

ACCIDENT AT BULLI COLLIERY
ON 9th NOVEMBER, 1965

REPORT

OF

Judge A. J. Goran following an Inquiry by the Court
of Coal Mines Regulation established under
Section 33 of the Coal Mines Regulation Act, 1912,
as amended

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ACCIDENT AT BULLI COLLIERY ON 9TH NOVEMBER, 1965

An accident occurred at Bulli Colliery on 9th November, 1965, which resulted in the loss of the lives of four men, Robert Stewart, Frederick Hunt, John Hilton Murray and Henry Albert Smith. It was considered that a formal investigation of the causes and circumstances of this accident was expedient and in pursuance of the powers conferred upon me by Section 31 of the Coal Mines Regulation Act, 1912, as amended, I directed that the Court of Coal Mines Regulation established under Section 33 of the said Act should hold such an investigation. The Inquiry was held at Sydney and Bulli commencing at Sydney on 2nd December, 1965, and concluding at Bulli on 17th February, 1966. The decision of the Court is to be delivered from the Bench by Judge A. J. Goran on 27th April, 1966. Judge Goran has also furnished me with the accompanying comprehensive report on his investigation of this accident and in accordance with the provisions of Section 32 of the Coal Mines Regulation Act, 1912, as amended, I have arranged for the printing and making public of this Report. It is my intention to table this Report in both Houses of Parliament as soon as possible after the opening of the Third Session of the Forty-first Parliament of the State of New South Wales.

I would like to express my appreciation to Judge Goran and all persons associated with the Court proceedings for the prompt efficient and thorough manner in which the Inquiry into this accident has been conducted.

T. L. LEWIS,
Minister for Mines.
19th April, 1966.



Whereas it appears to me that it is expedient that there should be a formal investigation of the accident that occurred at Bulli Colliery on 9th November, 1965, which resulted in the loss of the lives of Robert Stewart, Frederick Hunt, John Hilton Murray and Henry Albert Smith, and of the causes and circumstances of such accident, I Thomas Lancelot Lewis, Minister for Mines, in pursuance of the powers conferred upon me by the provisions of Section 31 of the Coal Mines Regulation Act, 1912, as amended, direct such investigation to be held and require the Court of Coal Mines Regulation established under Section 33 of the said Act to hold such investigation.

Dated at Sydney this 12th day of November, 1965.

THOMAS LEWIS,
Minister for Mines.

IN THE COURT OF COAL MINES
REGULATION
HOLDEN AT SYDNEY AND BULLI } Number 1 of 1965.

IN THE MATTER of an Inquiry in pursuance of the Coal Mines Regulation Act into an accident which occurred at the Bulli Colliery on the 9th November 1965 and its causes and circumstances.

REPORT

TO

The Honourable Thomas Lancelot Lewis,
Minister for Mines in the State of
New South Wales:

Sir,

Having been directed by your Notice dated at Sydney on the 12th day of November 1965, made and issued in pursuance of the powers conferred upon you by the provisions of Section 31 of the Coal Mines Regulation Act, 1912, as amended, to hold a formal investigation as the Court of Coal Mines Regulation established under Section 33 of the said Act of the accident that occurred at Bulli Colliery on the 9th November 1965 which resulted in the loss of the lives of Robert Stewart, Frederick Hunt, John Hilton Murray and Henry Albert Smith, and of the causes and circumstances of such accident, I have completed my investigation and have the honour to report as follows:

PRELIMINARY

I held the first Sitting of the Court at Sydney on Thursday, 2nd December, 1965, and accepted appearances on this day. I granted leave to appear to the following persons:—

Mr. J. A. Lee, Q.C., and Mr. B. Herron of Counsel on behalf of the Minister for Mines, the Chief Inspector of Coal Mines and other officers of the Department of Mines.

Mr. R. G. Reynolds, Q.C., and Mr. N. Westcott of Counsel on behalf of the Australian Iron & Steel Pty. Limited.

Mr. G. Sullivan, Q.C., and Mr. C. Bowie of Counsel on behalf of the Australian Coal and Shale Employees' Federation, Southern District, Joan Winifred Stewart (widow of Robert Charles Stewart),

Esme Isabel Murray (widow of John Hilton Murray), Pamela Smith (widow of Henry Albert Smith), and Wilma Margaret Hunt (widow of Frederick Hunt).

Mr. K. Murray of Counsel on behalf of the Electrical Trades Union of Australia, New South Wales Branch, and Barry H. Kent.

Mr. W. McNally of Counsel on behalf of the Illawarra Deputies and Shot Firers' Association.

Mr. Doyle on behalf of the Amalgamated Engineering Union.

Mr. Crane on behalf of the Colliery Mechanics' Association.

Mr. Hume on behalf of the Australian Colliery Staffs' Association.

Mr. Geddes of Counsel subsequently appeared with Mr. Sullivan, Q.C., and Mr. Bowie of Counsel on behalf of the interests that these gentlemen represented.

I granted conditional leave to Mr. W. Parkinson on behalf of the Central Council of the Australian Coal and Shale Employees' Federation and the New South Wales Branch of the Federated Engine Drivers' and Firemen's Association. Subsequently I allowed Mr. Parkinson to represent these interests for the duration of the entire Inquiry. I refused leave to appear to Mr. S. J. Sawyer, Secretary of the Colliery Managers' Association of New South Wales, Mr. A. C. Girard, Secretary of the Joint Coal Board did not seek leave to appear but informed the Court of the Board's willingness to assist the Inquiry. I make note here that from time to time I accepted the assistance of Mr. Girard, who was most helpful to me throughout the Inquiry in conveying to me the attitude of the Joint Coal Board to certain of the recommendations which it was suggested by those appearing that I might make in my Report. This gentleman also furnished me with copies of reports of Joint Coal Board proceedings and other reports of matters in the mining industry which were of considerable assistance to me.

A number of the interests represented nominated assessors and, after hearing an outline of the qualifications and experience of those nominated, I appointed Mr. E. A. D. Buck and Mr. W. J. Mahon as Assessors.

On Monday, 6th December, 1965, in company with Messrs. Buck, Mahon, Brigadier Chapman, Registrar of the Court, Mr. Victor Parkinson, District Check Inspector, and officials of the Colliery, I made a thorough inspection of Number 8 Section Right at the Bulli Colliery, the area in which the accident occurred.

On Tuesday, 7th December, 1965, I commenced the hearing of the evidence at the Court House, Bulli and continued the hearing of evidence and the submissions of Counsel and representatives of interests at this Court until the conclusion of the investigation on Thursday, 17th February, 1966, with the exception of one day when, as a matter of convenience, the hearing took place in Sydney. During the course of the Inquiry the Court did not sit after the 23rd December, 1965, until the 1st



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February, 1966 because the intervention of Law Vacation and the Christmas leave of the mining industry made it impossible for me to continue the hearing during this period. The evidence at the Inquiry was conducted over twenty Sitting days and addresses of representatives occupied a further four days. The evidence occupies 995 pages of transcript. Addresses of Counsel brought this total to 1,151 pages.

At this stage I draw attention to the zealous work performed by the Court Reporting Branch and the system of duplication of transcript afforded me by the Department of Mines. At the conclusion of evidence I made an order dispensing with the services of a full reporting of Counsel's addresses. However, on the representations of Counsel, in which I was informed that the transcript was being read not only by most of the mining interests in Australia but that copies of the transcript were also being sent to various mining interests in other countries abroad, I reversed my order and as a result Counsel's addresses were recorded and duplicated.

Throughout the Inquiry I received most valuable assistance from my Assessors, Messrs Buck and Mahon. These gentlemen carried to the Inquiry a wealth of experience and practical knowledge which made my task much easier than it would otherwise have been. They showed a keen interest in the evidence and issues of the investigation and consulted with me, both inside and out of the Courtroom on every Sitting day. I add that their attitudes at all times were completely impartial.

I also wish to express my gratitude for the assistance given me by Brigadier Chapman, Registrar of the District Court in Sydney, who was the Registrar of my Court, and to Mr. T. Bevan, Clerk of Petty Sessions of Bulli Court, who acted as Registrar when Brigadier Chapman was performing other duties. Both of these gentlemen carried out their duties in the conscientious manner to which one grows accustomed among officers of the Department of Justice. Mr. Bevan also assisted in the conversion of Bulli Courtroom and the appurtenances of the Court House for the comfort of those whose presence was necessary at the Inquiry, and in particular for my Assessors and myself.

The result was the fullest possible public inquiry on the evidence available to me. At one stage of the hearing Mr. Reynolds, Q.C., submitted that my duty was not to come to a decision on conflicting evidence as to the causes and circumstances of the subject matter which I was investigating, but merely to outline such evidence as was not in issue and such evidence as to which there was a conflict. I rejected this submission and as a result I have made findings of fact on all such matters as I consider are proved by the evidence.

I have decided objective issues raised at my investigation according to the civil standard of proof, that is on the balance of probabilities as revealed by a study of the whole of the evidence. I have not, however, made a finding of fact which casts blame upon or shows a fault in any individual without applying the standard of proof usually reserved for deciding issues of fact in criminal cases, that is, I have not made such a finding against an individual unless I have been satisfied on the whole of the evidence beyond reasonable doubt. I now proceed to set out the evidence which I considered relevant to my findings and also my findings on the relevant issues involved. I add my observations and in particular my recommendations as to courses which I think it advisable to take in the future. These recommendations are based upon the evidence adduced during the course of my investigation, and the submissions upon that evidence made by those gentlemen who represented interests at the Inquiry.

A: THE FIRE

The fire broke out at approximately 9.15 a.m. on Tuesday, 9th November 1965. It occurred in Number 8 Section Right at the Bulli Colliery. This is part of a development of pillar extraction which had been started some months before the day of the incident. The relationship of the immediate area of the outbreak to the previous development of the section is an important matter in determining the more remote cause of the fire and the question of whether any blame should fall upon persons at the mine for the fire itself. I deal with this aspect of my inquiry later in this Report.

The immediate site of the fire was part of a heading which was being used as a shunt for a shuttle car described as Number 40. I briefly describe the area as follows:—

It is pictured in diagram form in the plan which was tendered as Exhibit "A" during the hearing. Three main headings known as "A", "B" and "C", forming in effect three roads, had been driven parallel to each other through solid coal. Transverse roads had been cut across these headings so as to form pillars of coal and these crossing roads are referred to as "cut-throughs". They had been numbered consecutively from six to zero, and the pillars formed by the intersecting roads had been partly and at times wholly extracted as far as Number 3 Cut-Through, starting with the pillars formed by Number 6 Cut-Through. As I have said this work had taken some months to complete to the day of the working as it stood at the time of the fire.

During the shifts immediately prior to the morning of the fire Number 2 Cut-Through had been extended by driving a cut-through to the left opposite to its intersection with "A" Heading and at the end of this extension the coal had been cut through at an angle towards the right of the extension. If this extended tunnel or road had been completely driven through the coal, it would have created a further pillar bounded by the extension in Number 2 Cut-Through with its angled development as described, Number "A" Heading, and the worked-out area of the mine from which coal had been previously extracted. Exhibit JJ, tendered at the hearing, gives an approximate picture of the work as it stood at the time of the fire, and the extension on that Exhibit is depicted by a pencilled area marked "13". As it was, this extension had not been completely driven through so as to make such a pillar when the fire broke out.

Coal was being extracted from this extension at the time of the fire. It was being taken from the coal face by a continuous mining machine and removed from the machine by two shuttle cars numbered Number 40 and Number 67, working alternately. These cars, some 24-feet in length by 8-feet in width, transported the coal back up Number 2 Cut-Through to a loading point where this cut-through intersected with "C" heading, whence it was carried by other vehicles to the surface.

The shuttle cars moved as follows:—

Number 40 shuttle car, when fully loaded, moved up to the extension of Number 2 Cut-Through until it reached the intersection of Number 2 Cut-Through and "A" Heading. The driver then changed his seat to another seat at the opposite end of the shuttle car but on the same side as his previous seat, and drove his car around the corner into "A" Heading, that is, to his left when facing up Number 2 Cut-Through towards the loading point. This took him and his car out of Number 2 Cut-Through and allowed the empty Number 67 shuttle car to proceed straight down to the coal face in order to receive a load of coal. After this car had passed the intersection of Number 2 Cut-Through and "A" Heading, Number 40 shuttle car was driven out of the area into which it had shunted and thence up Number 2 Cut-Through to the loading point where it discharged its load of coal. It then proceeded back down Number 2 Cut-Through into the same shunt area and waited for the fully loaded Number 67 shuttle car to proceed straight up Number 2 Cut-Through. When the latter car had passed the shunt area, Number 40 shuttle car would proceed down the extension to Number 2 Cut-Through to receive its load.

The important feature of this system from the point of view of the fire was that the one area was always used as a shunt for Number 40 shuttle car and this area was that part of "A" Heading which was to the right of Number 2 Cut-Through looking towards the coal face, that is down the extension of Number 2 Cut-Through. A feature of very real significance in what occurred later was that this shunt area was blocked off some distance down its length by a sheet of more or less tight brattice stopping, that is hessian, across "A" Heading between Number 2 Cut-Through and what was formerly Number 3 Cut-Through and was now worked-out mining area. In the normal course of working Number 40 shuttle car could not proceed beyond this brattice screen.

The worked-out area of a mine, that is the area from which pillars have already been either completely or in the main extracted, is a part of the mine in which it is hoped that the roof through stress will fall. This area is known in mining terminology as "the goaf". The brattice in the shunt in question thus divided the shunt area from the goaf. There was a brattice stopping or seal also in a somewhat similar position in "C" Heading between Number 2 Cut-Through and the goaf. There was no brattice in this region in "B" Heading.

The intake airway through which the air entering the workings flowed was "C" Heading. Since in the immediate working areas this formed an intersection with Number 2 Cut-Through, the air thus proceeded down Number 2 Cut-Through which was also part of the intake airway. Since "B" Heading was connected by intersecting roads with this intake airway in "C" Heading, these roads and "B" Heading itself became part of the intake airway. "A" Heading was the return airway.

Because the extension to Number 2 Cut-Through was, as it was being worked, a dead-end which would not receive proper ventilation by the main flow of air alone, auxiliary exhaust fans were installed in the return airway in "A" Heading near where it intersected with Number 2 Cut-Through, and these were coupled to large vent tubes which ran the length of the extension towards the coal face being worked and a form of ventilation of the working faces was achieved in this fashion. An important feature of these auxiliary fans and the vent tubes was that an extension of the vent tube system had been placed into the shunt itself and this took the form of a narrow flexible vent tube which was described at the Inquiry as "the elephant's trunk". It ran from the fixed vent tubes across Number 2 Cut-Through at near roof level into the shunt near the left hand rib of coal in the shunt as one faced down it towards the brattice, and then descended to the floor of the shunt where it stopped short some distance in front of the brattice.

The grade down Number 2 Cut-Through towards the coal face was a fairly steep downgrade, becoming steeper down the extension to Number 2 Cut-Through itself. The shuttle cars are rubber-tired vehicles operated electrically, the power supply being through a trailing cable. Each shuttle car has its own cable and it comes from a gate end box to an anchor point whence it extends to a drum on the shuttle car which unwinds the cable as the car moves from the anchor point and winds it in as it moves towards it. In order to avoid tangling the cables, the driver's seat and the cable drum on each car are on the opposite side from the position on the other car. Both shuttle cars have a disc braking system.

Section 8 Right where the fire took place, is almost four miles from the portal of the Mine. Transport is by rail car pulled by locomotives and the average time taken by these to reach a particular working place from the portal is some 40 to 45 minutes. The working faces throughout the mine are widely scattered, some of them being at a distance of miles from Section 8 Right.

At the time of the accident the day shift was working at 8 Right and it consisted of eleven men working in the area under the control of a Deputy, Charles Stewart.

These eleven were as follows:—

One machine operator on the continuous miner, described as the miner/driver. He was Robert Charles Stewart.

Three timber men assisting the miner/driver, dealing with roof support and ventilation. They were Frederick Hunt, John Hilton Murray and Henry Albert Smith.

Two shuttle car operators, Thomas Michael Mangles, the driver of Number 40 shuttle car, and Frederick Albert Hope, the driver of Number 67 shuttle car.

Two electric loco drivers and shunter, Donald Alroyd Ashford, a man named Booth and another named McIver.

One fitter, whose duty it was to inspect equipment, carry out running repairs of a mechanical nature as well as oiling, greasing and the like. He was Dale Jones.

One electrical fitter, Barry Kent.

The crew had reached the working place at about 7.40 a.m. and so had been operating for a little longer than one-and-a-half hours when the fire broke out at 9.15 a.m.

Immediately prior to the outbreak shuttle car Number 40, driven by Mangles, went to the face and received a load of coal. It then proceeded uphill towards the shunt while shuttle car Number 67 waited further up in Number 2 Cut-Through for the road to be cleared by Number 40 being driven into the shunt. Mangles stopped his car prior to entering the shunt in order to change his seat. He then drove round the corner into the shunt and reached a point where the front of his vehicle was slightly protruding beyond the entrance of the shunt into Number 2 Cut-Through. He was applying the brakes. At that stage he saw a "large flame", blue in colour, at the back of his car on the side opposite from himself. The flame then ran towards the bleed tube known as "the elephant's trunk" and ran up the tube. Mangles immediately jumped from the car before it had quite stopped and ran up Number 2 Cut-Through towards Hope and car Number 67. Subsequently it was found that his car had overrun a metal brattice stool (a piece of equipment used for erecting brattice, which was probably alongside the brattice stopping in the shunt) and it proceeded through the brattice stopping before it came to a halt. The probability is that the car, not having been brought fully to a halt by Mangles, proceeded a few feet further after he left and ran. A few seconds later, according to Mangles, the fire was across the intersection of "A" Heading and Number 2 Cut-Through.

Driver Hope's evidence substantially confirms the evidence of Mangles. From his position in Number 2 Cut-Through he observed a bright flash near the floor of the shunt in the region of the front or "boom" end of the shuttle car. To him it appeared that the flash was on the driver's side of the car and it was followed by an orange coloured flame which rose on the same side of the car and ran above the car, across the intersection. According to this witness when he last saw the flame, some 60 seconds after the initial flash, it was practically across the intersection about halfway down from the roof, "going very strong", without any smoke.

He obviously believed that the fire was electrical in origin since he called out to Mangles to "knock off" the electrical gate end boxes situated in Number 2 Cut-Through between "A" and "B" Headings. He himself ran up to the ramp in "C" Heading and called out to the loco driver, Ashford, to "knock off" the transformer which is situated further outbye in "C" heading. This meant, of course, that from that point of time the electrical system in the section was no longer working.

At the time of the fire the following men were near the face in the extension to Number 2 Cut-Through, that is inbye of the intersection of that cut-through with "A" Heading: Robert Stewart, the miner/driver, who was standing beyond the continuous miner at the end of the extension; Charles Stewart, the Deputy, who was at the timber bay which is situated at the end of the extension where it turns right before reaching the actual coal face. This would be some 80 yards from the intersection and 25 to 30 yards behind the continuous miner. With the Deputy were collected, John Murray, Frederick Hunt, Henry Smith, Barry Kent and Dale Jones. Thus in all seven men were caught inbye of the fire.

Jones described it as a very large fire of an orange colour on the left hand rib of the extension near and facing the shunt and covering an area from the floor to the roof. Later as he ran towards it he noticed blue fingers of flame reaching out from the fire. He apparently was the first man to see the outbreak and he called out, "There's a hell of a fire" and shouted a warning to Robert Stewart who was behind the miner. The Deputy, Charles Stewart, told the men to follow him and ran towards the fire followed by Jones with the other men apparently following behind them. Deputy Stewart told Jones to run straight up the heading and with his head down charged through the fire area. Jones followed suit. At that stage the fire was across the roof of Number 2 Cut-Through but did not reach right down to the floor of the cut-through although it was probably burning at floor level near the left hand rib or in the shunt. Jones described the heat as "very intense" and says that for some distance there was no air to breathe. The air was good up to the fire but from then on he was unable to breathe until he reached approximately the crib room which was round the corner in "B" Heading, which would be in the vicinity of 80 yards away from the fire.

Jones received no burns to his body or clothing. He was unable to say whether the elephant tube was on fire or whether the bar to which it was attached was burning. He had difficulty in making telephone calls but finally reported the fire to Mine personnel. Deputy Stewart told him to knock down a brattice seal which had been erected in Number 1 Cut-Through, and after some difficulty he succeeded in doing this with the help of Donald Ashford. This apparently was an attempt to short-circuit the air from the fire. He then noticed swirling smoke coming through where the brattice stopping had been, and it was being held back by fresh air which was coming from the direction of the transformer. At that stage Deputy Stewart emerged through the smoke on hands and knees

in "B" Heading, and Jones assisted him out. There was no light at this time. The smoke then was very dense. Jones describes it as "just like driving in a fog, when your headlights hit the fog you can't penetrate. You could not see. I could not breathe."

Deputy Stewart's evidence is that on Jones calling out his warning about the fire, he saw the fire at the top left-hand corner of No. 2 Cut-Through in "A" Heading. He called out to the others and in particular to Robert Stewart. He described the fire as rather large, about four feet in length across "A" Heading and about two feet in depth from the roof. He led the way with Jones and the other men following him towards the fire. From a position about 15 yards from the intersection he could see the elephant's trunk burning to a point about three parts of the way across the Heading. He describes the flames as dripping from the plastic tube like drips of fire dripping to the ground. He says that there was no fire at floor level or in the area of the fans to his right in "A" Heading. He claims that the only thing on fire was the bleed tube. The fire was orange in colour apart from the drips of fire which appeared different. He put his head down, looked to his right and charged through the flames. He received small burns to the nose and the ear from pieces of plastic which stuck to his head at those points. The fire was only a matter of a few feet in depth with very little smoke, but the heat on the outbye side was very intense for about 15 to 20 feet.

The Deputy gave orders to Jones to go to the phone for assistance while he went to the loading ramp up No. 2 Cut-Through where he saw Hope. He then went to the crib cabin where he saw Jones and rang for extinguishers, but found that these had already been arranged. He told Jones; "Go to the rigi-seal stopping in No. 1 Cut-Through and pull it down to short-circuit the air." He went back through "B" Heading to No. 2 Cut-Through and round the corner smoke was swirling towards him. Smoke was also pouring through the No. 1 seal when he was trying to pull it down and he ordered Jones and Ashford to replace it. He returned to the crib room and smoke there began to swirl round him. He tried to leave and fell and Jones came through the smoke, took him by the hand and led him through "B" Heading to Number Zero Cut-Through.

