

**SECOND HAZELWOOD MINE FIRE INQUIRY**

**ANGLESEAMINE CLOSURE - FIRE PROTECTION**

**RODINCOLL**

**21 July 2015**

# CONTENTS

<b>INTRODUCTION.....</b>	<b>1</b>
EXPERIENCE AND QUALIFICATIONS.....	1
MY INDEPENDENCE .....	2
BACKGROUND FACTS AND MATERIAL RELIED UPON .....	2
<b>PREAMBLE .....</b>	<b>2</b>
<b>THE SPECIFIC MANNER IN WHICH FIRE COULD ARISE FROM OR IMPACT ON THE ANGLESEA MINE AFTER 31 AUGUST 2015.....</b>	<b>7</b>
WHAT HAS CAUSED FIRES IN THE ANGLESEA MINE BEFORE 31 AUGUST 2015, AND HOW WILL MINE CLOSURE CHANGE THIS? .....	7
<i>Fire in the western coal face</i> .....	14
<i>Fire in coal following disturbance of overburden cover</i> .....	14
<i>Fire in mine vegetation</i> .....	15
THE SPECIFIC MANNER IN WHICH FIRE COULD IMPACT ON THE ANGLESEA MINE AFTER 31 AUGUST 2015. ....	18
<b>THE SUSTAINABILITY, PRACTICALITY AND EFFECTIVENESS OF THE MEASURES TAKEN AND PLANNED TO BE TAKEN BY THE MINE OPERATOR .....</b>	<b>24</b>
INTERNAL POLICIES AND PROCEDURES .....	24
STAFFING AND RESOURCES .....	25
WATER SUPPLY.....	25
RELATIONSHIPS WITH EXTERNAL AGENCIES SUCH AS THE CFA AND THE SURF COAST SHIRE COUNCIL .....	26
<i>COUNTRY FIRE AUTHORITY</i> .....	26
<i>SURF COAST SHIRE</i> .....	27
<i>OTHER DEPARTMENTS</i> .....	27
<i>COMMUNITY</i> .....	27
<i>COMPANY WEBSITE</i> .....	28

## **GAPS OR SHORTCOMINGS IN THE FRAMEWORK FOR MITIGATING THE RISK OF FIRE ..... 28**

CONTROL OF VEGETATION GROWTH WITHIN THE MINE.....	28
STABILITY OF OVERBURDEN AND MAINTENANCE OF SOIL DEPTH .....	28
ACCESS TRACK NETWORK .....	29
MINE FIRE ALERT.....	29
INFRARED SENSOR .....	29
TOTAL FIRE BAN AND INTERNAL PATROL .....	29
SELF SUFFICIENCY OF PERSONNEL.....	29
AVAILABILITY OF SENIOR MANAGERS.....	29
CATALYTIC CONVERTERS ON VEHICLES .....	29
THREAD COMPATIBILITY.....	29
PUBLIC INFORMATION .....	30
STATUTORY RESPONSIBILITY.....	30

## **MEASURES THAT COULD BE TAKEN TO ADDRESS ANY IDENTIFIED GAPS OR SHORTCOMINGS ..... 30**

CONTROL OF VEGETATION GROWTH WITHIN THE MINE.....	30
STABILITY OF OVERBURDEN AND MAINTENANCE OF SOIL DEPTH .....	30
ACCESS TRACK NETWORK .....	30
MINE FIRE ALERT.....	31
INFRARED SENSOR .....	31
TOTAL FIRE BAN AND INTERNAL PATROL .....	31
SELF SUFFICIENCY OF PERSONNEL.....	31
AVAILABILITY OF SENIOR MANAGERS.....	31
CATALYTIC CONVERTERS ON VEHICLES .....	32
THREAD COMPATIBILITY.....	32
PUBLIC INFORMATION .....	32
STATUTORY RESPONSIBILITY.....	32

## **APPENDIX ONE-RESUME ..... 34**

## **APPENDIX TWO-EXPERT WITNESS CODE OF CONDUCT..... 39**

## **APPENDIX THREE - LETTER OF INSTRUCTION..... 40**

## **APPENDIX FOUR - DOCUMENTS SUPPLIED ..... 43**

**SECOND HAZELWOOD MINE FIRE INQUIRY**  
**ANGLESEA MINE CLOSURE - FIRE PROTECTION**  
**REPORT OF RODERIC INCOLL**

## **INTRODUCTION**

1. This report covers four issues as follows<sup>1</sup>.
2. The specific manner in which fire could arise from or impact on the Anglesea mine after 31 August 2015.
3. The sustainability, practicality and effectiveness of the measures taken and planned to be taken by the mine operator to mitigate the risk of fire arising from or impacting the Anglesea mine following its closure, including its internal policies and procedures, staffing and resources, and its relationships with external agencies such as the CFA and the Surf Coast Shire Council.
4. Whether there are any gaps or shortcomings in the existing framework for mitigating the risk of fire arising from or impacting the Anglesea mine following its closure that should be addressed.
5. The measures that could be taken to address any identified gaps or shortcomings and the sustainability, practicality and effectiveness of these measures.

