

8/98/JRL
7 April 1998

PRINCE OF WALES MINE

124s SALVAGE DISTRICT, Warren House seam.

REFERENCE – INVESTIGATION OF DOUBLE DANGEROUS OCCURRENCE

ACCOMPANIED BY [REDACTED]

ASSISTED BY [REDACTED]

CLASSIFICATION

Part II, No. 22 On 3 4 98
At 0130 and 0730.

PRECIS

Two ignitions of firedamp occurred separated by six hours, behind the part completed tailgate stopping of a salvaged longwall retreat district. No persons were injured but 141 persons were evacuated from the mine and 69 self rescuers were worn. The second explosion was violent enough to destroy air doors and an overcast, to disrupt the stopping, to damage air doors some 275m away and to open air doors at a booster fan site 890m away. The district was known to contain a spon. com. heating and this is concluded to be the source of ignition. The district was in a high risk seam and had ceased production some 21 weeks previously, with a fault on the face. The failure to comply with industry best practice and owners instructions was taken up strongly. Consideration is being given to serving Improvement notices on the company requiring safe systems of work.

LOCUS

The two ignitions occurred within the salvaged and part sealed 124s longwall retreat district. This unit had completed production on 8 11 97 at the end of its planned life. At that time the face was carrying faulting at No.116 powered support. The district had retreated to the rise at a shallow gradient.

Following salvaging of equipment the seals were being erected in the rectangular section gate roads. At the time of the incidents the maingate stopping was completed barring filling of the access tube. The tailgate stopping inbye wall was completed, the outbye wall was two courses of breeze blocks from the roof and the infill was pumped to this level. As a result of the local gradient the infill had reached the roof of the roadway at the inbye wall. The access tube was to fill.

The stoppings were both sited some 50m from the respective road end junctions with the SW Intake, which themselves were 65m apart. A site plan and photographs will be appended when available.

NARRATIVE

This narrative was constructed from discussions held with [REDACTED] [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

The five [REDACTED] entered the mine at 1800 hrs. on Thursday 24 98, along with [REDACTED] command supervisor. [REDACTED] was deployed to Zone 3, which contained the SW trunk roads. He was also asked to look after 124s stoppings, until relieved by [REDACTED] had also entered the mine at 1800, but was deployed for the first part of the shift to 132s development district to cover for an absence. He would be relieved by [REDACTED] who was expected to enter the mine at 2200.

[REDACTED] deployed the contractors to the stoppings, their foreman split the manpower to three at the maingate and two at the tailgate. [REDACTED] visited the men at 1945 and found them preparing both placing pumps. He examined the maingate stopping site and found the atmosphere to be fresh air and pumping to complete this stopping commenced.

At the tailgate stopping, [REDACTED] found 1.1 - 1.5% firedamp in the general body (GB) near the stopping. He detected 3% firedamp on his flame safety lamp coming through the access tube in the stopping, and with an SCO1 carbon monoxide detector, saw 15ppm indicated. He tested in the GB with the SCO1 and found 12ppm. This indication agreed with the static CO monitor on site. [REDACTED] stated that he opened the forcing fan regulator one notch in an effort to improve the atmosphere slightly.

He instructed the men not to stay at the stopping but to operate the pump (sited in the main intake), and to only go to the stopping periodically to check the fill. Pumping commenced and a total of 3t of material was placed. The men then cleaned the pump. There was insufficient grout available to complete the stopping. More was travelling from the surface; while it was awaited [REDACTED] redeployed the two men out of the tailgate and round to assist at the maingate stopping. He instructed them not to re-enter the tailgate until [REDACTED] arrived. [REDACTED] then made his way to 118s locomotive garage.

[REDACTED] was in the control room. He stated that the mine had received a barometric pressure fall warning, and he been noticing the firedamp levels in the mine rise over the shift. He stated that 126s coalface had stopped production but firedamp levels at the outbye end of the tailgate reached 1.8%. By 2200, levels in the return were such that power to the manriding conveyor had to be isolated. This resulted in the 2200 hrs. shift having to walk this road and were consequently late inbye.