Stewart says that when he first ran up to the loading ramp to a point roughly 60 yards from the fire, he looked back and could see no fire because of the smoke swirling round it. There was not even the glow of fire.

Barry Kent says that after the Deputy and Jones ran up the hill towards the intersection, the three timbermen moved with him, that is Hunt, Smith and Murray. He noticed that the miner/driver, Robert Stewart, was not with them and he stopped, went back a few yards and waited for him to catch up. He and Stewart were a few yards behind the three timbermen. When he first saw the fire he saw what he thought was the miner cable burning about 4 feet in length on the left-hand side of the place outbye the bleeder tube. The flame appeared to be coming from where the miner cable was tied. The fire appeared to burn outwards and then it caught the bleeder tube and burned along the outside casing of the tube towards the fans, and he noticed something dripping from the tube. At this time he saw the Deputy and Jones run through underneath the bleeder tube. He was then about 20 yards behind them. The flame was orange/red in colour with no smoke.

As the men ran towards the fire the whole bleeder tube fell to the ground and after it fell the flame expanded in both directions across the Heading and outbye and rolled towards them with a slow swirl up from the floor. This flame, according to Kent, was very different from the initial flame. The five men stopped because of the heat about 15 feet away from the flame. They were in a line, excepting that Hunt was slightly in front of them. Kent told the other men that there was only one course, namely to go through the flame. He ran into the flame, tripped over and fell on one hand, losing his helmet, and his light went out. By the illumination from the flames when he looked up he could see three bare wires. He got up, fumbled for his light, switched it on and guided himself by means of the props through thick black smoke up the heading. Finally he emerged from the smoke and received first-aid attention. He was badly burned about the face and hands. Kent says that as the men were running up the hill one of them suggested that they obtain the water hose and he warned them not to use this, because it was an electrical fire and the power was still on. He says he heard the fans stop when they were close to the flames.

The remaining witness to the fire itself was Donald Ashford, a locomotive driver, who was at the loading ramp at the top of No. 2 Cut-Through when the fire broke out. He says that he saw a flash and as he looked he saw a big fire at the intersection of Number 2 Cut-Through and "A" Heading at a depth of 2 or 3 feet from the roof itself. It was bright red in colour. He turned the transformer off at Mangles' request and asked two men, Zanni and O'Connor, to obtain extinguishers from the transformer and the locomotive. He then corroborates Jones and Stewart as to the attempts at controlling the air supply to the fire by means of the rigi-seal stopping in Number Zero Cut-Through.

I have endeavoured from these accounts to obtain a true picture of what occurred at the intersection on the morning of the fire. At this stage I do not deal with the causes of the fire which I cover in detail subsequently. It is important, however, before drawing any inferences as to what were the immediate and more remote causes, to be as clear as possible as to the events themselves, otherwise much of what follows, which is based upon tests made and opinions proffered by experts, could be inconsistent with the events as they actually happened on the 9th November.

I have made due allowance for the attempts by witnesses to reconstruct what happened rather than to depict what they actually saw. I have also been careful to assess the distortion which may affect the observation of men taken by surprise and swayed by shock and the terror of fire. I have weighed one other possible factor, namely the desire which might exist in one or more witnesses to colour their evidence in order to hide their own shortcomings.

Taking into account the various minor inconsistencies that occur in these accounts I find that at about 9.15 a.m. on shuttle car driver Mangles bringing Number 40 shuttle car almost to a halt in the shunt area, an ignition took place and flame spread around the area of the bleed tube which extended from the floor near the brattice erected in that shunt along the left-hand rib of the shunt, looking inbye, and which was tied to the roof timbers. The fire spread out from the shunt into Number 2 Cut-Through and across towards the area of the fans in "A" Heading. At first the fire was confined to the right-hand rib of Number 2 Cut-Through looking inbye and the area of the shunt itself, but it soon spread across Number 2 Cut-Through at a depth of some two to four feet from roof level. This left a space of from 3 to 5 feet between the lowest point of the flames and the floor of Number 2 Cut-Through which enabled Deputy Stewart and Dale Jones to escape comparatively unharmed.

By the time that the other men, trapped in the extension to Number 2 Cut-Through, reached the vicinity of the fire, that is seconds after the first two men had escaped, the electric miner cable, which also ran across the roof of the intersection of No. 2 Cut-Through, and the plastic bleed tube both fell to the floor, both having been burned by the application of external heat, and their supports having been destroyed by fire at the same time.

This left a wall of flame from roof to floor across the intersection. Barry Kent attempted to get through this wall of flame but tripped and fell, receiving somewhat severe burns. He was saved, however, from death by his own determination which caused him to pick himself up and grope his way through dense smoke to safety.

The four remaining men, Robert Stewart, Frederick Hunt, Henry Smith and John Murray, were not so fortunate and were trapped to their death behind the fire.

I discount the evidence of Deputy Stewart as to the extent of the fire in two respects. Firstly, it seems to me impossible, in view of the rapid spread and size of the fire, for him to have looked back from the loading ramp at the top of No. 2 Cut-Through and seen only smoke and no fire. It must be remembered that on any estimate of time the events from the first outbreak of fire to the escape of the three men, would have taken no more than a minute, probably substantially less. In this time the fire spread very rapidly and was raging when the men who were trapped were faced with the alternative of going through the flame or staying where they were. I cannot accept the proposition that at the end of this time a fire of such a nature as that described would have been invisible because of smoke from Stewart's viewpoint. Secondly, the fire as described by Stewart, was limited to an area involving the bleed tube itself and a comparatively small area on the rib of Number 2 Cut-Through near the corner of the shunt. The evidence of Mr. Henry Arthur James Donegan, Chief Analyst of the New South Wales Department of Mines, is that the plastic material with which the ventilation tube was composed, is a self-extinguishing material, which could only have been ignited by a fire or a temperature in the vicinity of 900° Centigrade or more, so that there would have to be an area of intense flame and heat around the tube before it would continue to burn. Any gases or other inflammable material carried inside the tube would themselves burn. Mr. Donegan accounts for the drips of fire which fell to the floor, as coming from the plastic material of the electric cable which tumesced and fell in burning molten drops. This is quite contrary, as is the direct evidence of other witnesses, to the evidence of Deputy Stewart. It appears to me that at the Inquiry Deputy Stewart was inclined to lead me to believe that it was the bleed tube alone which caught alight and not other inflammable material in the shunt. I am confirmed in this view by the subsequent discovery that a considerable mass of inflammable gas, independent of the bleed tube, existed in the shunt immediately prior to the fire. I shall deal with this aspect of the matter in the course of my Report.

B: RESCUE OPERATIONS

At about 9.20 am. Mr. Denis John Stone, the Manager of Bulli Colliery, received a message from the Colliery Clerk that he had received a telephone call from underground to the effect that there was a fire which had trapped men. Mr. Stone immediately rang the Traffic Control Officer underground who told him that he had no knowledge as to the extent of the fire. After some difficulty he managed to speak to Mr. Hope by telephone, who also could give him few details. Mr. Stone then arranged for the Colliery Clerk to telephone the Rescue Station.

Under the Mines Rescue Act Rescue Stations are permanently established in each district. The South Coast District Station is situated at Bellambi a few miles from Bulli Colliery. The personnel of Rescue Stations are specially trained for rescue work, are permanent employees and are available on call. In addition to these men the Mines themselves have crews who are trained in rescue work with the assistance of the men from the Rescue Stations. After the fire alarm at Bulli approximately 110 men took part in the rescue operations, using breathing apparatus which is adequate for a two-hour period before re-charging. Each group of men involved worked in the Mine in two stints of two hours each before being withdrawn.

Mr. Stone spoke directly to Mr. D. James at the Bellambi Rescue Station. At 9.40 am. the Under-Manager, Mr. Puddle, rang him to tell him that he was on his way to Eight Right Section, but had no details concerning the fire. Mr. Stone met the Superintendent of the Rescue Station at the Mine portal and they went inside the Mine at 10.20 a.m. together with Mr. Ryan, Assistant Superintendent of Southern Collieries. They travelled to the marshalling yard underground; where instructions were given for the drift to be kept clear so that rescue squads who were following behind could travel to the fire. On the way down towards the fire they met the local Check Inspector and discussed the removal of the men from the Mine. At 10.55 a.m. the party arrived at the sweeps at

the beginning of "C" Heading where a brattice screen had been partly erected in an attempt to control the spread of the thick smoke which was emanating from the fire. Deputy Stewart was at the scene and gave details as to the fire. Mr. Stone remained at this point to co-ordinate and control rescue activities. In the meantime three men from the Rescue Station, Mr. Puddle and Mr. Ryan went forward under the brattice screen but returned in a few minutes because of the smoke conditions.

At 11.30 a.m. Mr. H. Wilkinson, General Superintendent of Collieries, Mr. C. Martin, Deputy General Superintendent and Mr. J. J. Grierson, Superintendent, arrived and discussions took place as to the means of dealing with the major problem which was preventing rescue activities, namely thick smoke. A further screen was constructed in Zero Cut-Through which forced the smoke down "C" Heading, and a similar brattice screen was then erected in No. 1 Cut-Through. The smoke then receded to No. 2 Cut-Through. The squad, wearing rescue suits, moved inwards, and Mr. Stone and others assisted them with bringing rescue materials, hoses and the like. Difficulties were then encountered in controlling the smoke and by about 2 p.m., using a "sail" (a moveable hessian screen on a frame) and water, the party advanced past shuttle car 67. It was seen then that the fire was mainly in the timber and was in No. 2 Cut-Through between "A" and "B" Headings below shuttle car 67. The roof was breaking up and there had been some falls. Shoring-up operations then commenced.

In the meantime various Inspectors of the Mines Department, who were at different locations in the district, were notified and all arrived as soon as possible during the fire-fighting operations. The Under-Manager, Mr. Puddle, had organised the necessary supplies of fire-fighting material, including fire hoses, nozzles, breech pieces, stone dust, brattice and the like. He had inspected the return airway in which he found there was no serious blockage. The men working in other parts of the Mine were taken out of the Mine as the transport system became available to them after its primary use for introducing rescue personnel to the site of the fire. There was no immediate danger to these men, and I make no criticism of the fact that certain of these men remained underground for two hours after the first fire alarm. Mr. Kent, who was suffering from burns, was taken to the surface much earlier than this. In the meantime, the mine workers not involved were held at the marshalling yard in a perfectly safe position about a mile from the fire.

On Mr. Wilkinson's arrival he took charge of operations underground while Mr. Pierce, Assistant General Superintendent, was in charge of the surface. They remained on duty for the next 24 hours.

Mr. Menzies, Senior Inspector for the Mines Department, arrived underground at about 1 p.m. and commenced his investigation as well as inspection of fire fighting operations. Mr. Longworth, District Inspector of Collieries for the Mines Department, the Inspector for the area in which the colliery is situated, arrived at the scene of the fire at 2.40 p.m. He made certain tests and investigations which I refer to later in this Report. At 10.30 p.m. Mr. Menzies relieved Mr. Longworth. At this stage the fire was being fought from two directions. One crew was located on top of a roof fall in No. 2 Cut-Through, directing water towards the main seat of the fire, and a second crew was advancing up the return airway from No. 1 Cut-Through towards that portion of the fire still burning beyond the fans. The fire had in fact been brought under control by about 6 p.m.

By 4 p.m. Mr. Ryan had found a way round the goaf edge through a narrow passage and had seen the fire from the end of "A" Heading, that is the shunt. The fire was then burning on both rib sides alongside the shuttle car. At seven minutes past five Mr. Martin took the South Bulli Rescue Team under oxygen to this shuttle car and attacked the fire from there. They then discovered one body, badly burnt, lying in the shunt near the rear of the shuttle car. Two other bodies had been observed alongside the shuttle car between it and the right hand rib looking outbye from the shunt. They could not be moved immediately because of the close proximity of the fire and heat, but were brought out at 5.45 p.m. The bodies recovered by this time were those of John Murray, Henry Smith and Frederick Hunt, leaving Robert Stewart still to be accounted for.

Earlier in the afternoon a foam plug machine which had been brought to the Colliery from the Rescue Station had been set in position in No. 2 Cut-Through. This was brought into operation at 6.40 p.m. and after a short breakdown, foam from it was blown through No. 2 Cut-Through into the area of the fan with immediate effective results. Smoke problems were then re-encountered through recirculation and these were dealt with while water was still being played at the intersection of "A" Heading and No. 2 Cut-Through. Despite this no fire or glow was seen in the area immediately adjacent to the intersection.

By 11 p.m. entry had been made into the working place but Stewart's body was not then discovered. It is obvious that by this time he could not possibly have been alive. It was believed that he had been buried under a fall.

Fire fighting operations continued throughout that night and the managerial staff had no relief until the 10th November. At 1 a.m. Messrs. Stone, Ryan and Puddle left the Mine for some hours' respite and sleep, to return at 7 a.m. At 9 a.m. the Rescue Team under oxygen entered the working lift (that is the extension to No. 2 Cut-Through) under the lip of the fall. They had to leave because of smoke but returned with smoke goggles while timbering operations and hosing of the fall area continued. At 9.15 a.m. the body of Stewart was discovered near the timber-bay. At this point there was a "T"-piece in the vent tube and Stewart was found with his head in this vent tube, his miner's oil lamp upside down and extinguished on top of the tube and a watch, which apparently had belonged to one of the other men, lying in the tube itself. Stewart's battery headlamp was still attached to his cap. It is clear that he had carried his safety lamp with him until he died, possibly making tests as he moved around. The body was removed on a stretcher. Shortly after 10 a.m.

heating was found to be re-starting in the rib adjacent to No. 40 shuttle car and water was played upon this immediately. Subsequent operations included the clearing of the area of smoke and methane gas, which was found to be emanating, as well as the carting of hot material from the region of the fire.

On subsequent examination it was found that the fire had extended from a distance of some 12 feet from the intersection of "B" Heading in No. 2 Cut-Through down this cut-through to the intersection of "A" Heading and to an area limited to the first four bars under the lip of the extension to No. 2 Cut-Through. To the left of this intersection the fire had extended to the area of the fans, burning all the supports in the fan area. To the right in the shunt the fire had burned back on either side of No. 40 shuttle car, had destroyed the brattice stopping in the shunt and had been limited in its extent to a very short distance beyond where this stopping had been. The loaded coal in No. 40 shuttle car had also burned. During the course of rescue operations Mines Inspectors and, in particular, Mr. Longworth conducted tests for gas in the area, and discovered at various points methane and carbon monoxide. Methane was found at roof level. However, after a brattice sheet had been erected at the intersection of "B" Heading and No. 2 Cut-Through, which channelled air down "B" Heading into the goaf and forced it through the goaf edge into "A" Heading, three per cent of methane was discovered in the shunt adjacent to the shuttle car at roughly floor level. The significance of this discovery will become apparent later in my Report.

I can make no criticism of the rescue efforts on the part of any person involved. The operation was a combined one, involving Mine management, rescue teams, Departmental officers and men from the Colliery. There was a sense of extreme emergency with the lives of workmen involved. The task was most arduous, extending over many hours. The work was carried on under obvious difficulties and apparent danger. Nevertheless, the operation began as promptly as possible and was continued with great efficiency and with effort on the part of each man to the utmost limits of his capacity. I have inferred from the bare words of the evidence given by witnesses that this was a time of great anxiety. Some men, including the senior officials of the Mine, obviously worked almost round the clock without rest.

Inspector Longworth, an eye witness of what was done, describes the position as follows:

"There were senior officers of the Colliery at the scene of the fire and they had no need to be there. It was a voluntary effort on their part and they set an example of leadership by their presence and they had their wealth of experience and they were able to assist greatly in organising the work of rescue, and I would say that there was not one instance where a man refused to go and do some measure or contribute in some way to the effort that was being made to rescue these people. It was a quite commendable effort on everyone's part and it was the fact that there were men who were missing that was responsible for perseverance when had it not been for that, had there been no men missing, I think the area would have been sealed up and left. It was the fact that there were men missing, the object and the desire was to rescue them, even though the thought was held that it might be too late anyway."

Nevertheless, I would point to a feature of the evidence which has given me some concern and in respect of which I make certain observations subsequently. It is clear that no foam extinguisher existed at the Mine itself and the one in use had to be brought from the Rescue Station. Fortunately this Station was but a short distance from the Mine. The same Station, however, serves other Mines which may not be reached in the event of fire without considerable delay in view of present traffic conditions. Again, the scene of the fire was so far removed from the portal of the Mine that a substantial period necessarily had to elapse before any foam extinguisher could be brought from the surface. I am constrained to speculate as to whether this fire would not have been brought more immediately under control if there had been such an extinguisher located at a point nearer the seat of the fire.

I must say, however, that this was thought at first to be an electrical fire and the proper fire fighting equipment in such a case would have been of a dry chemical nature. Again, such equipment was lacking in that area of the Mine close to the fire. In fact the only fire fighting equipment available for such an emergency consisted of small extinguishers on the continuous miner and the shuttle cars and locomotives. These would only be effective for the purpose for which they were designed, namely the extinguishing of fires connected with the vehicles on which they were located.

Further there were no effective fire fighting hoses in the vicinity of the fire. The evidence clearly establishes that, although water lines extended practically to the face itself, only one-inch hoses used to combat dust conditions and the like were available. This would mean that a fire of major proportions, until relief was obtained, would have to be fought with water apparatus more suitable for the watering of gardens. There was also a lack of location points in the water lines to which hoses could be attached without substantial delay in the emergency circumstances that occurred.

The men themselves had no self-rescue apparatus such as has been available for some time which may have enabled them to pass safely through smoke. I merely make these observations at this stage and deal with the possibility of their remedy at a later stage.

C: THE VICTIMS

Dr. Francis Kelvin Bartlett, the Government Medical Officer for the District of Bulli, conducted a postmortem examination of the bodies of the four men who had died. This examination took place on the 10th November 1965. It is quite obvious from this examination and from the position in which the bodies were discovered near the shuttle car in the shunt that Henry Smith, John Murray and Frederick Hunt, met their death from similar causes and in the same circumstances as each other. Dr. Bartlett says that they died suddenly of asphyxiation. The bodies were so severely burnt that the extent of the burns in themselves would have been sufficient in each case independently to have caused death. The postmortem findings showed that each man had inhaled smoke and gas and had apparently been unconscious as a result during the period of most of the burning, if not all of it.

I was puzzled during the Inquiry as to how these three unfortunate men found themselves in the shunt at all. To arrive there they must have gone through a curtain of intense fire. When Barry Kent, the third man to escape, ran through the fire area, the flame must have extended almost from roof to floor, and these three deceased would have observed this condition of the fire at any time while they were still alive. Nevertheless, they had turned left down the shunt and were found in the vicinity of the shuttle car, one indeed having passed by that vehicle. It must be remembered also that the ribs of the shunt and the coal in the shuttle car were themselves on fire. The probabilities are that they died within seconds of entering the shunt. As to their motive for entering the shunt I can find no firm answer. It is possible that one of them believed or in fact knew that an escape route existed at the bottom of the shunt via the goaf. It is possible that when they saw the depth of the flame that lay directly ahead of them, they thought their better chance was to traverse the few feet of flame under the lip of the extension of No. 2 Cut-Through and turn to the left in the goaf where the fire, for all they knew, was smaller in depth and extent, rather than to face the awful prospect of charging through an extensive fire directly in front of them up No. 2 Cut-Through. It is, of course, not known at what time they made their bid to escape.

It was suggested at the hearing by one witness that they must have seen Kent trip and fall in the flames and, therefore, believed his route was the more dangerous and were loath to follow. On the other hand, Kent was of the opinion that when he fell the fire was so deep behind him that he could not have been seen by the trapped men.

These are matters which must remain for speculation. The crucial fact is that these three unfortunate men, after a period of terror, met shocking deaths.

The fourth man, Robert Stewart, received no burns at all. Postmortem findings in his case established conclusively that he died of poisoning by carbon monoxide gas generated by the fire itself. It is clear also that he did not die immediately but lived for over an hour after the fire commenced and, though close to death, was still alive when rescue operations commenced. The details of his last minutes of life can be clearly established from the position where his body was found and certain messages that he left while still conscious.

Stewart had obviously tried to stay alive by searching for air uncontaminated by extinctive or poisonous gases. He had visited the ventilation tubes which had been erected for drawing fresh air into and gas away from the working face. This was probably because he mistakenly believed that breathable air was to be found in this system. The fact is, of course, that the fans having been stopped, these tubes were not ventilating the extension to No. 2 Cut-Through in any way. He probably did not know this. However, even if the ventilation system had still been in operation the tubes would have drawn nothing but noxious gases and smoke from the fire since any air which would flow into them would have to enter the extension from the fire at the intersection.

At about 10 a.m. he had visited an open "T" intersection which had been let into the ventilation tube about halfway down the extension. In this he had written with chalk the following message:

" TELL WIFE
KIDS
I LOVE THEM
DEARLY
CANT LAST LONG
NO 10 a "

In the last section of the tube, which was described as resembling a 44-gallon drum, he had written, apparently with stone, the message:

" ALL CAN THINK OF
WIFE KIDS
HOPE CAN DIE LIKE MAN
NEARLY DONE FOR
10.25 am "

and below this he had written the words:

" CAN'T BREATH "

In another "T" piece which formed the angle of the tube near the timber-bay, he had left the message:

" IF GETTING WEAK
CANT L "

and some marks following this which were indecipherable. He died in this position.

These sections of the tube were taken into the possession of Detective Senior Constable Kevin Henry Parsons, who is attached to the Criminal Investigation Branch and stationed at Bulli, and are now in the possession of the Coroner at that town. A transcription of the messages has been made by this police officer, and this was tendered at the Inquiry as Exhibit "O".

It would be doing less than justice if I failed to draw attention to the character of this young man which emerges from the evidence. It is obvious that to the end he was a loving husband and father. Faced with the knowledge of the certain end which he was approaching, he died bravely and with dignity.

D: CAUSES OF THE FIRE

In the days that followed the fire Departmental Inspectors and others made specific tests in the section, designed to discover—

- (1) the nature of the combustible material which had ignited; and
- (2) the source of the ignition.