### **Experience and qualifications**

6. My work experience in natural resource management, fire management and control and service management commenced in 1960 when I started work as a forester with the Forests Commission, Victoria. I continued this work in other Victorian locations and gained expertise in forest fire control and management. In 1971/72 I established and managed the Forests Commission's fire training section.
7. During 1984 - 1989 I worked for the State Electricity Commission Victoria and managed the shift fire service, drafting, surveying and forestry service delivery to SECV Latrobe Valley departments.

---

<sup>1</sup> Request dated 23 June 2015 from Second Hazelwood Mine Inquiry, (Appendix Three)

8. I provided advice to the General Manager Production on the protection of Latrobe Valley assets from bushfires and wrote the Policy for the Protection of SECV Latrobe Valley Assets from Rural Fire. I became interested in other fields of fire protection and completed the preliminary Certificate of the Institute of Fire Engineers (UK) to further this.
9. From 1990 to 1996 I was employed as Chief Fire Officer by predecessors of the Department of Environment, Land, Water and Planning (DELWP). Since 1996 I have provided services for a range of corporate and private clients as a fire advisor. (Resume: Appendix One).
10. My qualifications are:
  - Bachelor of Arts in Social Science, Monash (1994)
  - Graduate Diploma of Business, Monash (1987)
  - Diploma of Forestry, Victoria, (1983)
  - Diploma of Forestry, Creswick, (1959)
  - Preliminary Certificate of the Institute of Fire Engineers UK (1973).

### My independence

11. I have had no commercial or other alliance with other parties to the second Hazelwood Mine Fire Inquiry.
12. My opinion is independently provided and non-partisan as required by the Code of Conduct (Appendix Two).

### Background facts and material relied upon

13. I have relied upon the documents provided by the Hazelwood Mine Fire Inquiry for the background facts. These are listed in Appendix Four.
14. I have carried out research within the public domain for other relevant information and have identified the source when this was used.

## PREAMBLE

### Comparing the fire risk at Hazelwood and Anglesea mines

15. Concerns have been aired about the fire risk from the Anglesea Mine, by individuals at the Anglesea Community Forums (28 June 2015) and a range of community groups in media statements. It is inevitable that comparisons have been drawn between the Anglesea and Hazelwood coal mines.

16. The data shown in Table One has been assembled to assist this comparison and set a baseline for the relative fire risk between the mines, to assist in determining the measures necessary at Anglesea after mine closure.
17. Hazelwood and Anglesea and open cut brown coal mines are of similar maximum depth. However Hazelwood open cut (Figure One) operates on a much larger scale, producing some 16.5 million tonnes/year of coal compared to 1.1 million tonnes/year at Anglesea (Figure Two).

LINE	FEATURE	ANGLESEA	HAZELWOOD
1	AREA OF OPEN CUT	127 ha	1,165 ha
2	PERIMETER OF OPEN CUT	5.3 km	18 km
3	DEPTH OF OPEN CUT	50-100 m	90-110 m
4	OVERBURDEN THICKNESS	Up to 80m	10-20m
5	COAL SEAM THICKNESS	27m (average)	100 -200m
6	COAL PRODUCTION	1.1 Mt/y	17.5 Mt/y
7	COAL MOISTURE CONTENT	45%	60%
8	MINING COMMENCED	1969 (46 years)	1955 (61 years)

Table One: Anglesea and Hazelwood Mines compared

18. Mining commenced at Hazelwood in 1955, fourteen years before mining began at Anglesea, and has covered nine times the area and has six times the perimeter of the Anglesea operation as can be seen from the images.
19. A significant difference between the mines is the "coal to overburden" ratio, that is, the amount of topsoil, sand, clay and other non-coal material that must be removed to expose the coal seam for mining.
20. At Anglesea, up to 80 metres of overburden must be removed to mine the coal, compared to 10-20 metres at Hazelwood. This results in a relative abundance of coal-free backfill for rehabilitation at Anglesea, while at Hazelwood this material is in short supply and must be transported long distances.
21. The coal seam averages 27 metres depth at Anglesea compared to 100 -200 metres at Hazelwood. The difference in seam thickness means that while coal can be removed and the void backfilled with overburden at Anglesea (Figure Four), a different approach must be used at Hazelwood.



Figure One: A section of Hazelwood Mine from south to north. Morwell in distance at right.<sup>2</sup>



Figure Two: Anglesea Coal Mine: east to west<sup>3</sup>

22. The current operations perimeter of approximately 5.3 km for the Anglesea mine is shown in Figure Three; the current coal operations area is approximately 127 ha.

---

<sup>2</sup> Photo: R. Incoll 2014

<sup>3</sup> photograph of Stuart McEvoy, Newspix





Figure Three: Perimeter of the current operations area of the Anglesea Mine (yellow line).<sup>4</sup>



Figure Four: Showing progressive rehabilitation at Anglesea as mining moves forward<sup>5</sup>

<sup>4</sup> Google Earth image



23. Hazelwood coal operations commenced at East Field in 1955. The northern extent of the open cut was a "cliff of coal", comprising exposed coal batters extending some one hundred metres from just below surface level to the mine floor via a series of slopes and benches. As mining moved on, this slope, known as the Northern Batters, was not rehabilitated.
24. An extensive coal fire was ignited in this location by wind-borne embers during the bushfires of 9 February 2014, and the whole of the Northern Batters caught fire (Figure Five). Large volumes of ash and fumes were carried upslope into the residential area of Morwell which was in places less than 300 metres distant.



