REPORT ON AN ACCIDENT

AT

KIANGA NO. 1. UNDERGROUND MINE

ON

SATURDAY, 20th SEPTEMBER, 1975.

WARDEN'S INQUIRY

Conducted pursuant to Section 74
of *"The Coal Mining Act, 1925-1974"*

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BEFORE: Mr. E. N. **LOANE,** S.M., Mining Warden.

Mr. R. D. **BULLOCH,** Mine Deputy and Member of the Queensland Colliery Union Management Board and District Vice President Queensland Colliery Employees Union.

Mr. J. **CARTHEW,** B.E., Superintendent of Collieries, Queensland Coal Mining Company Ltd.

Mr. R. **MARSHALL,** B.E., Chief Mining Engineer, Underground, Utah Development Company.

Dr. D. **ROWLANDS,** Ph. D., M.E., B.Sc., Dip. Met. Min., Senior Lecturer in Mining, University of Queensland.

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APPEARANCES

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Ipswich,
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With Mr. I. Callinan of Counsel
Instructed by Messrs. Thynne & Macartney,
For Thiess Peabody Mitsui Coal Pty. Ltd.,
the owners of the Kianga Mine.

SUMMARY

At about 5.10p.m. on September 20th, 1975, an explosion occurred in the underground workings of the Kianga No. 1 mine in Central Queensland. Thirteen men who were underground at the time attempting to seal off a heating in the 4 North Section were killed.

As a result of the fatalities an Inquiry was held in Rockhampton, conducted by the Mining Warden with assistance from four persons having practical mining knowledge. The Inquiry commenced on November 10th, 1975, and closed on November 24th, 1975.

During the Inquiry evidence showed the mine to be worked by a bord and pillar system. The seam being worked was not extracted to the full height and the coal was liable to spontaneous combustion. Methane had also been found in the workings.

The Inquiry found that an explosion was initiated by a spontaneous combustion source which ignited inflammable gas and was propagated involving coal dust. The explosion flame front did not reach the surface.

It was recommended by the Inquiry that:—

(a) the knowledge of all members of the coal mining industry in Queensland be upgraded with regard to spontaneous combustion.

(b) changes be made in the Queensland Coal Mining Act to provide for:
- additional protection against the propogation of coal dust explosions,
- monitoring or sampling of ventilation,
- preparatory seals and the recognition and delineation of responsibilities of persons with technical authority superior to a Manager.

(c) additional analytical facilities to be provided for the industry.

Other general recommendations relating to safety were also made.

INTRODUCTION

(1) **THE OCCURRENCE**

About 5.10p.m. on Saturday, September 20, 1975, an explosion occurred in the Kianga No. 1 underground mine. The mine, the property of the Kianga Coal Company Pty. Ltd., is about 18 kilometres from the township of Moura in Central Queensland.

The names and addresses of the 13 men who died in the explosion are listed in Appendix "A".

The men were engaged in sealing a heating in the No. 4 North Section of the mine at the time of the explosion.

The magnitude of the explosion can be gauged from the fact that sections of the main conveyor were blown out of the mine. Belt-rollers were blown 200 to 300 metres from the tunnel mouth.

The casing of the ventilation-fan was blown off and bolts around the explosion doors were sheared. A private motor vehicle parked at the top of the mine incline was damaged beyond repair.

Dust, inches thick, was deposited around the main incline and the general mine office complex. The dust was grey in colour and there was no discernible odour. There was no evidence of fire in the debris, or in the smoke which emitted from the portals of the mine immediately after the explosion.

An analysis of samples of the mine's atmosphere taken through drill holes established that the 13 men must have died almost instantly.

(2) **THE INQUIRY**

As a consequence of these fatalities an Inquiry was convened under the provisions of Section 74 of the Coal Mining Acts 1912-1974 by the Mining Warden of the Mount Morgan Mineral Field. To assist him in the conduct of the Inquiry the Warden called upon the services of the following persons who were shown to have a practical knowledge and skill in the mining industry and no connection with the coal mine where the accident occurred:

* Roy D. Bulloch, Mine Deputy and Member of the Queensland Colliery Union Management Board and District Vice-President of the Queensland Colliery Employees Union.

* John Carthew, B.E., Superintendent of Collieries, Queensland Coal Mining Company Ltd.

* Roger Marshall, B.E., Chief Mining Engineer — Underground, Utah Development Company.

* David Rowlands, Ph. D., M.E., B.Sc., Dip. Met. Min., Senior Lecturer in Mining, University of Queensland.

The Inquiry opened on Monday, November 10, 1975, and closed on November 24, 1975.

Twenty-seven witnesses, who are listed in Appendix "B", were examined and a total of 55 items were tendered as exhibits. These are described in Appendix "C".

The Kianga No. 1 underground mine was worked under Special Coal Mining Lease No. 159, which was approved on December 19, 1968, for a term which expires on March 31, 1978. The mine began operations in June, 1971.

(3) **THE MINING METHOD**

The basic mining method utilised continuous miners for development and pillar extraction. Barriers were left between adjacent panels so each panel could be sealed immediately working was completed. This procedure was adopted so that any subsequent spontaneous combustion could be controlled. The panel workings were developed with 3 headings: 2 intake airways (man-and-supply and belt road), and a return airway in each of 4 sections designated Nos. 1, 2, 3 and 4 North.

No. 4 North wasthe most remote panel from the surface. Its working face was located about 1100 metres along the slope of the seam and then to the north at right angles a distance of about 420 metres. As the 4 North panel developed, the management found difficulty in maintaining satisfactory roof conditions. A fall occurred in the development and it was decided to retreat from the section, recovering such coal as could be mined.

The method of mining involved the removal of the bottom 3 metres of the seam by the use of continuous miner-shuttle car combinations. The top 1.2 metres of coal was left against the roof.

(4) **EVENTS PRIOR TO 20th SEPTEMBER, 1975**

By a letter dated March 17, 1975, Mr. Donald Fowler, Manager, informed Mr. G. E. Hardie, Inspector of Coal Mines, Department of Mines, Rockhampton, that No. 8 cut-through in the No. 4 North Section had fallen completely from the return

road to the man-and-supply road. Roof coal and stone had broken to an horizon 2.3 metres above the seam at a smooth parting. Because of the time it would take either to clear or drive around the fall it was decided not to develop the district any further north.

It was assessed that coal to the North could be mined by extending the length of the sub-panels in the contiguous 3 North Section.

It was proposed that the coal would be extracted from No. 7 cut-through in 4 North back towards the main dips, developing splits to the dip side of the man-and-supply road and lifting the fenders formed in the same manner as had been practised in 2 North.

The plan of this proposal is shown on Exhibit 15 (two sketch plans). By this letter dated March 25, 1975, addressed to the Manager (Part of Exhibit 19) Inspector of Mines Hardie, in accordance with Section 86A (2) of The Coal Mining Acts 1912 to 1974, indicated "no objection to such extraction".

It was predicted that the coal recoverable by this method would be totally extracted within 6 months. It was then planned to withdraw completely and erect permanent stoppings to seal this section permanently. This action was to be taken because it was known that coal in the Moura District tended to spontaneously ignite after an assumed incubation period of 6 months.

This process of extraction was implemented and is shown in Exhibit 16 (Appendix "G").

Some variations from the method and extent of extraction shown in Exhibit 16 occurred in Exhibit 47 which were plans prepared from sketches submitted by witness Stafford, a Mine Deputy, who had been associated with the workings of 4 North from its beginning.

In the 4 North Panel 8 lines of pillars were developed. Extraction was then commenced and 11 splits were driven from the man-and-supply road. These are numbered from inbye (No. 1) to outbye (No. 11) on the plan (Appendix "G").

The pillars between 7 and 8 cut-throughs were "punched" and on March 12th, 1975, No. 1 split was driven. No. 2 split was then driven a similar distance to No. 1 and a holing made in the fender to the face of No. 1 split for an airway. No. 2 split was extended another 21 to 24 metres. The fender between Nos. 1 and 2 splits was only partly extracted.

No. 3 split was driven a similar length to No. 2. A connection was made between 3 and 2 adjacent to the holing to No. 1. The fender inbye this connection was not extracted. Part of the fender outbye the connection was left for protection and the remainder was extracted back to the supply road. A fall occurred in this goaf area. A bleeder road had then been established from No. 3 split via Nos. 2 and 1 and along No. 1 to No. 7 cut-through.

No. 4 split was driven next and a connection made to the face of No. 3. No. 4 was extended a further 4.5 to 6 metres. Two stooks of coal were left to protect the holing and the remainder of the fender extracted. The roof in the extracted area again fell.

There had been a fall in the supply road between Nos. 1 and 3 splits after No. 4 split had been completed. Extraction of the pillar between 6 and 7 cut-throughs and the supply and belt roads was then commenced. The inbye half was mined from a split which had been driven through the pillar previously. Next came work on the pillar between the belt road and the return. This was split lengthwise from 6 to 7 cut-through and "punched" up and down hill. Not all "punches" in the down hill direction holed into the belt road.

No. 5 split was driven and a holing made to the face of No. 4. A stook of 4.5 metres was left and the remaining fender extracted. The roof again fell including the whole of the supply road from No. 5 to No. 1 split. At this stage the bleeder was open from No. 5 to No. 1 split and air was circulating through it. Nos. 6 and 7 splits were driven and the fenders extracted leaving stooks to protect the bleeder road.

By means of the bleeder road, air coming into the sections was directed, by brattice on the supply road, over the fallen area and partly up each of Nos. 6 and 7 cut-throughs to the section return. This method aimed to disperse any gas formed in the goaf to the return.

Subsequent to the extraction of No. 7 fender the pillar between Nos. 4 and 5 cut-throughs was split from the belt down to the supply road.

By July 2nd or 3rd, No. 8 split had been driven, a connection made to the bleeder and the fender removed. Nos. 9 and 10 splits were then driven, connected to the bleeder and the fenders extracted. A roof fall occurred after each fender was removed. The final piece of No. 10 fender was removed on the afternoon shift of August 6th and the goaf fell at 5.00p.m.

No. 11 split was commenced on August 12th, 1975. Deputy Stafford said that when he ceased work on August 12th there was no methane (CH_4) present in No. 7 cut-through or at the edge of the fall that was blocking No. 7 cut-through. There was air passing across the fall and out via the return.