[REDACTED] was relieved by [REDACTED] at approx. 2330 hrs. and made his way outbye to 124s. He found the maingate stopping had been completed and the front wall was being faced off. He found two men at the tailgate preparing to complete the front wall. [REDACTED] entered the tailgate and detected 1.6% firedamp in the GB. This rose to 1.8% half way to the stopping, and at the men's working position at the stopping he detected 2.2%. The workmen's automatic firedamp detector indicated 1.6%. The men stated that conditions this shift were similar to the

past couple of days. [REDACTED] sent the two men out of the tailgate to the maingate. He used his Mentor instrument in the access tube and read 40ppm CO; 5% CH4 and 20.6% O2.

On leaving the heading, [REDACTED] fenced off the road some 5m from the junction with fencing materials on site. He then telephoned [REDACTED] in the control room and informed him that he had withdrawn the men, and relayed the instrument readings. [REDACTED] then phoned [REDACTED] at 118s and asked him to go down and see if he could help [REDACTED] with the gas problem.

[REDACTED] went to the maingate to check on the men, then went back to the tailgate to check on the gas. He got to the fence and noticed one of the access tube blanking plates propped against the RH road side, looking inbye. He decided to write "gassed off" on the plate as an additional warning and to prop it against the fence.

As he was reaching for his chalk he heard a very loud bang like a cannon from inbye in the road. He stated that he saw an orange glow for a split second out of the corner of his left eye. (This could have been the result of a blow on the head as [REDACTED] was adamant he was facing outbye at the time). [REDACTED] felt dust coming all around him and found himself on the floor against the wooden air door some 4m into the cross cut on the other side of the junction. He had been blown approx. 14m. [REDACTED] couldn't see a thing for the thick dust. His cap lamp was still on and he just made out the grain of the wooden door right in front of his eyes. He found his helmet was on his head but the interior cradle was missing. Afraid of another explosion and seeking some protection, [REDACTED] went through the first air door. He stated that it was no easier or difficult to open than normal. He donned his self rescuer. His way appeared blocked with brattice which he knew had come from the overcast. He then went back through the air door back onto the intake, and hearing the fan knew that was the way to go. The air was still very thick with dust but as it began to clear he noticed that the strip lights in the intake were still on.

The workmen stated that they were near the pump in the maingate, some 20m from the stopping. [REDACTED] had only been gone for a couple of minutes when they felt the ground vibrate, then heard a rumble which became a roar and a bang. A blast of air came through the stopping access tube and brought debris which hit the roof as the tube was angled upwards. There was choking dust all round. One man found himself on his hands and knees. The men put on their self rescuers and followed the legs of the supports to the intake.

[REDACTED] had received the phone call from [REDACTED] asking him to help with the gas problem at 124s, and started to make his way back inbye. He was some 50m away from 124s maingate junction when he heard a bang and a rumble. Suddenly he felt a rush of air reversal and the air was full of dust. The conveyor was running and [REDACTED] stopped it, applying a lockout. [REDACTED] knew there were men inbye and carried on. He met one of the contractors coming up the road with his self rescuer on, and ascertained that all the contractors were OK. [REDACTED] put his own self rescuer on and continued inbye, where he met the remainder of the contractors and [REDACTED]. Just past 124s maingate junction the dust was so bad he couldn't see so then turned back and went to 118s.

[REDACTED] was the [REDACTED] on 126s production district, the next inbye from 124s. He was making his way round the district on an inspection and had reached the maingate end, 270m inbye of 124s tailgate junction. He had noticed higher than normal firedamp in the intake, 0.8% at the start of the shift compared with 0.2% normally. Now it was 1.05%. The CO monitor was normal at 6ppm, but as he was looking he heard a bang and felt a rush of air.

