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REPORT
on examination of materials relating to explosion and fire at Blakefield South coal mine on 5 January 2011

by

James William MUNDAY MIFireE, FSSocDip, IAAI-CFI, FFSSoc

Expert Witness Code of Conduct
I, James William Munday, certify that I have read the Expert Witness Code of Conduct Schedule 7 to the Uniform Civil Procedure Rules 2005 and agree to be bound by it. To the best of my ability, this report has been prepared in accordance with the Code.

Signed:

Date: 09 February 2012

Prepared on the instructions of:
NSW Government Department of Trade & Investment
Investigation Unit
8 Hartley Drive
Thornton NSW 2322

Attn: Jennie Stewart
Ref: 11/233

1 INTRODUCTION

1.1 I am a consultant forensic scientist specialising in the investigation of fires, explosions and related matters. A summary of my qualifications and experience has been supplied. I have investigated and given expert evidence concerning numerous incidents having features in common with this matter.

1.2 I was instructed by the DTI Investigation Unit to assist in their investigation of an incident which occurred at Blakefield South mine on 5 January 2011. My terms of reference were to examine certain items recovered several months after the event when the mine was re-entered, to study the eyewitness statements and plans showing the exhibit locations, and to offer any relevant opinions which might assist in determination of the origin, cause and circumstances of the incident.

1.3 On 24 January 2012, I attended the Investigation Unit at Thornton and carried out a joint inspection of a heat-damaged Mimic chock controller, Exhibit 5. Also present were representatives of Xstrata Mining, the controller manufacturer and electronics specialists from DTI.

1.4 During my investigation, I took a total of 21 digital photographs, all of which were transferred in unmodified form to CD storage; copies are available on request. A selection of the images has been used to illustrate this report and may have been enhanced to improve clarity or provide composite views.

1.5 This report is based upon my observations of physical evidence and information to hand at the time of writing. Should any of this subsequently prove to be incorrect or incomplete, I may need to revise my findings and opinions.

2 DOCUMENT SCRUTINY

2.1 Documents provided were:

- Handwritten witness statement of [redacted]
- Records of Interview with [redacted] and [redacted]
- Plans and technical data
- Photographs of Exhibits 1 to 5, as described below

2.2 From the witness accounts and plans, there was a substantial overpressure event which produced a pressure wave moving across the face from the goaf area and/or Chock 158. Soon after this occurred, flames were seen immediately behind Chock 158. The area was then evacuated; at that time there was no fire progression across the face or into the remainder of the pit.

3 EXAMINATION OF EXHIBITS

3.1 Items 1-4 were received in sealed packages from Jennie Stewart of DTI and examined at our laboratory/workshop facility. The items were later returned to Ms Stewart. No destructive testing was carried out, the examinations being limited to visual and microscopic inspection under visible light. Photographs taken by DTI investigators during initial examination showed the samples adequately and no micrographs were required.

3.2 **Sample 1 – rope**

This was a section of rope or similar material with a helical-stranded natural fibre outer cover and a synthetic core, probably nylon. The natural fibre was partially charred but mainly scorched and intact. The core had melted and resolidified, becoming rigid. This indicated a loss of plasticisers, consistent with prolonged heating above the softening temperature but below the auto-ignition temperature.

3.3 In my opinion the maximum temperature reached was between approximately 150ºC and 300ºC. There was no visible directionality to the heat damage which could help orientate the initial flame front direction with respect to the sample.

3.4 **Sample 2 – hose**

The package contained three sections of double-walled rubber hose, thermally degraded and apparently pyrolsyed. The hose material was brittle and friable, with directional bubbling along approximately 1/3 of the circumference consistent with off-gassing of volatiles. Because the orientation of the hose remains was not recorded at the time of recovery, I could not associate this bubbling reliably with the location of a heat source.

3.5 **Sample 3 – batbag holder**

This item comprised parts of a softened and rehardened polymer assembly, containing more than one polymer. The appearance indicated that high density polypropylene was probably one of the components. As with sample 1, the rigid nature indicated a loss of plasticiser consistent with prolonged heating. There was no visible burning residue, which suggested that the plastic did not reach ignition temperature or it only did so in a low-oxygen environment (below about 11%).

3.6 **Sample 4 – wood**

The sample comprised sections of heavy gauge timber, evenly charred through but without distinctive surface burning. This appearance is similar to that of charcoal produced by traditional pyrolysis methods. In my opinion, the most probable explanation is that the wood was in a low-oxygen environment (less than about 8%) for a period of time exceeding 2-3 days. There were no directional indicators which could orientate the wood with respect to a heat source.

3.7 **Sample 5 - controller**

This was a plastic-bodied electronic interface device with a front keypad and the remains of a cable connection to the chock at the rear. My understanding is that each chock was fitted with a similar controller but this was the only one showing heat damage.

3.8 I was advised that the plastic casing was impregnated with metal particles as part of the electrical safety requirements, and that the unit operated on low voltage and current (approx. 12VDC and less than 100mA).

3.9 There was a gap along one edge where the controller appeared to have been broken away from a bracket or mounting. The clean edge showed that this occurred after the heating and I was further advised that the unit was broken away from its location on the chock by the recovery operators. Other than this, the casing remained intact with no heat penetration in either direction.

310 Initial inspection of the interior through this gap showed no heat, smoke or other internal damage to the electrical components. The unit was then cut open in the presence of interested parties.

3.11 This revealed no heat or smoke damage to the interior, no indications of dry solder joints, component failures or other localised heat sources.

3.12 In my opinion, the controller was damaged only by exposure to external heating at relatively low temperatures (probably under 300ºC).

Photo 1 – control unit showing keypad

Photo 2 – reverse side of control unit, showing cable entry

Photo 3 – broken edge with partial view of interior

Photo 4 – control unit opened, showing circuit boards

Photo 5 – closer view showing back of main processor board & connector to keypad board

Photo 6 – closer view showing back of keypad board

Photo 7 – keypad, membrane & circuit board separated

Photo 8 – internal wires detached during separation of boards

4 EVALUATION

4.1 Based upon the witness accounts and plans, I consider it probable that the overpressure event experienced near the face was caused by ignition of a methane-air mixture in the goaf area or between chock 158 and the cutting face.

4.2 The damage to samples 1-4 indicates that this initial flame front and pressure wave was followed by a period of prolonged low-temperature heating in a low oxygen atmosphere, after the mine evacuation. This would be consistent with combustion of the coal in an underground environment.

4.3 Sample 5, the chock controller, showed only external damage with no communication between the outer and inner surfaces. Internally there was nothing to indicate localised overheating or fault conditions capable of igniting a gas-air mixture.

4.4 However, the cable connections between the controller and the chock were not examined and I cannot eliminate a low-voltage arc between conductors or to earth as an ignition source. This would require some degree of damage to the cables, to expose one or more conductors, and possibly some abnormal movement to bring them together or in contact with an earthed surface. When full access to the face is possible, this possibility should be checked.

5 CONCLUSIONS

5.1 Samples 1-4 had been subjected to prolonged heat exposure in a low oxygen atmosphere, but gave no directional indication to the original ignition.

5.2 Sample 5 as seen was not a viable ignition source for a methane-air mixture, and in my view a malfunction of the controller did not cause this incident.

5.3 I cannot eliminate electrical initiation arising from the control cables because they have not been inspected.

End of report