Deputy Stafford had detected 5% CH_4 with an oil flame safety lamp in the goaf area inbye No. 6 cut-through during the 3 weeks when "punching" of the pillars between the supply and return roads was taking place. With the establishment of the bleeder road no further gas problem was encountered. On August 12th, 1975, when the 11th split had been commenced, there was no evidence of CH_4 in the return up to No. 8 cut-through.

It is emphasised that it was expected to complete the extraction of the whole panel within 6 months from March 12th, 1975. Work progressed until August 12, 1975, when the miners' annual holiday started Work re-commenced on August 25th, but then lapsed until September 18th because of an industrial dispute. Production took place on September 19th, the day before the explosion; but the mine was not scheduled to work on Saturday, September 20th.

From August 28, Deputies Allison and Butterfield recorded the following reports in the Deputy's Record Book in respect to heating in the goaf area of No. 4 Section, under the heading, "Action taken re gas, danger and any other remarks":

Report No.	Date	Deputy Recording	Report Comment
178201	25/8/75	Schofield	to be under control quiet in goaf area 2 & 4 North
178209	28/8/75	Allison	some signs of heating taking place goaf area 4 North but no cause for alarm
178211	29/8/75	Butterfield	goaf area 4 North warm . . . . .
178227	5/9/75	Butterfield	throughout waste area No. 4 North warm
178263	20/9/75 (6a.m.)	Allison	
		Gas Present	Nil later inspection with Drager 25p.p.m. & CO less than .1% CO_2 in return side first
		Ventilation	Fair all sections
		Any other source of danger	Fire in goaf area 4 North pre shift inspection
		Action taken	Manager notified of smoke coming up main return 7.30 a.m.
178264	20/9/75 (8.15a.m.)	**Gas Present**	10 p.m.m. CO where men working in return. 1½% CH_4 in goaf area G/body.
Final and Last Report Recorded			Last inspection 80 p.m.m. CO, 1.1% CH_4 at stopping return
		Ventilation	Stopping put up across each heading to cut off air to fire left open enough for some ventilation of fire area
		Another source of danger	CH_4 level to be watched
		Action taken	Smoke building up behind stoppings

(5) **EVENTS OF 20th SEPTEMBER, 1975.**

Deputy Allison commenced work at 6.00a.m. on September 20, 1975, to perform a pre-shift inspection of the No. 4 North Section. He inspected all Sections including the return which he entered at about 7.30a.m. In the No. 3 cut-through in the main return "a slight haze" was observed. Uncertain as to its source, Allison walked inbye for a distance of two pillars. No smell was discernible but Allison was still dubious. He travelled to the surface in order to take observations at the fan. He observed no smoke but attributed a fire stink to a fire that had occurred previously in a bolter-shunt in the return outbye of the fan shaft. Nevertheless he was still suspicious and he immediately reported to the Manager, Fowler, in the presence of another employee, Faber.

Fowler accompanied Allison underground and after visiting the 2 North return they went to 4 North where in the return smoke was obvious and the smell (fire stink) more pronounced. Fowler's comment, "Oh!, looks like we have got a fire alright — I can smell it now", confirmed Allisons' earlier suspicions. Having travelled to No. 6 cut-through in the return both retreated; Fowler contacted the surface by phone about 7.40a.m. and then both Fowler and Allison returned to the surface.

While Fowler contacted Pocock, Hardie, Airey and Jump, Allison and Faber returned underground to take readings with a Drager multi-tube detector and a methanometer and to procure gas samples. In the 4 North return at the 5th cut-through readings of carbon-monoxide (CO) of 25 p.p.m. and methane (CH_4) of "a bit less than 1%" were found.

At the 7th cut-through readings of 1½% CH_4 and 25 p.p.m. CO were taken in the general body. Air samples were taken at the No. 7 cut-through. The precise heating area was not visited on this occasion; Faber and Allison choosing to proceed no further than the No. 7 cut-through. Smoke was slight and fire stink discernible. The smoke was coming from the goaf area out through No. 7 cut-through to the return. On returning to the surface the air samples were tested on the Beckman analyser, giving CO readings of 24, 25, 25 p.p.m.

At approximately 9.00a.m., Mine Superintendent Rasmussen, Manager Fowler and Deputy Allison went underground with a view to taking further tests on the Drager multi-tube detector and the methanometer. A pattern of progress similar to that of Faber and Allison was followed. Tests were taken and recorded rather crudely on Exhibit 45 (a plan). Allison took the readings and Rasmussen noted them on Exhibit 45. The party proceeded through No. 5 cut-through and took readings of 25 p.p.m. of CO and just under 1% of CH_4. At No. 6 cut-through the readings varied little. They proceeded to the junction of No. 7 cut-through and the return. Readings were taken and little variance noted in CO and CH_4. They then walked down No. 7 cut-through to the belt road and then outbye along the belt road to a fallen area. The area was defined as being in an extracted pillar, outbye of No. 7 cut-through between the belt road and the man-and-supply road. At the edge of the fall, the floor had heaved approximately 0.5 metres. Smoke was seen to ooze from a wide area of fallen stone 1 to 1.3 metres thick, heaped upon 0.6 to 0.9 metres of coal. There was slight ventilation and readings of 25 p.p.m. CO and 1½% CH_4 were taken. At one point CH_4 a little over 1½% was found. Where the goaf had broken off in No. 7 cut-through, between the belt and supply road, Allison took a reading of 3% CH_4 and on moving the methanometer along and a little higher a reading of 4% was found. There was no smoke in this dead end and the air was stagnant where the 3 and 4% CH_4 was detected. The party withdrew and the decision was taken to build permanent brick stoppings in the positions indicated on plan Exhibit 16, Appendix "G". Work was set in train to set brattice sheets prior to the construction of the brick seals. The brattice sheets were set on the supply road, belt road and the return. Allison and Mine Safety Officer, Jump, later entered the goaf area near 7 cut-through and although there is a deal of variance in their individual descriptions of the scene, it is accepted on the evidence that at 11.30a.m. smoke behind the brattice had increased in density. Readings given by Allison in evidence showed 100 p.p.m. CO; and there was no variation in CH_4 which was still holding at 1½%.

Construction of the brick stoppings began about 11.30a.m. Regular readings were taken by Deputy Allison and about 1.00p.m. readings of 1% CH_4 and 80 p.p.m. CO were conveyed to the Manager Fowler.

Allison, Rasmussen and Fowler returned to the surface at 3.15p.m. At that time Deputy Fletcher assumed Allison's duties after conferring underground with him. Later the Manager of Moura No. 1, McMullen, took over underground from Fowler who was then engaged in surface duties.

McMullen went underground with the first of the afternoon shift. Under the direction of Fletcher and McMullen work on the stoppings continued.

Manager Fowler received a request by phone from Deputy Fletcher for the supply of a steel plate on which to mix cement for the laying of bricks at the stopping on the intake road while the cement mixer was being used for similar purpose on the other two stoppings. Fletcher reported that work on the stoppings was progressing well and that he had taken readings. He said he proposed taking further readings and would ring the result back to Fowler.

About 4.00p.m. McMullen returned to the surface and about 4.50p.m. Fletcher rang from underground and requested that his "crib-bag" be taken underground to him. Fowler told Fletcher he would bring it down himself as soon as the Rover was repaired. It was proposed that Fletcher would then return to the surface to make out his report. Fletcher informed Fowler that readings had been taken in the return airway and that immediately behind the stopping a reading of 1% CH_4 had been revealed. Further along the return, where the "punches" from the conveyor road had broken through into the return, he had found 1¼% CH_4 but inbye of that, at the normal sampling point, the reading was 1%. Fletcher stated his CO reading was "about 60 p.p.m." and that the conditions underground as far as smoke was concerned "remained the same".

As Manager Fowler and oncoming Manager McMullen waited in the Manager's office for the repairs to the Rover to be completed they conversed with Superintendent Rasmussen. About 5.10p.m. a "popping noise" was heard, and according to McMullen, "the lights flickering, a deep explosion and I saw it coming out of the tunnel, this greyish dust — it didn't push out. It was rolling over and in front of that I could see the roofing iron and the timber blowing up in the air. There was no flash at all. I did not detect any heat".

A chronological precis of events preceeding and succeeding the explosion is contained in the Appendix "D".

The foregoing commentary, not only on the "nature" of the incident; but, on the general circumstances and influences creates a vehicle for this Inquiry's further function to establish the "cause" of the loss of life, damage to property and impact on the general economy of the mining industry.

FINDINGS

(1) **NATURE OF OCCURRENCE**

From the evidence it would appear that the Kianga explosion initiated from the ignition of flammable gases by a spontaneous combustion source in the goaf of 4 North district.

The explosion progagated outbye involving coal dust, but evidence shows that the explosion was extinguished outbye before it arrived at the mine portals.

The force of the underground explosion was sufficient to project material to the surface and cause damage to surface structures in a direct line from the mine portals.

Heat from the explosion was not experienced by witnesses on the surface, but some of the coal dust ejected shows evidence of having been affected by heat.

The explosion was followed by fires underground.

(2) **CAUSES OF OCCURRENCE**

A heating developed in the goaf area of 4 North section of the mine. As the heating accelerated in its intensity the coal would ignite at a temperature of around 400° C. This would draw air and goaf gases, which by this time would include H_2, CO and CH_4, to the fire; any of these gases could then have been ignited. Ignition temperatures are as follows:—

Hydrogen	580-590° C
Carbon Monoxide	644-658° C
Methane	650-750° C

There appears to have been a large body of CH_4 in the goaf area of which the 3 to 4% of methane found at the edge of the goaf at 7 cut-through was part.

Sufficient air was not passing over the hot material to dilute the gas or to cool the material below the ignition point of all the inflammable gases. A drop in barometric pressure could increase the volume of inflammable gases in the goaf, such as to bring an explosive mixture of gas into contact with the fire.

Over the six hour period prior to the explosion a barometric pressure drop of not less than 5 millibars occurred.

Sufficient coal dust was present in the vicinity of the gas concentrations to propagate a coal dust explosion.