Figure Five: Northern Batters fire in middle distance. Lights of Morwell in background at right <sup>6</sup>

25. In contrast with Hazelwood, at no time was there such a tall "cliff of coal" in the Anglesea mine, let alone adjacent to Anglesea township. Simply put, a fire of this nature could never have occurred at the Anglesea mine, and the circumstances that led to the inundation of Morwell by smoke and fumes could not have occurred at Anglesea.

---

<sup>5</sup> Google Earth image

<sup>6</sup> Image from Witness Statement of D. Steley to first Hazelwood Inquiry

26. This conclusion is supported by the circumstances of Ash Wednesday, 16 February 1983, when a high intensity bushfire swept through Anglesea and the mine precinct, destroying 132 buildings in the township. Ember showers inundated the mine operations area, starting numerous spot fires on the coal. Once the main fire front had passed through, the mine operator was able to control the fires with conventional mining equipment, with no residual or ongoing issues experienced for the mine or the community<sup>7</sup>.

## **THE SPECIFIC MANNER IN WHICH FIRE COULD ARISE FROM OR IMPACT ON THE ANGLESEA MINE AFTER 31 AUGUST 2015.**

What has caused fires in the Anglesea mine before 31 August 2015, and how will mine closure change this?

27. The value of coal lies in its ability to burn and produce heat. Coal is a reactive material that interacts with oxygen when exposed to the air<sup>8</sup>. Because of the need to ensure that burning occurs only when this is intended, stringent fire precautions are necessary to prevent ignition during coal mining operations.
28. The main causes of ignition of fires at open cut coal mines may be grouped into the following categories:
- Mechanical or electrical faults in machinery or infrastructure;
  - Natural causes, e.g., lightning strike, embers from bushfires or fuel reduction burns;
  - Human agency, e.g., smoking, careless work practices, deliberate lighting;
  - Flare up of a pre-existing geological hot spot
  - Spontaneous combustion.
29. The record of fires suppressed at the Anglesea mine shows a low incidence of machinery fires and "nil" infrastructure fires. In the nine year period 2000-2008, twenty fires were recorded as occurring on coal mining plant. None of these fires spread to coal<sup>9</sup>.

---

<sup>7</sup> Statement of Christopher John Rolland

<sup>8</sup> Statement of David Cliff to first Hazelwood Inquiry

<sup>9</sup> Source: A "Collation of Relevant Records" from the Alcoa Incident Database

30. As previously reported, bushfire embers started multiple fires on the coalfield during the Ash Wednesday bushfire of 16 February 1983, which were extinguished by the mine operator without fire spread or damage using conventional mining plant.
31. A controlled burn on adjacent public land escaped control and spread to the mine fence in March 2008. This was a relatively intense fire, as aircraft were deployed to control it. While the power station output was reduced in case a shutdown was needed<sup>10</sup>, no incident report was created for a mine fire.
32. The mine operator has a no smoking policy for the mine that is strictly enforced.
33. Geological hot spots have ignited during open cut mining of brown coal as evidenced by the 2008 fire on the Southern Batters at Hazelwood coal mine. This fire originated in a hot spot that first broke out in 2005<sup>11</sup>.
34. While inert fire-holes, or pockets of coal burnt in times long past have been uncovered and dug out while mining at Anglesea, these have not been the source of mine fire reports or subsequent issues over 46 years of mining<sup>12</sup>.
35. Anglesea coal is older and harder than Morwell coal<sup>13</sup> and has a greater heating value. The coal has comparatively less moisture and contains less volatile hydrocarbons. This results in a lower tendency for spontaneous combustion.<sup>14</sup>
36. For example, the power station emergency coal reserve has been stacked in the open as shown in Figure Six for many years without combustion incidents. This coal will be used in production prior to closure<sup>15</sup>.
37. Spontaneous combustion initiates in powdered and disturbed coal especially when it forms windrows, as for example along road verges. Loose heaped coal is also susceptible to spontaneous combustion<sup>16</sup>. Anglesea has experienced 6-12 spontaneous combustion events a year mainly in this class of material<sup>17</sup>.

---

<sup>10</sup> Herald Sun report of 3 March 2008

<sup>11</sup> Statement of Robert Ronald Dugan to first Hazelwood Inquiry (p.3).

<sup>12</sup> Pers. comm. Mr. C Rolland during mine visit 29 June 15

<sup>13</sup> Holdgate et al, *Geology of coal-bearing Palaeogene sediments, on-shore Torquay Basin* Victoria, Australian Journal of Earth Sciences 2001, 48, p663.

<sup>14</sup> Statement of Christopher John Rolland

<sup>15</sup> Pers. comm. Mr C Rolland during mine visit 29 June 15.

