**GROSVENOR MINE INQUIRY SUBMISSION Key Issue 4**

**2) The relative likelihood of the ignition source being frictional ignition, electrical fault, static electricity or PUR induced heating/spontaneous combustion.**

**FINDING**

**THERE IS LOW RELATIVE LIKELIHOOD OF IGNITION SOURCE BEING A PUR INDUCED HEATING/SPONTANEOUS COMBUSTION**

**References**

1. **WEST CLIIFF COLLIERY PUR FIRE (1986) INQUIRY REPORT**

[**http://mineaccidents.com.au/uploads/westcliff-incident-report-part-a.pdf**](http://mineaccidents.com.au/uploads/westcliff-incident-report-part-a.pdf)

1. **Experimental study on thermal effect and gas release laws of coal-polyurethane cooperative spontaneous combustion January 2021**

[**https://www.nature.com/articles/s41598-021-81537-5**](https://www.nature.com/articles/s41598-021-81537-5)

1. **ANGLO GROSVENOR LFI IN.00224943 Ignition of Gas LW104. Incident Date: 6 May 2020. Report Date: 5 June 2020**
2. **REFERENCE**
3. **IN.00226742 & IN.00228255 Withdrawal from Mine and Ignition of Gas LW104. Incident Date: 8 June 2020. Report Date: 24 January 2021**

**EVIDENCE**

1. **THERE IS ONLY ONE MENTION of ODOUR of “*SLIGHT SMELL of GROUND CONSOLIDATION PRODUCTS*” from the NIGHTSHIFT ERZC on 14th MAY.**
2. **“*SLIGHT SMELL of*** ***GROUND CONSOLIDATION PRODUCTS*” DETECTED and NOTED by ERZC on any STATUTORY REPORTS until GROSVENOR MINE EVACUATED on the 8th JUNE prior to the IGNITION on the 8th of JUNE.**
3. **THIS SINGLE REPORT of “*SLIGHT SMELL of GROUND CONSOLIDATION PRODUCTS*” WITHOUT ANY OTHER SUPPORTING DATA OF ANY SORT seemingly is the SOLE BASIS on which the THOERY ADVANCED by COUNSEL ASSISTING.**
4. ***A small intense PUR driven c*ombustion *spontaneous event within 5 or so metres of #96 Chock; (that no one detected prior to the event) suddenly flares to over the ignition temperature of methane from around 150C to over 540C in seconds.***
5. ***There is sufficient OXYGEN and METHANE for a METHANE IGNITION***
6. ***The PUR driven event after reaching 540 Degrees C now CEASES BURNING even though again reaching OXYGEN SUFFICIENT to SUPPORT a METHANE EXPLOSION, once the GOAF ATMOSPHERE REACHES a STEADY STATE***
7. ***The PUR driven Event after reaching 540 Degrees cools sufficiently quickly, that any coal it is in contact with does not catch on fire in the Oxygen Rich Zone***
8. **LW 104 FACE IGNITION 6th MAY 2020 and RSHQ DIRECTIVE PUT IN PLACE PREVENTING MINEWORKERS RE-ENTERING MINE.**

***“Directive issued by DNRME – no persons are to re-enter the UG workings until the UMM can demonstrate to an inspector of mines, that an acceptable level of risk has been achieved to permit re-entry to occur.”***

1. **NO CHANGES to VENTILATION UNDERGROUND Taken Between 6th and 10th of MAY.**
2. **NO SIGNS of SPONTANEOUS COMBUSTION to SATISFACTION of RSHQ on the 9th MAY.**

***New directive issued by DNRME – the SSE is to ensure that the area defined by a mine’s inspector as the accident site on Longwall 104 is isolated from all persons unless they are accompanied by a Mines Inspector.***