1. The Combustible Material:

On the 10th November 1965 Inspector Longworth with assistants conducted tests for gas in the fire area. He noticed that prior to this time a brattice sheet had been hung from the roof to the floor across the intersection of "B" heading and No. 2 Cut-Through. This had been designed by Mr. Stone after the fire to channel air through the goaf. Some of the air so channelled would flow through that portion of "A" Heading which had been used as the shunt. Mr. Longworth tested for gas in the area of the roof fall and the shunt and he recorded 1.75% of methane at the roof, and at roughly floor level adjacent to the shuttle car 3% of methane.

Upon discovering the presence of this gas Mr. Longworth asked Deputy Kelly to come to the scene and told him what he had discovered. He asked the Deputy to make a test for gas with his oil lamp in the same position. Deputy Kelly's lamp showed at least 2½% of methane at the floor and at least 1½% at roof level. Thereupon Inspector Griffiths made a test at the same place for methane with the oil safety lamp and obtained a reading of 2% methane at roof level. He obtained a methanometer for Mr. Longworth (an instrument designed for accurate detection and reading of percentages of methane gas) and with this instrument Mr. Longworth tested throughout the area. He traced methane at floor level from the back of the shuttle car to the edge of the goaf. The reading obtained was 2% in the general body of the shunt near the shuttle car with a maximum reading of 4% at floor level at the edge of the goaf. These methanometer readings were checked with the oil safety lamp. Mr. Longworth regarded them as significant quantities in that the concentrations were sufficient to ignite in the presence of an ignition source. He informed Mr. Stone that an approaching condition of danger existed in "A" Heading and made suggestions as to its control.

At the time these tests were being carried out Mr. Longworth noticed the "feel" of carbon dioxide at floor level in the same area. Mr. Griffiths, testing with an oil safety lamp for methane, actually lost his light in carbon dioxide at this area. The Inspectors came to the conclusion that the gas actually present at the goaf edge in "A" Heading and in the shunt area was "Illawarra Bottom Gas".

Abundant evidence was tendered during the Inquiry as to the nature of this gas and of methane and carbon dioxide. I refer in more detail to this evidence later. At this stage of my Report the position in brief may be summarised as follows from the evidence of Mr. H. A. J. Donegan, Chief Analyst for the New South Wales Department of Mines, who prepared a report for the Inquiry which is now Exhibit "X".

Mine atmospheres contain several gases. Apart from fresh air which contains 20.93% oxygen, the following are those which are relevant to my Inquiry:—

- (a) Carbon dioxide (CO₂). This gas is heavier than air having a density relative to air of 1.53. It is an "extinctive" gas, being in itself incombustible and of a nature which will not support combustion. Owing to its density it accumulates on floors and in the lowest parts of mine workings. In sufficient concentration it will extinguish an oil safety lamp. It is a constituent of the gas which in mines is called "black damp" or "after damp". In its lower concentrations it causes difficulty in breathing and substantially increases respiration. In its higher concentrations it will cause impairment or loss of consciousness and death. The permissible upper limit in working areas in New South Wales coal mines is 1½%, beyond which limit the gas must be removed, diluted, or failing this work must stop.

Mine personnel who gave evidence said that they could detect this gas by a peculiar taste or smell and a feeling of warmth around the lower limbs.

- (b) Methane (CH₄). This is a colourless, tasteless and odourless gas. It is lighter than air, having a relative density of 0.55. In sufficient concentration in air it will burn, and between certain limits of concentration it forms an explosive mixture with air, the most explosive mixture being one volume of CH₄ with 10 volumes of air. At a concentration of about 5½% of methane the gas burns in an oil safety lamp and extinguishes the oil flame owing to its rapid consumption of oxygen. Below this concentration it can be seen as a cap on the flame of a safety lamp with difficulty at 1%, becoming more readily visible as concentration increases before it reaches the extinctive limit. Owing to its low density it tends to rise to the roof and highest parts of mine workings. It can issue from floor strata or from the coal seam

itself. It is the main constituent of the gas known in mines as "fire damp". The Coal Mines Regulation Act prescribes certain limiting average percentages of methane in the air under various circumstances in New South Wales coal mines.

- (c) Illawarra Bottom Gas. Over geological time in coal seams the movement of methane and carbon dioxide may cause them to mix and once mixed they do not stratify unless over a considerable period. On the South Coast of New South Wales (Illawarra area) although the seam gases range at various places from almost pure carbon dioxide to almost pure methane, normally the gases are variable mixtures of carbon dioxide and methane with a little nitrogen. These gases are known as "Illawarra Gas". When the gas issuing from the seams is predominantly carbon dioxide and so is heavier than air and flows along the floor, it is called "Illawarra Bottom Gas". Depending upon the percentage of methane in this mixture, the gas will burn in the presence of oxygen, and in certain concentrations may explode on being ignited.

Upon discovery of these percentages of gas in the shunt Mr. Longworth, Mr. Stone and Mr. Puddle decided to hang a sheet at the edge of the goaf in "A" Heading from the roof just clear of the floor in order to dilute the Bottom Gas that was coming in from the goaf edge at floor level 8. At 2.25 p.m. the same day further tests were made in the shunt area and it was then found that there was a concentration of methane of 4% on the left rib near the floor at the goaf edge, and 2% in the general body of air outbye the brattice sheet which had been hung at the goaf edge. A further search made it clear that air was being short-circuited to the goaf because a brattice sheet in No. 2 Cut-Through between "A" and "B" Headings, had been partly opened. On this sheet being restored the percentage of methane in the general body of air in the shunt dropped to 1%. A bleed of methane, however, was coming from the left-hand lower rib side of the shunt and appeared to be coming from the goaf past the rib. This was being diluted by the intake air which had been directed across the brattice sheet erected in the goaf.

Mr. Longworth says that he made tests at this point on several occasions after the day of the fire and on each occasion found methane.

On the 8th December, the day after the hearing of evidence at my Inquiry began, the conditions immediately prior to the fire were simulated with the co-operation of the management of the Mine. It was generally agreed by the parties appearing at the Inquiry that, except for some very minor differences, the duplication of the exact pre-fire conditions represented a satisfactory test of the arrangement of ventilation as at the moment of the outbreak of fire. The fans in "A" Heading were put into operation, brattice screens and stoppings were re-erected and, in particular, the brattice stopping in the shunt, which had been destroyed by fire, was replaced in the same position as it had occupied at the moment when the flash of fire was first seen by the shuttle car drivers. Tests were then made by the Inspectors and others. Mr. Longworth discovered that there was air leaking between the side of the brattice sheet and the right-hand rib of the shunt. He found methane there on his lamp and he felt a sensation of black damp in his throat a little lower to the floor. He tested for methane in the air which was leaking through and found it right along the right-hand rib side of the shunt to the entrance, the percentages varying from 5% to 2½% or 3%. This was verified both with a methanometer and the oil safety lamp. At floor level the maximum methanometer reading was 2½%. Nearer to the roof the reading fell to 1.8%.

On Friday, 12th November, three days after the fire Mine Inspectors took samples of the air at various points in the shunt area from the goaf edge to the intersection of "A" Heading and No. 2 Cut-Through.

On the Monday following the day of the fire, that is the 15th November, Mr. Longworth and Mr. Donegan took samples of the air in the shunt at similar points including the goaf itself beyond the end of the shunt, and Mr. Donegan subsequently analysed all the samples which had been taken. On Tuesday, 16th November, 1965, with Mr. Griffiths, Mr. Stone and Mr. Puddle, the general quantity of air passing through the section was measured by Mr. Longworth, the shuttle car and its braking system examined, and the shunt area was tested for gas both within the shunt and beyond it in "A" Heading. Measurements showed that the back of the shuttle car had run through the brattice stopping in the shunt for a distance of 3 feet 7 inches, and a brattice man's metal stool which before the fire had been standing in front of the brattice, was found jammed under the shuttle car without any signs of burning. The shuttle car's brake was not in the "on" position. Gas tests revealed that at the bottom of the place where the brattice had been approximately 12 inches above floor level at the left-hand rib looking inbye, there existed 2.2% methane and 3.4% carbon dioxide. At roof level in the same position there was 1% methane and less than 1% of carbon dioxide. At floor level in the same position there was 3.4% of methane and 10% of carbon dioxide. At the goaf edge there was 4% of methane.

Mr. Donegan's analysis of the eleven samples which were taken showed that under the ventilation conditions existing on the days when they were obtained, eight contained over 96% air, five of the latter being about 99% air, while one contained 99.9% air. Leaving aside this last sample, Mr. Donegan calculated the remaining ten samples to air-free basis and found that all except one of these were capable of forming inflammable or explosive mixtures with air with approximately the same upper and lower limits. He states that the alterations in the ventilation when the samples were taken gave fairly good respirable air in all parts of the fire area except near and behind the brattice in the shunt. Despite this when the samples were calculated on a basis of being free of air, the portions of gas remaining had approximately the same composition as the air-free gas portions of the samples near and behind the brattice, that is 40% methane, 58% carbon dioxide and 2% nitrogen. Mr. Donegan infers from this fact that the latter was the composition of the gas which flowed from

the goaf at the time of the fire. It was of a constant composition and it was the gas discovered in the goaf in the days and weeks after the tragedy. According to Mr. Donegan such a gas would burn fiercely and not explode if ignited in air. It would explode, however, if the gas itself were mixed with air within the explosive range.

At this stage I stress that there was no evidence before me of any explosion of gas or of coal dust. Mr. Donegan's analysis and conclusions support the proposition that no explosion occurred.

Mr. Donald Sellars on behalf of the Company made tests for methane at various points in the section at a later date. While at times the analysis that he proffered to the Inquiry may differ slightly from the findings of Mr. Donegan, the tendency of all the evidence is to support the proposition that on the day of the fire Illawarra bottom gas of a concentration sufficient to ignite and sufficient to keep burning, flowed around the sides of the brattice stopping in the shunt and was set on fire by an ignition point coming in contact with it. This gas could, if mixed with the appropriate quantities of oxygen, have caused an explosion which possibly would have magnified what occurred into a major disaster. The fact is, however, that while no such explosion occurred, the burning gas spread its flames into the flexible bleed tube which tended to draw the gas into itself and the flames generally travelled to the ribs of the shunt and upwards towards the roof. According to Mr. Donegan the natural result of such a gas fire would be to cause convection currents to flow and gas, therefore, would burn in the upper regions of the workings. The coal in the ribs and in the shuttle car ignited as did the timber roof supports. The limits to the extent of the fire were due probably to the consumption by the fire of available oxygen in the area and to the formation by the fire itself of extinctive material. It is probable that the gas in the shunt having already ignited, the shuttle car ran through the brattice stopping and partially removed it allowing more gas to escape from the goaf which fed the flames. However, even if this incident had not occurred, it is probable, in my view, that the fire which broke out in front of the brattice stopping would itself have destroyed the brattice bringing about the same result.

2. The Ignition Point:

There being no suggestion that the fire in the shunt was caused by the use of contraband materials such as matches or cigarette lighters, the Departmental Inspectors embarked upon an investigation of what had set alight the bottom gas in the shunt. Some of the miners who had witnessed the fire begin had believed it to be due to an electrical fault in the equipment. Mr. J. L. James, the Senior Electrical Inspector of the Mines Department, was put upon enquiry as to this being a possible cause of the fire when the Chief Inspector of Coal Mines summoned him to the Colliery on the 9th November, 1965. In the late afternoon of that day Mr. James commenced his investigation at Eight Right Panel. At first he was unable to advance beyond No. 67 shuttle car. At the intersection of "B" Heading and No. 2 Cut-Through he saw some cables in which the majority of the dielectric, that is the insulating media surrounding the conductor, and the neoprene sheath around the cable was charred, and in some places completely burnt away. From a description of the fire by Mr. Mangles and Mr. Hope, the shuttle car drivers, he also considered the possibility of an electrical open flash in the vicinity of the traction motors of No. 40 shuttle car or the associated connecting cables and terminals. On examining the shuttle car and its cables he found that the external cabling on the car had been affected by heat from an external source, several sections being burnt and others being severely charred. An examination then and subsequently of the shuttle car cable wiring and flameproof enclosures revealed no sign of any electrical fault. Subsequently also an examination of the gate-end boxes which had been buried under the roof fall revealed no sign of electrical failure. Although a portion of this equipment made of aluminium alloy was found in a molten condition, the manufacturers of this equipment claim that a temperature of 1,100 to 1,150 degrees Fahrenheit would be necessary to cause this metal to melt. This gives some indication of the heat reached by the fire itself.

It is clear from the evidence of Mr. James that an electrical failure or open flash must be ruled out as the ignition point of the fire that occurred.

On the Monday following the fire Mr. Longworth, in the presence of Inspector Griffiths, Mr. Stone and Mr. Puddle, examined shuttle car No. 40, and noticed a piece of wood jammed between the disc brake of the shuttle car and the output drive shaft flange. There was also packed around the base plate of the brake area coal dust, lubricating oil and small pieces of coal to a height of half an inch above the bottom of the brake disc. The coal and oil showed no signs of having been on fire but the wood adjacent to the brake disc was charred to the appearances of charcoal and was very friable, giving every appearance of having been on fire. Inspector James also saw this piece of wood and this was subsequently removed for analysis. On Monday, 6th December, the shuttle car was dismantled for further inspection and immediately behind the position where this piece of wood had been jammed, a further charred piece of wood was removed. Mr. James is of the opinion that this process in which the jammed piece of wood had been burned, had occurred previously with other wood in the disc brake assembly.

Mr. Donegan forwarded a sample of the charred wood to the Division of Wood Technology of the New South Wales Forestry Commission for identification. It was identified as Stringy Bark (*Eucalyptus* sp.). Mr. Donegan then conducted a series of tests to ascertain at what temperature *Eucalyptus* species Stringy Bark type timber would ignite and subjected pieces of this timber to friction tests against a brake disc when jammed between the disc and the universal joint as well as furnace tests of similar wood, both oil-soaked and untreated. The oil used was hydraulic brake fluid of the same type as used in shuttle car No. 40. Scientific research on the ignition of wood shows that if, over a period, it has been heated slowly so that the wood chars, the resultant material will ignite at a lower temperature than uncharred wood heated very rapidly. Applying this knowledge to his own

tests Mr. Donegan came to the conclusion that timber of the type found jammed in the disc brakes of shuttle car No. 40 would ignite at a temperature of 340 to 450 degrees Centigrade, and that this temperature would be attained in the brake assembly of shuttle car No. 40 when in use in the Mine.

Mr. Donegan is of the opinion that the temperature required to cause the charred wood to glow so as to provide an ignition point is lower than the temperature at which the coal dust in the bottom of the brake assembly would burn. In subsequent tests he was unable to ignite the hydraulic brake fluid which was used in that shuttle car by injecting it against the disc. He therefore came to the conclusion that the most probable cause of the ignition in the shunt was the glowing or burning of the piece of wood jammed in the disc brake assembly at the time when shuttle car No. 40 entered the shunt in "A" Heading. This in turn came in contact with the Illawarra bottom gas found to exist in that shunt and ignite this gas causing the fire.

The following observations are important in coming to this conclusion:—

- (1) The grade from the loading ramp to the Mine face in this section is a very steep downhill grade and the brakes of the shuttle car must be used almost continuously in this descent.
- (2) The shuttle car is an extremely heavy vehicle.
- (3) Prior to the outbreak of fire on the 9th November the shuttle car had made several trips unladen to the face and laden on its return journey to the loading ramp.
- (4) At the time of moving into the shunt the fully laden vehicle had been brought to a standstill by the application of the brakes; the driver had changed his seat, had driven into the shunt and was applying the brakes again when the fire broke out.
- (5) There is abundant evidence from employees at the Mine that the brakes of these shuttle cars became very hot in operation so that they would burn the hand of an employee touching them and would cause any liquid thrown upon them to boil. They were also known to smoke.
- (6) Timber of the type found in the brake assembly was used in the timbering of the section and it was commonplace for pieces of such timber to lie on the roads used by the shuttle car.
- (7) Similar pieces of timber have since been found in the brake assembly of another shuttle car used in the colliery and in other collieries.

In a very limited sense it may be said that the outbreak of fire in No. 8 Section Right on the 9th November was due to a coincidence in that it occurred because a glowing or burning piece of timber was brought into contact with inflammable gas. The problem, however, is far deeper than this. Ignition points in mines are common even though the ignition point in this case is unusual in the sense that it is unusual in a mine to find a glowing or burning piece of timber heated by friction. There are common instances of electrical sparks, open electrical flashes, sparks caused by metallic friction, not to speak of ignitions caused by the careless or mischievous actions of workmen underground. The real problem in this case is the question: how was the Illawarra Bottom Gas in this area allowed to accumulate so that any ignition point would cause it to burn? I now propose to consider the answer to this question.

E—THE ACCUMULATION OF ILLAWARRA BOTTOM GAS

I have already made it clear that the Illawarra bottom gas which flowed into the shunt on the morning of the fire emanated from the goaf. To understand the nature of this emanation and the accumulation of the gas itself in the goaf, it is necessary to consider how the goaf came to be developed in this district.

The development of Eight Right Section was commenced about May 1965. As already described, the first workings were in solids and they consisted of three headings driven towards a fault in the seam with their associated cut-throughs at right angles to the three main headings. It was known that the seam dipped towards the main geological fault and "C" Heading ran along the flattest grade available in the area. A comparison of the grades to be found in "A" and "C" Headings caused the management to decide that "C" Heading should be the haulage road and, since this should be in the intake airway, "A" Heading was made the return airway. As development progressed the cut-throughs were progressively "stopped" to secure a proper flow of air for ventilation purposes. The three main headings met a disturbed geological area near the geological fault and in accordance with ordinary practice they terminated at this point. In addition to the ventilation provided by the main flow of mine air through these headings the Company introduced an auxiliary fan with ducting to assist the ventilation. This was in accordance with previous procedures in similar developments performed by the Company.

Pillar extraction began on the 12th July, 1965. This ordinarily would mean the extraction of pillars formed by the intersection of the three main headings and the cut-throughs. In addition, however, the management decided to extract coal to the left of these pillars, that is by extending each cut-through to the left, forming additional pillars from which coal was to be extracted at about the same time as the coal was being extracted from the original pillars. This block of coal to the left of the development extended some 90 to 100 yards to the left-hand side of "A" Heading.

By 9th November, 1965, 51,749 tons of mined coal had been extracted from the area. In 1960 the Mines Department, through Inspector M. J. Muir, had laid down a set of conditions before an auxiliary fan could be used to ventilate the face during pillar extraction. This came as a result of an application by the Company to the Department for permission to use such a fan in other developments. At that time the management co-operated with the Department through an

experimental period when the effect of the fan was examined in a pillar development. During the course of this experiment it was noted that a potentially dangerous condition of emanation of methane from the goaf existed. Thereupon the Inspector insisted that the goaf gas should be bled from the goaf by the provision of a bleed tunnel to outbye of the working area from the goaf through which goaf gasses could bleed into the return airway beyond any working place. This requirement was made a condition by the Department for the use of auxiliary fans as an addition to ordinary ventilation in pillar extraction. The system was used successfully in other similar developments before the development of Eight Right commenced.

An examination of the coloured plan, Exhibit JJ, gives some idea as to how Section 8 Right was developed. The plan has been admitted to be inaccurate in some respects, perhaps the most important of which is that the yellow area marked "7" is in fact the first area to the left of the three pillar headings from which coal was extracted after driving a bleeder heading. However, the nature of the system of driving bleed tunnels or headings into the goaf from the left of the main development is sufficiently clear. For example, coloured heading marked "1" was first driven before any pillar coal to the left was extracted. In fact the intersecting tunnel marked "2" was itself driven before extraction. This meant that when the tunnel 2 was being driven and the coal marked "7" was being extracted, the goaf formed by the extraction was being "bled" by the tunnel "1" which was outbye the actual workings. Although difficulties in holding the goaf were experienced, nevertheless a system of bleed tunnels outbye of the working place by some two pillars' distance was maintained until a short time prior to the day of the fire. It will be seen that shortly before the fire this system of bleed tunnels was at least temporarily abandoned.

The system of extracting coal in pillars and to the left of the main pillars from the furthest point of the driven headings "A", "B" and "C", involved a progressive retreat from that furthest point. The area from which coal was extracted, of course, became goaf and as coal continued to be extracted and the operators retreated from the extracted area, the goaf gradually increased in size.

It is to be noted that the management claims, and I accept this evidence, that roof conditions were bad from the start of the extraction of coal. This was to be expected, since it is common to find bad roof conditions when extracting coal near the area of a geological fault. On one occasion, as a result of these conditions, a fall buried the miner and a shuttle car. At times, particularly in the early stages of the development, complete extraction from the pillars, both in the main headings and in the extension to the left, could not be achieved. An examination of the first workings in Exhibit JJ gives a rough idea of how much coal was to be left at this stage. In fact it is true to say, as one Counsel described it before me, that at this stage coal was "snatched" from the pillars.

At the time when the extension to No. 3 Cut-Through (marked as No. 9 in Exhibit JJ) was driven, roof conditions had improved somewhat. Nevertheless, at this stage, Mr. Puddle, the Under-Manager, decided that he would extract coal not only from the pillar marked "10", but also from the pillars "11" and "12" immediately. He says that he took this course because the coal in pillar 11 was still "green" and that he feared that if the coal were allowed to stand in pillar 11 for some days, bad roof conditions would again be encountered. He advances this position as the reason why he did not wait before extracting pillar 11 to drive a bleed tunnel into the goaf. In fact by the time of the fire no such bleed tunnel had been completed. The management claims that this bleed tunnel had been commenced at the time of the fire, and it represents the extension to No. 2 Cut-Through and this is the area in which the miners who died and those who escaped were trapped at the time of the fire. The management claims that at the very instant of outbreak of fire the men were in the process of driving this tunnel as a bleed towards the area of goaf created by the extension to No. 3 Cut-Through and the extraction of pillar 11.

The result of this decision by Mr. Puddle meant that No. 2 Cut-Through (with its extension) and the intersection with "A" Heading (the shunt area) was close to the goaf without the provision, which had existed in previous workings, of a bleed tunnel from the goaf outbye of the workings themselves. Whether or not this contributed to the subsequent emanation of gas in "A" Heading, it must be clearly stated now that the decision of the Under-Manager (with the subsequent concurrence of Mr. Stone, the Manager) was in breach of the conditions for such developments laid down by Inspector Muir of the Mines Department in 1960.

