fire forensics Pty Ltd

QUALITY - KNOWLEDGE - INTEGRITY

Our reference: 2102027

Prepared for: Queensland Coal Mining Board of Enquiry

Client reference: RK:RK-181

Date issued: 29 March 2021

FURTHER REPORT #2

in the matter of

Explosion and Fire at Grosvenor Mine

Moranbah QLD on 6 May 2020

EXPERT WITNESS DECLARATION

I certify that I have read the Expert Witness Code of Conduct UNIFORM CIVIL PROCEDURE RULES 1999 - REG 428 and agree to be bound by it. To the best of my ability, this report has been prepared in accordance with the Code. I have carried out all the enquiries which I consider to be necessary in this case.

Investigator: James William MUNDAY MIFireE, FSSDip, IAAI-CFI, FCSFS

Signed: [redacted]

Reviewed by: Vithyaa Dayalan BSc, MSc, Grad Dip FI, IAAI-FIT, NAFI-CFEI

Signed: [redacted]

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1. Further to my reports dated 11 March 2021 and 19 March 2021, I have been asked for additional comments in a third letter of instruction (LOI 3) dated 26 March 2021. A copy of LOI 3 forms Appendix A to this report. I was supplied with copies of the documents from which extracts appear in LOI 3. I have also been supplied with a copy of Shift Statutory Reports dated 5 and 6 May 2020, including wet and dry bulb temperatures.

2. The material supplied with LOI 3 indicates that there is likely to have been a spontaneous combustion in progress within the goaf for some time prior to the methane explosion occurring in the longwall.

3. If this was the case, then it is possible that an initial gas-air ignition occurred within the goaf some way back from the face. Fuel gases there could include methane plus carbon monoxide, hydrogen, ethylene and acetylene released by heating of coal. The flame front could then have dissipated within the goaf due to combustion of the immediately available gases, while the overpressure produced by that event would have manifested as the first pressure wave noticed by the workers and recorded at the maingate.

4. Given this new information, it is no longer my opinion that the first pressure wave in the face most likely resulted from a goaf fall. I now consider it at least equally probable that two explosions occurred, the first in the goaf and the second in the face. Under these circumstances, it is possible that a quantity of unreacted methane from within the goaf was displaced into the face where it became ignited.

5. This would be a reasonable explanation for the delay between the two pressure waves and the workers only being aware of flames associated with the second wave. If there was coal combustion in the goaf behind Chock 111, then this could have been the source of a hot (or glowing) surface, or a small flame, capable of igniting the methane-air mixture in the face via the exposed space between the chocks.

6. I have also reviewed the wet and dry bulb temperature data provided and used an online calculation system[1] to determine the Relative Humidity (RH) from the data. The lowest RH recorded at any time in the documents provided is 71.1% (6/5/20, 10:55, Longwall Production C33-34). This value is too high for any realistic possibility of a static electrical discharge in air between clothing or personal items, or between them and earth. If such conditions were in place immediately prior to the ignition, an electrostatic spark can effectively be eliminated as a potential ignition source.

End of Further Report #2.

[1] http://www.ringbell.co.uk/info/humid.htm

Appendix A – copy of LOI 3

Queensland Coal Mining Board of Inquiry

Your Ref:
In reply please quote: RK:RK-223

Mr James Munday
Founder / Senior Investigator
Fire Forensics Pty Ltd
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By Email: jim@fireforensics.com.au

26 March 2021

Dear Mr Munday,

EXPERT EVIDENCE – FIRE AND EXPLOSION

Thank you very much for your assistance so far.

The Board would be grateful if you would be willing to address some further matters, as foreshadowed in my email on Friday.

It is tolerably clear to the Board that the first overpressure event was the likely mechanism that brought methane onto the longwall face, whatever the cause of the overpressure event.

Our understanding of your opinion is that the time lag from the first overpressure event to the face ignition event is too long for it to be likely that the events are explicable as a cascade ignition.

It seemed in our conference that you did not rule out the scenario that the first overpressure event was an ignition in the goaf (that forced methane onto the face), followed by a second ignition in the face area resulting in the deflagration that caused the injuries to the coal mine workers.

Without casting any doubt on the veracity of your opinion, we do note that it was expressed without you having the benefit of considering some relevant material in the possession of the Board.

The Board would appreciate if you would consider the following –

1. There was evidence of an advanced heating in the goaf in the tailgate area prior to the 6th of May, including:
    a. Ethylene was detected in samples taken from the goaf – see the attached report of Mr Sean Muller MSE.001.001.0001 at .0050 (page 43):

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"Spontaneous combustion indicators identified include elevated carbon monoxide (CO) levels, presence of ethylene, Graham's ratio above normal, and CO/CO2 ratio above normal. These were present in numerous samples across the investigation period from the 17th of March until the first event."

2. Products of combustion were observed in samples taken from the goaf wells immediately after the event, suggesting there had been an ignition of methane in the goaf – this is also covered in the attached report of Mr Muller – particularly:
    a. Results from goaf wells – gas chromatograph and real time data (MSE.001.001.0001 at .0050 (page 43) provides a summary as follows):
        i. Well GRO4V009.5 (approximately 25 metres back from the longwall face) results showed high CO_2 (at least 5%) and low CO (not exceeding 40ppm), indicative of an efficient methane air combustion;
        ii. Well GRO4V009 (approximately 50 metres back from the longwall face) results showed higher CO, indicative of a less efficient combustion, which would be expected moving further back into the goaf in a fuel rich environment;
    b. Results from bag sample GRO4V009 at 15:05 on the 6th of May showed further evidence of an ignition in the goaf – MSE.001.001.0001 at .0050 (page 43):

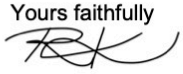
    "A sample taken from GRO4V009 at 15:05 on the 6th of May contained levels of gases consistent with the combustion of coal. These gases include high levels of ethylene, hydrogen, and carbon monoxide (over 1000ppm). This sample also contains significantly increased levels of carbon dioxide (CO2) as would be expected from methane combustion. The sample appears to be a mix of methane combustion and coal combustion."

3. The results referred to in 2a. above also show that there was a drop in both O2 and CH4 at these locations just after the event, suggesting that those gases had been consumed by combustion – see attached report of Mr Watkinson (WMA.001.001.0001 at.0063 (page 55):

    "The minimum oxygen reading seen was 5.5%. The oxygen starts to climb from around 14:24 from 12% to around 14% this then falls rapidly at 15:01 along with a rapid fall in methane and increases in CO and CO2."

If you have any questions or wish to discuss this request, please contact me on 0477 312 075 or at renae.kirk@coalminesinquiry.qld.gov.au.

Yours faithfully



Renae Kirk
Special Counsel
Queensland Coal Mining Board of Inquiry