(3) **COMMENTS ON CAUSES**

In order to establish the cause of the explosion and the resulting loss of life, it is necessary to examine the factors that allowed:—

(a) A spontaneous heating of coal to develop to the point that it could ignite an explosive mixture of gases in the goaf.

(b) That explosion to propagate a coal dust explosion.

The factors involved may be conveniently discussed under the following headings:—

(i) Planning and Method of Work

(a) Petrology
(b) Stratigraphy
(c) Method of Work
(d) Ventilation Systems

(ii) Atmospheric Control
(a) Gas Detection
(b) Other Indicators of Heating (sweating, smell, smoke)

(iii) Stone Dusting

(iv) Emergency Action

(i) **Planning and Method of Work**

(a) **Petrology**

The coal at Kianga was known to be both gassy and liable to spontaneous combustion. These facts were recognised by Management as is evidenced in panel lay-out where secondary extraction was planned to be completed within 6 months (the assumed incubation period).

The mine had already experienced spontaneous combustion in a pillar near the surface between the main intake and return and a fire in a heap of coal in the main return near the surface.

The Management had also recognised the need to accurately analyse for carbon monoxide by providing a Beckman-CO-Analyser.

Due to disruptions to production the panel was not completed within the 6 month period. The continuation of extraction was jusified by the Management on the basis of a reliance on the Beckman analyser to alert them to an incipient heating. The exclusive reliance upon CO determinations can be misleading unless the air quantity flowing remains constant. Sampling of the mine atmosphere for CO without also measuring the air quantity produces unreliable data. In this regard it must be emphasised that the distribution of the air within the district was never established, so that when emergency action had to be taken the essential background information was not available.

(b) **Stratigraphy**

In order to appreciate the nature of the events that contributed to the Kianga explosion, it is necessary to make some assumptions and deductions about the goaf region in the 4 North district.

It would appear from the evidence of Deputy Stafford that the roof in the entry and fender section of 4 North caved rapidly and completely following extraction of the fender between entries. Considering the caved superjacent strata, (coal, shales, siltstone and sandstone) they, when broken, would occupy a volume of approximately 150% of their solid volume. This means that the strata above the seam would cave for approximately twice the seam thickness, thereafter this caved material would offer some support to overlying beds which would be subjected to bed separation and fracturing. The degree of bed separation and fracturing becoming less intense as one proceeds away from the workings. (See Appendix "E")

It is probably worthwhile to consider the goaf as a large dome filled with broken rock. On the dip side of this dome the bleeder provided an air passage, while the man-and-supply road and the belt road, with their associated remnant pillars to the rise, provided another restricted air passage.

Under such conditions it would be doubtful if the goaf was ever fully ventilated and kept free of methane. One would assume that the upper regions of the goaf contained high percentages of methane because the normal air flow would only keep the lower peripheral regions, adjacent to the air passages, clear. With regard to the dip bleeder, this would only operate intermittently. Methane emissions to the goaf would emanate from the exposed coal around the periphery of the goaf and probably from the lower and upper seams shown in Appendix "E", by way of breaks in the strata. If the velocity of the ventilating current was not high enough to cause turbulent mixing of the CH_4 and air, the CH_4 would migrate to the upper levels of the goaf. The goaf would slowly fill with CH_4 and then "spill out" under the lip of the roof strata at the rise side of the goaf. The 3 to 4% CH_4 roof layer in No. 7 cut-through could have had some significance in this regard.

(c) **Method of Work**

The full thickness of the seam was not worked. This resulted in broken top coal being present in the goaf area. Where seams are prone to spontaneous combustion it is preferable, if the seam cannot be worked completely in one lift, that bottom coal be left rather than top coal. In any event the extraction of coal should be as complete as practicable.

No preparations had been made at the mine for speedy sealing of working sections.

(d) **Ventilation Systems**

The 4 North panel was designed to operate with a dip-side goaf ventilated by a bleeder system. In respect to gassiness, the panels were designed to use bleeder returns in an attempt to keep goafs clear of CH_4 accumulations.

Whether the attempted ventilation of the goaf is justifiable, knowing the likelihood of spontaneous combustion, is strongly arguable. If the goaf is **to the dip of the returns,** it is possible, without a bleeder system for some migration of air into the goaf as a replacement for the lighter CH_4. However, this is not the case if the goaf **is to the rise of workings,** where high percentages of CH_4 will preclude oxidation of coal and hence spontaneous combustion. This feature demands further investigation.

(ii) **Atmospheric Control**

(a) **Gas Detection**

Instruments were available at Kianga to detect:—

1. CH_4
2. CO
3. CO_2
4. Air Quantity

The use at the mine of the Beckman gas analyser was a considerable improvement on methods generally in use in Queensland for the detection of the early stages of spontaneous combustion. The method of sampling was such as to allow for errors to occur and the lack of contemporary ventilation readings reduced the value of the gas analyses.

With regards to CO_2, whilst some readings were taken, no evidence was adduced to show that the CO_2 readings were said to establish CO/O_2 ratios at any time prior to or during the occurrence.

The reliability of the instruments available at the mine was confirmed by comparison with gas sample analyses conducted by the Queensland Government.

As noted in Deputy Allison's report number 178209 — dated 28/8/75 and Butterfield's report No. 178211 — dated 29/8/75, together with the gas samples taken on the 25th August, 1975, it is possible that there was an incipient heating in 4 North goaf prior to the first use of the Beckman analyser in August.

In this regard it should be noted that neither the Mines Department nor Management were able to give full recognition to these results because they had no prior information upon which to base a comparison.

(b) **Indicators**

The normal signs of sweating, fire stink and haze were not detected in 4 North return or goaf area prior to the discovery of smoke.

(iii) **Stone Dusting**

Even though all witnesses agreed that the Manager attached priority to stone dusting there were samples which indicated the non-compliance of the mine with stone dusting standards. Nevertheless, this explosion involved the untreated coal dust in the goaf area and formed a gas-coal dust explosion which was fed by insufficiently treated coal dust in the return. How far the coal dust explosion was propagated is unknown but it is evident that it was brought under control by well stone dusted areas outbye.

The areas most likely to contain explosive gas mixtures are the areas which pose the greatest problem with regard to stone dusting, e.g., goaf, face area and inbye return. Conveyor roads are also extremely difficult to maintain in compliance with current regulations.

(iv) **Emergency Action**

In hindsight it is obvious that the fire was further advanced on the morning of September 20, 1975, than was recognised by any of the people involved. At no time during the 20th did any person know exactly where combustion was occurring or what the state of ventilation and gas concentrations were in the immediate vicinity of the heating or fire. Neither was the extent of the layer of 3 to 4% CH_4 in the goaf area accurately determined. There was general agreement, by all persons who were aware of the practicalities of the situation, that the only feasible method of dealing with the fire was to seal it off.

The lack of information relating to air quantities meant that no one knew the absolute rates of emission of CH_4 and CO. Thus it was impossible to make the basic calculations necessary to establish the safe siting of the permanent brick seals.

The erection of the brattice "seals" in the man-and-supply road, the belt road and the return road together with the destruction of the brick seal in No. 4 cut-through would have caused a drastic reduction in the current of air that was ventilating the Eastern rise zone of the goaf. Such a reduction in air flow would reduce the dissipation of heat at the site of the heating and thereby accelerate the spontaneous combustion process. In addition, any CH_4 that was migrating through the goaf would be less diluted. The increased rate of heating would draw air and any migrating gases to the source.

All authorities agree on the need to dilute gases surrounding a heating during sealing. Neither Inspector Hardie nor Management appeared to understand the effects of erecting brattices and no attempt was made to measure the air flow at any time on the day in question. This is contrary to the advice of the Mines Fires Seminar held in

Queensland on November 12th, 1973, (Exhibit 22) and possibly the omission of this detail may have been in itself responsible for the explosion. However, it cannot be said with certainty that the explosion would have been averted if the brattices had not been erected.

The disagreement during the Inquiry as to whether the brattices had openings at all times was not significant because the time that they may have been fully closed was short and considerably prior to the explosion occurring. It would have been much more pertinent to have established the quantity of air passing the seal sites before and after their erection. No preparations had been made at the mine for speedy sealing of the working sections. Neither was there recognition of the urgency of the situation.

Whilst on September 20, 1975, two barometric pressure readings were taken and recorded by the respective Deputies, no weight was attached to the barometric changes by persons responsible for making decisions.

The barometric pressure drop from 1015 to 1010 millibars reported at the Baralaba weather station (375) over a period of 6 hours prior to the explosion would cause an expansion of goaf gases of about 0.6 cubic metres per minute. Under normal circumstances this would not have been important; however, under the conditions that existed that day the effect could have been quite significant.

From barographs taken in Central Queensland, it is evident that the diurnal variation results in a depression which is lowest between 3.00p.m. and 5.00p.m., each day.

Notwithstanding the fact that the Manager and Superintendent were actively involved, the mine organisation underground on the day was wholly inadequate in that:—

1. No senior officials were left in charge throughout the period;

2. No regular comprehensive sampling at specific sampling points was initiated;

3. No checks were made to see that men did not enter goaf areas without the knowledge of the Deputy in charge;

4. No attempt was made to get as near as possible to the fire site, i.e., the belt heading just outbye No. 7 cut-through, after Jump and Allison were in the vicinity at about 11.30a.m.

Due to these inadequacies the accelerated progress of the fire was not recognised.

During September 20, 1975, persons were entering zones of smoke, without instruments to determine the toxicity of the atmosphere, commencing with the initial inspection by the Manager and his Deputy.

No organisational structure, with a definite line of command, was established on the surface during the emergency period. Thus there was no comprehensive system of briefing of officials or recording of the information obtained during the sealing operations.

The disagreement during the Inquiry as to the accuracy of some details of the mine plan in what became the 4 North goaf was not significant because no person knew accurately the position of the heating or fire. However, no Deputy's plans were kept regularly in the section.

RECOMMENDATIONS

(1) **RESEARCH**

It is recommended that:—

An autonomous Safety in Mines Research Organisation be established urgently in Queensland to examine among other items:—

(a) Spontaneous combustion and the determination of proneness of the various coals;

(b) Effective ventilation systems for pillar extraction in seams liable to spontaneous combustion;

(c) Rapid means of effective sealing;

(d) Early warning systems (including portable gas analysis instruments) for detection of heatings.