<sup>16</sup> Standard Work Instruction, Management of Hot Coal and Fires

<sup>17</sup> Fire Planning Meeting Minutes 13 May 2014.



Figure Six: The emergency coal stockpile has been stored outdoors for many years without incident

38. The progressive stages of spontaneous combustion of Anglesea coal are described as "steamy coal", "blue smoke/odour coal", and "open/visible flame coal". Heat haze visible from steamy coal and any associated odour indicate that spontaneous combustion is developing. Prompt action is then taken to prevent further heat development.
39. Spontaneous combustion also occurs in failed or cracked strata between coal blocks. This creates fissures that allow the entry of oxygen and subsequent coal heating. This has happened at Anglesea three times, in the late 1990's, and in 2003 and 2014. These incidents led to visible flame events that were rapidly extinguished with conventional earthmoving equipment<sup>18</sup>.
40. The evidence shows that there has been a low incidence of fires associated with coal mining at Anglesea over more than 46 years of operation. Fires were caused by faults in mining plant and vehicles; coal igniting spontaneously; or external bushfire.
41. All mine fires on this site have been controlled by the workforce. Fires did not move outside mine boundaries, albeit that air pollution was noticed in the township during at least one of the open-visible flame incidents<sup>19</sup>.

<sup>18</sup> Statement of Christopher John Rolland

<sup>19</sup> EPA news report 2 June 2014 <http://www.epa.vic.gov.au/>





Figure Seven: Exposed coal zone in the Operations Area in 2014 within the yellow polygon<sup>20</sup>

42. Exposed coal in the mine covers approximately 42 ha (Figure Seven). This does not include the coal haul roads, another 4-6 ha.
43. Recognising the potential risk of fire, the mine operator indicated that all horizontal coal (i.e., the mine floor) would be covered with approximately one metre of overburden by 31 August 2015.
44. A section of the west wall approximately 850 metres long and 5-15 metres high will not be covered, as access to overburden for this work is limited by the proximity of the Cultural Heritage Management Plan Boundary<sup>21</sup>.
45. Portion of the west wall is shown in Figure Eight<sup>22</sup>
46. The mine operator intends that the west face will be covered in 2017/18 as part of the longer term rehabilitation process<sup>23</sup>.

<sup>20</sup> Google Earth image

<sup>21</sup> Warren Sharp - Supplementary Witness Statement

<sup>22</sup> Image recorded on 17 July 15.

<sup>23</sup> Warren Sharp - Supplementary Witness Statement para 13 p.2



Figure Eight: The coal face on the western wall of the mine will not be covered with overburden

The specific manner in which fire could arise *from* the Anglesea mine after 31 August 2015 can now be addressed.

47. How could a fire start in the mine after the 31 August 2015?
48. Table Two shows the 20 year statistics 1976-1996 for fire causation in Victorian public lands from the 2004 Year Book Australia<sup>24</sup>. This is similar to more recent data that is not available for citation.
49. Table 2 shows that the main cause of vegetation fires on public land is lightning strike. This started 26% of fires on public land.
50. By comparison with the public estate, the Anglesea coal mine is a small area with no high objects in its landscape. No lightning caused fires have been recorded in 46 years of operation. On this basis a fire started by lightning is assessed as a "rare" event (*very unlikely to occur*<sup>25</sup>).

<sup>24</sup> 2004 Year Book Australia, Australian Bureau of Statistics p.666

<sup>25</sup> In the context of the Aust/NZ Standard for Risk Management 4360/2004 (ISO 30001/2009) (Similar references in paras 61 - 70)



<b>CAUSES OF BUSHFIRES IN VICTORIA</b>		
Fire cause	Average no. of fires each year no.	Proportion of total fires %
Lightning	149	26
Deliberate	145	25
Agricultural	96	16
Campfires	59	10
Cigarettes/matches	41	7
Cause unknown(a)	37	6
Miscellaneous(b)	26	5
Machinery/exhausts	15	3
Prescribed burn escapes(c)	9	2
Public utilities(d)	7	1
<b>Total(e)</b>	<b>584</b>	<b>100</b>

Table Two: Causes of fires on public land in Victoria, 20 years to 1996<sup>26</sup>.

51. The potential for fires caused by electrical or mechanical faults igniting coal dust on plant and vehicles will cease at the completion of mining operations.
52. There will be less activity, and fewer vehicles and plant items on site after the completion of the overburden spreading project.
53. The mine operator has undertaken to maintain a twenty four hour /seven day security service for monitoring the Anglesea operations for the immediate future<sup>27</sup> to, amongst other things, limit unauthorised access to the site.
54. While cigarettes and matches caused 7% of public land fires, a strict no-smoking rule applies to the mine and this will be continued after closure.
55. The incidence of fires in well maintained plant and vehicles is low, and accounted for only 3% of fires on public land over 20 years (included in a broader category "machinery and exhaust" fires, Table Two).