The goaf created by the 9th November 1965 was about 600 feet long by about 500 feet wide with an area of about five acres. The seam extracted was $7\frac{1}{2}$ to 8 feet in depth. Bulli Colliery is a "gassy place" within the meaning of Section 3 subsection (1) of the Coal Mines Regulation Act, 1912. It is also known in fact to be an area in which seam gases abound. The nature of the geological structure of the Eight Right Development made it most probable that gas problems would arise in the workings. It adjoined a geological fault. At the inbye end of the panel there was an intrusion of igneous rock into the coal seam. Near the outbye end of the goaf there was a dyke system containing the decomposed remains of thin volcanic dykes (mainly vertical intrusions of volcanic material into the horizontal seam). The incomplete extraction of coal owing to roof difficulties would leave numerous fenders and stooks of coal which would cause roof fall and floor upheaval from which gas could be expected.

The normal expectation of gassy conditions under these circumstances was borne out in fact by the discovery of both black damp and inflammable gas from time to time during the course of the development. This is clear from the Deputies' reports and the evidence of witnesses at the Inquiry. The management claims that at all times in the past these gas conditions had been effectively dealt with by the fundamental ventilation system existing in the section and also by special devices used to dilute specific outbreaks of gas. Perhaps the most significant example of gas emanating from the goaf

prior to the 9th November was an incident described by witnesses, and ultimately resolved by other evidence, as occurring on or about the 5th October. It is clear that the incident occurred at the intersection of No. 3 Cut-Through and "A" Heading in an exactly similar location to that in which the fire of the 9th November occurred, except that the goaf was then about half a pillar further from the intersection. Mr. C. J. Lake, a Bricklayer employed by the Company at the Colliery, gave evidence that on the day in question he was asked, with his labourer Mr. Tilby, by Mr. Wright, the Assistant Under-Manager, to go to Section 8 Right as quickly as possible. They hurried to the area and saw Deputy Stewart who was erecting a brattice stopping across "A" Heading near its intersection with No. 3 Cut-Through (the witness himself was uncertain as to the number of the cut-through but subsequent evidence places the location beyond doubt). The Deputy told him that the stopping had to be erected and rendered with cement. In fact the three men completed the erection of the brattice across the heading. Mr. Lake says that Deputy Stewart said to him:

"It's pretty crook, isn't it?"

and he himself agreed. He noticed in the heading in the vicinity of the brattice that it was very hard to breathe. His words in evidence are:

"You had to breathe twice as deep and twice as hard and perspiring and we could only work in there for about two minutes at a time and we had to go out and get some fresh air. It was terrific."

Mr. Stewart himself confirms that in testing for gas at about this time in this region with his oil safety lamp he lost his light and had to borrow a lamp from the miner-driver. Mr. Lake says that Mr. Booth brought a bag of cement for the rendering of the brattice and also various lengths of "elephant trunk" to be attached to the vent tubes. In fact Mr. Puddle states that he directed the erection of the brattice and the provision of the "elephant trunk" or bleed tube.

Mr. Lake says that at the time of this incident the miner/driver had gone about 100 ft. down the extension to No. 3 Cut-Through. It is to be noted that work was allowed to be continued while this substantial emission of gas from the goaf took place. According to Mr. Stewart this gas was black damp, an extinctive gas. One fact, however, is clear, namely that he had lost his light. It is doubtful in these circumstances whether any reliance can be placed upon this test for the exclusion of the existence of inflammable gas.

The method of dealing with whatever gas was present on that occasion was the erection of a brattice in the heading to keep gases which were emanating from the goaf back from the heading, and the provision of a narrow exhaust tube to remove such gases as still escaped. Deputy Cambourn says that there was always a distinct odour or taste in Eight Right Section which he could not identify or obtain on his lamp, but he never suspected it was Illawarra bottom gas. Deputy Walker found no gas in the area before the fire but had found inflammable gas at the goaf edge before the goaf reached the position as it existed at the time of the fire. On the 5th, 6th, 14th and the 27th October, he had made reports which were countersigned by the Under-Manager, Mr. Puddle, as to his discovery of this gas at the goaf edge. At the time of the creation of the shunt at the beginning of November, the Deputies reported noxious gas at the goaf edge. In the afternoon shift of the 2nd November Deputy Cambourn reports:

"Noxious gas detected on goaf side of the miner place—being diluted."

At his last inspection on the shift his report reads:

"Noxious gas detected on goaf edge."

Mr. Stewart on the morning shift of the same day makes two reports of noxious gas. On the 3rd November, in the afternoon shift, Deputy Cambourn again makes two reports of noxious gas on the goaf edge which he claims as being diluted. On the 3rd November, in the night shift, Deputy Gordon makes the same report on two occasions. On the 4th November Deputy Gordon reports on two occasions in the night shift noxious gas at the goaf edge. On the 8th November, on the second inspection of the morning shift, Deputy Stewart reports:

"Noxious gas in old lift."

There is evidence that over the week before the fire some of the men from time to time were aware of the presence of gas in the shunt which they thought was black damp.

Shuttle Car Driver Hope says that he had felt black damp in Section 8 Right and the Deputies had talked about it.

Shuttle Car Driver Mangles had noticed a strong odour at the back of his car in the shunt area, although he is not certain as to whether it was gas.

Another Shuttle Car Driver Mr. McGarrity says that the week before the fire he tasted gas in the shunt. He was working there with a man named Clark and another man named Robinson, and the men told Deputy Cambourn that they could taste "the black damp". He says the Deputy asked them to obtain some brattice which was put across the cut-through at an angle into the shunt area. He said that after the erection of this brattice he still obtained the taste of gas and this was discussed with the Deputy who attached a piece of elephant's trunk from the vent tube extending into the shunt area and after that the taste of gas vanished. He relates an occasion some days prior to the fire when the man, Robinson, complained that he felt "squeamish" as a result of the gas.

Mr. Ackerman, a Shiftman, whose work involves the bringing of timber props to the face, says that on the night that the brattice stopping was erected in the shunt he tasted gas at the entrance to the shunt and at the intersection of the shunt with No. 2 Cut-Through. He says:

“ We were getting a fair bit of black damp at the time and it was just a normal occurrence
..... We were aware of it most nights.”

He says that on the Tuesday or Wednesday before the fire he spoke to Deputy Cambourn about it and asked Mr. Cambourn:

“ Is there anything you can do about it?”

At Mr. Cambourn's direction he and another man obtained the “concertina trunk” and erected it. Later this bleed tube was extended until it reached almost to the brattice. He says that he is not sure if he smelt gas after the installation of this tube, but he says that he smelt it most nights. He says that the gas made him dizzy and cough when he was near the floor and at times he became nauseated.

Mr. Robinson, the driver of Shuttle Car No. 40 on the afternoon shift, says that he noticed the gas in the shunt and reported to Deputy Cambourn that it was “making me a bit squirmish in the stomach”. He confirms that it was then that the Deputy had erected the bleed tube leading into the shunt but he says that he still tasted gas in the shunt when the shuttle car went in. After that the extension was added to the bleed tube. There was a “big improvement” but he still tasted gas in the shunt which he reported to Deputy Cambourn.

Deputy Cambourn substantially confirms the evidence of these men but he says he cannot remember the last complaint by Mr. Robinson although he agrees the complaint could have been made. He says that after the fitting of the extension to the bleed tube he did not detect gas in the shunt again.

Mrs. Esme Isabel Murray, the widow of John Murray who lost his life in the fire, gave evidence that during the week before the fire, her husband had complained that he could not taste his food for the taste of gas in his mouth. She noticed that on the Sunday before the fire her husband, who was normally a very active man who worked around the house all day, was apparently only able to work for a short time before taking frequent rests. He also refused his usual Sunday dinner. The symptoms described by Mrs. Murray are consistent with the evidence of Mr. Donegan as to the effect of carbon dioxide upon persons inhaling it.

Deputies' reports for the last three shifts before and including the morning shift on the 9th November when the fire broke out are as follows:—

Deputy Cambourn, who inspected on the afternoon shift of the 8th November reports no gas. Deputy Walker on the night shift known as the “dog watch” on the 9th November immediately prior to Deputy Stewart's morning shift, also reports no gas. Deputy Stewart himself for the shift in which the fire broke out, namely the morning shift of the 9th November, made no report until the 11th November because he had no opportunity through the outbreak of fire to report at the end of that shift and because he was under sedation on the following day. This late report states that he commenced an inspection at 7.45 a.m. which he completed at 9 a.m. The inspection revealed:

“Noxious gas found at goaf area (of previous lift) and A Heading others clear”.

I deal subsequently with Deputy Stewart's evidence as to this inspection.

The significant feature of these various reports concerning gas near the goaf through October and during November until the fire occurred is that nowhere was there recorded a finding of Illawarra bottom gas. Probably because of this fact, among others, the Company tended, at the early stages of the Inquiry at least and at times later in the hearing, to maintain a proposition that the gas which ignited in the shunt on the 9th November was a sudden emanation from the goaf after Deputy Stewart had made his last inspection. This also was the substantial stand taken up by Counsel for the Deputies' Association. One of the main problems at the Inquiry was to decide whether the true position is that Illawarra bottom gas had been for some time emanating from the goaf but had remained undetected by Deputies and management, or whether the emanation from 9.15 a.m. on the 9th was something entirely new of which the Company had no prior notice.

Methane readings are taken under the Act every month in the return airways of the Mine and are recorded in the Company's returns. These records reveal that in the return airway of Eight Right District the percentage of methane in the return airways from April to August was 0.1%. In September the figure rose to 0.2% but fell again in October to 0.1% and increased in November again to 0.2%. In December the figure rose to 0.3%. It is quite clear on the tests made by the Inspectors after November 9th that a significant quantity of this methane was emanating from the goaf. The only other possible source of any significance would be the face where the miner was extracting coal. Mr. Sellers, an expert in mine gases, estimated, after careful testing, that the face would yield about 20 cubic feet per minute of methane. Calculating the total make of methane in the district from 0.2% in the returns during November, he estimated that the balance of methane which was being made in the goaf represented some 56 cubic feet per minute when the fire occurred in November. It is to be noted firstly that the same percentage was present in the returns during September and November although it had dropped during the month of October. Secondly, the percentage increased during December. Mr. Sellers argued that since there was an increase in December there was probably a sudden increase during November. I fail to see that this follows. However, it is clear that during the months of September, October and November, the goaf was making methane at a substantial rate and this methane was finding its way into the return airway of Eight Right Section.

Tests by Mr. Sellers and the Departmental Inspectors failed to find any gas of significant quantity emanating from the goaf other than Illawarra bottom gas. The tests made by the Departmental Inspectors show that this gas was of a uniform composition. The percentage of methane emanating from the goaf, therefore, which found its way into the air returns during the relevant months was not free methane but was contained in this uniform mixture of Illawarra bottom gas. I can draw no other inference from these facts than that the gas which was detected from time to time at the goaf edge in Eight Right Section and classified either as inflammable or noxious gas, was in fact the mixture of the two which was issuing from the goaf as Illawarra bottom gas.

The evidence of Mr. Sellers brought to light a further significant set of conditions. He produced a contour map of the district including the goaf area. This showed that the goaf floor rose sharply from the left at its lowest point of 40 feet above sea level to a high level at the intersection of "A" Heading and No. 2 Cut-Through of almost 110 feet. However, the goaf edge in the shunt was itself the lowest point in No. 2 Cut-Through as compared with the goaf edge in "B" Heading and "C" Heading. Mr. Sellers showed that the Illawarra bottom gas contained in the goaf maintained a continuous surface height above sea level so that as the gas was made in the goaf and was still contained in the goaf, its level in the goaf rose. This was described as a "pond" of gas contained in the goaf and was probably present but growing over the whole period of extraction of pillars in Eight Right Section. This gas pond gradually grew until it reached the lowest point at which it could overflow and spill out into the headings and cut-throughs. On the day of the fire this lowest point was the goaf edge in "A" Heading at the end of the shunt.

The gas probably had already begun to spill out over a month before on October 5th at the intersection of "A" Heading and No. 3 Cut-Through, but was largely contained by the tight brattice stopping which was erected there on Mr. Puddle's direction. As at the time of the fire it was again spilling out in "A" Heading but was substantially blocked by the brattice screen which had been erected in that heading. It therefore began to build up behind the brattice screen. By measuring the level of the gas in the goaf at the end of "B" Heading which was 107 feet above sea level and comparing it with the height of the floor of the shunt at the goaf edge in "A" Heading, Mr. Sellers came to the conclusion that the height of the pond of gas behind the brattice screen in the shunt was some 4 feet above the floor behind this screen. It was thus issuing at the time of the fire through the apertures at the edges of the screen. Indeed this is confirmed by the tests for gas after the fire made by Departmental Inspectors.

There is still the question as to why the methane found in the return airways dropped to .1% during October. Mr. Sellers suggests that the reading of .1%, being an integral number, may not be accurate and the figure may be somewhere between .1% and .2%. Mr. Sullivan, Q.C., however, has submitted an ingenious theory for this fall which is at least plausible. He points out that it was during this time that two large pillars of coal were extracted leaving substantial voids in the goaf. He then argues that at this stage the reduction overall of Illawarra bottom gas escaping from the goaf dropped as the level of this gas in the goaf filled these voids and fell. This is a reasonable theory. However, whether it be the true explanation, does not appear to me to be any more than a matter of interest. The fact remains that when one accepts the hypothesis that the gas in the goaf was always Illawarra bottom gas, not only is the cause of the fire explained but the problem immediately arises as to why it was allowed to remain there and why it was not detected as such.

It is clear that the management was aware over a substantial period that the goaf was making gas. The repeated findings of both inflammable and noxious gas at the goaf edge clearly meant to any experienced mining man that the goaf contained gas, and that from time to time it was issuing into the mine workings. Gas in mining operations, particularly on the Illawarra Seam, is a common phenomenon. It is a problem which must be dealt with or else production must cease. There are recognised ways of dealing with gas. The proper way, of course, is to anticipate the source of gas emissions if this is possible, and to plan a ventilation system which can deal with them or be adapted to do this, from the start. The solution to the problem of gas is its proper dilution, and various methods, all recognised in mining practice, have been described to me at the Inquiry. In almost every instance the reports of the Deputies of findings of gas which were produced at the Inquiry described that gas as being diluted. If these reports are accurate then work has properly been allowed to proceed even though gas has been detected.

However, the emission of substantial quantities of gas from the goaf about the 5th October at the intersection of "A" Heading and No. 3 Cut-Through was obviously a serious matter. It was dealt with, as has been described, by sealing back with cement-washed brattice the flow of gas so as substantially to reduce that flow, and when this allowed some gas still to escape, the flexible bleed tube was connected to the fan vents and placed in the region of the emission in order to remove the gases that escaped and cause them to flow into the fan vent exhaust system. The Under-Manager appears to be satisfied that this effectively dealt with the gas problem at the time.

Mr. Stone, the Manager, agrees that it was probable that if gas flowed into the shunt area near No. 2 Cut-Through, it would come from the goaf. He agrees with the proposition that the converse was also probably true, namely that if gas was going to come in anywhere from the goaf the most likely place was the shunt area. This position could not possibly have escaped the mind of Mr. Puddle, the Under-Manager, yet at the very time when the workings were going to be developed towards No. 2 Cut-Through, Mr. Puddle decided to dispense with the system of a bleeder heading from the goaf, a system which had already been laid down in 1960 by Inspector Muir and which had been followed in similar workings after that time.

There is no certainty that the provision of a bleed tunnel at this time would have removed sufficient gas from the goaf outbye of the working area so that gas escaping from the goaf would not be a problem. However, in view of the fact that goaf gas was continually being made in the goaf and was in effect lying in a pond, the deeper part of which would be at the very position where this bleed tunnel would have holed into the goaf, the strong probability is that the creation of the bleed tunnel would have materially assisted in draining the goaf of a substantial quantity of gas.

The Company's argument on this issue is that the bleed tunnel would only have averted a danger at the time when pillar 11 was being extracted, and that in fact that period was over when the bleed tunnel was being driven as the extension of No. 2 Cut-Through, and the fire occurred during the driving of this bleed tunnel. My view is that this argument would hold good if the gas in the goaf comprised a series of isolated emissions from the spent workings in the goaf area. The real position, however, was that there was an existing lake of gas in the goaf, the draining of which was important at any time. On this view the fire may well have been averted if a body of this gas had been drained at the right time.

The explanation proffered by Mr. Puddle for dispensing with the bleed tunnel shows that he knew that he was taking some risk. He describes the roof problems that he had encountered in the development and says that he decided to extract pillar No. 11 first instead of immediately driving the bleed tunnel, because the coal in that pillar was still "green" and for this reason he would be able to avoid roof problems by its early extraction. He admits that this was "undesirable" but he then says:

"We had serious roof problems but ventilation had been normal. I believed that, in the interests of safety, ventilation could make some concession to roof control."

The necessary implication of this is that he decided, for whatever reason, to concede some of the ordinary steps that he should have taken in regard to providing proper ventilation. He himself describes the position as "a compromise", and says that he made "a considered decision". This decision he justifies by saying that ventilation conditions had been normal and he explains this by saying that he had had no reports of inflammable gas. The fact is, however, as he admits under cross-examination, that he had had, within the month of October, reports of four findings of inflammable gas at the goaf edge. Furthermore, the serious emission of what he took to be noxious gas in "A" Heading near No. 3 Cut-Through was obviously a matter of some concern. I am forced to the conclusion that Mr. Puddle decided to depart from the normal ventilation practice with a full knowledge that goaf gas was a real problem in this development. I cannot believe, since the management had a surveyor's plan of the contours of the area, that Mr. Puddle was unaware of what was happening to the make of gas in the goaf.

His method of dealing with the gas in the shunt and at the earlier intersection on October 5th is clear evidence of this. This method was to keep the gases back in the goaf and the only inference I can draw is that he knew the gases had built up in the goaf and were likely to be emitted at the point where the brattice was erected.

The provision of the elephant's trunk or flexible bleed tube into the dead ends created in "A" Heading on each of these occasions was apparently something of a novelty. Its express purpose was to remove any gases that might leak through. This was suggested at some times during the Inquiry by Mr. Puddle and other witnesses. At other times it was stated that the purpose of this tube was "to ventilate the shunt". It was installed for this purpose by Deputy Cambourn apparently as a repetition of the ventilation equipment which had been used to deal with the problem of gas on October 5th. The situation in the shunt area was almost a replica of the position in "A" Heading near the intersection of No. 3 Cut-Through on that day, although the brattice in the shunt was a double sheet, one sheet of which was not cement rendered.

The bleed tube failed lamentably to deal with the gas or to ventilate the shunt. Any experienced mining official who had given the matter some serious consideration must have foreseen this. It was a tube, the diameter of which was some 14 or 15 inches at the most tapering to a narrower mouth. It ran over the roof timbers on the left hand rib and then was allowed to fall to the floor at a point near the brattice. The amount of air drawn into the mouth of the bleed tube had practically no effect in changing the air in the shunt. The shunt itself was 30 feet long, approximately 21 feet across and about 8 feet high. The quantity of air it contained was approximately 5,000 cubic feet. The bleed tube could handle some 1,200 cubic feet per minute. On the face of it it would, therefore, handle approximately 5,000 cubic feet every four minutes, but it would only do this within the near vicinity of the mouth of the tube. Mr. J. F. Wasson, an expert on ventilation, said that as the distance from the bleed tube increased the less effect it would have on the air in the shunt; for example, that at 10 feet away there would be a minimal effect. When Mr. Puddle was faced with this problem in the witness box he agreed that the shunt could not be ventilated by the bleed tube, but he attempted to add that the entrance and exit of the shuttle car in the shunt would also assist. Finally he agreed that neither the bleed tube nor the shuttle car were proper means of ventilating a shunt in a mine.

The tube was also ineffective in dealing with gas problems that might arise. It would remove such gas as was in the effective radius of the mouth of the tube but would not deal with pockets of gas elsewhere in the shunt outside that effective radius. It was, to use a homely description, very much like a large vacuum cleaner.

The evidence shows that the decision of Mr. Puddle to dispense with the bleed tunnel and to use the brattice and flexible tube system of ventilating the shunt was made without consultation with the Manager, Mr. Stone. However, it is clear that Mr. Stone did nothing to correct the situation when he became aware of what was happening. He says that at that stage the work had advanced so far under this new method that it was too late to correct it. At the same time he says:

"I cannot say that, had he consulted me, I would have disagreed with his proposal nor do I say that this is the only view to take of the problem."

Mr. Stone accepts full responsibility for what Mr. Puddle did. It also appears that the decision to win coal under this system of ventilation, both in No. 2 and No. 3 Cut-Throughs, was done with the approval of the Assistant Under-Manager, Mr. Fred Wright, who visited the section daily and saw what was going on. The management claims that it was justified in this decision because on its prior knowledge of the gas problems in this section, it could not expect the danger that arose, and the methods of ventilation it had already adopted had been adequate to deal with the gas situation as the officials knew it.

As a matter of hindsight, of course, it is easy for those with a knowledge of how inadequate the system turned out to be, to criticise this planning. Mr. Reynolds, Q.C. on behalf of the Company, has submitted that most of the criticism that has been directed at the Inquiry to the system of ventilation adopted is in fact based upon the knowledge of what occurred as a result of this ventilation system, and that the dangers could not have been foreseen by the management. He suggests that the true test for me is to place myself in the position of the officials themselves in the situation which confronted them. He says that mining men have to make day to day decisions to deal with problems as they occur, and there was nothing of any consequence to warn the management of what was likely to occur.

In the light of what I have already said I think that the true view is that the officials who manage a mine are expected to be experts in the field of ventilating that mine. They have the benefit, not only of the experience and knowledge which they themselves have gained, but they also have the assistance of surveyors. If they choose to avail themselves of it, as they did not do on this occasion, they have at their call the experienced Inspectors of the Mines Department to review what they propose to do. This was not a day to day problem but was an example of lack of foresight from the start. Further it is my view that there was sufficient warning given to the management from time to time, not only by the situation which occurred on October 5th but also by the Deputies' reports of inflammable gas at the goaf edge during the month of October. Even if I were to accept Mr. Reynolds' test of the standards to be expected from the management in dealing with situations as they arose from day to day, I completely fail to see how the method of dealing with gas issuing from a goaf by erecting a brattice with a bleed tube in front of it to seal off goaf gases and to draw off what leaked through the brattice could be anything but a crude improvisation.