(e) Effective fire fighting techniques in various underground mining conditions.

The organisation should be designed to disseminate information in the form of safety circulars to enable better and more up to date information to be made available to the mining industry. Ideally this proposal should ultimately lead to a National Safety in Mines Research Establishment.

(2) **EDUCATION**

It is recommended that:—

(a) There is a basic need for all members of the coal mining industry in Queensland to improve their knowledge with regard to the fundamentals of spontaneous combustion and the underground mining problems associated therewith. A lack of appreciation of these fundamentals obviously contributed to the disaster at Kianga.

(b) A publication be assembled urgently and distributed to all members of the industry by the Mines Department explaining the hazards and giving guide lines for handling of underground fires and heatings. The Queensland Coal Owner's Association and the Queensland Combined Mining Unions should assist in this task.

(c) Rescue Station Superintendents be trained to become expert in dealing with mine fires and be available for consultation with mine managements.

(d) Mines Department District Inspectors be trained to become expert in dealing with mine fires and travel immediately to any mine where a heating or fire has been reported. The Inspectors should be available for consultation but decisions should still be the prerogative of management.

(e) A mobile training centre be established and transported to each mining field in Queensland to instruct all mining supervisors on the latest techniques in detection and control of mine fires and heatings This should become a permanent feature and refresher courses incorporating changing techniques should be developed.

(f) In addition to the training of rescue brigades in underground rescue and salvage operations , higher management be involved in supervising simulated disaster situations. Emergency action charts should be developed, not only to alert all the necessary personnel and emergency organisations but extended to include self checking lists of standard requirements and operations.

(g) All parties, i.e., Inspectors, Managers, and Workmen, be made more aware of the dangers of interrupting pillar extraction operations, particularly where spontaneous combustion is likely underground.

(3) **LEGISLATION**

It is recommended that:—

(a) The Queensland Coal Mining Act 1925-1974 and New South Wales Coal Mines Regulation Act 1912 (amended) be standardised.

(b) The Queensland Coal Mining Act be amended to provide for:

(i) stone dust or water barriers on roadways where it is difficult to maintain compliance with stone dust regulations, and

(ii) the provision at the surface of each mine of a barograph.

(c) District returns in seams liable to sponaneous combustion should be continuously monitored for CO or sampled at least daily prior to and during pillar extraction operations. Weekly measurements of air quality and quantity should be made to establish the volumes of CH_4 and CO emitted, as well as the CO/O_2 deficiency ratio for each underground district.

(d) Provision be made in mines liable to spontaneous combustion, at the entrance to every pillar section for preparatory seals prior to the commencement of pillar extraction operations. The preparations should be approved by the District Mines Inspectors. The seals need not necessarily be explosion proof, but should be capable of rapid erection.

(e) The Queensland Coal Mining Act should be amended to provide for persons with technical authority superior to a Manager. These persons should be qualified Managers under the Act and should bear the same statutory liability as Managers in respect to any acts to which they are party.

(4) **PROVISION FOR ANALYTICAL FACILITIES**

It is recommended that:—

All mines have available at short notice the means of analysing the air samples obtained while dealing with an out-break of fire below ground. This end may be accomplished by either mobile laboratories or laboratories established in each mining locality.

(5) **STONE DUSTING**

It is recommended that:—

(a) Adequate supplies of stone dust be available at all times on the mine surface and means of loading and transporting stone dust quickly to any portion of the underground workings should be maintained.

(b) In the case of a sealing taking place, as much stone dust as is allowed by time constraints and accessibility should be placed between the sealing sites and the source of the combustion.

(c) Stone dusting must be kept up to specification throughout all underground coal mines and trickle dusters or other effective means of placing incombustible dust continuously in the immediate return, must be kept working at all times while continuous miners or other coal producing machines are operating.

(d) Recent innovations in roadway-dust-sampling methods should be evaluated with a view to providing rapid and preferably "on the spot" determinations of incombustible content to enable immediate remedial action to be taken.

(6) **GENERAL RECOMMENDATIONS**

It is recommended that:—

(a) The prime consideration in the control of any heating or fire must be the safety of the personnel present.

(b) No person should enter an area on the return side of a suspected heating or fire or on the intake side where smoke is present unless he has the instruments and knowledge to ensure his own safety.

(c) In any working section underground a plan be made available to the Deputy or other official in charge of the section, this plan to be brought up to date daily and to be available to assist the Mine Surveyor to keep the mine plan accurate and current.

(d) All Check Inspectors' reports be sent to the District Mines Inspector.

(e) At all times during efforts to control fires or other combustions underground, whether those efforts be carried out underground or on the surface, all persons should present any documents or other evidence to the officials charged with making decisions.

(f) Where possible mine surface buildings should be positioned out of the direct path of any underground explosion.

COMMENTS

During the Inquiry Counsel for the Mine Management foreshadowed a proposal to re-open the Kianga Mine. While this issue was not further pursued, we feel it necessary to recommend that there be no haste in re-opening the mine. Re-opening should follow safety procedures and should be carried out in stages by and with the advice of experts. Such a re-opening is unlikely to modify substantially the causes as assessed by this Inquiry nor to alter substantially the recommendations herein.

R. D. Bulloch

J. Carthew

R. Marshall

D. Rowlands

I agree with the above findings and concur with the recommendations.

E. N. Loane
WARDEN

Dated at ROCKHAMPTON
this fifteenth (15)
day of December, 1975.

CONCLUSION

I desire to record my expression of appreciation for the invaluable contribution made to the conduct of this Inquiry by my fellow Bench-members. They have each brought to the Inquiry a wealth of skilled expertise, practical knowledge and experience. They exhibited a keen interest in the evidence and issues of the investigation and discussed intelligently and responsibly their individual appreciation of the evidence as it unfolded. I add that their attitudes at all times were completely impartial.

The Court Reporting Staff worked zealously and untiringly in recording the evidence and together with my office staff and the Under-Secretary Department of Mines and his officers, in providing a system of duplication of transcript, are deserving of commendation and my grateful thanks.

The exercise was veiled in an overtone of sadness for the relatives of the deceased miners and for my part on behalf of my fellow members, I extend our sincere sympathy.

E. N. LOANE
WARDEN
15th December, 1975.

APPENDIX "A"
List of Victims

Name	Age	Marital Status	Previous Address
Eric Leslie Fletcher,	52 years ,	married of	17 Burnham Street, Moura.
Bruce Douglas Elliott,	30 years,	married of	22 Farmer Street, Moura.
John Raymond Tebbit,	28 years,	married of	3 Lederhouse Street, Moura.
James Clarence Ferris,	56 years,	married of	10 Damian Court, Slacks Creek, Brisbane.
Mervyn James Walker,	22 years,	married of	36 Engel Street, Moura.
Clifford John Strudwick,	45 years,	married of	King Street, Moura.
Leslie Arthur Deeth,	33 years,	married of	Caravan Park, Theodore.
Ronald Thomas Linderburg,	59 years,	married of	T.P.M. Caravan Park, Moura.
Michael Lennox Carige,	24 years,	single of	Wandoon Property, Baralaba.
George Sidney Widt,	44 years,	married of	111 Wandal Road, Rockhampton.
Kevin John Widderick,	54 years,	married of	10 Hunter Street, Rockhampton.
Leslie Gordon Williams,	25 years,	married of	13 Lederhouse Street, Moura.
Murray William Martin,	33 years,	married of	7 Becker Street, Moura.

APPENDIX "B"
List of
Witnesses Examined

Number	Name		Occupation
1.	STAIB	C. W. Sergeant 1/c.	Police
2.	HARDIE	Graham W.	Mines Inspector
3.	GRULKE	Alwyn Herbert	Stone Duster
4.	FRANKLIN	Peter David	Chemist
5.	COUPER	Charles Howard	Chemist
6.	DEASY	Keith Hyman	Chief Chemist
7.	MCMASTER	Alan E.	Mines Electrical Inspector
8.	FOWLER	Donald	Manager
9.	AMBROSE	Henry J.	Lime Works Manager
10.	RASMUSSEN	I. A.	Superintendent
11.	McMULLEN	K. J.	Deputy
12.	STAFFORD	R. J.	Deputy
13.	ALLISON	W. M.	Deputy-6th and 7th
14.	JUMP	Eric Darius	Safety Officer
15.	KELLY	Raymond Edward	Miner (5 years)
16.	POUND	William	Miner (7 years)
17.	MURPHY	Ronald James	District Union Inspector
18.	POCOCK	Peter John	Under Manager
18A.	RASMUSSEN — recalled		
19.	SEALEY	Colin David	Miner (4½ years)
20.	WILSON	Warren James	Miner (2½ years)
21.	DOPSON	Stephen Charles	Mine Electrician
22.	FABER	Terrance Ronald	Mechanical Engineer
23.	TSAKOVIC	Refik	Union Check Inspector Miner
24.	BEATON	Kerrod Andrew	Bachelor of Electrical Engineering C.R.E.B. Transmission Engineer
25.	MAGARRY	Neil William	Assistant Mechanical Engineer
26.	MAYALL	Allan James	Paymaster
26A.	ALLISON	William Mead-recalled	Deputy
27.	DONEGAN	H. A. J.	Specialist