<sup>26</sup> 2004 Year Book Australia Australian Bureau of Statistics p.666

<sup>27</sup> Statement of Warren Steven Sharp

56. In view of the changes in the nature and intensity the of work that will be carried out on the site after closure, the risk of a fire in a vehicle or plant item is estimated at "unlikely" (*not impossible, more likely not to occur than to occur*), until the commencement of further rehabilitation.
57. Deliberate lighting was responsible for 25% of public land fires during the relevant period. While malfeasance cannot be excluded, acts of arson by individuals who can be readily indentified as in this instance are likely to be "rare"(*very unlikely to occur*).
58. While the rationale for a deliberate ignition on the western wall following covert entry is difficult to imagine, this could be achieved and cannot be ruled out. This is also classed as a "rare" event (*very unlikely to occur*).
59. On the other hand, fires due to human carelessness can never be ruled out, as evidenced by the litany of destructive fires started by individuals (for example) using tools like angle grinders to cut steel, or carry out arc welding in the open on fire danger days.
60. This class of activity is regulated by a Hot Work Permit issued by a manager or supervisor at the Anglesea coal mine. Hot work includes activities like cutting, welding and grinding, which give rise to heat and generate sparks. The Hot Work Permit requires the operator to take steps to manage sparks from hot work including wetting down the area, locating fire suppression equipment on the job site, and conducting hot work checks after job completion<sup>28</sup>. This procedure will remain after 31 August 2015.<sup>29</sup>
61. The frequency of heat-generating activities like hot work in the open will decline if not cease with the shut-down of coal mining.
62. The risk of fires starting through non-observance of permit conditions is considered "unlikely" (*not impossible, more likely not to occur than occur*).
63. The incidence of fires due to spontaneous combustion would be further reduced by covering of the mine floor prior to mine closure.
64. So while fire causing agencies will be reduced after 31 August, it is still possible that fires could be started within the mine by vehicles or mechanical plant, carelessness during maintenance work, and non-observance of non-smoking or no-fire lighting rules, or spontaneous combustion.

---

<sup>28</sup> Statement of Christopher John Rolland

<sup>29</sup> Warren Sharp Supplementary Witness Statement

65. If one of these fire causing events did start a fire, what would burn? How serious would the fire be?
66. Once the horizontal coal surface has been covered, a fire could arise in:
- exposed coal on the western wall of the mine;
  - coal exposed when overburden cover is disturbed;
  - vegetation within the mine boundary.

### **Fire in the western coal face**

67. Sections of the western face have been exposed for 28 years without any spontaneous combustion events<sup>30</sup>.
68. The mine operator intends to implement a system of daily checks of the west wall to identify "steamy coal" events (explained in para. 38). Should such an event occur, the necessary machinery and operators will be on site 24/7 and available for corrective action.
69. The probability of a coal fire occurring in the western coal face is assessed as "rare" (*very unlikely to occur*); the consequences of such an event would be "insignificant" (*less than \$0.25 million*). Any ignition should be detected and extinguished at an early development stage with minimal loss or damage.

### **Fire in coal following disturbance of overburden cover**

70. The mine floor is sloped and irregular. The overburden cover could become eroded by heavy rain and the subsequent water flow, or be otherwise dislodged or shifted, potentially allowing a coal-air reaction to commence<sup>31</sup>.
71. The probability of a coal fire following disturbance of the overburden cover is assessed as "unlikely" (*not impossible, more likely not to occur than to occur*) and the consequences of such an event would be "insignificant" (*less than \$0.25 million*) should it occur given that it is quickly detected and corrected.
72. The impact of a coal fire arising in the Anglesea mine after 31 August 2015 is illustrated in Table Three in terms of likelihood and consequences.
73. Notwithstanding the worst case assessment for the risk of a coal fire in the mine after closure is "unlikely", the risk will only be reduced to zero when the all coal is covered with a stable layer of earth that has been revegetated.

<sup>30</sup> Warren Sharp Supplementary Witness Statement para 13

<sup>31</sup> Warren Sharp Supplementary Witness Statement, Technical Review by Mining One 5.5.1 para 2

LIKELIHOOD OF FIRE	CONSEQUENCES				
	INSIGNIFICANT	MINOR	MODERATE	MAJOR	CATASTROPHIC
ALMOST CERTAIN					
LIKELY					
POSSIBLE					
UNLIKELY	<b>2</b>				
RARE	<b>1</b>				

**1 = fire in coal on western wall; 2 = fire in coal where covering material has been disturbed**

Table Three: Likelihood and consequences of a coal fire in the Anglesea Mine after 31 August 2015

### Fire in mine vegetation

74. How much vegetation will be present in the mine after 31 August 2015?



Figure Eight: Fuel types within Anglesea coal mine precinct after spreading of overburden