The reading on the CO monitor started to rocket, and the air was filled with dust. [REDACTED] shouted on the tannoy to his stage loader operator to put his self rescuer on and to get out. [REDACTED] donned his own self rescuer and waited till he could see. He looked up the intake and saw the dust was clearing quickly. He couldn't see any lights. When the air had cleared [REDACTED] went up the intake. There was no-one at 124s tailgate and as he passed he noticed that the fan was still running but the ventilation duct was off the fan and on the floor. [REDACTED] turned off the fan. He noted that there appeared no other damage, and saw that the air crossing was still standing.

[REDACTED] reached the maingate junction and saw a man on the telephone. He grabbed the handset and spoke to [REDACTED] telling him that 124s had blown up and to get in touch with those inbye.

[REDACTED] immediately put the Emergency Plan into action, calling out the Mines Rescue Service and contacting those inbye. **In total some 141 persons were evacuated from the mine without further incident.**

Mines Rescue personnel established a **Fresh Air Base at 118s garage, and were on site there when at 0730 a further explosion occurred.** This was much more violent than the first and caused the air doors at the garage to be blown open. This area was approx. 890m from 124s tailgate junction.

OBSERVATIONS

Investigation of the incident commenced once the situation had been brought under control and the area was safe to enter. This was accomplished by sealing off the maingate stopping access tube and injecting nitrogen through the stopping. Once an inert atmosphere was proved in the district, the tailgate access tube was sealed and a 1m pumped stopping added to the outbye face of the existing tailgate stopping. Following a site inspection, a further 4m of stopping was to be added to the tailgate stopping. Early analysis from the tube bundle line was accomplished by the insertion of a multigas analyser at the fresh air base, this removed three hours from the 3.1/2 hour delay time and proved extremely beneficial.

The scene at the tailgate junction was one of devastation, the scene being best depicted by reference to the site plan and photographs.

The area was inspected on 6 4 98 when an investigation into possible ignition sources was mounted. It was noted from descriptions of the scene following the first explosion and the observed effects of the second, that the first explosion was much less violent than the second. The possibility existed that the first ignition was initiated from outside the stopping.

The possible ignition sources were electrical defects; contraband; damaged safety lamps; frictional heating from machinery; and the spon. com. heating, and were investigated as follows:

1. Electrical defects.

It was confirmed by observation that no cables passed through either stopping into 124s district.

██████████ carried out a thorough investigation of electrical equipment from the site and the adjacent roadways. He has reported separately on this investigation, but concludes that the electrical apparatus energised at the time was not contributory.

2. Contraband.

A careful search of the area was conducted during the on-site inspection. No evidence of any contraband at all was noticed in the mine, other than crisp packets which are known to be incapable of igniting firedamp.

██████████ was the only person in the vicinity of the first ignition. He admitted to being a smoker and his underground clothing and equipment was searched thoroughly. No contraband was found. ██████████ did not carry a watch, stating that he relied on the inbuilt clock in the Mentor instrument for timekeeping.

3. Damaged Safety Lamps.

██████████ cap lamp, his mentor and the workmen's AFD were all impounded and sent for examination by ██████████

██████████ had a flame safety lamp. He stated that it was not lit during his inspections of the tailgate. On examination in the lamproom it was found serviced and ready for issue. Examination of the lamp damage and repair records showed that a record was being kept: there were no entries for 3 4 98.

4. Frictional heating from machinery.

The only machinery in operation at the time of the first ignition was the SW Intake trunk belt conveyor running through the tailgate junction. At the time of inspection, the line of the conveyor had been disrupted by the impact of debris including sections of steel air ducting. Observation of the position of slings, examination of structure components in the area and also an appraisal of the installation standards of the remainder of that conveyor indicated that the installation standards were good: the belt was well lined and graded and no indications of recent rubbing of belting on structure were apparent.