APPENDIX "C"
Exhibits

1. Coroner's Inquest — File
2. Four (4) photographs Nos. 1-4 inclusive
3. Three (3) photographs Nos. 5, 6, 7.
4. Four (4) photographs Nos. 8, 9, 10, 11.
5. Four (4) photographs Nos. 12, 13, 14, 15.
6. Seven (7) photographs Nos. 16, 16A, 17, 18, 19, 20, 21.
7. Three (3) photographs Nos. 22, 23, 24.
8. One (1) photograph No. 25.
9. Eight (8) photographs Nos. 26, 27, 28, 29, 30, 31, 32, 33.
10. One (1) photograph No. 34.
11. One (1) photograph No. 35.
12. Six (6) photographs Nos. 36, 37; 38, 39, 40, 41.
13. Two (2) photographs Nos. 42, 43.
14. Five (5) coloured photographs Nos. 1, 2, 3, 4, 5.
15. Two sketch plans
16. Maps (6) of Mine workings
17. Electrical Reports in respect to Kianga (Chief Inspector Coal Mines)
18. H.O. File Dust / Gas — Survey File
19. H.O. Files Mines Department (A. / B.)
20. General Correspondence File from Department of Mines Rockhampton
21. List of stone dusting stations with result of analysis
22. "Mine Fires" by Dr. Willett
23. Plan of Kianga Underground Workings
24. Finding and Recommendations of Box Flat Inquiry
25. Stone dusting plan
26. Gas Analysis Sheets (5)
27. Gas Analysis from Mine Management (2)
28. Report on Survey (1973) by Senior Chemist
29. Report by Senior Chemist and photograph attached.
30. Report on stone dusting by Mr. Rynja
31. List of Barometric Pressures
32. Letter from — Chief Chemist to Chief Inspector Coal Mines
33. Electrical Inspector's Report
34. Report — Electrical Inspector dated 16.9.75
35. Electrical Inspector's Report — Telephones dated 5.11.75
36. Press Statement by Mr. Campbell — "Morning Bulletin" dated 28.8.1975
37. Notice of Labour Required for 20th and 21st September, 1975
38. Set of Safety Rules
39. Mine Managers Report Book
40. Mine Deputy Report Book
41. Statement by Jaques as to volume of coal extracted.
42. Contour plan of 4 North
43. Plan of Entire Mine
44. Deputy's Report Book — Fletcher — 2 North

44A. For identification — Map of 4 North

45. Map showing markings of tests by Fowler and Rasmussen
46. Invoices of stone dust
47. Plan of Mine No. 4 North from design by Stafford
48. 7 hand-drawn plans by witness Stafford

APPENDIX "C" (Cont'd.)

49. (1) Methanometer
    (2) Drager and tubes
    (3) Safety lamp
    (4) Instruction charts
    (5) Aspirator bulb
    (6) Tubes as tendered by Allison
50. Diamond Driller's Log Geo. Particulars of Coal Seam
51. List of names of those on surface and underground and book of such records
52. Morning Bulletin dated 25th September, 1975.
53. Statement by witness Stolenberg
54. Petrological Information
    Re Coal seams and drill core
55. Synoptic Weather Charts for 19th, 20th and 21st September, 1975.
    (3) charts for each day.

APPENDIX "D"

Sequence of Events at Kianga Underground No. 1 From March, 1975, to 9.00p.m. on 22nd September, 1975.

1975

March	Manager advised extraction 2 North completed.
	Manage requests approval for extraction 4 North. Inspector advises no objection.
	Mine fan relocated from within slot cut on to fan shaft — no loss of performance.
August 1st	Manager commissions Beckman 865 CO analyser.
	Results: 2 North 8 p.p.m. 4 North 9 p.p.m.
August 8th	2 North 7.5 p.p.m., 4 North 9 p.p.m.
August 15th	2 North 7.5 p.p.m., 4 North 9 p.p.m.
August 22nd	2 North 6 p.p.m., 4 North 11.5 p.p.m.
August 25th	Inspector visits mine and takes samples from 2 North and 4 North for complete analysis. Requires that additional tests be taken in 2 North, 3 North and 4 North returns as well as main upcast.
	Results of the sampling on that day tested on Beckman, 2 North return 3.5 .p.m. 4 North return 5.5 p.p.m. Main Upcast 2.5 p.p.m.

APPENDIX "D" (Cont'd.)

Analysis results of samples taken in 2 North and 4 North waste areas gave readings.

	2 North		4 North	
Oxygen	20.5	%	20.5	%
Nitrogen	78.6	%	78.6	%
Carbon Monoxide	0.0008	%	0.0012	%
Carbon Dioxide	0.24	%	0.10	%
Methane	0.65	%	0.83	%
Ethane	0.0001	%	0.0001	%
Ethylene Less than	0.0001	%	0.0001	%
CO/O_2 Deficiency	0.25	%	0.38	%

The above confirms the CO results obtained by the Manager.

August 29th — Manager's Tests:

2 North waste area 8.5 p.p.m., 4 North waste 13 p.p.m., 2 North return 3.5 p.p.m. 3 North return 2 p.p.m., 4 North return 5.5 p.p.m., Main return 2.5 p.p.m.

September 5th — Manager's Tests:

2 North waste 8.5 p.p.m. CO, 0.65% CH_4
4 North waste 11 p.p.m. CO, 0.8% CH_4
4 North return 4.5 p.p.m. CO, 0.35% CH_4
3 North return 1 p.p.m. CO, 0.3% CH_4
2 North return 2.5 p.p.m. CO, 0.15% CH_4
Main return 3.5 p.p.m. CO.

September 8th & 9th — Fire detected in return near main upcast fan shaft — Inspector advised.

Fire covered with stone dust and accepted as under control — area regularly checked for temperature thereafter.

September 12th — Manager's Tests:

4 North waste 11 p.p.m. CO & 1.0% CH_4
2 North waste 8 p.p.m. CO & 0.7% CH_4
Main return 2 p.p.m. CO

September 16th — Electrical Inspector A. E. McMaster and Mine Electrician A. J. Henderson inspect all underground electrical equipment. Inspector satisfied with all aspects of equipment.

September 18th — Mine resumes production after a period of no mining as from 25th August.

September 19th — 4 North produces on day shift but because of mechanical problems on continuous miner is not scheduled for mining on the second shift (3p.m. — 11p.m.)

3.45p.m. — Underground Manager, Peter Pocock enters 4 North waste area to draw samples for analysis for CO — He does not see any evidence of heating, smoke etc., in the area.

4.15p.m. — Pocock arranges for Deputy J. Booth to take atmosphere sample from 2 North section for analysis.

9.00p.m. — Pocock analyses samples on Beckman, Readings for each sample are equivalent to 1 p.p.m. which is so low that he concludes that samples have been contaminated by air whilst standing. Pocock leaves message for Manager Fowler to say results obtained not satisfactory.

11.25p.m. — Mine clear of all workmen — fan running — only persons remaining on mine site throughout night are Storeman Mervyn J. Strauss and Ian D. Renfroy.

APPENDIX "D" (Cont'd.)

September 20th

6.00a.m. William M. Allison — Deputy — arrives at mine and goes underground to inspect all working places.

6.45a.m. Donald Fowler — Mine Manager — arrives at mine and reads report left by Pocock regarding CO analysis. He is later joined by Underground Mechanical Engineer Terrance R. Faber.

7.15a.m. Allison comes to the surface and advises Fowler that there could be smoke in the main return.

Fowler and Allison go underground immediately leaving Faber on the surface. They go into the main return and are not sure whether there is smoke or dust in the air — there is no smell.

They check other places in the return and eventually define a slight smell and smoke travelling in 4 North return. The return is travelled as far as the area between 6 and 7 cut-through. A test is made and 1% of CH_4 detected in the general air. Fowler telephones Faber and asks him to inform Ivor A. Rasmussen — Mine Superintendent of the possibility of a heating in 4 North; he and Allison then return to the surface.

7.40a.m. Faber informs Rasmussen as directed. Rasmussen is at his office at Moura Mine.

8.00a.m. Allison completes Deputy Report No. 178263.

8.15a.m. to Allison and Faber go underground to collect air samples for analysis on CO analyser.

8.30a.m. Fowler telephones:— A. Pocock — Superintendent Mines Rescue station, Blackwater to advise of suspected heating: G. Hardie — Inspector of Coal Mines with similar advice but no detail. Promises to telephone Inspector when details to hand: W. Airey — Union Delegate for arrangement of labour and E. Jump — Mine Safety Officer, to request that he contact tradesmen to come to the mine.

8.40a.m. Fowler analyses the three samples collected from 4 North waste area and determines CO readings of 24,25, 25 p.p.m.

8.45a.m. Fowler, Rasmussen and Allison go underground into 4 North waste to perform tests. General air tests in the area gives results: CH_4 1.0% , CO 25 p.p.m. CO_2 — less than 0.1% . A layer of CH_4 from 3% to 4% is determined at the junction of the roof and fallen ground in No. 7 cut-through halfway down from the conveyor roadway to the man-and-supply roadway. Light smoke is noted to be issuing from an area of crushed coal on the conveyor roadway outbye of 7 cut-through.

The Manager and Superintendent decided that all the evidence points towards an early stage heating and concluded that the area must be sealed. They make an inspection of sites for possible stoppings. While in the course of the inspection three workmen W. Pound, R. Kelly and R. Tsakovic arrive in the section and are put to work erecting brattice stoppings to control the flow of air to the heating zone.

8.30a.m. Fowler and Rasmussen return to the surface leaving Allison in charge of the work underground.

On arrival at the surface Rasmussen contacts Clive Machin a mines rescue brigade member to ask him to stand by with other brigade members in case they were required for final sealing.

9.45a.m. Eric Jump — the Mine Safety Officer goes underground and meets Bill Allison. Together they examine 4 North waste. Jump sees Allison perform tests which gave results: 1% CH_4 25 p.p.m. CO.

10.30a.m. Fowler goes underground to check on progress; he checks to be sure that the brattice stoppings have sufficient openings in both the intake and return to allow some air flow through the waste.