75. Minimal vegetation will be present on the floor of the coal mine and the coal haul road, after coal clean up and topping with overburden has been completed. This area, plus the bare areas previously spread with topsoil but not replanted, are included in the notional polygon shown in Figure Eight.
76. Other vegetative fuel within the Anglesea mine precinct is visible in this diagram. The developing heath vegetation in rehabilitation areas A and B south of the coal haul alignment have a fully developed (if immature) floristic structure and would sustain a fire on a hot, dry, windy day.
77. This risk is offset to some degree by the newly spread overburden, and the bare soil areas visible in area C to the south, which would offer opportunities to control fire spread from area A and B under all but severe fire weather conditions.
78. It is noted that the heath vegetation regrowth in Area D south and east of the ash pond in the power station precinct could sustain a fire during fire danger weather. The heath vegetation situated within the mine boundary in area E was not physically assessed but from the Google Earth image, appears not to have been fuel reduced.
79. Whether a bushfire in vegetation above buried coal could heat the soil sufficiently to raise the coal to combustion temperature is answered in Figure 9, which shows that the surface heat generated by bushfires in heath and forest vegetation is dissipated less than 75mm below the surface<sup>32</sup>. So there is zero chance of coal ignition by a bushfire at a depth of one metre.
80. The overall fuel hazard of the vegetative fuels in the Anglesea coal mine is less than is present around the mine boundary.
81. The impact of a fire arising in vegetation in the Anglesea mine after 31 August 2015 is illustrated in Table Four in terms of likelihood and consequences, and is described as follows.
82. The probability of a vegetation fire occurring during extreme fire weather and destroying a vehicle, plant item, property, or causing environmental damage is assessed as "unlikely" (*not impossible, more likely not to occur than to occur*); the consequences of such an event could be "moderate" (\$1-5 million).
83. The probability of a vegetation fire occurring on the mine site other than during extreme fire weather is assessed as "rare" (*very unlikely to occur*); the consequences of such an event would be "insignificant" (less than \$0.25 million). Scrub fires would be quickly suppressed with minimal loss or damage under normal weather conditions.

---

<sup>32</sup> McKenzie, Neil, *Impacts of fire on soil*, CSIRO Land and Water, Canberra

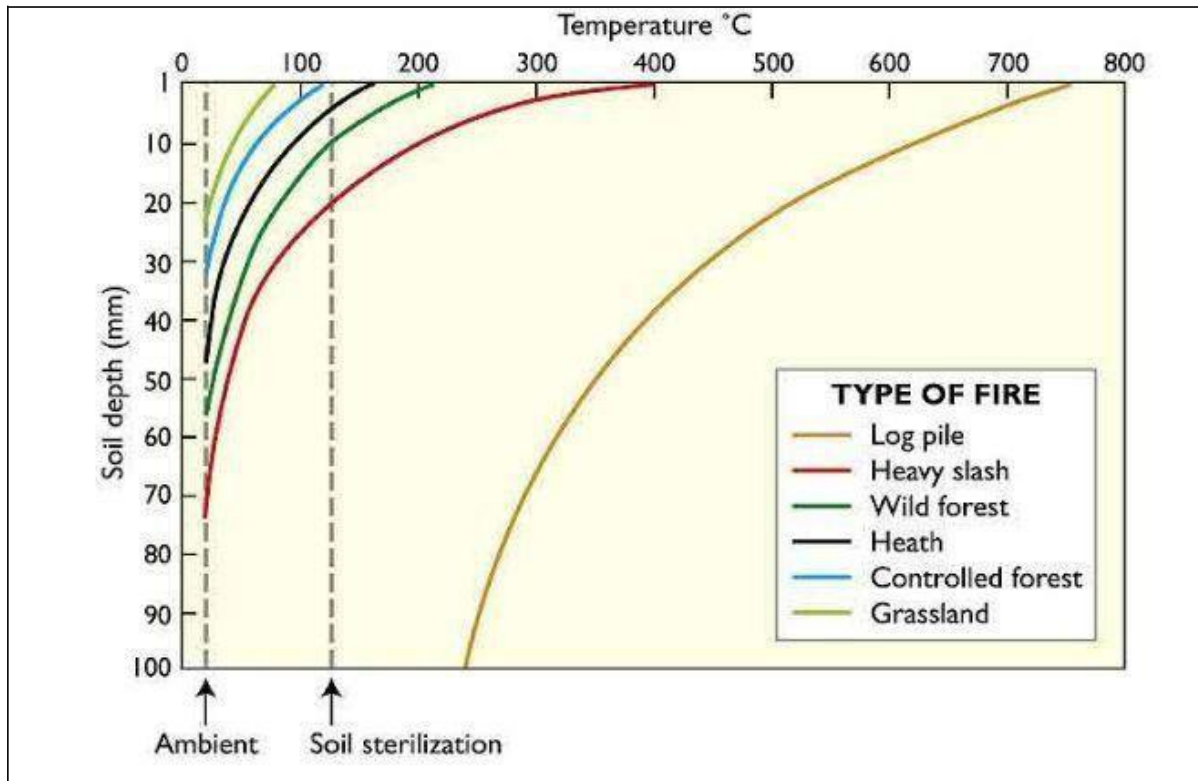


Figure 9: Temperature change with soil depth for a range of surface fire loads<sup>33</sup>

LIKELIHOOD OF FIRE	CONSEQUENCES				
	INSIGNIFICANT	MINOR	MODERATE	MAJOR	CATASTROPHIC
ALMOST CERTAIN					
LIKELY					
POSSIBLE					
UNLIKELY			<b>1</b>		
RARE	<b>2</b>				

**1 = fire impact during extreme fire weather 2 = fire impact during other than extreme fire weather;**

Table Four: Likelihood and consequences of a vegetation fire in the Anglesea Mine after 31 August 2015

<sup>33</sup> McKenzie, Neil, *Impacts of fire on soil*, CSIRO Land and Water, Canberra



The specific manner in which fire could impact *on* the Anglesea mine after 31 August 2015.

