Mr. Claber who was in the control room at the surface. At this time men at the surface had seen clouds of dust coming from the exhaust of the ventilation fan.

The undermanager directed McGuire to investigate the Plodder district and with Mr. Crooks to jointly evacuate the men from other parts of the mine. Mr. Eaves, the deputy manager was informed and he took control of the situation by putting into operation the Emergency Procedure. he summoned the Boothstown Rescue Brigade and notified various responsible persons.

Below ground Mr. McGuire went inbye by locomotive to within 80 meters outbye of the Plodder Intake level where he had to stop because he could not see because of the dust. From here he went inbye taking great care with the locomotive driver Mr. H. Baxter. After they had gone about 30 meters they came across Mr. B. Trumble who was crawling and groping his way out. He was very badly burnt and could not see properly. His lamp was light but was dragging on the floor.

Mr. McGuire told Baxter to stay with him and he went forward on his own. A further 10 meters he stumbled over Peter Grainey who was badly burned. he stopped to comfort him but after a little time Grainey got up and walked towards Baxter and Trumble. Baxter took charge of both injured men.

The visibility had improved and McGuire went forward again and found another survivor, Mr. W. McPherson badly burned lying near the Intake Drivage fans. Mr. McGuire decided to go outbye for help but a few yards outbye, he saw a fourth survivor, Mr. B. Rawsthorne standing on the conveyor. He assisted him to the sub-station and gave him a drink. He then went to the top of the Plodder Intake Dip and reported to the surface. He was told that rescue teams were on their way.

Crooks and Mcguire then made their way into the Plodder workings and passed four injured men in the Plodder Dip Intake and in the intake they released a severely burned man Mr. B. Sherman from under rubble. They also found Dallimore under rubble and they thought he was dead. McGuire remained with the injured while Crooks went for more assistance. At this time six casualties had been found and there were five men that had not been accounted for.

Mr, Crooks reached the top of the Plodder Dip about 12.00 and saw the Rescue teams arriving along with members of the colliery workforce with stretchers and blankets. The colliery personnel organised the stretchers and the Rescue Team went inbye. Trumble, McPherson and Grainey were taken to the surface,. Rawsthorne had returned to the sub-station and was repeatedly saying, "Come here. I want to tell you what happened. I told him not to do it."

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During the rescue operations, Mr. Crooks noted that the auxiliary fans for the intake drivage were running. To reduce the noise he stopped them by pushing the stop bottom on the gate-end switch since the fans were not doing anything useful due to the destruction of the air ducting by the explosion. It was pointed out at the inquiry that this meant that there was still power on after the explosion.

Sherman and Rawsthorne were the next to be taken out of the mine and under the direction of Harris, a third officer at the Boothstown Rescue Station the Team continued to search for survivors. They found four more casualties in the Return Connection which left one man still missing.

The Team returned at 13.10 to the outbye end of the Intake Drivage which had been made the fresh air base. The Team inspected the drivage but did not find anyone else and they returned at 13.40. After consultation with the senior management officials of the colliery and Mr. L.D. Rhydderch, a third Rescue Team made another search of the Return Connection and found Mr. J. Berry apparently dead and covered with debris. He was taken out of the pit at 13.50.

All the electricity was turned off to the area by Mr. A. Parr on the instructions of Mr. Reid, the manager and the area was left for a thorough investigation as to the cause of the disaster.

The men who lost their lives were-
John T. Berry, development worker,
Colin Dallimore, electrician,
Desmond Edwards, faceworker,
Patrick Grainey, development worker,
Peter Grainey, development worker,
Raymond A. Hill, development worker,
John McKenna, deputy,
Walter McPherson, ventilation officer,
Brian Sherman., electrician,
Bernard Trumble, development worker and
Brian Rawsthorne was seriously injured.

It had been established by the Rescue teams that there were no fires and tests were made on the state of the atmosphere. The Plodder seam recovered quickly but the Intake Drivage was left unventilated until 21st. March and work in other parts of the mine were suspended until the de-gassing was completed.

On the morning of the 19th .March a meeting was held at the colliery and the investigation under the direction of H.M. Chief Inspector of Mines was begun and a group from the Safety in Mines Research Establishment (SMRE) were called in to assist.

As in any mine explosion there had to be a build up of firedamp, air and a source of ignition. It was known that the Plodder seam was gassy and it was confirmed that the fans that were ventilating the Intake Drivage had been stopped before the explosion for a minimum of ten hours and a maximum of fifteen hours.

The rate at which the seam gave off gas was calculated to be 95 litres per second so in that time 3400 to 5100 cubic meters of firedamp would have been released. Four hours after the explosion samples taken at 100 meter intervals along the Intake drivage

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averaged 20% firedamp. Careful monitoring of the de-gassing operations were made on 21st. March and about 6680 cubic meters of gas were driven from the mine.