The management claims that its ventilation system was "overwhelmed" by a sudden unexpected emission of gas. For the reasons that I have outlined I do not accept the theory that this was a sudden emission of gas from the goaf. It has been put on behalf of the Company and by Mr. Sellers that there was possibly some major fall in the goaf immediately prior to the shuttle car's final entry into the shunt which occurred after Deputy Stewart had made his last test in the shunt. I shall deal later with Deputy Stewart's final test. But apart from this last issue there is no evidence whatsoever of a large fall in the goaf which might cause a sudden emission of gas. Further, I find it most difficult to believe that there was a sudden emission of gas from the goaf into the shunt which coincided with the arrival of a shuttle car with a burning piece of wood in its brake system. The theory is even harder to believe when one considers that this same gas continued to issue from the goaf for many weeks afterwards.

Even if I accepted the possibility that there was a sudden emission immediately prior to the outbreak of fire, this would afford, in my view, little comfort to the Company's officials. With the knowledge that gas was contained in the goaf there must always be the possibility of a sudden emission, whether due to a fall or otherwise. Steps must be taken beforehand to control such a situation. The method adopted here of controlling any sudden emission into the shunt was hopeless from the start. The attempt to contain the gases in the goaf by a brattice seal could only lead to a bank up of those gases behind the brattice. At the same time the brattice itself prevented inspection behind it. It is obvious that that is what occurred in this case and that should have been foreseen by the management.

During the Inquiry Mr. Puddle in answer to some questions by myself made clear what I think was the true position. He had stated that he was always mindful of the possibility of noxious gases in the shunt area. I asked him whether there was any particular danger in a shuttle car working in a shunt in noxious gases. He said that the only danger was the effect it might have if it was present in sufficient quantities to cause physical discomfort to the people who were exposed to it, and the only man in this case who might be exposed to the gas would be the shuttle car driver who would only be in the shunt for such time as he took to back into and come out again. There then appears in the transcript the following questions and answers:

Question: "You correct me if I am wrong but is not this the position: from the point of view of those in control and I am talking about Deputies and yourself or any assistants who may be there, looking at the situation and expecting only noxious gas, it was a risk worth taking to keep production going to run a shuttle car in and out of the shunt since it was only a shunt and not a working place and since if it became substantial in volume you would expect the shuttle car driver to report it. Is that the position?"

Answer: "No. It was actually a part of the working area and as such had to be kept clear and this is fully understood by all the people in the place but ——"

Question: "I know what the Act says and I know it is understood. I am now talking about the practical situation as it exists when the work is being carried out, that the working place you are talking about here is a shunt where only a shuttle car goes in and out and there is only noxious gas in there. You see, you started off with the assumption, did you not, that the gas in there is noxious?"

Answer: "Yes."

Question: "Getting down to realities is not that the practical position?"

Answer: "The area ——"

Mr. Reynolds: "May I say this, Your Honour: I think what is troubling the witness is that the word "risk" has been introduced by Your Honour. Would Your Honour put it that it was a course worth taking?"

His Honour: Question: A course worth taking in fact if noxious gas alone is there, then because there is not much risk, it is a course worth taking?"

Answer: "Yes."

Question: "That is the practical position, is it not?"

Answer: "Yes".

I accept the proposition that the management believed that the only gas of quantity with which it was dealing was noxious gas, that is black damp or carbon dioxide. I am certain that the officials would have stopped production, or at least stopped the shuttle car from working if they thought that the work was to be performed in the presence of inflammable gas of any substantial concentration. I have also come to the opinion that the officials were not very concerned with noxious gas in the shuttle car shunt, and in fact were prepared to take some risks in order to win coal. This was the real compromise with safety which the officials were making.

This position, of course, is completely contrary to the spirit and letter of General Rule (1) (Section 54) of the Coal Mines Regulation Act. That Rule in its first paragraph states categorically:

"In every mine which is in operation an amount of ventilation by air drawn from a pure source, by means of a mechanical contrivance, shall be continuously produced adequate to dilute and render harmless inflammable and noxious gases to such an extent that the working places of the shafts, levels, stables and workings of the mine and the travelling road to and from those working places shall be in a fit state for working and passing therein".

Leaving aside the question as to whether a flexible vent tube coupled to a fan ventilating system is a mechanical contrivance which can ventilate any part of a mine, it itself, of course, does not draw air from a pure source. It is clear that there was no real ventilation of this shunt and it was either a working place or a travelling road to and from the working place. In my view there has been a clear breach by the Company of this Rule.

Apart from the question of whether the management was justified in believing it was dealing only with noxious and not inflammable gases, its method of dealing with noxious gas as being a gas with which it could afford to take some risk for the sake of production was completely unjustified. It has been stated from time to time by the assessors advising me that any gas, whether noxious or not, for the sake of safety, must be regarded as inflammable gas until proved otherwise. In fact Mr. Stone stated at the Inquiry that he has since the fire instructed all mine personnel to adopt this very attitude to any gas. By its actions the management imperilled, although acting on a false assumption as to the nature of the gas, the lives and safety of the workmen. In a mine there can be no bargain with safety.

A curious circumstance arose in relation to the driving of the bleed tunnel, that is the extension to No. 2 Cut-Through. Deputy Cambourn who was in charge of the final drive which was to hole the goaf failed to penetrate through to the goaf. The continuous miner, apparently with the concurrence of other Mine officials, was then removed from the position in which it was operating and set up in another position adjacent to the first to make further lifts of coal in the direction of the goaf. This failure to penetrate the goaf on the first lift and the change of position of the miner led to a suggestion during the Inquiry that the Company never really intended to hole the goaf in the first place but was content to take a succession of lifts along the extension of No. 2 Cut-Through. In other words, it was suggested the Company did not intend to return to the system of bleed tunnels when it was driving the extension to No. 2 Cut-Through.

Some support was given to this proposition by the fact that at a place about halfway down the extension a surveyor's peg had been driven into position and opposite it, at the vent tubes, a "T" piece of tube had been inserted. It was put by various Counsel to the Company's officials that the management intended to split the pillar which had been created, down the centre at this point. The Company's answer to the latter suggestion was that the surveyor's peg and the vent "T" piece were only there in case the shift which holed into the goaf had completed that task prior to the end of the shift. The miner was then to be removed from the hole and the remainder of the shift was to be occupied by the men taking lifts from the place which was marked by the surveyor's peg. The Company contended that the reason why Deputy Cambourn's shift did not hole the goaf in the first place was that the pillar being holed was in fact a double pillar and Deputy Cambourn did not know of this fact. Deputy Cambourn claimed that he thought this was an ordinary sized pillar and on

failing to hole the goaf he thought that he was driving in the wrong direction and had so missed the goaf. He then sought instructions and was told to remove the miner to its new position. This place incidentally was the point from which coal was being extracted at the time of the fire. Mr. Menzies is of the opinion that a break-through into the goaf at this point would itself have created a critical situation in that goaf gases would have been emitted into the extension itself with no means of relieving the position. He is reluctant to believe that the Company ever intended to break through into the goaf at this point. He says:

"I can't read people's minds, I can only read the plan. My impression is that there were no indications of breaking through into the goaf."

The management says that it intended to create a small hole at first, withdrawing the men from any situation of danger that might arise.

In the face of the Company's claim as to its intentions I could find no evidence which was sufficiently clearcut to do more than arouse a suspicion concerning the declared intention of the officials. In view of this I have decided that I must accept what has been sworn to by the officials of the Company in this regard, and I find that it was the Company's intention to replace the bleed tunnel system as soon as pillars 11 and 12 had been extracted and that that in fact was the operation which was being carried out at the time of the fire.

The Company's officials in their evidence before me did not seek to deny that their ventilation system was faulty. I think that Mr. Stone and Mr. Puddle were commendably frank in agreeing with the defects in the system as discovered by the Departmental Inspectors and as proved by the events that occurred as a result of these defects. The attitude of the officials, however, was that they acted in good faith in designing the system of ventilation and in making the day to day decisions concerning winning coal under difficult roof conditions and improving ventilation techniques to deal ad hoc with problems as they arose. The officials claim also that they acted on the strength of Deputies' reports and tests made by themselves and other officers of the Company which did not demonstrate a potential gas situation which would cause than any alarm. I have already said that there was no justification on the reports of the Deputies or, for any other reason, for the management to assume that the ventilation system would be successful, nor was there any justification for assuming that because gas had behaved in a particular way in the past it was not likely to become dangerous in the future. Much of Mr. Puddle's concern seems to have been the question of bad roof conditions which would prevent the winning of coal. It was this, as I have already said, which led him to "compromise" (to use his term) in regard to ventilation. It was urged, on the Company's behalf, that a mining company is constrained by Statute not to waste available coal but to seek to attain the fullest production possible. This argument led to accusations by various Counsel and by Mr. Parkinson on behalf of the Miners' Federation that the Company was more concerned with production than with safety. I feel that I should deal with this proposition, and I do so now.

Throughout the Inquiry there was evidence which showed that the Company through its officials, the Manager, the Under-Manager, the Assistant-Manager, persons described as "overmen" and Deputies, were most anxious to win the greatest amount possible per working shift. In fact it appeared to me, and I said so on more than one occasion, that the men themselves seemed to share this spirit of production. At an early stage in the Inquiry Deputy Walker, who was in charge of the shift before the morning shift in which the fire broke out, said that on the changeover he told Deputy Stewart that things were "very nice. They are as sweet as a nut and you should fill a thousand skips today." It will be recalled that on October 5th, even though there was a serious gas problem at the intersection of No. 3 Cut-Through and "A" Heading, the miner with its team of assistants was allowed to drive 100 feet into the extension of No. 2 Cut-Through without work stopping. I found it significant that, throughout the Inquiry, there was no evidence tendered before me to show that in Eight Right Section work had been stopped for any safety reasons. At the very time of the outbreak of fire Mr. Victor Parkinson, the Check Inspector, was investigating complaints from the men in regard to a section known as Western Returns. Mr. Puddle was there with him. The complaints concerned dust conditions and gas. Both Mr. Parkinson and Mr. Puddle found methane gas at roof level in the headings, Mr. Parkinson claiming that he found it in two headings. However, work had not stopped in that area at the time. There was the evidence of the shuttle car drivers in Eight Right Section as to the presence of what they thought was black damp in the shunt in which they had to work. It was never suggested that the shuttle cars stop working. There was also the evidence of Mrs. Esme Murray as to her husband being affected by gas in the week before he died, and here again there was no suggestion that production had stopped at any time during this period.

Bulli Colliery has the reputation of being a mine where production is maintained at a high level. The men themselves receive substantial bonuses for their production. I noted that officials known as "overmen" appeared regularly on shifts and it was explained at the Inquiry that, while these officials had no statutory recognition, which would mean that they have no specific duties in regard to safety, they were superior as far as the Company was concerned to the Deputies. Their only purpose, it seems to me, is to see that the level of production is maintained. It is against this background that I must consider what factors inspired the actions of the management in the development of Eight Right Section.

Mr. Longworth said of the management:

"In general they are endeavouring to promote safety by safety campaigns, they have established a means of accident prevention or of a system whereby accidents and their various causes can be reduced by job study methods to find weaknesses. I am speaking

generally but in particular at Bulli I know that Mr. Stone, the Manager, has recently been trying to promote safety in the mine as to various gases and there has been some degree of success to that end."

I am prepared to accept this evidence from Mr. Longworth.

On the other hand, the whole justification by the management in the development of Eight Right Section appears to me to hinge upon the proposition that one can make some compromise with safety in regard to gas in order to obtain a maximum output. As Mr. Lee, Q.C., on behalf of the Department of Mines, suggested to Mr. Puddle, the danger from roof conditions was an obvious one, if it occurred, because a bad roof would be apparent to the men and work would of necessity stop under such conditions. Gas was not such an obvious danger, yet Mr. Puddle was prepared on his own admission, in the interests of the obvious danger which would stop production immediately, to compromise as far as ventilation was concerned.

I feel, however, that, while the management might think it worthwhile to take certain risks, the men themselves were loath to cease work because of possible danger from noxious gas. Mr. Longworth in evidence disagreed with the suggestion that there might be a reluctance on the part of the men to stop working at times of danger. The facts as related to me in evidence do not give me much confidence in his optimism. In addition to the evidence of the men who continued to work in the presence of noxious gas, there is a description by Deputy Walker of a warning which he gave to two fitters sitting on the floor in the shunt working on a shuttle car, a practice which should never occur in such a place in a mine because of the danger from black damp arising out of the floor. Mr. Walker, despite his warning, did not stop the men from this dangerous practice and the men themselves, having been warned, did not themselves stop. I was told later that the men in this Mine were reluctant to carry self-rescue apparatus before the fire. It appears to me, on the whole of the evidence, that there was no true appreciation of the danger of noxious gas in this Mine. There was instead a keenness to continue work and win coal. I think basically this attitude of mind on the part of both management and men lies ultimately as a root cause of the tragedy. By this I do not for one moment intend to suggest that the unfortunate men who died were in any way aware of the danger that was pending. I am certain that they, far removed from the source of the danger, did not appreciate it. Even more important is the fact that none of them realised that they were in the presence of the real enemy—inflammable gas.

While the winning of coal and the avoidance of waste of coal are essential to the nation's economy and must be pursued throughout the mines of this State, the safety of the men working in hazardous conditions in mines is paramount. It is the overriding factor in production. The legislature has laid down the most stringent conditions for carrying on the work of winning coal in mines. The safety code imposed on management and men alike is the result of a wealth of bitter experience in the coal mining industry. It is not to be lightly regarded. In my opinion, there is no such thing as a mere technical breach of this code as has been suggested by Counsel at my Inquiry. Every technical breach, as far as I am concerned, is a serious breach which may endanger the lives of men.

The Departmental Inspectors strongly criticise the system of ventilation adopted by the Mine management at the very beginning of the development of Eight Right Section. Mr. Longworth says that the problem of ventilation would arise when the development departed from the plan to extract pillars from the simple three-heading design and included a scheme to drive off headings to the left of the three headings and extract coal from these areas at the same time as the main pillars were being extracted. He describes this problem as follows: for as long as mining was contained within the three headings, the tendency was that any gases made in goaves would be drawn from the intake airways, that is "C" and "B" Headings, to the return airway in "A" Heading. With the extension of the workings to the left of the three headings goaf gases, if they were to come out, must come out into the Headings "A", "B" and "C". That meant that they could not get into the return airway "A" without crossing the working area.

Mr. Longworth says that the way out of the difficulty would have been for the Company to have created a system of ventilation which would have drained the existing goaf into the return airway. He suggests alternatives to the method adopted by the Company, for example, using "A" Heading as the intake airway and "C" Heading as the return airway. He agrees that at the stage reached in the development on the 9th November this would have been a major undertaking. In fact any substantial alternative method of ventilation at this stage would have caused considerable inconvenience to the Company. The proper system should have been adopted at the commencement of the operations. However, if the Company was not prepared to undertake the major alterations it was left with a choice limited to working within the confines of the three headings or improvising methods of dealing with the ventilation problems as they arose.

Mr. Menzies is firm in his opinion that the section could not be successfully ventilated unless the direction of airflow were changed. He says that the most important factor involved in the ventilation system is to prevent the emission of goaf gas into the working area. This could only be completely successful if the gases from the goaf were drawn off in such a way that direction of airflow in the goaf was always away from the working area. This was not the ventilation system adopted in Eight Section Right. He said it must have been obvious to those who were charged with the duty of ventilating the area that the goaf gas could only escape into the working area. According to Mr. Menzies, under the existing system of ventilation it was always possible that an unsafe condition could develop. There would be always a potential danger even while driving bleeder headings from outbye of the working place into the goaf for the purpose of draining it of gases. He agrees that the airflow could have been reversed after the development had been in

existence for some time, but it would necessitate considerable alteration by the erection of air crossings in the nature of overcasts. Mr. Menzies suggests that an ideal system could have been achieved in the early planning stages by having a bleeder system from the back of the goaf straight into the return airway with the direction of airflow across the goaf from the working face into the return. He himself has known it to have been a very successful method in the past in dealing with large quantities of goaf gases.

This Inspector says that, even under the existing faulty system of ventilation which the management adopted, the danger that occurred on the 9th November could have been avoided by leading a 22½ inch vent tube from the floor inside the brattice at the back of the shunt and taking that tube directly to the return airway without passing through the vent. He would have used the flexible vent tube connected with the fan in front of the brattice stopping in addition to this main bleed from the danger zone.

The Inspector is also critical of the location of the shunt. He says that it would have been better located in "B" Heading rather than in "A" Heading since this was a higher point than "A" Heading and not so close to the low point in the goaf in "A" Heading where goaf gas must obviously bleed off.

Inspector Muir is also of the opinion that the airflow in the section should have been reversed. He says:

"If it were wholly and solely left to me at this point in time I would suspend any further work on that side of the "A" Heading (that is the extension to No. 2 Cut-Through) but if I am forced to work it as it is I would reverse the air."

He points out that this would involve an alteration in trackwork with the building of overcasts. He describes this as not a large operation but a considerable nuisance at the time.

I have not dealt with all the possible solutions to the problem which have been suggested at the Inquiry. All of them involve a considerable amount of technical detail which is not relevant to my findings. It is clear, however, that the Departmental Inspectors were of the opinion that an improper ventilation system was designed from the start of the development once the management decided to win coal to the left of the three main headings. The fundamental fault in the system as designed appears to have been to institute a direction of airflow which would not ventilate the goaf without bringing any goaf gases into the working areas. The Company's answer is that the direction of airflow was determined by the relative grades of "A" and "C" Headings. As I have already said, because of the fact that "C" Heading had an easier grade for the purpose of it becoming an haulage road, this was made the intake airway with "A" Heading the return. The most charitable view of this decision is that it was an unfortunate one, but I draw a more serious inference from these facts. The choice of the particular direction of airflow meant that the management, because of the desire to have a convenient haulage method, sacrificed fundamental principles in ventilation. The officials who planned this system must have considered the peculiar gas problems which would arise when striking off into the seam to the left of the return airway. Either this inference is the correct one or the alternative must be that the management were not aware of any defects in the ventilation system when they designed the development. I am unable, in view of the experience of these men in mining, to believe that they could have failed to realise the gas problems that they were creating. This is a further example of the desire to win coal by the easiest method overcoming a firm adherence to safety principles at all times.

In the early stages of the Inquiry it was suggested on behalf of the Departmental Inspectors that a fall in barometric pressure had caused the gas to flow out of the goaf. There is little doubt on the expert evidence adduced at the Inquiry, that a sudden drop in barometric pressure will tend to cause gases which are building up in the goaf, to flow into the mine workings. From barometric records at the Mine the Inspectors established that in the twenty-four hours before 9 a.m. on the 9th November the barometer had dropped half an inch. In fact the fall continued after this time. It must be understood here that an attempt was being made to explain, on the basis that the Deputies had reported no finding of Illawarra Bottom Gas in the shunt, why there came a sudden emanation of gas at approximately this hour. On the basis of my accepting the evidence that this gas had been building up against the brattice in the shunt for some time and in fact had been flowing out into the Mine workings undetected by the officials, the search for the cause of a sudden emanation of gas is somewhat superfluous. In any case, however, as the Inquiry progressed better opinion considered that the fall in the barometer was a gradual one over a period and not a sudden drop, and while it might tend to a degree to cause goaf gases to expand it was probably of little significance in what occurred later. I must, however, draw attention to the fact that, although the Coal Mines Regulation Act prescribes the existence of a barometer at the Mine in a conspicuous and available place with a constant record of its fluctuations, the Mine officials did not consider the study of barometric pressures to be of any great importance. I cannot myself, on the evidence, come to any firm conclusion as to whether a consistent study of barometric pressure fluctuations is of great assistance to those controlling the Mine in anticipating what may flow into the goaf. It appears that the provision in the Coal Mines Regulation Act is an inheritance from practice in Great Britain. I suggest that further investigation by the Mines Department of the value of the barometer at the Mine should be undertaken with a view to determining whether the retention of this instrument and what it records over a period is a necessary feature of safety methods in coal mines.

A further suggestion was made by the Departmental Inspectors that the use of auxiliary fans had contributed to the emanation of goaf gases. Inspector Griffiths took various pressure readings in the region of the shunt and airways to the fans and found a slight reduction of positive pressure in the vicinity of the shunt and in particular at the brattice. This creation of an area of what was

described as "negative pressure" in the vicinity of the brattice in the shunt led to the submission that gases would tend to flow either through the brattice or around its sides. It was put that the negative pressure was caused by the creation of a flow of air into the mouth of the bleed tube which, of course, was connected to the fan duct system. My view is that, on the whole of the evidence, it is probably true that once gases had emerged from behind the brattice in the shunt in the vicinity of the mouth of the bleed tube, they would tend to be drawn into that tube because of the negative pressure existing at the mouth of the tube. Mr. Sellers was of the opinion that the effect would be insignificant. I am inclined to agree with him. The evidence showed that the area of negative pressure was mainly concentrated at the mouth of the tube and the tube would have little effect upon those parts of the shunt or the brattice which were any substantial distance away from the tube itself. The tube did not as it were "suck" air or gases through the brattice or from around its sides. The real position was that the build-up of gas behind the brattice was creating its own pressure and forcing it through such gaps between the brattice and the rib or floors as existed.

It is true that no permission had been sought by the Company to instal fans in Eight Section Right as was required of them by Inspector Muir after he laid down the conditions under which auxiliary fans could be used in pillar development when he dealt with the matter in 1960. Still less was any permission sought by the Company for the introduction of the entirely new feature, namely the flexible bleed tube connected with the main fan system. Mr. Stone explains that he did not know of the existence of the file in the Colliery dealing with this matter. He had only come to Bulli Colliery in February 1965. Mr. Puddle did know of the requirements. However, he appears to have been influenced by Mr. Ryan, the Deputy Superintendent, who believed that the Departmental Inspector had no power to make it a requirement that the Department's permission should be sought before every installation of fans in a new development.

I find it unnecessary at this stage to come to a conclusion as to whether Mr. Ryan's view of the legal position is correct. The fact is that on a number of previous occasions after the requirements were laid down by Mr. Muir, Mr. Ryan had made such application to the Department before introducing an auxiliary fan into a particular development. I would have been more impressed if the management had decided to comply with the spirit of the Department's conditions as to safety in regard to auxiliary fans rather than to rely upon a doubtful legal quibble. It would have given greater strength to the Company's claims that at all times it was vitally interested in the principles of the safe operation of its Mine. In point of fact, having neglected to make its application to the Department for permission to use the fan, it prevented the Department from making any inspection or suggestion as to the development of the section. Further, without communicating with the Department, the management not only introduced one fan into the section but decided to do something for which it had never received permission, namely to use two fans in series and to tap the ducting to those fans in order to ventilate the working place other than the coal face itself. I do not wish to imply that the use of the fans contributed to the fire on the 9th November. There is no evidence before me that it did. I make these comments merely to draw attention to the fact that one must interpret the claims by the Company as to its attitude towards safety in the light of its admitted attitude towards complying with Departmental requirements.