Some 13 top idler sets were missing from the area adjacent to the tailgate junction. The idlers were scattered about, some on the bottom strand of the conveyor. Score marks on the underside of the conveyor suggested that the top belt had moved outbye some 0.84m while in contact with the idler cradles. This would be consistent with the belting being blown about by the second explosion, and not consistent with the belt running at the time of the second explosion.

The trough of the top belt was measured at 1.84m from the underside of the junction support girders, and 2.2m from the floor.

All the loose top idlers were checked. None had flats and all bearings were in good order.

5. Spontaneous Combustion.

A spon. com. heating had been identified in the district some two weeks prior to the incident, as the last powered supports were being salvaged. [REDACTED] stated that the heating was just on the tailgate side of the fault, which had been at 116 powered support when the face stopped production. Before the stoppings were erected, officials were required to take CO determinations at various points through the faceline. The CO pickup across the heating area was stated to be approx. 7ppm. As the powered support were removed, the waste edge was systematically bratticed in an attempt to reduce ventilation leakage into the waste. At the tailgate end of the brattice some 20ppm was detected.

In the absence of any evidence to suggest alternative ignition sources, it is concluded that the ignition source for the first ignition was the heating. The second ignition was definitely from behind the stopping, its ignition source being either the heating or burning material or a hanging flame ignited by the first ignition.

The reasons that a heating was allowed to develop were investigated:

Environmental monitoring records from the mine were reviewed with [REDACTED]. It was noted that the tube bundle sampling efficiency was not good, however a first alarm was generated on 24 3 98.

Gresham tube samples were taken to check the tube bundle monitoring and to provide an analysis for hydrogen. The CO and CH₄ was found to be approx. twice that indicated on the tube bundle system, indicating that a leak existed on 124s tailgate line. (Tube bundle 6ppm, Gresham 11 ppm). Attempts were made to trace this leak. Eventually, these attempts were aborted and the 124s tailgate tube was re-connected to 122s tailgate stopping line on 1 4 98. Relative readings before and after the changeover were 2ppm and 0.1% CH₄, compared with 9ppm and 1.04% CH₄. At that time the alarm settings on the line were not changed, with alarms continuing to reflect conditions at the back of a stopping and not in a roadway which was now being sampled.

The tube bundle system from 124s tailgate had a 3.1/2 delay. The last two results prior to the first ignition were:

0107hrs, 3 4 98, barometer 100.4 mbar:
17ppm CO, 2.74% CH₄, 19.59% O₂, ratio 0.19

0456hrs, 3 4 98, barometer 100.04 mbar:
49ppm CO, 3.99% CH₄, 19.02% O₂, ratio 0.4

The rapid rise in readings could be from a combination of mechanisms:

- a. the rapid fall on the barometer drawing out gasses from deeper in the waste,
- b. a genuine increase in heating activity. With the stoppings being sealed, the ventilation quantity will have significantly reduced. This will have reduced the cooling effect of the ven-

tilation on the heating, but the readings indicate that sufficient O₂ was still be supplied. It is therefore likely that activity increased as a result of the sealing operations.

The ratio of 0.4 would normally be taken to be too low for the heating to have sufficient heat to ignite firedamp (600 deg.C). However experience has shown that a very small scale heating would consume little O₂ and produce relatively little CO, but would still be hot enough to ignite paper for example, (233 deg.C). Flame from burning paper would then ignite the fire-damp, which was known to be in the explosive range.

The CO peak at the tailgate stopping after the first ignition was 10 000 ppm, and after the second ignition 22 000 ppm.

Ventilation records indicated that during production the face was ventilated by 24.7 m³/s with 0.5% CH₄ in the return (21 11 97). Soon after cessation of production this was reduced to 7.33 m³/s (25 11 97), this gradually rising to 10.0 m³/s by 19 3 97. No further records are available. It is likely that the quantity reduced to 4 m³/s or less with the completion of the stopping walls.

Inspection reports from the district officials for the preceding week were examined. There were no significant comments.