There could be no doubt that on the morning of the explosion the Intake Drivage contained large quantities of firedamp and this could have been overflowing into the Plodder Dip Intake when the fans were not working. This accounted for the build up of the gas.

The drivages were protected by stone dust barriers and two of these barriers in the Dip Intake and a single barrier in the Dip Return were found to be completely disrupted with the supporting brackets torn from the arch girders.

The investigations of the S.M.R.E. suggested a sequence of events of the explosion and the possible sources of ignition were considered. There were no open fires in the pit and no contraband was found. All the flame lamps that were issued were considered safe after the explosion and no shotfiring was even considered on that Sunday morning with no detonators issued. There was no evidence of frictional heat being made by any of the machines and ignition from a stone falling and causing a spark was not a possibility as there had been no falls.

There was a well founded suspicion that the gas was fired from an electrical source and there was an exhaustive investigation into this cause. It was established that the power was on at the Dip Intake but the apparatus at the inbye end of the Return Connection and all the apparatus at the Dip Return was not live.

All the apparatus was fully tested at the N.C.B. Area Central Workshops and several items were found to be damaged or defective and could have ignited gas but they were not considered to have caused the explosion. The damaged fan that had been found by Mr. Molyneaux, a deputy was examined. After the explosion it was found that the studs fastening the fan motor terminal box were sheared and the motor leads were damaged. The section switch controlling the fan had tripped out. It was possible that the loose fan blades caused the fan to vibrate and damaged the terminal box and leads.

The two casualties in their conversations after the explosion gave a pointer as to the cause of ignition. Both gave the cause of the ignition to the actions of the electricians. One mentioned a 'remote cable' associated with the switch and a 'rectifier' and a 'flash'. These remarks when coupled with Rawthorne's concern at the time of his rescue to Cooks were very significant.

The main switch to the Intake drivage was closed manually but it could be opened manually or automatically. It had an auxiliary transformer at 25 volts for remote tripping and locking. This circuit left the side of the unit by a bolted socket to which a meter of cable was attached. An identical plug was fitted at the other end of the auxiliary cable and both bore the notice, 'DO NOT DISMANTLE WITH POWER ON.'

Tests at the S.M.R.E. confirmed that the interlocking 25 volt circuit was not designed or intended to be intrinsically safe. These tests showed that the spark could be caused by a short circuit across the live pin and earth or by connecting a remote control circuit rectifier between live pins or between a live pin and earth. These sparks were capable of igniting an explosive mixture of firedamp and air.

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No rectifier could be found near the switches but there was evidence that Dallimore was using a rectifier prior to the explosion. He was probably in the act of testing the operation of the section switch interlocking circuit. The seriously injured Rawsthorne, the apprentice electrician confirmed this in his evidence the day after the explosions and again nine weeks later when he had fully recovered.

The Inquiry concluded that the explosion was the result of an ignition of firedamp in the Plodder Dip Intake airway. The gas built up due to the excessive delay in restoring the ventilation and the ignition of the explosive mixture was a spark produced between two live connector pins in an auxiliary plug on the interlocking circuit cable attached to a section switch on which the electricians were working.

As a result of the Inquiry the following recommendations were made-

1. "Switchgear which controls auxiliary ventilating fans should be sited on the intake end of the drivages which the fans ventilate.
2. The manger's auxiliary ventilation rules for de-gassing of drivages should ensure that-
3. unless firedamp concentration can positively be controlled to not exceed 1.25% all electrical apparatus on the return side of the place to be de-gassed should be isolated. This does not apply to apparatus which is certified intrinsically safe and is also approved under regulation 20 or regulation 21A of the Coal and Other Mines (Electricity) Regulations 1956 as amended.
4. all persons are withdrawn from places likely to be affected before the de-gassing operation is commenced.
5. In places where regulation 22 of the Coal and Other Mines (Electricity) regulation 1956 applies
6. no exposed live circuit should be tested unless the circuit and the method of test are certified intrinsically safe, and
7. the type of circuit used for the control and interlocking of auxiliary fans and section switches should be clearly identified and should be intrinsically safe.
8. Close co-ordination between mining and electrical departments is necessary to ensure the proper planning of electrical installations and reliability of electrical supply in relation to places ventilated by auxiliary fans.
9. Greater supervision and inspection of electrical control and interlocking arrangements of auxiliary fans, and early warning devices for the mechanical protection of such fans.
10. In the event of interruption in the normal ventilating arrangements of drivages in known gassy conditions, alternative arrangements should be provided where practicable to maintain adequate standards."

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