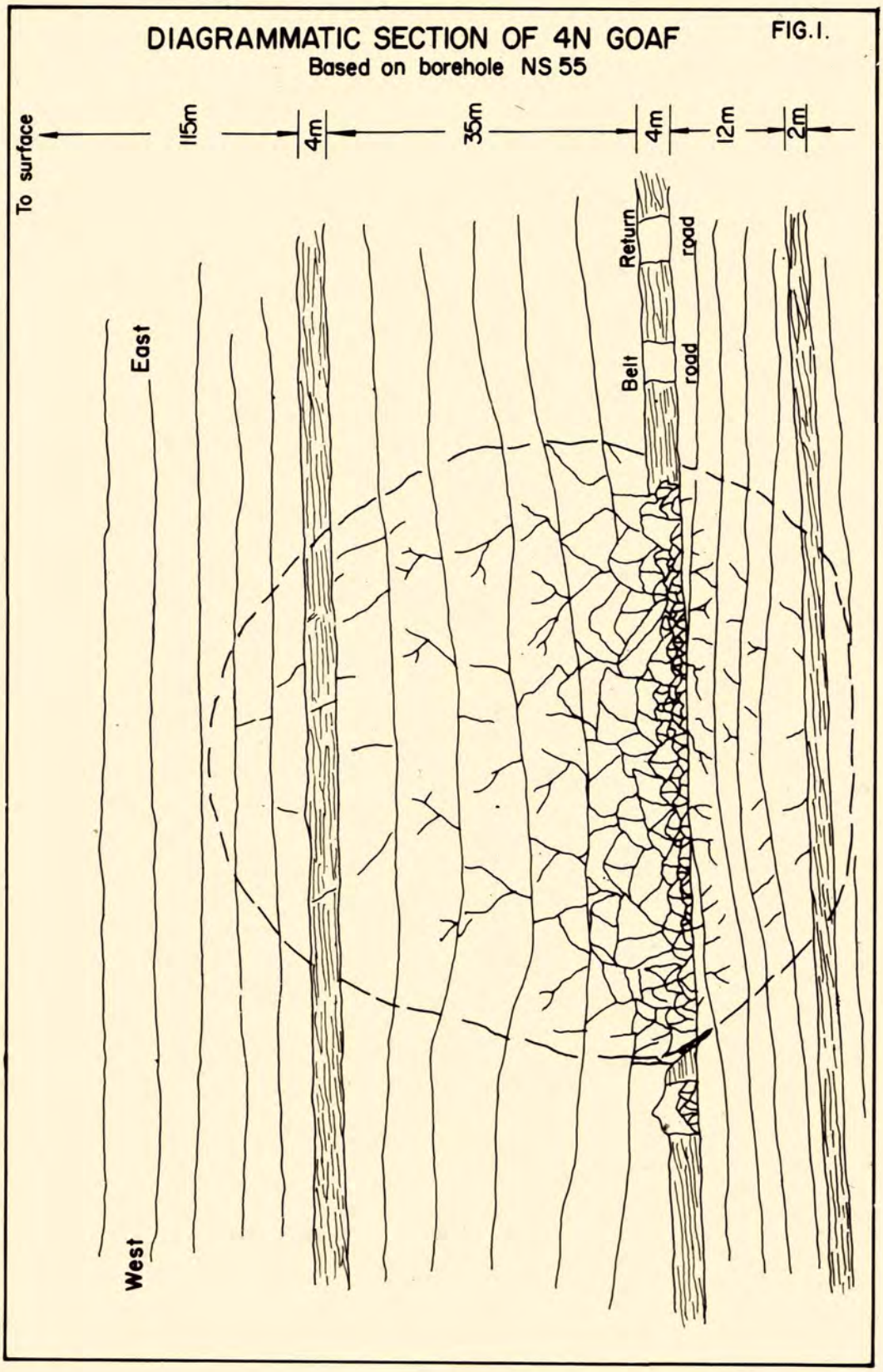
11.00a.m. Allison returns to the surface and completes the first notations on inspection report 178264.

APPENDIX "D" (Cont'd.)

11.20a.m.	Mechanical Engineer Faber returns underground with Allison.
12.30p.m.	Fowler and Faber travel to the surface.
12.45p.m.	Eric Jump returns to the surface.
12.55p.m.	The Manager telephones Inspector and advises CO 25 p.p.m. CH_4 1% and no change at any time since first report. He considers the problem to be a heating in the corner of a pillar left on the conveyor road. Air flow to the area has been controlled but not cut off. Tests are being done regularly and advice will be called if the position changes.
2.00p.m.	Fowler, Rasmussen and Eric Fletcher (oncoming Deputy) go underground. They have a discussion with Deputy Allison and Fowler conducts Fletcher on an inspection of 4 North.
3.00 p.m.	Fowler, Rasmussen and Allison return to the surface.
	Rasmussen leaves the mine for his office at Moura.
	Kevin J. McMullen arrives at the mine.
3.25p.m.	Allison completes second notation to Report No. 178264 stating "80 p.p.m. CO, 1.1% — CH_4. Smoke building up behind stoppings.
3.30p.m.	K. McMullen and ten men of the second shift go underground. Some of the men who are scheduled for the second shift are identified by McMullen. They are: Ron Linderberg, Merv Walker, Cliff Strudwick, Mick Cariage, George Widt and Murray Martin.
	The men who were underground are driven out in the machine which took the ten into the mine.
	While underground McMullen makes an inspection with Deputy Fletcher. On the outside of the brattice stoppings across the return he reads 0.4% CH_2 on the test instrument there is no smoke or smell. Fletcher re-arranges a brattice screen and following such can no longer detect any CH_4. McMullen then walks up to the brattice screen and can detect a slight heating smell only.
3.45p.m.	Neil W. Magarry, Assistant Mechanical Engineer travels into the mine with four further men for the second shift.
4.00p.m.	Magarry and McMullen leave the section for return to the surface.
4.30p.m.	Graham W. Walker drives a transport vehicle out of the mine for further supplies.
	Superintendent Rasmussen returns to Kianga with an oxygen and carbon dioxide testing instrument (Fyrite).
	The Superintendent has Fowler telephone Deputy Fletcher and ask him to take a further series of tests.
5.00p.m.	Fletcher phones surface and advises tests gave following results 1% CH_4 behind stopping in return, 1.2% between 6 and 7 cut-through, and 1% in 7 cut-through. No noticeable increase in smoke or smell. No positive statement regarding CO.
5.12p.m.	Rasmussen, Fowler and McMullen in office, Magarry in workshop, see lights blink, hear explosion. Those in office covered in cloud of black dust.
5.30p.m.	Rasmussen places calls to Mines Rescue Blackwater: C. Machin, Mines Rescue Moura; Moura Ambulance and Police; Mines Inspector, Rockhampton, General Manager Kianga Coal Co.
5.55p.m.	John R. Stafford — Electrical Engineer — Moura Underground Mines arrived at Kianga and arranged outside telephone communication from the Kianga workshop.
8.15p.m.	Inspector of Coal Mines Hardie arrives at Kianga.
8.45p.m.	Blackwater Mines Rescue Teams begin to arrive Kianga.
9.00p.m.	Conference: Mine Manager, Mine Superintendent Inspector and Mines Rescue Superintendent decide to arrange testing of atmosphere from the belt conveyor and man-and-supply portals which are exhausting smoke and fumes.

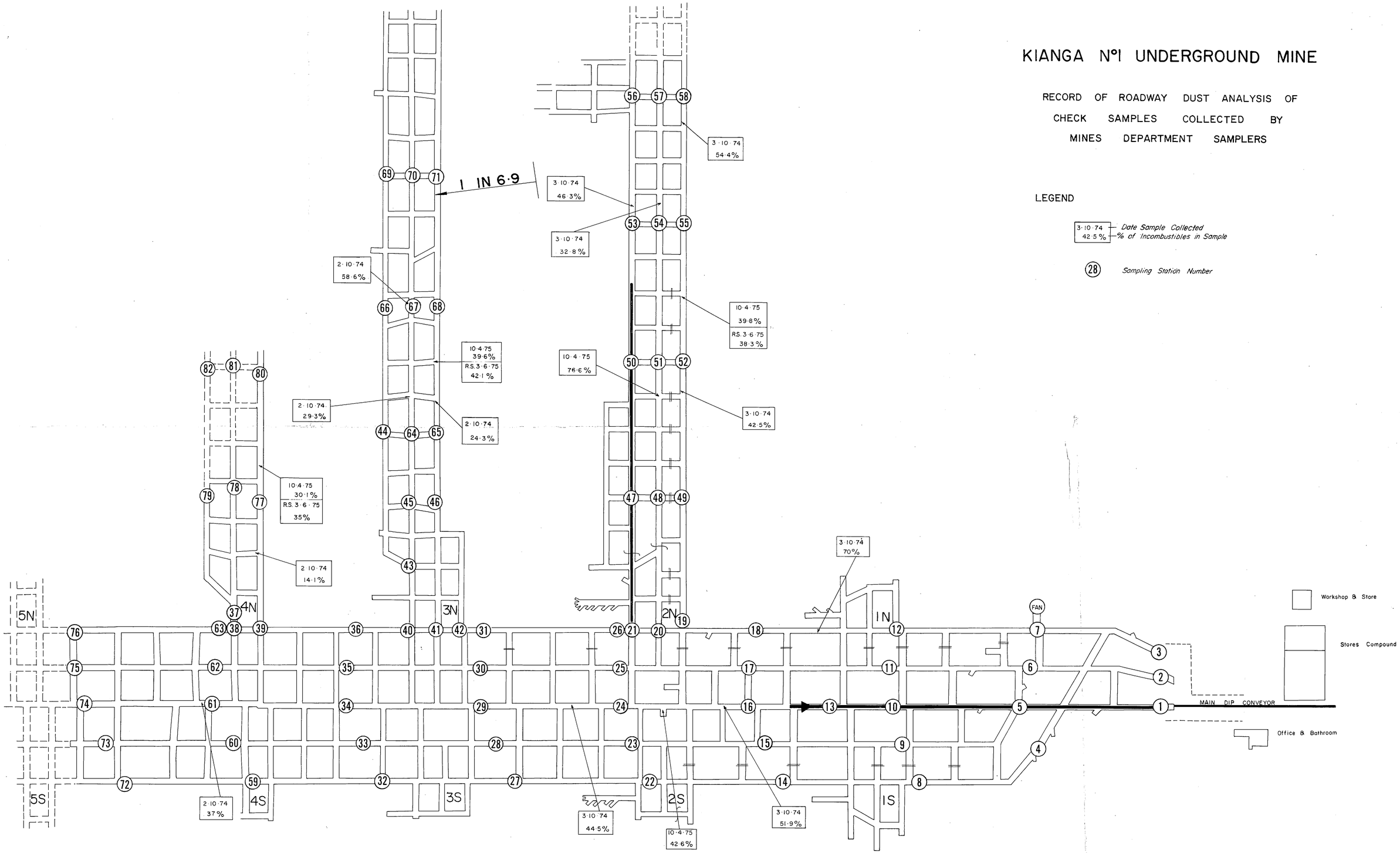
APPENDIX "D" (Cont'd.)