F: FAILURE TO DETECT ILLAWARRA BOTTOM GAS

Mr. Reynolds, Q.C. urged the proposition that the real cause of the disaster was a failure by officials to detect the presence of Illawarra bottom gas rather than the failure of the Company's ventilation system in Eight Right Section. This involved, of course, two assumptions:

- (1) Illawarra bottom gas had issued from the goaf into the Mine workings over a substantial period and not merely during the minutes before the outbreak of fire.
- (2) Those testing for Illawarra bottom gas and in particular the Deputies, had so little experience of the gas and so little expectation of its presence, since the gas was a rare occurrence in the Mine, that they found either black damp or methane and did not realise it was bottom gas that they were detecting.

Mr. Reynolds then argued that since this was the situation, the company's management, relying upon the Deputies, could not possibly be aware of the real danger that existed. If they had become aware, he says, they would have immediately dealt with the problem and would not deliberately have put the men's lives in danger. I agree with the last part of this reasoning. I am satisfied that the Mine management did not know that the gas they were dealing with was Illawarra bottom gas. I therefore agree that they did not deliberately expose the men to danger from this gas. I also believe that the company was not aware of the seriousness of the danger existing from inflammable gas in the section since the Deputies' reports stated that such inflammable gas as was detected was being diluted.

However, in view of what I have already said I must reject the proposition that the fire was allowed to occur simply because of the lack of detection of Illawarra bottom gas. The main cause of the difficulty in which the Company found itself was that the management had ignored the fundamental principles of ventilation. Its ventilation system broke down because of this and it was forced to experiment and improvise to deal with the outbreaks of gas that followed. It may be true that it mistakenly believed that these outbreaks were mainly noxious gas. Nevertheless it should not have tolerated outbreaks of noxious gas in the working areas.

Furthermore I have come to the conclusion that the management should have had an awareness of the likelihood of Illawarra bottom gas being made in the goaf, and should, on proper testing and proper instruction of Deputies, have discovered the presence of this gas in the mine workings.

It appears true that Illawarra bottom gas, even in the Bulli Mine, is of comparatively rare occurrence in large quantities. I qualify this statement by pointing out that it is possible, indeed likely, from what has been discovered at my Inquiry that the occurrence of Illawarra bottom gas is not so rare as described at Bulli Colliery but has been present undetected over a considerable period of time. That Illawarra bottom gas exists in the Bulli Seam is common knowledge within the mining industry. Inspector Menzies says that he did not know of its existence at Bulli Colliery before this Inquiry. However, no person connected with the Bulli Colliery claimed this ignorance. A printed gas chart, devised by Mr. Donegan, has been issued for some time by the Joint Coal Board in conjunction with the Department of Public Health and this chart refers to the fact that methane and carbon dioxide may be found in the presence of each other without specifically referring to the Bulli Seam or naming the gas. This is a chart widely circulated among Mine officials. Mr. A. J. Hargraves, Senior Lecturer of the Department of Mining Engineering of the University of Sydney in 1963 delivered a paper which was published in the "Proceedings" of the Australasian Institute of Mining and Metallurgy (December 1963 Issue) in which he specifically refers to the gas as follows:

"Concerning CO₂ in Bulli Seam gas, the occurrence of 'Illawarra Bottom Gas' has been one of the persistent features of mining the Seam in many areas. This anomalous 'gas' lies on the floor of workings in low places and gives a gas cap on a flame safety lamp as the lamp is slowly lowered towards the floor."

The writer then describes the variations in composition of the gas and gives illustrations. He then proceeds:

"Both of these conditions in a transition zone would produce a gas cap, and are illustrated only as typical possibilities with 'Illawarra Bottom Gas' in Metropolitan, Coalcliff, Excelsior, Bulli, Corrimal, Kemira and perhaps other collieries. (Page 266)."

I am informed that this publication is widely read by officials in the mining industry.

Mr. Longworth was acquainted with this gas at the colliery from his own association with the same colliery some years ago. Mr. Stone says he knew of its existence at the colliery because of a talk with the Under-Manager. He says he was never concerned to speak to any of the Deputies about the necessity for always testing for bottom gas. As far as he was concerned it was a rarity unlike methane, which was a common thing:

"If there has been a bit of bottom gas about other parts of the mine in similar conditions I think we would have said something to people who were going to work in an area like this."

When he was asked how he would know where there was bottom gas in the area he said:

"You wouldn't. I wouldn't as at this stage, or the stage before the fire. I would know now. I would be looking."

He agrees that the very deceptive nature of bottom gas would have made it necessary to put all Deputies on guard against it.

Mr. Puddle says that at no time did he have any suspicion in Section 8 Right as to the presence of bottom gas. He knew that it had been found in other parts of the Mine and he realised that it could be found elsewhere so that he had no reason to assume it might not be found in Section 8 Right. He says that he himself tested in Eight Right for bottom gas on the 5th October when No. 9 Heading (the extension to No. 3 Cut-Through) was being driven and he found no trace of methane at all. He made these tests in "A" Heading and at the intersection of "A" Heading with No. 3 Cut-Through and at the mine face itself. These tests were made with an oil flame safety lamp. Mr. Puddle says that he discovered carbon dioxide at the floorlevel at the face. He says that it was routine to inspect for Illawarra bottom gas. The tests were always made with an oil flame safety lamp, although a methanometer was available.

The three Deputies who gave evidence—Mr. Walker, Mr. Cambourn and Mr. Stewart, all claimed that they knew of the existence of Illawarra bottom gas and tested for it, but were unable to detect it on an oil flame safety lamp.

If I accept this evidence that the officials of the Mine knew of the existence of Illawarra bottom gas and the necessity to test for it as such, then it is clear that the management can find no comfort from the argument that its occurrence in the Mine was so rare that they can be absolved from the duty of anticipating its occurrence in Section 8 Right and testing for it. The problem that confronted me at the Inquiry was that after the fire it was readily discoverable in the shunt area by the Mines Inspectors, Mr. Sellers and by all persons who are named at the Inquiry as having tested for it, including the Deputies except Deputy Cambourn. Yet before the fire no person who declared that he tested for it in the shunt area was able to detect it. Apart from the Deputies who tested the area and the previous areas near the goaf, Mr. Puddle said that he tested on October 5th and failed to find this gas and witnesses said that other persons also tested at various times with negative results. Indeed it was suggested by two Counsel that the evidence showed that at least 13 persons had tested for gas in different parts of the area at various times from the beginning of October until the fire, yet nobody had discovered Illawarra bottom gas. In the face of the vast body of evidence that the gas that was emanating from the goaf at all relevant times was the same gas and that this gas had been detected as black damp or methane on various occasions (and this latter position was conceded by Mr. Reynolds on behalf of the Company) I was confronted by a conflict which appeared impossible of solution other than on the basis that

- (a) some witnesses were lying or withholding evidence or both, or
- (b) the witnesses themselves were mistaken as to the gas that they detected, either through a lack of knowledge as to its true nature or through their inadequate methods of testing.

On more than one occasion I expressed the disturbance that I felt by saying that I thought that the complete picture was not being presented to me. In a sense I believe that this is true. I say this because I have come to the conclusion that the reason why nobody in the Mine detected Illawarra bottom gas is that the witnesses who described their tests did not test for it. I feel that they did not do so for the reason that they believed at all times that they were looking for black damp on the floor and did not in fact, with the possible exception of Mr. Puddle, look for Illawarra bottom gas.

The reports of the Deputies for the week before the fire showed the position as follows:

On the "dog watch" shift that is the one prior to the morning shift, Deputy Gordon, who was replacing Deputy Walker, on 2nd November, reported the area free of gas. The "dog watch" shift is not a production shift. It sets up the working place and the machinery, including the miner, for the shift to follow. On the morning shift Deputy Stewart reported that there was noxious gas at the goaf edge which was being diluted. In the afternoon shift Deputy Cambourn reported noxious gas "at the goaf side of the miner place" and noxious gas at the goaf edge. In the "dog watch" of the 3rd Deputy Gordon reported noxious gas at the goaf side of the working place. In the morning shift Deputy Stewart reported that the area was free of gas. In the afternoon shift Deputy Cambourn reported noxious gas at the goaf edge. On the 4th November Deputy Gordon, on the "dog watch" shift, reported noxious gas at the goaf edge being diluted. On the morning shift Deputy Stewart reported the area free from gas. On the afternoon shift Deputy Cambourn also reported the area free from gas. On the 5th November all three Deputies in their respective shifts reported the area free from gas. Deputy Walker on that day had resumed duty as the Deputy on the "dog watch" shift. The weekend, when no work took place and when the fans were turned off, intervened.

The position on the Monday, that is the day before the fire, is that again all three deputies reported the area clear of gas on their respective shifts. It must be noted that the brattice stopping was erected during the "dog watch" shift of the 2nd November. This was done by Deputy Gordon as the result of a request by Deputy Cambourn. Deputy Cambourn says that, prior to this, he had detected noxious gas at the goaf edge and his report confirms it. He himself had the first two sections of the flexible vent tube placed in position. He had also used a side screen of brattice erected in No. 2 Cut-Through across the corner of the shunt area to force air into the goaf and this appeared to be effective to him. However, since the shunt could not be used with this side screen, this was taken down again although apparently it had been doing its job in ventilating the shunt. The shunt was now left with the tight brattice stopping across it and the flexible vent tube which was extended until it reached a point near the brattice resting on the floor of the shunt. Apparently Deputy Gordon on the 4th was able to find noxious gas in the area despite the ventilation arrangement as it existed then.

Although Deputy Cambourn insists that he found no noxious gas in the shunt area on either the 4th or 5th of November, there is clear evidence that the witness Robinson, the shuttle car driver, on Friday 5th reported to him that there was in the shunt and that it had made him "squeamish". Deputy Cambourn denies that he had any report about gas there after he had erected the "elephant's trunk". He was asked whether any man told him that he felt ill in some way. His answer is:

"They could have. There's hardly a night goes past without somebody has got a headache or something. I couldn't remember this."

Deputy Cambourn says that his report of noxious gas on the 3rd November was not in the shunt at all but at the goaf edge in "B" Heading. Indeed he suggests that his report for the 2nd November as to the discovery of noxious gas did not relate to the shuttle car shunt at all but the shunt area generally. His discovery of gas at the goaf edge apparently on each occasion was in "B" Heading and not in "A" Heading. Since then up till the time of the fire he found no gas of any kind. Although the men who have given evidence insist that on the following days they complained to him of gas being in this area, he did not detect gas. He agrees that, although he does not remember, it is possible that the men did make this complaint to him. He says that after the brattice was erected it would be wrong to say that gas was seeping out. The evidence of this witness as to the reason for erecting the brattice and the vent tube in "A" Heading is that it was not because he feared that gas might be coming out of the goaf but it was "to ventilate the shunt" because that is what had happened when the extension to No. 3 Heading had been driven about a month before. He was merely repeating the process because it had been used on the previous occasion. As far as he was concerned he appreciated no danger of gas coming from the goaf in this area.

If I am to accept this evidence it leaves me with the feeling that Deputy Cambourn has little knowledge of methods of ventilation and no appreciation of why the management adopted the practice of sealing in goaf gases by a brattice stopping at the edge of the goaf. This picture to me is completely unreal in that I find it most difficult to believe that Deputies do not discuss these things with each other, and that as a consequence Deputy Stewart would never have communicated directly or indirectly to Deputy Cambourn the problem that had occurred in the intersection of "A" Heading with No. 3 Cut-Through and the method of dealing with it. Deputy Cambourn prefers to say that this is what the management approved of a month before and, without realising what the true reason for its adoption was, he adopted the same system in the shunt area.

I feel that I cannot rely upon Deputy Cambourn's evidence. When I look at other features of his evidence I find them most unsatisfactory. Not only is he in conflict with the men as to his erection of the brattice and the flexible tube as a result of direct complaints made to him about gas in the shunt and also in conflict with the shuttle car driver, Robinson, as to gas still being in the shunt after the erection of this "ventilation system", but he is also in conflict with all other persons

who have tested the area since the fire. As at the 21st December, 1965, when he gave evidence before me, he said that he had been in the area every night since the fire, under the simulated conditions and after them, and he had found no noxious gas but only inflammable gas. He had found this gas "everywhere—on the roof, on the floor, on the sides", and the discovery had been made with an oil flame safety lamp. He says:

"I have not found a trace of black damp or CO₂ since the fire."

Mr. Longworth had said that he had smelt carbon dioxide and had tested with both the methanometer and an oil safety lamp and had found both gases present. In fact, prior to the simulated conditions, Inspector Griffiths had actually lost his light in black damp as he bent down searching for methane but the carbon dioxide persisted after conditions were simulated. Indeed much later under similar conditions, Mr. Sellers suggested that an analysis of the gases found then showed that the percentage of carbon dioxide in the composition of the bottom gas had increased. I find it difficult to believe that any efficient Deputy could have missed the gases found by the others in substantial quantities after conditions were reconstructed in the section to simulate the ventilation system that existed before the fire.

I can place no reliance on Deputy Cambourn's evidence as to the making of his tests or his discoveries. On being recalled at a late stage in the Inquiry Deputy Cambourn apparently attempted to retrieve the position by claiming that under the simulated conditions on a date suggested by his Counsel to be the 8th December, he had found Illawarra bottom gas in the area on his safety lamp. In view of his previous evidence I reject this claim also.

A curious circumstance concerning the erection of the brattice stopping in the shunt area by Mr. Cambourn is that, despite his claim that it was erected merely as a repetition of what had occurred a month earlier at the intersection of No. 3 Cut-Through, Mr. Puddle, the Under-Manager, appears to differ from this view. On the 22nd December, a statement made by Mr. Puddle was handed to me by Counsel and marked for identification. It was in the nature of a proof of the evidence which Mr. Puddle was to give when called. On the last page of that statement there appears this sentence:

"I therefore formed the conclusion that, for a short time only, the bleeder from the goaf could be replaced by the bleed tube."

On its face value it obviously implied that the institution of the bleed tube was a deliberate decision by the Under-Manager as a temporary improvisation until the bleed tunnel, which had been abandoned while pillars 11 and 12 were extracted, was reconstructed by driving the extension to No. 2 Cut-Through. After the Inquiry resumed in February of this year Mr. Puddle altered this sentence in his statement to read:

"I therefore formed the conclusion that, for a short time only, the bleeder from the goaf could be omitted."

I find his explanation for this alteration unconvincing. However, at no time does he suggest that the bleed tube was merely an automatic copying of what had occurred near No. 3 Cut-Through. It was indeed a planned method of ventilation for which he does not deny responsibility.

Mr. Cambourn was the Deputy who was instructed to erect a tight brattice stopping across the shunt on the 8th December and to replace the flexible vent tube in an endeavour to simulate as closely as possible the conditions that existed at the time of the fire. It was upon the substantial accuracy of the simulation of these pre-fire conditions that the evidence of the Inspectors as to tests made on the 8th December was tendered and received at the Inquiry. At the time of this evidence there was no suggestion put to these witnesses that the simulation of the conditions was unsatisfactory and that, therefore, I could not rely upon the results of the tests described.

Mr. Cambourn appeared to give evidence after this expert evidence had been given. His evidence extended over two days the 21st and 22nd December. On the second day, obviously on instructions to which Mr. Cambourn must have been a party, Mr. McNally, Counsel for the Deputies' Association, questioned him on the basis that the simulated conditions were materially different from the pre-fire conditions. Mr. Cambourn suggested that the brattice which he himself had erected on instructions from the management was not as tight as the brattice before the fire. The brattice screen behind the fans, he said, before the fire reached from roof to floor, whereas that re-erected after the fire finished some 18 inches above the floor. Another brattice screen across No. 2 Cut-Through between "A" and "B" Headings which was closed before the fire was folded back in the new conditions. The size of the bleed tube, according to Mr. Cambourn, was smaller than that used in the shunt as at the 9th November. I was satisfied that an attempt was being made to suggest that, since I could not rely on the tests made under the simulated conditions, I could not infer that the Illawarra bottom gas seeping from behind the brattice in the shunt on the 8th December had also been seeping through for some time prior to the fire on the 9th November.

I indicated, on hearing this evidence, that I considered this a very serious matter and could draw inferences adverse to the management, who had allowed these conditions to be created when they knew that the departmental inspectors were attempting to produce accurate evidence as to conditions which must have obtained at the time of the fire. Mr. Cambourn said that he had done the best he could and had left it to the management to decide the effectiveness of his work. I suggested to Mr. Cambourn that it was his duty, since he knew the purpose of the work he was doing, to draw the attention of the management to the fact that this work was not satisfactory. I also said that I would "have my reservations about whether these conditions were or were not simulated and I shall require abundant evidence as to difficulties as to reasons why, if they were not simulated, they

were not simulated, because that leads me to a number of inferences which I am loath to draw." Mr. Cambourn then indicated that he thought that conditions under the simulated arrangement would not make much difference. He was quite satisfied that the test was being made by the Department was a fair test (in fact Mr. Reynolds Q.C. stated from the bar table that his company was not claiming that the new conditions rendered any test invalid).

Mr. Cambourn was asked when he had first discussed this new evidence with any person. He said that he could not remember and he did not even know if the discussion had occurred for the first time on the previous day when he had first commenced his evidence at the Inquiry.

I felt that throughout the course of his giving evidence Mr. Cambourn suffered from lapses of memory which I can only call convenient. His demeanour did not impress me. Time after time he would ask for a question to be repeated before giving his answer, and would gain time to consider what his answer should be by repeating the question which had been asked before he ventured a reply.

I formed the opinion that this witness was concerned to maintain the original hypothesis that the fire was caused by an unforeseeable emission of gas into the shunt. To achieve this end he had to deny that gas had been previously found in the shunt and had to maintain that his direction to erect the brattice stopping and the bleed tube system was not because of an awareness of a position of danger in this area but was merely a carry-over from a system of ventilation in force a month earlier. He also had to lead me to infer that this system was on the known facts, to all intents and purposes an effective one. I am convinced that Deputy Cambourn's motives in thus attempting to mislead me were a desire to remain loyal to the company, and a further desire to protect the deputies, himself included, from any possible criticism due to their shortcomings.

Deputy Walker, the "dog shift" deputy, also gave evidence. During the week before the fire he had only been on duty on three nights—5th, 8th and 9th November, (that is the early morning hours of the day of the fire). As I have said he found no gas, noxious or inflammable, on any of his shifts. He had found inflammable gas mainly at the goaf edge on a number of occasions during the month of October. The goaf at this time, of course, had not advanced as far as it existed at the beginning of November. He also claimed that he knew of the existence of Illawarra bottom gas and had tested for it in all working places, and all accessible places with an oil safety lamp, but had not discovered this gas at any time. The reports show that he had discovered inflammable gas after the fire at the goaf edge on a number of occasions but in the main used a methanometer to detect it. He had never been supplied with a methanometer before the fire.

On the shift before the fire he describes a number of tests which he made in the working areas including the shunt. Three of these took place between midnight and crib time, which was 3.00 a.m., with a further test after 4.20 a.m. He also says that he made a final test of all areas at about 6.00 a.m. If these claims are correct Deputy Walker made more tests than he is required to make by Statute under General Rule 4, which provides for two tests of these areas at intervals of not more than four hours. The Rule does require tests of all working faces where continuous mining machine operations are in progress at intervals of not more than two hours, but this situation did not obtain during the "dog watch" shift. On tests before crib time the shuttle car occupied the shunt and the tests at the brattice were made by stretching as far across the back of the shuttle car as the Deputy could reach. This, of course, is by no means a proper test for Illawarra bottom gas or even black damp at the brattice area, and must, therefore, be considered unsatisfactory. There is no record by Deputy Walker of any test made at 6.00 a.m. In fact his report shows that his final inspection was commenced at 3.45 a.m. and completed at 5.50 a.m. His evidence is that the final test was made a few minutes after 6.00 a.m. and it was a test with the shunt empty.

Deputy Walker states that on a number of occasions he had found inflammable gas at the goaf edge as the development proceeded. These tests were mainly along "B" Heading. He also agrees that he lost his light in "a goaf area" on occasions. He understood that the brattice in the shunt was to prevent black damp from seeping out of the goaf, and under cross-examination he agreed that any gas found could have seeped out of the goaf.

Some criticism was levelled at Deputy Walker's method of testing for Illawarra bottom gas. He stated that, before making the test, he would reduce the flame on his safety lamp and then lower the lamp slowly towards the floor. He would do this despite the fact that if his lamp came in contact with black damp in any concentration it would tend to go out, and would more readily be extinguished if the flame was reduced.

In fact there were various descriptions at the Inquiry by Mines Inspectors, Deputies and Mr. Sellers as to the proper method of testing for Illawarra bottom gas with a safety lamp. The Departmental inspectors claim that the proper method is to establish the presence of black damp first by lowering the lamp with a large flame and then if this gas is discovered the lamp is to be withdrawn, and the flame considerably reduced to a small testing flame. The lamp is then lowered gradually towards the area of gas so that when it reaches the fringe area where the gas meets the ordinary air, the methane in the Illawarra bottom gas produces a small halo or cap upon the reduced flame.

I was left with the distinct impression which was in fact agreed to by some of the experts, that an inexperienced Deputy might well have difficulty in detecting the presence of methane in a concentration of bottom gas with an oil flame safety lamp. All Inspectors and Mr. Sellers, however, agreed that it must have been detected by the Deputies even taking into account the defects in their methods of testing when one considers the quantities of methane in Illawarra bottom gas which existed from time to time in the shunt area prior to the fire.

It is most difficult to understand how the Deputies came to miss methane if they carried out the tests which they describe. I have already dealt with my view of the evidence as to these tests given by Deputy Cambourn. On the face of the claims made by Deputy Walker, there is no evidence given at the Inquiry other than what must have been the condition in the shunt prior to the fire which contradicts his claims. It must be remembered also that Deputy Walker had actually found inflammable gas on his oil safety lamp at the goaf edge. I am left in doubt on the whole of the evidence, therefore, and make no finding in criticism of Deputy Walker in the conduct of his duties. It may be true that certain of his tests in the shunt on the 9th November were hampered by the presence of the shuttle car. On the other hand, the shuttle car was not in the shunt when he made his tests after 3.00 a.m. yet he discovered no gas. There are two possibilities which make his evidence consistent with the evidence of those who tested after the fire.