84. How could a fire impact on the Anglesea mine after 31 August 2015?
85. Anglesea township is surrounded on three sides by extensive native vegetation comprising heathlands, grassy-heathy dry forest and coastal scrub. It has a hot dry summer and has been the setting for a number of destructive bushfires.
86. What is the previous history of bushfires affecting Anglesea and the mine?

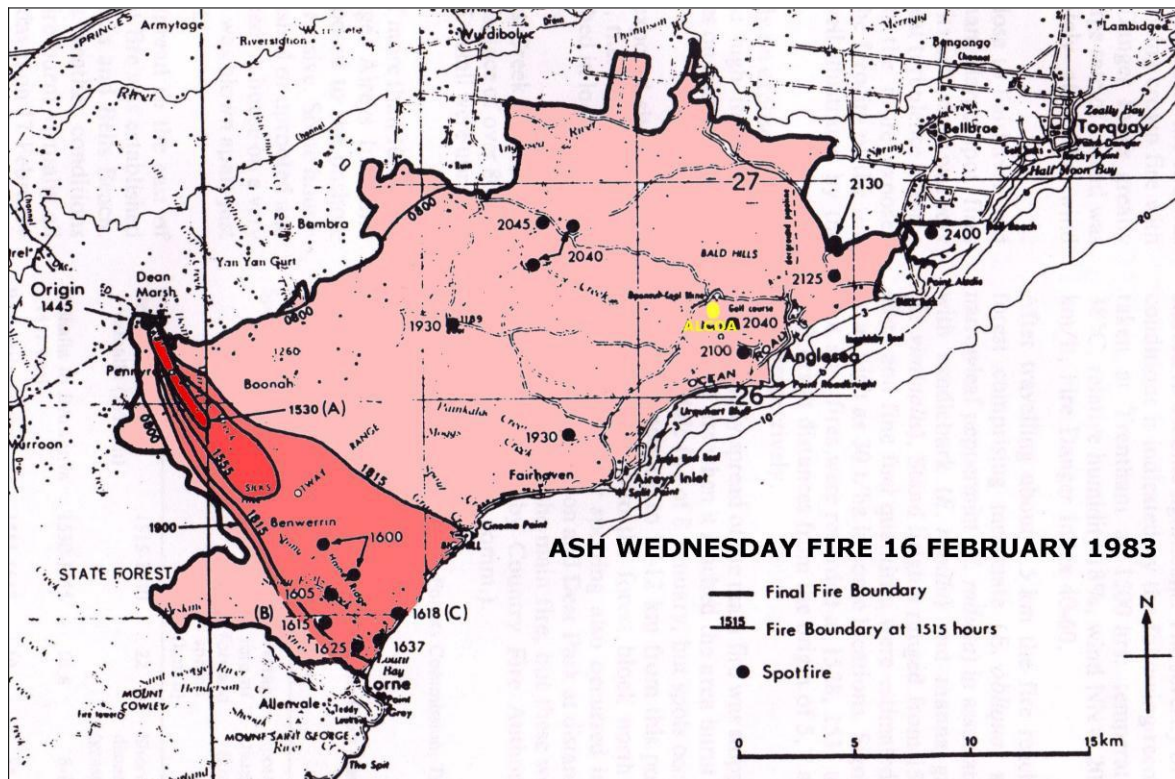


Figure 10: The "Deans Marsh fire" of Ash Wednesday, 16 February 1983<sup>34</sup>

87. In 1947 a fire swept through central Anglesea; in 1966 fourteen houses were lost; in 1982 the camping ground was burnt. On 16 February 1983, the "Ash Wednesday" bushfire burnt 18km from Deans Marsh in the grasslands to the coast at Lorne in less than two hours.

<sup>34</sup> Figure 10 is based on diagram from Rawson, Billing, & Duncan, *The 1982-83 forest fires in Victoria*, Australian Forestry 1983, 46 (3) 163-172.

88. Following a south west wind change about 1830 hrs (6.30 pm), the fire swept along the coast beyond Anglesea. Three lives were lost and 782 buildings, including 132 in Anglesea, were destroyed. The mine site was directly impacted by this fire.
89. The Ash Wednesday bushfire is not the worst case scenario for the mine site or Anglesea. A fire starting in the grasslands north west of the Otway Range during "Code Red" weather conditions and burning directly towards the town through the heathland would create an impact greater than that experienced on Ash Wednesday.
90. The impact for a worst case scenario is indicated by Figure 11. Buildings would be entirely destroyed and human life seriously endangered. All vegetation would be consumed leaving only charred tree trunks protruding from powdered soil and ash. Such a fire would sweep unhindered through the mine and on to the township.