RJB Mining Policy Instruction 3/97 instructs managers to **salvage and seal districts within 13 weeks of the cessation of production.** There is provision for this to be extended with the permission of the Director of Mining, application to be made at least two weeks before the termination of the initial notification. The manager of the mine notified the Director of Mining of the cessation of production on 8 11 97 with a 13 week salvage program, to be completed by 7 2 98.

On 2 2 98, five days before the expiry of the original plan, the manager requested a 10 week extension. This was granted by the [REDACTED] on 9 2 98. [REDACTED] indicated that he had not been aware that the salvage program had drifted off target. The manager had not told him and he had not asked.

It would appear that the manager presented the Director of Mining with a fait accompli, whereby the Director of Mining had little choice but to agree if he wished the powered supports to be salvaged. **The decision was made on commercial grounds.**

No additional precautions were required to be taken by the Director of Mining, over the requirement in the Instruction to ensure that materials for the construction of the stopping were on site or as close as practicable. This also was not complied with, as fill material was on the surface.

It is noted that there was no indication of any spon. com. activity within the 13 week period specified.

CONCLUSIONS

1. The initial ignition was caused by spontaneous combustion activity in the waste of 124s salvage district, possibly igniting paper or timber and hence an explosive mixture of fire-damp.
2. The second ignition was also initiated behind the stoppings of 124s, possibly by a hanging flame remaining from the initial ignition. This explosion was much more violent.
3. Although the level of activity was indicated by air sample analysis to be low, there was nevertheless sufficient activity to initiate at least one ignition.
4. The spontaneous combustion was allowed to develop by the manager not ensuring that the district was salvaged and sealed within 13 weeks, in compliance with known industry good practice and the company's own Policy Instruction 3/97. After 12 weeks of salvage, the work was 10 weeks behind program.
5. The district was at particular risk, having faulting present at the time of production cessation. This was ignored.
6. By ineffective management of the colliery manager, the Director of Mining failed to detect that the salvage program was grossly behind schedule, and accordingly no steps were taken to redress the situation. It appeared that the managers performance was judged on production only.
7. The extension to the salvage program was asked for too late; stopping materials required to be on site were not on site, and the extension was granted without proper consideration for the consequences.
8. The resulting heating was of relatively low activity, but the activity increased as the stoppings were erected. The failure to alter alarm level settings on the tube bundle system after the lines were changed may have prevented this increased activity being detected.
9. This is the second time a heating has been allowed to develop by the failure to seal a district with a fault on it in recent months. On this occasion a coal dust explosion was not propagated, but had it been the results would have been catastrophic.
10. After the incident, accounting for, and evacuation of, personnel was completed efficiently and without further incident.
11. The introduction of the multigas analyser near to the problem area eliminated 3 hours delay in obtaining air analysis results, and gave much higher confidence.

RECOMMENDATIONS

1. That an Improvement Notice be served on RJB Mining to require a safe system of work be in place and followed for the salvage and sealing of all coal face districts.
2. That consideration be given to including a 13 week time limit for sealing, in forthcoming Mines Environmental or Ventilation legislative packages.

3. That when tube bundle lines are re-connected, alarm levels are altered to suit.
4. That consideration be given to developing a replacement for the few remaining and now old and unreliable, multigas analysers.

ALLEGED CONTRAVENTIONS

Health and Safety at Work Etc. Act 1974, Section 2(2)(a) by the [REDACTED] in that he failed to provide and MAINTAIN a system of work for the sealing off of 124s salvage district that was, so far as is reasonably practicable, safe and free from risks to health.

Management and Administration of Safety and Health at Mines Regulations 1993, Regulation 9(1) by the manager, in that he failed to exercise control of the mine subject to instructions given to him by the owner, namely Policy Instruction 3/97.

[REDACTED]
H M INSPECTOR OF MINES.

8/98/JRL

Postbook Ref.

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KEYWORDS: NY 241, ug, 124, Warren House, DO, ignition


H M INSPECTOR OF MINES