Firstly, it is, of course, possible that the gas in the shuttle car shunt issued in varying quantities. If this were the case it is possible that the bleed tube was at certain times effectively dealing with the seepage of gas. It is also possible that the gas, owing to the presence of the bleed tube, was collecting in pockets at other parts of the shunt and that these were not effectively tested by the Deputy at all, so that he missed them. I merely mention these as two possibilities. There is no evidence to confirm them. There is, however, the general proposition which I must accept, namely that from time to time gas did appear in the shunt area and was detected by some Deputies as noxious gas and gas was in the goaf and detected by Mr. Walker at certain times as inflammable gas and at other times as noxious gas; yet, the abundance of expert evidence is that the only gas existing in the goaf was the mixture of noxious and inflammable gases, namely Illawarra bottom gas and it was this mixture which was being examined by the Deputies at all times. It must be said also that it was this gas which was being discovered by the men in the shunt during the week before the fire.

Deputy Stewart found noxious gas at the goaf edge on the morning of the 2nd November. For the four ensuing work days prior to the 9th November, he claims to have found no gas whatsoever. His report for the morning of the 9th, which was made on the 11th November, relates to the first hour or so of the shift. His inspection commenced at 7.45 a.m. and was completed at 9.00 a.m. He says that he found noxious gas at the goaf area of the previous lift and "A" Heading. This, he says in evidence, relates to his discovery of noxious gas in the shunt. He states that he began his general inspection for gas by testing with the miner/driver at the working face. He then tested the rubbers on the vent tubes for leakages of air up as far as the fan area and around this area, and then he went straight across to the shuttle car shunt which was empty at the time. He tested on the right-hand side of the shunt first and then towards the middle and then on the floor. He found no gas at all on this test. His next test was in "B" Heading where there were some cross sticks erected to denote a danger area. These had previously been erected by himself because gas had been discovered at the goaf edge in this heading. Apparently he discovered no gas there on the 9th November and he returned to the face and supervised the work there until about half past eight.

Stewart then says that he went to the shuttle car shunt again—

"and this time I got down on my hands and my knees and I got this sensation right down low on the ground. It is a smell or a sensation or whatever anyone likes to call it."

Thus, he had discovered carbon-dioxide in the shunt on the floor by his senses. He goes on to say:

"I gave this elephant tube a little bit of a wave around and then I could not smeli anything else again and I tested all round that area with the lamp and could not find anything."

I asked Deputy Stewart whether he thought, looking back on the incident, that the goaf was the most probable area through which the gas was coming. He agreed that it was but he said that at the time it did not strike him that the gas might be coming from the goaf. He was then asked whether he thought that, having got rid of the gas temporarily, the source might replenish the supply at some later stage. His answer was:

"I treated that smell as black damp and I got rid of it with the elephant trunk until there was no smell left in that area at the time."

I treat this as a most significant piece of evidence. It shows that in Deputy Stewart's mind at least there was no consideration given to the danger of gas continuing to issue from the goaf from time to time either after it had been dispersed or between inspections. This appears to me to be a fundamental error in which not only the Deputies were to blame. It is obviously dangerous to assume that if gas on the goaf edge is once dispersed the area could be safely left so that work continues in the area. The failure by Deputy Stewart on the morning of the 9th to take additional precautions by continuing to test so that the source of the gas could be determined was the immediate cause of the build-up of gas in the shunt which preceded the fire.

I believe that Deputy Stewart sought to avoid this conclusion subsequently when he gave his evidence at the Inquiry as to the extent of the first outbreak of the fire. I have already referred to this in that section of my Report dealing with his description of the fire. He attempted to present a picture to the Inquiry where the most significant feature was gas burning in the bleed tube. The implication was that in some way the gas in the bleed tube itself and not in the general body of the shunt had ignited. This, as I have indicated, is contrary to the evidence by other witnesses.

Deputy Stewart says that he had during the last month before the fire found noxious gas "six or eight times down in that bottom side and inflammable gas once or twice". He qualified this by saying that he had not found inflammable gas in that particular area but had reported it inbye of the goaf area, although he is vague as to where this was.

He also says that he has been shown bottom gas in the Bulii Colliery and has seen the cap formed on the flame of the safety lamp. He agrees that the gas which he treated as black damp could in fact have been Illawarra bottom gas, but he says when testing for black damp he always bears in mind the possibility of Illawarra bottom gas. Mr. Stewart was cross-examined as to his method of testing for Illawarra bottom gas on a safety lamp. He, like Deputy Walker, says that he raises his flame until it is slightly below normal height and lowers the lamp towards the floor. If there is any inflammable gas in the area it will "flame" on his light, and if there is no inflammable gas but only black damp it will tend to extinguish the light. The flame he uses to detect carbon dioxide is the one that he uses to reveal methane. He will not agree that a small flame is necessary to be able to see the cap on the flame that is formed in the presence of methane.

It must be emphasised that, although the Departmental inspectors who heard the evidence of the Deputies say that on the tests described by the Deputies they would not have failed to detect methane in the concentrations that were present after the fire under the simulated conditions, and although Mr. Sellers agrees with the Inspectors as to this, the raised flame in a safety lamp is not the proper means for testing for methane. Safety pamphlets on this subject stress this fact. A British Mines Department safety pamphlet, tendered as Exhibit U at the Inquiry, contains this statement:

"A low testing flame is essential, for, unless the flame is lowered, the light from it renders invisible the caps described below."

The approximate percentage of methane can in fact be read from the nature of the cap on the flame of a safety lamp. It is possible for an expert tester to see a methane cap when the concentration of 1% of fire damp is present. As the percentage of fire damp increases the cap becomes taller and eventually spires. The different heights and shapes of the fire damp or methane cap indicate the various percentages that are present. The obvious difficulty in using a relatively high testing flame when testing for methane is that the methane itself will tend to become invisible in the yellow light produced by the flame. From what has been described at the Inquiry a test for methane in Illawarra bottom gas is a delicate procedure. The Inspectors agree that methane may be missed in this composite gas by an inexperienced observer. It certainly would be missed by a Deputy or other official who does not expect to find Illawarra bottom gas in what he believes to be black damp. This, to my mind, is one of the unsatisfactory features of the oil flame safety lamp in testing for Illawarra bottom gas.

One fear that every Deputy shares is that if his flame is low he may well lose it in a concentration of black damp. This causes substantial inconvenience to the Deputy and he does his test in a manner calculated to avoid losing the flame. With the lamps in common use up to the present time, once a flame is extinguished the tester cannot immediately re-light his lamp. Safety rules provide that he must go to a lamp station specially assigned for this purpose before the lamp can be relit, and this may be a considerable distance from the area in which he is working. The alternative is for him to obtain another lamp from somebody else and, of course, this is a practice to be deplored since it leaves that person without his own testing lamp.

I believe that it is this fear of losing a lamp that will cause a Deputy, once he lowers the lamp into a concentration of black damp, to decide immediately that it is black damp which he has discovered and to treat the gas as such. I have come to the conclusion that, despite the Deputies' claims to have tested for Illawarra bottom gas in this Mine, any tests performed for this particular gas, if in fact they were carried out, were merely perfunctory. I am convinced on the evidence of Mr. Stone and Mr. Puddle that little attention was paid to the possibility of bottom gas existing in the workings for the reason that it was treated as a rarity and its danger was not appreciated. The very ignorance of Deputies Stewart and Walker as to the proper test to be employed and the nature of the flame which was required to be used is an illustration of the fact that they had never been instructed in the proper testing for bottom gas and that they themselves had not bothered to discover for themselves the correct test required because they did not expect to find Illawarra bottom gas. As far as Deputy Cambourn is concerned, apart from what I have already said about my reaction to his evidence, it must be pointed out that he gave his description of the test he used after the evidence as to the proper test had been given by the Departmental inspectors. I think he availed himself of what they had said should be done. Deputies Walker and Stewart gave their evidence before the proper test was described.

In dealing with the evidence of the Deputies one further fact must be noted concerning Deputy Walker, which comes not so much from him as from a report which was tendered in evidence. On the 5th October, probably the very morning on which Deputy Stewart erected the brattice in "A" Heading near the intersection of No. 3 Cut-Through and apparently the same morning on which this Deputy lost his light in what he thought was noxious gas, Deputy Walker reports during his two periods of inspection "inflammable gas on edge of goaf area being diluted." This report is countersigned by Mr. Puddle, the Under-Manager. It is not made clear by the report as to whether this gas was discovered by the Deputy in "A" Heading or in "B" Heading.

One would think, however, that the management would have been put on enquiry as to the possibility of this gas being emitted into "A" Heading. There are two gases here during the same period coming from the goaf. If, as Mr. Puddle says, he was at all times testing for the presence of bottom gas, I am compelled to ask why he did not make exhaustive tests with a methanometer to see whether a gas which he must have known was coming into "A" Heading was not that gas. There is no satisfactory answer to this question, unless it be that Mr. Puddle was content to rely on an unwarranted assumption that he was only dealing in the shunt with noxious gas and that, providing there was some control over this gas by the use of the brattice and bleed tube, it was not of any great importance since it was not reaching the working face. I put this proposition in the context that an Under-Manager knows what happens in mines and in particular knows the vagaries of gas in a goaf. I must assume that at all times Mr. Puddle must have known that this gas was contained in the goaf. If it came out at "B" Heading why should it not also come out of "A" Heading?

The very erection of the brattice in "A" Heading, both near No. 3 Cut-Through and No. 2 Cut-Through, made it impossible for the Deputies or any other person to inspect for gas at the goaf edge in this heading. This is the most important fault in a system of erecting a tight brattice stopping across the goaf edge, namely that it forbids inspection of what is occurring behind it. There was no system of ventilating the goaf edge. There was only a system of containing gases in the goaf. Mr. Puddle had all reports in his hands at the relevant times, yet he took what must have been to an experienced mining man a calculated risk that inflammable gases might escape from behind the brattice between the normal inspections made by Deputies and create a situation of extreme danger. It is no answer to this argument that tests for Illawarra bottom gas were ineffective or that there was no real suspicion that Illawarra bottom gas existed in the goaf. Once it became known that inflammable gases were in the goaf, it was imperative upon the management to alter its system of ventilation so that at all times these gases were rendered harmless. It must also be remembered that it was after this discovery of inflammable gas that Mr. Puddle decided temporarily to dispense with the system of headings which bled the gas from the goaf. The Under-Manager was aware that gases might issue from the goaf despite the brattice and the bleed tube. He himself says that he warned Deputies to pay particular attention to the shunt area. There is no evidence from him, in fact the evidence indicates otherwise, that he made any attempt to see that his instructions were being carried out.

The fundamental fault in safety precautions at Bulli Colliery was twofold:

(1) As I have already emphasised, the management gave no proper thought to the problems of ventilation which they were likely to encounter in the method of development in Section 8 Right. It adopted the most convenient method for winning coal quickly but made no real attempt to ventilate the section so that at all times they would have a real control of the gases which were likely to escape from the goaf into the workings. Although officials commenced with a system of bleeder headings which tended to drain the gases from the goaf to an area outbye of the working places, they abandoned this system at least temporarily in the interests of winning coal at a time when they should have known there was a tendency for a vast volume of gas to accumulate in the goaf. At the same time they failed to ventilate the edge of the goaf and on two occasions within a month of each other, they prevented an inspection of the goaf edge at a critical point by erecting a tight brattice screen across that edge. By this device also they caused a build-up of gases behind the brattice screen which was likely at any time to break out into the working area.

(2) Although they had warnings from time to time of the inflammable gas that existed in the goaf, they chose to treat them as merely local outbreaks and did not associate them with the noxious gas which they also knew to exist in the goaf. With the admitted knowledge of the existence of an insidious and deceptive gas, the mixture of both noxious and inflammable gases, they ignored the possibility that they were in fact dealing with this mixture in the goaf and not with two separate gases. This basic hiatus in the reasoning of the management led it to treat noxious gas as a gas which could be tolerated providing it was not forming at or near the face itself. In the shunt it tolerated concentrations of noxious gas which drew complaints from the workmen. Its method of dealing with this gas was a mere improvisation for which no justification could be found in mining practice and which was dangerous in the extreme.

This attitude of the management communicated itself to the Deputies. It could not be expected that the Deputies would treat seriously what the management itself not only knew about but tolerated. As a result, even if the Deputies tested for and discovered gas, all that resulted were improvisations by the Deputies to deal with it without any attention to the serious nature of the problem which actually confronted them.

This can only be called a cavalier attitude on the part of the management and Deputies towards the problem of gas at Bulli Colliery. It displays a laxity which should never have existed. Since as a result of these fundamental faults on the part of those concerned, four men lose their lives, it is to be hoped that the management of this Colliery and of other collieries in which gas exists in this State and elsewhere will be warned for the future.

It has been said by counsel for the Minister and the Department of Mines that only good can come from this Inquiry. It is my earnest hope that Mr. Lee is right in his prediction. He says that at last people in mines have become aware of the nature and dangers of Illawarra bottom gas. I believe that this is true. At the same time I must issue a warning that the tragedy which occurred on the morning of the 9th November 1965 at Bulli Colliery can be repeated at this and other collieries with possibly far more disastrous results unless the lessons learned at this Inquiry become rooted in the minds of all men who work in mines, both management and employees.

It is in an attempt to avert such future disasters that I have taken upon myself the task of making certain recommendations which may improve safety procedures in mines for the future. I do this, having heard a number of considered suggestions as to these measures from all counsel and miners' representations who have appeared before me at the Inquiry.

G: OBSERVATIONS AND RECOMMENDATIONS

1. Ventilation Problems:

- (a) Senior counsel for the Mines Department has submitted that I should, amongst my observations, recommend that in regard to pillar extraction of coal, whenever a new development is contemplated the management of the Colliery should be compelled to advise the Department of Mines of the ventilation system it proposed to adopt, showing:
 - (i) any existing goaf areas or old workings in the vicinity;

- (ii) the intake and return of airways;
- (iii) the position and type of all stoppings; and
- (iv) the proposed location of auxiliary fans and the number thereof.

He also asks that I recommend that the management of the Colliery must receive Departmental approval of this ventilation system before commencing pillar extraction in such a development and that no variation of such system should be permitted after pillar extraction has commenced, without the written approval of the District Inspector. Counsel for the company at this Inquiry has made no challenge to this suggestion, and it apparently is considered desirable by the Inspectors of the Department of Mines. The suggestion, of course, arises from the lessons that have been learned at my Inquiry in regard to the peril of altering an approved system of ventilation. I can see no substantial difficulty by way of inconvenience or otherwise if the Coal Mines Regulation Act is amended to give statutory authority to this idea. I believe that it is in the interests of safety in pillar extraction that this plan should have the force of law, and I, therefore, recommend this course.

- (b) Despite what I have said in (a) above, I believe from the evidence at the Inquiry, that there is a problem more fundamental in relation to ventilation systems than the receiving of Departmental approval for any scheme. It seems to me that there is room for considerable study in New South Wales Collieries of the science of ventilation, and that safety in our Mines demands the undertaking of investigation and general research into the theory and techniques of ventilation. It became clear to me that there can be many divergent opinions among experts as to the safest and most convenient way of attacking a problem of ventilation in pillar extraction. There was considerable difference of opinion, for example, between Mines Inspectors and gas and ventilation experts, and in fact between my own Assessors as to the effect of auxiliary fans upon the water gauge at various points of the ventilation district with which I was dealing. There was evidence of the loss in certain ventilation splits of a substantial quantity of air and this loss could not be satisfactorily explained by anybody at the Inquiry. As a further example, it is apparent that I came to the conclusion that the company had problems in regard to contours of the district, grades of wheeling roads and roof control which made it compromise as to its method of ventilating the section. I have said that this compromise in the particular circumstances before me was not warranted. Nevertheless, I can envisage situations where it would not be possible economically to win coal because of difficulties of this kind, unless an effective ventilation system involving a minimum of risk to those operating in it were devised.

To this end I earnestly suggest that there should be attempted, as a matter of urgency, a study within the Department of Mines and with the possible assistance of outside individuals or institutions, of ventilation problems. I contemplate a planned expert research programme with its end goal a code of safety as to ventilation which would be made a standard written guide for Inspectors, mine management and deputies. I have no knowledge of any precedent for such an undertaking in this country or abroad. I do know from what I have been told at the Inquiry and through discussions with my Assessors, that there have been devised ad hoc schemes for dealing with particular problems of ventilation. My suggestion, of course, goes much further than this, since I recommend that the study begin with a codification of the very fundamentals from a scientific and engineering point of view of ventilation methods. I am impressed with the calibre of the Inspectors and experts in the Department of Mines who have assisted me in coming to my conclusions. I feel confident that these gentlemen will understand the problem which has been troubling me and I am certain that they have the ability to undertake the study and codification that I envisage and that I feel is necessary in the interests of future safety in coal mines.

2. Testing Devices:

The oil flame safety lamp has had a long and successful history in mines as an instrument of safety. Its flame can readily detect carbon dioxide or methane. For that reason, even without its use as a testing device, it has saved many a life by being an automatic reactor when its user inadvertently comes into the presence of a volume of noxious gas. Despite any criticisms which have been levelled at it during my Inquiry and elsewhere, it is truly the miner's friend and, in my opinion, cannot at present be supplanted.

At the same time it has several disadvantages, some of which may be removed by improvement of the device itself. However, I am satisfied that for certain conditions in mines it needs supplementing by other devices.

One disadvantage of the oil flame safety lamp, as it has been known up till the present time, is its tendency to be completely extinguished suddenly in a large concentration of carbon dioxide. It is to be noted that this can also happen in a sufficiently rich concentration of methane. The first result, of course, is that this leaves the user without a light, and considerable inconvenience is caused by the need to go to a somewhat distant lamp lighting station before the lamp can be unlocked and relit. This fact also carries with it a psychological result in the user in that there is a tendency, amongst men who are lax in their attitudes, not to test further in a particular area with the lamp once it is shown that a gas is lowering the flame because there is a constant fear that the lamp will be extinguished. Thus, if methane were present mixed with black damp, it could easily be missed.

There has been demonstrated before me an improved oil flame safety lamp manufactured in Great Britain which has a relighting device within it, whereby the lamp can be relit by the use of a lever which generates by friction a spark in the safety of the lamp itself, without the lamp being unlocked for this purpose. I was told at the Inquiry that the Chief Inspector of the Department of Mines sees no reason why he should not approve of the general use of this type of lamp in mines amongst most of the officials who test for gas. There is a difficulty in its use by men working on a machine, (for example, the miner/driver) in that if the lamp has been extinguished because of a rich concentration of methane, it should not be relit except in the main body of the air current. This is because there may be an explosive mixture within the lamp itself. A repeated explosion would render the lamp ineffective, since its gauze would become red hot.

The type shown to me also can overcome another disadvantage apparent in the old safety lamp. It has been demonstrated conclusively that the oil flame safety lamp at present in use cannot detect a layering of gas which is less than five inches in depth either at roof or floor level. Thus it would be unable to detect such a narrow layer of methane, carbon dioxide or Illawarra bottom gas. In fact it is within the bounds of possibility that Illawarra bottom gas lying in a thin layer at floor level could frequently have been missed by those testing for gas at Bulli Mine. With regard to methane, because of a previous occurrence of an ignition of this gas at Bulli Mine, the Act in 1964, was amended as to the Seventh Schedule, Section III, in a number of respects to approve of the use of an alternative device for the detection of the gas, approved by the Chief Inspector either in conjunction with or as an alternative to the locked oil flame safety lamp. These amendments relate to circumstances where a flame has to be lit, or an arc has to be struck, or a stationary machine has to be started. The improved oil flame safety lamp can be adapted by the use of a probe with a gas sucking device to draw samples of gas at roof or floor level or from otherwise inaccessible pockets. This would eliminate the defect which I have described; particularly in regard to black damp or Illawarra bottom gas.

I was told that the cost of the improved lamp and probe would not cause any great hardship to colliery proprietors, if their use was made compulsory by statutory enactment. This can be done by an appropriate amendment of the Act in the various places wherein the oil flame safety lamp is referred to, or it can be done by a notice of gazettal emanating from the Chief Inspector of Mines indicating that as from a certain date no oil flame safety lamp which does not bear the improved features and which is not accompanied by a gas probe will be approved by the Chief Inspector for use in mines. This date of commencement of the compulsory use of the improved lamp and probe will, of course, depend upon the availability at the time of these instruments in New South Wales. However, I am certain that if notice of the impending change were given to overseas manufacturers or even to local manufacturers who may be interested in supplying such lamps and probes, there will be no difficulty in fulfilling the demand for them. I draw attention to Section 79A of the Act which sets out the powers of the Chief Inspector as to approvals. The Chief Inspector has power to impose conditions and grant exemptions in regard to such approval and this is important, since it is probable that there are some mines which have no difficulties from gas problems, and it would be an unnecessary burden to compel the proprietors of such mines to adopt the new lamps.

A further defect in any oil flame safety lamp was amply demonstrated at the Inquiry in relation to the discovery of inflammable gas. I have already described the proper test for methane either separately or in Illawarra bottom gas, by using the oil flame safety lamp. There is, however, still some disagreement as to whether the test described is the best method. In any case it is clear that the ability to detect methane, particularly in Illawarra bottom gas, depends upon the experience of the tester and also upon his attitude towards his duty. It was said time after time by experts that certain Deputies could easily miss the presence of methane in Illawarra bottom gas merely by using an oil flame safety lamp, since the detection of this gas depends upon the ability to observe what might be a faint and transient halo on the top of the flame. A far more certain device for detecting methane in any circumstances is a methanometer. There are other devices of this nature, but the most popular and readily obtainable is the M.S.A. type methanometer. In fact, since the fire occurred at Bulli, Deputies have been given methanometers to use by the management and have successfully been detecting Illawarra bottom gas by this method. The great advantage of the methanometer is that it actually measures the percentage of methane present on a scale. It was suggested that the actual reading of the percentage may be rendered inaccurate at times in the presence of carbon dioxide in a percentage of 10 per cent or more. Whether this be so or not, methane is registered on the methanometer even in lower percentages. I believe that the use of a methanometer in gassy mines in this State is essential for future safety in those mines. It should not be regarded as a substitute for the oil flame safety lamp but must be used in conjunction with such lamp, so that any person whose duty it is to test for gas in these mines must in fact carry both. No objection has been raised at the Inquiry to this proposal. The representatives of all interests who appeared before me were unanimous that the compulsory introduction is necessary. I strongly recommend its introduction and urge that wherever an oil flame safety lamp is referred to in the Coal Mines Regulation Act there should be added the words "and some other device of a type approved by the Chief Inspector for the purpose" and that the Chief Inspector gazette his approval of the M.S.A. methanometer as such a device or, if this device could be improved, that he include his approval for any approved device which in future becomes available and which he approves.