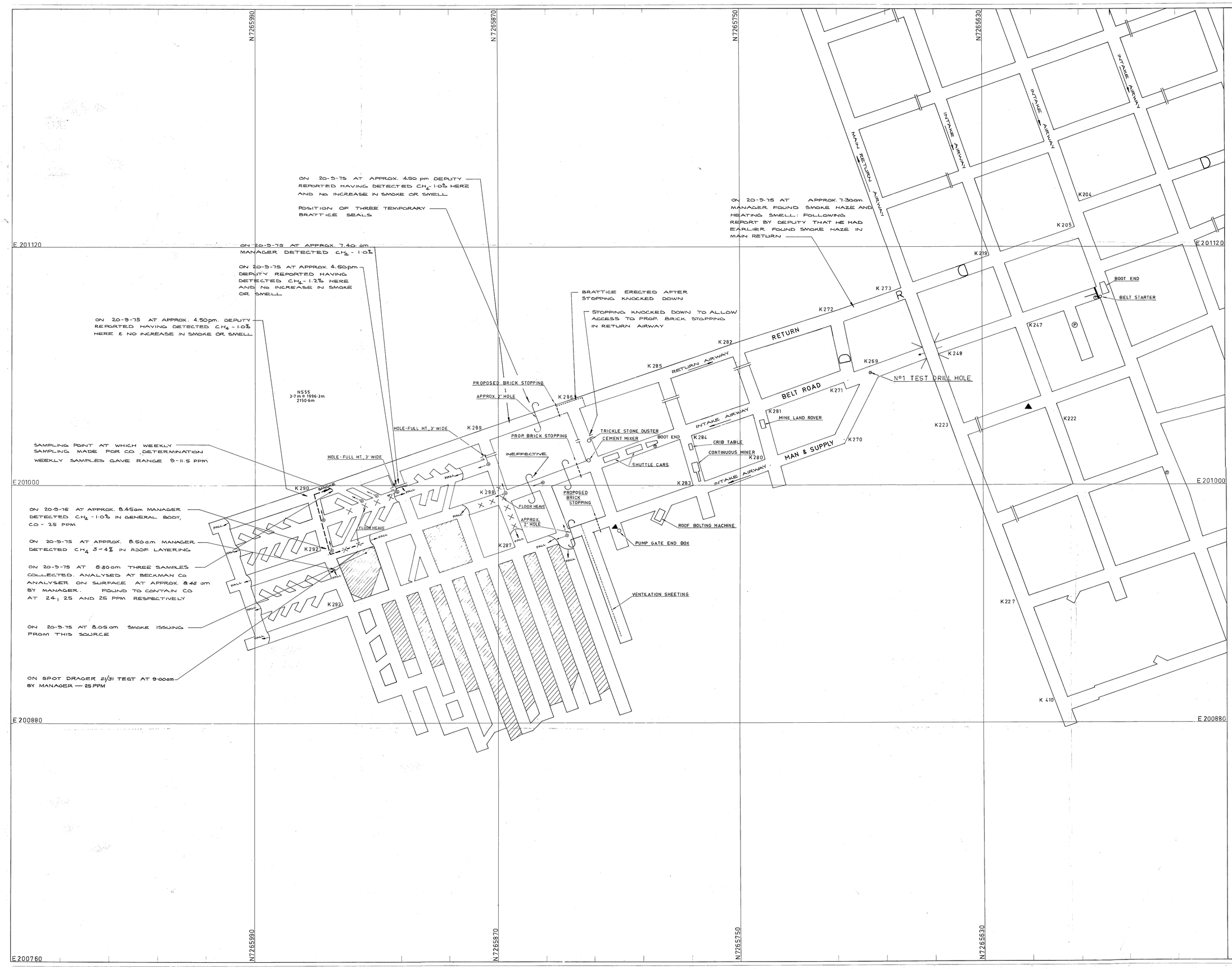
9.40p.m.	Rescue team member samples above the belt portal and determines + 0.3% CO and 0.5% CO_2.
	As a result of these readings, distances to 4 North and the possibility of a second explosion it is decided not to risk sending a team underground.
10.45p.m.	Further tests taken by C. Machin from above belt portal. Gas samples drawn into tubes for later analysis — samples in Tubes QMD 7 and QMD 10.
September 21st 1.00a.m.	Thiess Peabody Mitsui — Managing Director, R. A. Campbell, arrives and suggests in conference with Mines Inspector Hardie, Police, Union and other officials that a drill is available to open a hole from the surface into 4 North to sample the atmosphere directly.
	Also agree to open known drill hole which enters mine at the junction of the man-and-supply roadway and 2 North headings.
2.15a.m.	Messrs. C. Murphy (President), C. Peterson (Secretary), S. J. Morgan and R. J. Murphy (District Union Inspectors), Queensland Colliery Employees Union arrive at mine.
4.30a.m.	Further tests of atmosphere exhausting from belt portal, samples pumped into Tubes QMD 11 and QMD 12.
4.50a.m.	Samples dispatched to Brisbane — Government Chemical Laboratory — by aircraft.
10.50a.m.	Telephoned advice of results of analysis from Government Chemical Laboratory. Results support opinion that fires exist in mine.
11.30a.m.	Air reserves in mine — belt heading and man-and-supply intake. Such attributed to change in air temperatures on surface.
3.50p.m.	Drill hole into 4 North holes through. On-the-spot tests 0.6% CO, 1.2% CO_2. Tubes QMD 8 and QMD 9 sampled.
4.50p.m.	Drill hole adjacent 2 North holes through. On-the-spot tests 1.0% CO 1.0% CO_2 — 2 unbranded tube samples taken.
5.15p.m.	Samples directed by air to Brisbane.
8.25p.m.	Laboratory advises that analysis result confirm on-the-spot tests and that all indications are that the mine is on fire.
8.45p.m.	Meeting of Police, Unions, Management, Mines Rescue Brigade and Inspectors agree that mine must be sealed to control fires.
	Unions ask that final decision be delayed until 8.00a.m. Monday 22nd but agree to the covering of the fan shaft as of 6.00a.m. Monday.
September 22nd 7.00a.m.	Fan shaft covered.
10.35a.m.	Work starts on the covering of the three remaining surface entries.
1.00p.m.	Upcast drift is covered.
9.00p.m.	All entries finally covered — further material pushed over for another 10 hours so as to improve seal efficiency.


DIAGRAMMATIC SECTION OF 4N GOAF
Based on borehole NS 55
FIG.1.
To surface
115m
4m
35m
4m
12m
2m
Return
road
Belt
road
East
West

KIANGA N°1 UNDERGROUND MINE

RECORD OF ROADWAY DUST ANALYSIS OF CHECK SAMPLES COLLECTED BY MINES DEPARTMENT SAMPLERS





REFERENCE

Surveyed line—fenced		Unsurveyed line—fenced	
County boundary		Telephone line	
Parish boundary		Power line	
Limits of workings—open cuts		Surface areas	
Portion number	POR 18	Railway	
Reserves	R14 Town Res	Subdivision and resubdivision number	Sub7 Resub2
Limits of Roads—to scale, with description	Gravel	Building—shape approximate, with description	Office
Pipelines—type and size—surface plan only		Track	
Underground	Air 100 mm	Sp.ℓ Height	120
Surface	Water 50mm	Contour—with height in metres	40
Trigonometrical station		Gravel pit	
Permanent mark		Quarry	
Survey station—in brown	12	Tank—earth	
Bench Mark	B.M.	Wind pump	
Rivers and creeks		Well	
Dam		Gully	
Swamp		Weir	Weir
Waterhole	W.H.	Lake or lagoon	
Normal fault		Overthrust or reverse fault	70
Full dip		Apparent dip	
Syncline		Anticline	
Igneous intrusion —in brown or light brown wash		Drift	
Shaft	15/S	Adit	
Intake air—blue arrows or blue wash		Return air—red arrows in red wash	
Conveyor driveheat		Dust Zone	A1 A2 A3
Stopping		Stopping—explosion proof	
Side for emergency stopping		Brattice	
Prepared Side	P.S.	Water dams	
Selected Side	S.S.	Doors	
Pressure chamber	P.C.	Regulators	
Air crossing—Normal		Air crossing— Explosion proof	
Solid working		Extracted pillars or Goaf	
Borehole—No. 18, 3m coal at reduced level 703m, 1.5m coal at 1880m surface reduced level 2100m			703 1880m 2100 1.5m 3m
Underground ambulance station—Red +		Deputies station	D
Switchboards		Transformer/Substation	
General		Fan	F
High voltage SIB—3 panels		Compressor	C
Medium voltage SIB—Isolator—1 panel		Winch	W
Cable routes—symbols used between broken-lines signifies type and number of cables	Ta 1" = 2" diameter 1" high cable	Telephone	T
Cable symbols		Hydrant	H
Telephone		Valve	V
Low voltage		Pump	P
Medium voltage		Fire extinguisher	E
High voltage		Hose	H
Pipelines—type and size		Tee and tap—type and size	
Spoiled area		Open cut coal mined	