1. **10th MAY RE-ENTRY to GROSVENOR MINE in presence of DNRME (RSHQ) (as per risk assessment)**
2. **NO VISIBLE SIGNS of SPONTANEOUS COMBUSTION DETECTED by RSHQ INSPECTORS or GROSVENOR MANAGEMENT.**
3. **GROSVENOR MINE Spontaneous Combustion Management Team (SCMT) IS NOT FORMED UNTIL the 2nd JUNE 2020.**
4. **NO SIGNS of SMOKE between 14th MAY and 8th JUNE.**
5. **BURNING PUR at WEST CLIFF COLLIERY (1986) Ranged in Colour from BROWN to YELLOW to WHITE.**
6. **At WEST CLIFF COLLIERY the PUR was BURNING and PRODUCING YELLOWISH BROWN SMOKE within TWO HOURS and THIRTY MINUTES of PUR PUMPING being COMPLTETED. (8am to 10:30am) 12th December 1986**
7. **PUR FIRES DO NOT GO OUT BY THEMSELVES and REQUIRE EXTENSIVE FIRE FIGHTING EFFORTS TO EXTINGUISH. (WEST CLIFF).**
8. **OXYGEN LEVELS in the GOAF where PUR was PUMPED in the week prior to 6th MAY likely not LOW enough for a PUR FIRE if it EXISTED PRIOR to 6th MAY or at the 14th MAY ONWARDS to be EXTINGUISED and DISAPPEAR.**
9. **OXYGEN LEVELS in the GOAF where PUR was PUMPED in the week prior to 6th MAY likely high enough for a PUR FIRE if it EXISTED PRIOR to 6th MAY or at the 14th MAY ONWARDS to continue to SMOULDER.**
10. **NO MENTION IN ANY TECHNICAL REPORT INCLUDING MULLER SIMTARS of GC DETECTION of PRODUCTS of PUR COMBUSTION such as HYDROGEN CYANIDE,** **AMINES, ETHERS or POLYHYDRIC ALCOHOL.**

**PRODUCTS of PUR COMBUSTION**

**Experimental study on thermal effect and gas release laws of coal-polyurethane cooperative spontaneous combustion January 2021**

***Polyurethane is an organic polymer material that contains many additives. It is flammable but will not ignite spontaneously at room temperature. There are a lot of CO, CO2 and many toxic gases, such as CO and HCN, released during the combustion of polyurethane. Many scholars researched the mechanisms of pyrolysis and combustion and the flame retardancy modification of polyurethane.***

 ***Polyurethane begins to pyrolyse from 200 °C.***

***(A polyol is an organic compound containing multiple hydroxyl groups)***

***During its pyrolysis process, first, formate groups decompose into isocyanate segments and polyols.***

***Then, the polyols decompose into ethers and alcohols with increasing temperature.***

***From 300 to 500 °C, the residues decompose into amines, ethers, volatiles and CO2. Oxygen has a significant influence on the pyrolysis and combustion of polyurethane.***

***The distribution of the pyrolysis products of polyurethane is determined by temperature, and the primary and secondary pyrolysis products are generated by the breaking of urethane bonds and hydrogen conversion of polyhydric alcohol2***

**REFERENCE**

 **IN.00226742 & IN.00228255 Withdrawal from Mine and Ignition of Gas LW104. Incident Date: 8 June 2020. Report Date: 24 January 2021**

***14th May 2020***

***Observation on night shift ERZC report - “TG goaf stream had slight smell of ground consolidation products”.***

***Subsequent discussion with ERZC confirmed that “I noted it due to something that smelled different to a normal LW GOAF stream/return” and “it did not smell like it was burning or smell of heat”.***

***There were no further similar observations by the ERZC or other ERZCs on their reports thereafter. Of note, PUR was last pumped on 3rd May 2020.***

**ANGLO GROSVENOR LFI IN.00224943 Ignition of Gas LW104. Incident Date: 6 May 2020. Report Date: 5 June 2020**

***6.5 Spontaneous Combustion***

***Leading into the event on the 6th May 2020, no Spontaneous Combustion TARP was active and no additional actions beyond normal operating procedure were required. The below data was reviewed for the week prior and days post event as part of the re-entry risk assessment:***

* 1. ***Goaf Stream CO***
	2. ***Tailgate Roadway CO make***
	3. ***Tube bundle CO levels from goaf seals around LW perimeter***
	4. ***CO levels from goaf well***

***No TARP triggers or of-concern trending was identified from Carbon Monoxide levels analysed. See Figures 9-12 below for CO trends prior to and post ignition.***

***The investigation team considers at this time that spontaneous combustion was not an issue prior to the event and is unlikely to be a contributing factor to the ignition.***