I draw particular attention to the following parts of the Act which will require examination in considering amendments of this nature (the list may not be exhaustive):

- General Rule 4 (b)
- General Rule 4A (b)
- General Rule 7

General Rule 8

General Rule 10 (a)

The Fifth Schedule Regulation 6 (i) & Regulation 17

The Sixth Schedule Regulations 25 and 137

The Seventh Schedule Regulations 20 (f), 20 (g), 21 (a), 25, 27 (a), 27 (4), 69 and 98 (14).

3. Other Devices:

Inspector M. J. Muir of the Mines Department has prepared an excellent paper dated 7th February 1966 on the subject "Gas Concentration Measurements and the Law." Inter alia he deals with the methods of detection of gas and recent developments in instruments designed for such detection. Some of the instruments which he describes are already in use here; for example, the Rikon and Toka Methane detectors which are interferometer detectors. They appear to me to be instruments which may be of use in special circumstances, but for general use in Mines by Deputies and the like they have some disadvantages, particularly the readiness by which the reading can be rendered inaccurate in the presence of other gases and in particular carbon dioxide.

These interferometer detectors can also be adapted to determine the percentage of carbon dioxide in the atmosphere. However, the most common chemical detection means for this gas is by use of the Drager detector, which gives an immediate indication of the percentage of carbon dioxide present.

Inspector Muir also describes recent developments in fixed devices which provide continuous detection of fire damp. Some of these were demonstrated to me at the Inquiry. They are in the nature of monitors which give an alarm, usually of the nature of a fixed or flashing red light, in the presence of a predetermined figure of methane between $1\frac{1}{4}$ per cent and 3 per cent. These instruments usually will also automatically shut down immediately any electrical equipment being used in the presence of the detected gas. The purpose of the instrument is to monitor the presence of methane by placing it near or upon a working machine in a mine, or in a position where the presence of gas from time to time is suspected. Some of the instruments can be located at either roof or floor level. Mr. Muir particularly notes the English Electric Automatic Fire Damp Detector and Alarm, the M.S.W. Methane Alarm, the Sigma Recording Flame Methanometer (which will record methane percentages on a time chart for a continuous period of eight days and is suited to the continuous recording of methane in such situations as return airways), and the Irga Infra Red Methane Monitor and Recorder.

Inspector Muir has drawn my attention to the recommendations of the Chief Inspector of Mines, Great Britain, following the Inquiry into the explosion at the Cambrian Colliery, Glamorgan, on 17th May 1965, into the making of fire damp determinations at the end of face return airways and the development of instruments and systems for the continuous monitoring of fire damp. My Inquiry and my reading of reports of mine fires and explosions generally leads me respectfully to adopt the recommendation of the Chief Inspector in this regard. I do not think that at this stage any legislative change is necessary. I do, however, strongly urge that the Mines Department conduct research into the devices which are available or are being developed for the purpose of monitoring and recording gas in coal mines. It will be necessary, if this is done, that an investigation be carried out of all overseas developments in this regard and into the effectiveness and availability of the relevant devices. Following upon this the Chief Inspector of Mines in New South Wales should make his own recommendations as to the desirability of introducing any devices of which he approved into the appropriate coal mines of this State. I specifically draw attention to the suggestion of Chief Inspector H. S. Stephenson in his Report of the 30th September 1965, at p. 18:

"That a number of such instruments are installed at potentially vulnerable points in a ventilating district and then coupled together to provide continuous monitoring of the fire damp conditions there."

4. Deputies:

(a) Curriculum:

I make no general criticism of Deputies either at Bulli mine or any other mine in the State. There is nothing before me to show that as a body of men they are not conscientious in their duties and safety conscious when they are working in mines. At the same time it became clear, in regard to individual Deputies at least, that the circumstances under which they had received their Third Class Certificate of Competency probably left something to be desired. There seems to be very little opportunity for Deputies undertaking their courses of instruction and offering themselves for examination to demonstrate their competency in testing for gases under field conditions. One Deputy told me that he had only discovered Illawarra bottom gas years ago when shown it in a box. Other Deputies, as I have described, were prepared to test for methane near the floor by raising the same flame as they would for discovering black damp. There was a constant reference in reports to gas "being diluted" when these Deputies were unable to say about the gas that they had discovered anything other than that as they withdrew the lamp from the presence of the gas, the gas did not continue to affect the lamp. It seems to me to be essential in the elementary training of Deputies that no Deputy should receive his Certificate until he has passed a proficiency test under the supervision of official examiners in the detection of various types of gas within the actual workings in a mine. I urge that a direction be given at Ministerial level to the Coal Mines Qualification Board as to the necessity for Deputies to have this practical experience.

It has been put to me by Counsel for the Department that there is no reason, with the availability of higher standards of education in the community, why Deputies should not themselves possess such standards before they can be considered suitable for the responsible duty that they are undertaking. This is not meant to imply that Deputies should be graduates of Universities or the Higher Technical Colleges. At the same time, a Deputy is required to be a responsible official in a mine, a man who can understand the directions that he is given and who can also impress the men whom he is leading when he works with those men in a mine. It is common experience in mines today to find amongst the men working under a Deputy not only skilled tradesmen but highly skilled technicians, and these men can have very little respect for a Deputy who is poorly educated under the standards that apply in our community today. It is commonplace for men undertaking the duties of responsibility in industry to have an education up to third or fourth year secondary standard. I see a very real need for what has been urged upon me by Counsel and I recommend that the Coal Mines Qualification Board at all times be conscious of the necessity of improving the general standard of Deputies in this regard.

Neither of these recommendations touch the problem of those Deputies who are already working in mines. I think it is essential that something be done about the qualifications of these men also. While the second of the recommendations that I have outlined above cannot apply to these men without great difficulty and hardship, I believe that the first can. I would suggest that at the end of a sufficient period of time, for example twelve months from the decision to carry out the recommendation that I am about to make, all Deputies be informed that they are liable to be examined in the field, that is within the mine in which they are working or at some other suitable mine, as to their competency to test for gases, and that these Deputies should in fact be examined by persons deputed for that purpose, either examiners at present acting for the Coal Mines Qualifications Board or other persons of sufficient competence deputed for this purpose. I recommend further that any Deputy who fails to pass such an examination should have his certificate of competency suspended until such time as he has shown himself fit to pass the examination required by a further examination. It appears to me that although this scheme may require substantial organising to put it into effect, it is essential in the interests of safety in coal mines. The alternative is a system of Deputies many of whom may show themselves to be incompetent to detect a potentially dangerous situation arising out of the presence of gas.

(b) *Employment:*

Certain parts of the evidence at the Inquiry led to a suggestion that Deputies at Bulli Mine were at times inclined to disregard potentially unsafe situations, whether from the point of view of gas or dust conditions, in the interests of winning more coal per shift on behalf of the management. It was put to me, and I believe with some merit in the argument, that a Deputy had other duties on behalf of the Company than to ensure the safe working of the mine, and that there was a certain pressure from the management on the Deputy to produce as much coal as possible. Deputy Stewart, whom I interrogated as to this, denied such a pressure existed. At the same time it became clear that from time to time, during a shift, a Deputy would not only be visited by the Under-Manager or the Assistant Under-Manager but also by officials called "Overmen" whose job it was to see that a high standard of production was maintained.

As a result, it was submitted to me from the Bar table that a Deputy should not be the employee of the Colliery proprietor but should be the Deputy of the Department of Mines. A corollary to this suggestion was that the finance for payment of Deputies' salaries should be obtained by a levy from the colliery proprietors. It is true that the removal of the Deputy as a safety supervisor from the employment of the Company might remove much of the criticism which has been aimed at the Deputies in this Inquiry. There would be no reason, of course, for a Deputy to make any compromises as to safety in the interests of production. At the same time, while I urge this as a matter for Ministerial scrutiny, I do no more in regard to this situation, since the institution of such a scheme would require an investigation which is beyond the scope of my Inquiry.

5. *Other Officials:*

The hierarchy of control at Bulli Mine involves the following gradation of officials:

- (a) The Manager, who is responsible for the control of the whole Mine.
- (b) The Under-Manager, who, apart from his control of the underground workings of the Mine which involves a responsibility to the Manager, has, in the absence of the Manager, the same responsibilities and is subject to the same liabilities as the Manager under the Act (Section 5 subsection 2(a)).

Both of the above officials have specific statutory duties under the Sixth Schedule of the Act.

- (c) The Assistant Under-Manager. There is no statutory position of Assistant Under-Manager and the only possible statutory recognition of such an official is contained in the Sixth Schedule Regulation 10 which says that the Under-Manager "shall personally, or by Deputy, give all necessary instructions to the officials and workmen in the Mine respecting their work". I think it is very doubtful, however, whether this Regulation envisages a position such as that of an Assistant Under-Manager. I am inclined to the view that the word "Deputy" refers specifically to a Deputy appointed under the Act. I am strengthened in

this view by Regulation 9 of the same Schedule which specifically states that if an Under-Manager "is not in attendance at the Mine, the Manager shall carry out the duties imposed by these Regulations on the Under-Manager".

The necessity for the existence of one or more Under-Managers in a large mine is apparent. Neither the Manager nor the Under-Manager can pay sufficiently frequent visits to all working sections of a mine in any one day, or even over several days, to ensure the proper working of that mine. Furthermore, neither a Manager nor an Under-Manager can be present throughout three shifts at the mine, and some officials must take his place when he is absent. I can see no objection to the creation of a position of Assistant Under-Manager or of more than one such position, provided that the office carries with it specific statutory duties and liabilities. The position could be cured by creating the office under Statute and giving the same duties and liabilities to any Assistant Under-Manager when he has been deputed by the Under-Manager to carry out the duties of the Under-Manager himself, either when the Under-Manager is absent from the mine or when the Assistant Under-Manager is deputed to control certain limited sections of the mine in the absence of the Under-Manager. Unless this is done, there must of necessity arise the position which occurs at Bulli Mine, where the Assistant Under-Manager has assumed the control and direction of sections of the mine workings without any statutory responsibility and without any liability being imposed upon him by law. I would point out that I can find no requirement by Statute for any Certificate of service or competency for an Assistant Under-Manager. I recommend that urgent attention be given to deal with this problem.

(d) Overmen:

Again there is no statutory recognition of this office. An Overman appears to be an official appointed by the Company who is in the nature of a supervisor of production. In regard to production he can give directions to a Deputy. He is thus in a position to place a Deputy in a dilemma as to whether to carry out the wishes of an Overman when he may feel that to obey such instructions he may be jeopardising the safety of the men. There was no direct evidence at the Inquiry that any Deputy found himself in this position. No Deputy complained that this state of affairs existed, or relied upon it to excuse any failure on his part. I would not have expected a Deputy to have made such a complaint to me in the circumstances. Apart from any question of disloyalty to the Company, it would have been obvious to any such Deputy that he could have been met with the answer that his first duty was the safety of the men and, therefore, he should have disregarded the Overman or at least sought instructions from a superior official. Nevertheless, from time to time in the evidence, the figure of the supervisory Overman appeared. When Deputy Cambourn failed to hole the goaf on the Friday before the fire it was an Overman who gave instructions that the miner/driver was to be moved to another place. I point to this as one specific example of the interference of an Overman in the working of the mine, which may well have contributed indirectly to the tragedy that followed. Another example is the description by Deputy Stewart of his conducting a new Overman equipped with his own safety lamp around the district on the morning of the fire. It is clear from his evidence that the Overman, without any statutory duty or liability, actually makes tests for gas, although none was conducted by him on that particular shift.

In my view the possibility of such interference cannot be allowed to continue. The framers of the safety code which has been embodied as a result of long experience in the Coal Mines Regulation Act never envisaged the existence of such an official. Production and safety can both be maintained satisfactorily by the Deputy under the supervision of statutory officials. I can see no place in mining legislation for the position of a "Production Foreman" who is superior to or can interfere in any way with a Deputy. The Deputy is the person upon whom the men working in the mine must immediately rely for their safety. There must be no interference by any person who is not himself responsible for the safety of the men. I strongly recommend that the creation of officials such as Overmen whether by that name or otherwise, be forbidden by Statute.

6. Gas Reports:

General Rule 4 provides for the making of reports of the circumstances as to the finding of gas after the required inspections described in the Rule. The Rule specifically states that the report must be "full and accurate" and must give the location where any noxious or inflammable gas is found. The reports of Deputies which were tendered during the Inquiry fall far short of these requirements. In almost every case there is a mere description that noxious or inflammable gas, as the case may be, was found, as "being diluted" with a vague reference to the place where the gas was found. So poor was the latter reference that not only was it impossible without assistance from the Deputy concerned to discover exactly where this gas had been found, but frequently the Deputy who made the report found himself in difficulty in describing where he had found the gas. The phrase "being diluted" moreover gives no detail as to whether the gas was being naturally diluted as it was given off so as not to constitute a condition of danger, or whether steps had been taken to dilute the gas and the nature of the steps adopted.

This position is completely unsatisfactory. In my opinion it is not only a breach of General Rule 4 but gives a very incomplete picture to the Under-Manager whose duty it is to read and counter-sign the reports. The fault, however, is as much that of the official who is satisfied to accept such report as it is of the Deputy who will continue to make reports of this nature unless he is corrected. The management can receive no comfort from reports of this nature if a situation of danger ultimately develops, as it did at the Bulli Colliery. Inspectors and Check Inspectors are hampered in the exercise

of an effective control over the system of gas detection if they are faced with records of this kind. In my opinion this problem does not call for remedial legislation. What is necessary is an enforcement of the provisions of the Act already existing to cover this situation. I urge that the Chief Inspector instruct all Inspectors to keep a close watch upon gas reports and bring unsatisfactory reports to the attention of the management. They should issue a warning that any repetition of such laxity will lead to prosecution. The attention of the management of all collieries where gas problems arise should immediately be drawn to this matter.

7. Brakes:

I have already described the collection of foreign material and in particular the presence of a piece of burnt wood in the disc brake system of shuttle car No. 40 and the discovery in similar positions in other shuttle cars of a like nature. There are three matters here which require close attention:

- (i) The floor of a working place of a mine in which any vehicle is to travel should be kept continually free of pieces of wood.
- (ii) Any braking system, the design of which may permit the entry of foreign material should be inspected regularly during each shift. Where such a vehicle or piece of travelling machinery has been used or is in use, an inspection should be made at regular intervals by a competent person and such intervals, I suggest, should be no longer than one hour. If on such an inspection foreign material has entered the braking system; then the vehicle should not be allowed to continue its operation until the material has been completely removed. After hearing the evidence at the Inquiry I have come to the conclusion that such measures, although they may appear to be stringent and may be expected to cause inconvenience, are entirely necessary. Much time has been spent in drawing up safety regulations to ensure that there will be no points of ignition in any part of a mine where inflammable gas may accumulate. The braking system at least of the shuttle cars in use in mines have proved to be a source of potential danger, and all steps must be taken to guard against this danger in the future.
- (iii) Hydraulic brake fluid. Counsel for the Department of Mines has suggested inflammable brake fluid is a potential source of ignition where brakes become overheated. Although the evidence in the Inquiry persuaded me that the brake fluid had not ignited, I feel that the suggestion that Mr. Lee makes is a worthy one and I recommend what he seeks, namely that non-inflammable hydraulic brake fluid be used at all times in mobile machinery in coal mines.

8. Rescue Equipment:

(a) Rescue Devices:

Much criticism was tendered at the Inquiry because the men who died at Bulli Colliery were not provided with self-rescue equipment. A self-rescue device which would permit the men who carried it to travel through smoke providing there was oxygen still present in the atmosphere, was described and produced at the hearing. It was of a portable nature and its weight would not be so great as to prevent every man working underground from wearing it at all times on the same belts as carry their headlamp batteries. Worn over the face and clipped over the nose it is simple to use in time of emergency. It was suggested that with this device some of the men who died may have been able to follow those who escaped. Whether this be so I am not in a position to say from the evidence. At the same time there are situations of fire or dangerous gas concentrations in a mine through which men equipped with a device, would be able to travel in safety. I was told that this device is quite well known amongst mining men and indeed was in compulsory use at some collieries. The reason given for its not being supplied to the men at Bulli is that it had proved itself unpopular with the men who were reluctant to wear it. I do not believe that any man working in a mine who knows what happened at Bulli will be reluctant in future to carry this equipment. In any case, however, the reluctance of any man should be made no excuse for the failure of the men to be supplied with the device. I suggest that it be made a matter of compulsion in the future by an amendment of the Act to provide that no miner in any mine which has not been specially exempted from the provision of the Act shall work underground unless he is equipped with a self-rescue device of a type approved by the Chief Inspector of Mines.

(b) Fire Fighting Equipment:

I am troubled by the fact that there existed no foam fire fighting machine at Bulli Colliery. As I have said, the one that was ultimately put into use had to be brought from the Mines Rescue Station, and this could occasion great delay in its use in fires at certain other mines. I believe it is necessary that each mine have its own foam extinguisher of a type which can be used to control fires of magnitude. It was put to me by some Counsel that such a machine should be located at the pit top. I do not think that this is sufficient. The fire at Bulli Colliery was in fact some miles from the pit top, and by the time the transport system can be cleared during any fire located as far as this from the fire foam equipment, a tragedy can occur before it is put into use. I would suggest that it be made compulsory in each mine which is not specially exempted by the Chief Inspector to have a foam fire fighting device approved by him at a location of no more than one mile outbye of any working place in operation. In the case of a large and scattered mine such as Bulli Colliery, it may be necessary to have several machines, the actual number depending upon their possible location near the various working places. However, I do not believe that such equipment is beyond the resources of colliery proprietors whose developments are on such an extensive scale.

(c) Fire Hoses:

Considerable inconvenience and delay must have been caused in fighting the fire at Bulli by the fact that fire hoses of an effective type were located at a considerable distance from the site of the fire and further that the water pipes had no convenient places where they could be immediately used, but the pipes had to be tapped before they could be attached to the water system. I can see no substantial reason why it should not be made a requirement in mines that fire hydrants be located at a point no further than 400 yards from any working place, and that the water lines in any such place shall be provided with taps for the use of such hoses at intervals of no more than 50 yards. It seems to me that this is a matter which is worthy of the attention of the Mines Department Inspectors and the distances which I suggest may in fact be unsuitable in the light of their experience. However, I strongly urge the investigation by Mines Department Inspectors of this problem.

9. Other Submissions:

Mr. Sullivan, Q.C., on behalf of the Australian Coal & Shale Employees' Federation, Southern District, urged that I recommend that District Check Inspectors should not be paid entirely out of Union funds but that the burden should be shared by either the Minister for Mines or the Joint Coal Board. Mr. Parkinson, appearing, inter alia, for the Central Council of the same Federation says:

"We would not want our Check Inspectors to be paid if it was going to mean that our independence in relation to their work was going to be placed in jeopardy but we would want and would accept annual expenses for travelling."

For my own part I feel that such a matter is somewhat remote from my specific terms of reference and I make no recommendation. It may be that the Department of Mines and/or the Joint Coal Board consider that this subject is worthy of investigation but I do not urge such an investigation since it is outside my province.

I adopt the same attitude to the submission of Mr. Parkinson:

- (a) that the Inspectors of the Department of Mines have "individually too much territory to cover" and therefore their number should be increased;
- (b) that battery locomotives, shuttle cars and cable cars should be replaced by diesel-operated vehicles; and
- (c) that the Unions should have the right to appoint Electrical Check Inspectors in addition to the existing District Check Inspectors.

I wish to make it clear that I am not suggesting that any of these submissions are unworthy of further investigation. They have, however, not been issues within my Inquiry and I feel that they are matters entirely out of my province.

10. Costs:

Mr. Sullivan, Q.C., asked that I award professional costs for the representation at the Inquiry of the widows of the four men who lost their lives. Mr. Murray made a similar application on behalf of Mr. Barry Kent, and Mr. McNally also asked for costs on behalf of the Illawarra Deputies and Shot Firers' Association. It was submitted by Mr. Sullivan that I have a discretion to award costs under Section 33 of the Act. Mr. Lee, Q.C., on behalf of the Department, on the other hand, says that this is not an Inquiry or proceeding under Section 33 of the Act but is really a proceeding under Section 31 of the Act in which the machinery of the Court of Coal Mines Regulation which is set up under Section 33 is used by the Minister for a formal investigation under Section 31. Mr. Lee contends that I have no power under Section 31 to make such an award as is sought by the Counsel concerned.

My view is that, although there are certain apparent conflicts between parts of the two Sections of the Act involved so that there appears to be some substance in both arguments, I am inclined to adopt the submission of Mr. Lee as the correct one. However, I feel it is unnecessary for me to make a final determination upon this point of law. I feel that even if I have a discretion to award costs, this is not the type of proceeding in which I would make such an order. The interests represented at this Inquiry are not parties in the true sense of the word in that there is no contending litigation between them. Furthermore, while they have the right to be represented and while they may be compelled to attend as witnesses, they are not compelled to be represented as interested persons in the investigation. The Minister and the Department of Mines are themselves interested "parties" in this sense, as is the Company that owns the Bulli Colliery. I see no reason why I should ask either of these latter interests to foot the bill for the representation of the interests that claim an award of costs. I, therefore, refuse all application for costs.

11. General Observations:

I feel that I would be failing in my duty to you, Sir, as Minister of Mines, if I did not draw your attention to the excellent work performed on behalf of this Inquiry by the several Inspectors and officers of the Department of Mines. It was mainly the enthusiasm of these gentlemen and the painstaking care with which they carried out their duties that enabled me to come to my conclusions. At every stage of the Inquiry where I made a request for assistance their help was immediately forthcoming. Their impartial attitude was a marked feature of their evidence. I am certain that the carrying out of such of my recommendations as are adopted can safely be left in their hands.

I have the honour to be,

Yours faithfully,

(A. J. GORAN) Judge,
Court of Coal Mines Regulation.