LEGEND

GENERAL AIR FLOW

KIANGA UNDERGROUND MINE

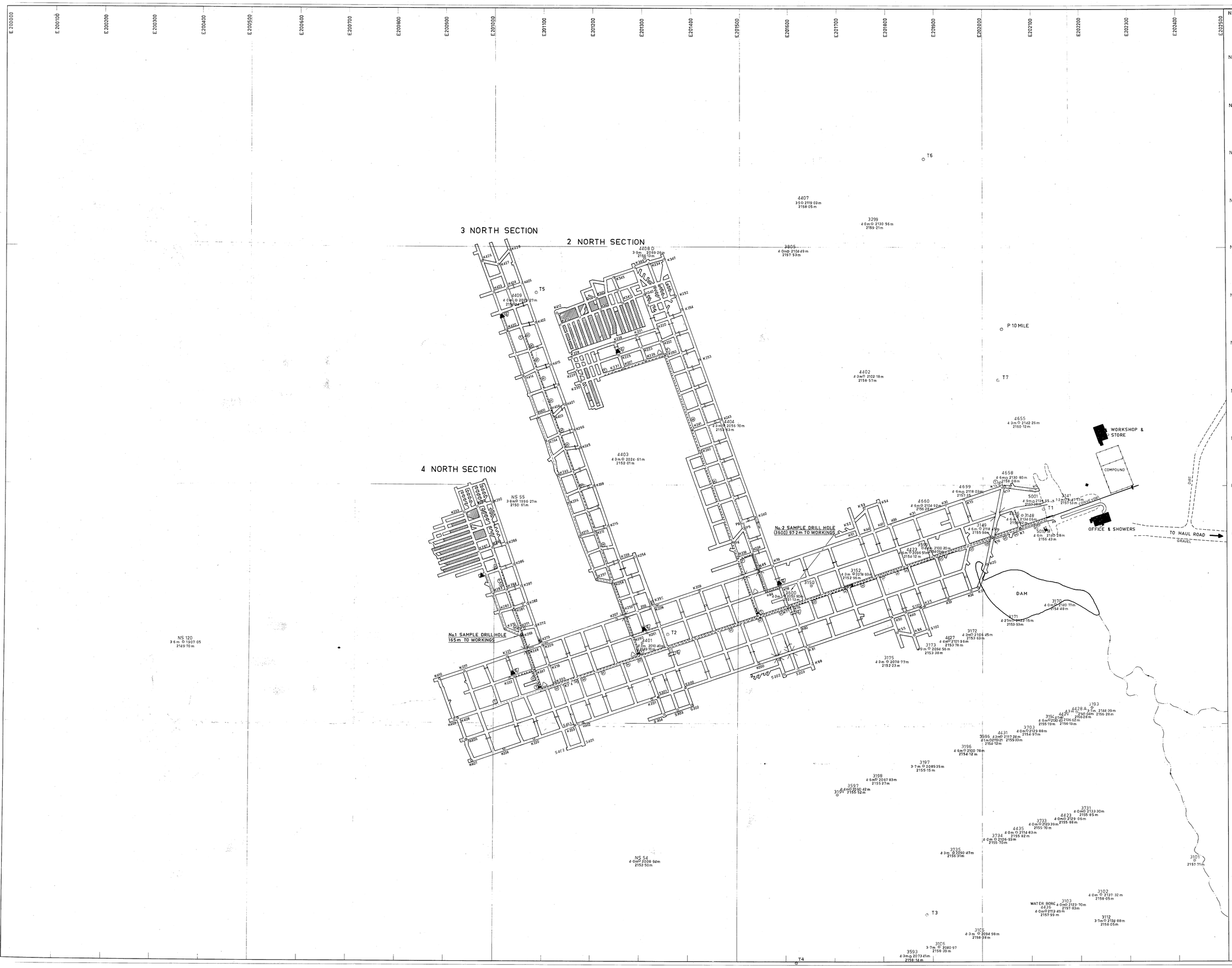
PLAN SHOWING WORKINGS IN 4 NORTH SECTION AS AT TIME OF MINE EXPLOSION - APPROX. 5.00 pm SATURDAY SEPT. 20, 1975

KEY TO ADJOINING SHEETS

SURVEYOR	DATE

REVISION

MINE - KIANGA No1 U.G.	SEAM
LESSEE	
LEASE	MINING DISTRICT
COUNTY	PARISH
CERTIFIED CORRECTOR: / DATE	UNIVERSAL GRID REFERENCE SOUTH WEST CORNER OF SHEET (UG OSD MAP (NAME AND NUMBER))
DRAWN G.D. JAQUES	
HORIZONTAL DATUM: Australian Geodetic Datum (AGD)	EASTING / NORTHING
VERTICAL DATUM: Australian Height Datum (AHD) +2000 m	PLAN
SCALE 1:600 METRES	REF. No 600 / 1A


E200000
E200100
E200200
E200300
E200400
E200500
E200600
E200700
E200800
E200900
E201000
E201100
E201200
E201300
E201400
E201500
E201600
E201700
E201800
E201900
E202000
E202100
E202200
E202300
E202400
E202500
N7267000
N7266900
N7266800
N7266700
N7266600
N7266500
N7266400
N7266300
N7266200
N7266100
N7266000
N7265900
N7265800
N7265700
N7265600
N7265500
N7265400
N7265300
N7265200
N7265100
N7265000
3 NORTH SECTION
2 NORTH SECTION
4 NORTH SECTION
T5
T6
T7
T1
T2
T3
T4
P 10 MILE
4407
3 50·2119·03m
2159·05m
3299
4·0m⊙2130·56m
2159·21m
3805
4·0m⊙2104·49m
2157·53m
4408 D
3·9m 2159·26m
2158·13m
4409
4·0m⊙2029·27m
2158·54m
4402
4·3m⊙2102·18m
2158·57m
4403
4·3m⊙2024·61m
2152·01m
4404
4·3m⊙2056·70m
2153·63m
4655
4·3m⊙2142·25m
2160·12m
4658
4·6m⊙2130·80m
2158·28m
4659
4·6m⊙2118·03m
2157·35
4660
4·6m⊙2104·52m
2156·28m
5001
4·9m⊙2134·55m
2157·53m
3141
4·0m⊙2127·17m
2157·53m
3148
4·6m⊙2134·06m
2156·72m
3149
4·6m⊙2118·
2155·94m
5002
4·6m 2120·28m
2156·43m
3530
4·6m⊙2100·20m
2156·91m
4623
4·6m⊙2096·91m
2154·12m
3152
4·3m⊙2074·93m
2152·96m
3150
3607
4·3m⊙2052·90m
2151·12m
3170
4·0m⊙2160·77m
2164·48m
3171
4·27m⊙2122·15m
2153·93m
3172
4·3m⊙2106·45m
2153·93m
4427
4·4m⊙2101·96m
2153·78m
3173
4·2m⊙2094·56m
2153·38m
3175
4·3m⊙2078·77m
2152·23m
4401
4·2m 2010·40m
2149·70m
NS 55
3·8m⊙1996·27m
2150·61m
NS 120
3·6m ⊙1907·05
2149·70m
NS 54
4·0m⊙2008·94m
2152·50m
No.1 SAMPLE DRILL HOLE
165m TO WORKINGS
No.2 SAMPLE DRILL HOLE
(3600) 97·2m TO WORKINGS
WORKSHOP &
STORE
COMPOUND
OFFICE & SHOWERS
TO HAUL ROAD
GRAVEL
DAM
3193
3·7m 2144·39m
2155·28m
4428 A
4·3m
2141·04m
2156·28m
4429
4·3m
2136·62m
2156·13m
3194
4·6m⊙2130·
2155·79m
3702
4·0m⊙2129·88m
2154·97m
4431
3595 4·33m⊙2117·24m
4·1m⊙2093·21
2154·12m
2155·33m
3196
4·6m⊙2100·78m
2154·12m
3197
3·7m ⊙2085·35m
2155·15m
3198
4·6m⊙2067·63m
2155·27m
3597
4·4m⊙2060·42m
3101 2155·52m
3731
4·0m⊙2133·30m
2155·85m
4423
4·0m⊙2129·06m
2155·68m
3733
4·0m⊙2123·33m
2155·70m
4435
4·0m ⊙2114·83m
2155·62m
3734
4·0m ⊙2106·93m
2155·70m
3735
4·3m ⊙2090·47m
2155·91m
3101
2157·71m
3102
4·0m ⊙2137·32m
2158·05m
3103
WATER BORE
4420
4·0m⊙2123·70m
2157·83m
4·0m⊙2113·49m
2157·99m
3112
3·7m⊙2139·88m
2158·05m
3105
4·3m ⊙2084·98m
2158·38m
3106
3·7m ⊙2080·97
2158·39m
3593
4·3m⊙2073·41m
2158·14m
REFERENCE
Surveyed line—fenced
County boundary
Parish boundary
Limits of workings—open cuts
Portion number — POR 18
Reserves — R14 Town Res
Limits of Roads—to scale, with description — Gravel
Pipelines—type and size—surface plan only
Underground — Air 100 mm
Surface — Water 50mm
Trigonometrical station
Permanent mark
Survey station—in brown
Bench Mark — B.M.
Rivers and creeks
Dam
Swamp
Waterhole — W.H.
Normal fault — 5·0 m
Fault dip
Syncline
Igneous intrusion — brown or light brown wash
Shaft — S/S
Intake air—blue arrows or blue wash
Conveyor drivehead
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Side for emergency stopping
Prepared Site — P.S.
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Pressure transder — P.C.
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Solid working
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General
High voltage SIB—3 panels
Medium voltage SIB—isolator—1 panel
Cable routes—symbols used between broken lines signifies type and number of cables
Cable symbols
Telephone
Low voltage
Medium voltage
High voltage
Pipeline—type and size
Spoiled area
Unsurveyed line—fenced
Telephone line
Power line
Surface areas
Railway
Subdivision and resubdivision number — Sub1 Resub2
Building—shape approximate, with description — Office
Track
Spot Height — ·120
Contour—with height in metres — ·40
Gravel pit
Quarry
rank—earth
Wind pump
Well
Gully
Weir — Weir
Lake or lagoon
Overthrust or reverse fault — 5·0
Apparent dip
Anticline
Drift
Adit
Return air—red arrows or red wash
Dual Zone
Stopping—explosion proof
Brattice
Water dams
Doors — D D
Regulators — R
Air crossing— explosion proof
Extracted pillars or Goaf
Deputies station — D
Transformer/Substation
Fan — (F)
Compressor — (C)
Winch — (W)
Telephone — (T)
Hydrant — (H)
Valve — (V)
Pump — (P)
Fire extinguisher — (E)
Hose — (H)
Tee and tap—type and size
Open-cut coal mined
KEY TO ADJOINING SHEETS
234 235 236
244 245 246
254 255 256
SURVEYOR DATE
REVISION
MINE KIANGA UNDERGROUND
SEAM KIANGA "C"
LESSEE THIESS PEABODY MITSUI COAL PTY LTD
SCML 159 LEASE
MINING DISTRICT MT MORGAN
COUNTY DAWSON
PARISH KIANGA
CERTIFIED (SURVEYOR) DATE
UNIVERSAL GRID REFERENCE SOUTH WEST CORNER OF SHEET
DRAWN G.D.J. & R.B.R.
100 000 MAP (NAME AND NUMBER)
HORIZONTAL DATUM: Australian Geodetic Datum (AGD)
VERTICAL DATUM: Australian Height Datum (AHD) +2000 m
EASTING NORTHING
No.1 U/G PLAN
SCALE 1:2500
50 METRES 100