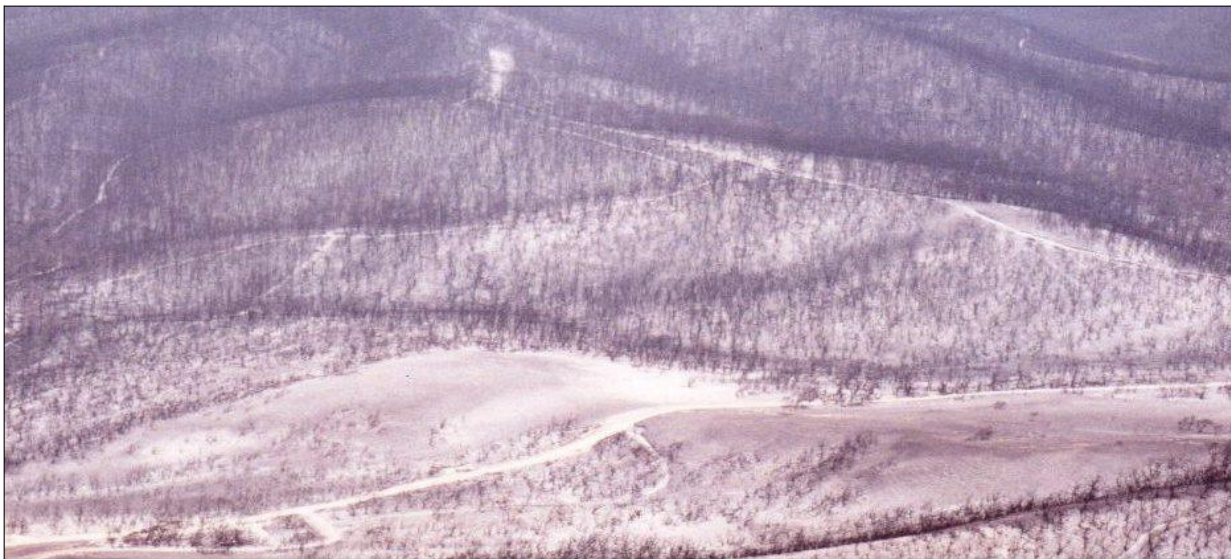


Figure 11: Dry forest burnt on Otway coast line during the Deans Marsh fire on Ash Wednesday<sup>35</sup>

91. Extreme fire danger days are characterised by elevated temperatures, low humidities, low fuel moisture content and strong north to north west winds. A bushfire starting under these conditions cannot be suppressed, and runs rapidly in a south east direction. Following the progress of a cold front, the eastern flank of the fire expands significantly to the north east, driven by the strong south westerly wind that accompanies the change. This is the way the Ash Wednesday fire developed in 1983, as can be seen in Figure 10.

---

<sup>35</sup> collection R Incoll

92. There is a pattern of fire ignitions taking place at random time intervals throughout every day. When one of these events coincides with Extreme to Code Red fire danger weather, a high intensity fire develops. Such fires cannot be controlled because their energy levels exceed the capability of fire suppression technology, often by many orders of magnitude.
93. Low intensity prescribed burning carried out during mild weather reduces the amount of fuel available to bushfires, resulting in fires with lower energy levels and slower rates of spread. The loose fibrous material that contributes to ember production is also reduced (see Figure 14). This is significant, as embers carried ahead of the fire front by fire winds or convection can markedly increase the rate of spread of forest fires.
94. The Department of Environment, Water, Land and Planning (DEWLP) is responsible for fire prevention and suppression on public land and conducts an annual program of prescribed burning.
95. The Department's Strategic Bushfire Management Plan for the Barwon Otway Bushfire Risk Landscape says that Anglesea heath vegetation is "highly treatable" and that parts of it are regularly burnt to reduce the risk to Anglesea, which it states is "one of the State's most at risk towns<sup>36</sup>".
96. The Department claims that planned burning "has reduced the risk of bushfires impacting on the Anglesea power station by 60% and reduced the risk to the coal mine by 30%", using PHOENIX Rapidfire computer simulations. The reason for the difference in risk reduction between the power station and the mine was not explained.
97. The Department claims that the burning it has carried out has resulted in a downgrading of Anglesea's risk of catastrophic bushfires from high to moderate, and that the simulations indicate that by 2050 there can be up to a further 10% reduction in the risk to Anglesea, compared with the risk had there been no planned burning.
98. Even if the assumptions underlying PHOENIX Rapidfire are valid, the predicted outcome to 2050 depends on eleven future State Governments providing the necessary policy commitment and funding support. Nevertheless, prescribed burning carried out in the Anglesea heathland over several decades has provided significant protection for the town and will continue to do so.
99. The description of the Anglesea heath as being "highly treatable" refers to the fact that this ecosystem is fire tolerant and regenerates well after burning.

---

<sup>36</sup> Barwon-Otway Strategic Management Plan 2014 p.22 (online).



100. The recent prescribed burning and bushfires of immediate value to mine protection is identified in Figure 12.

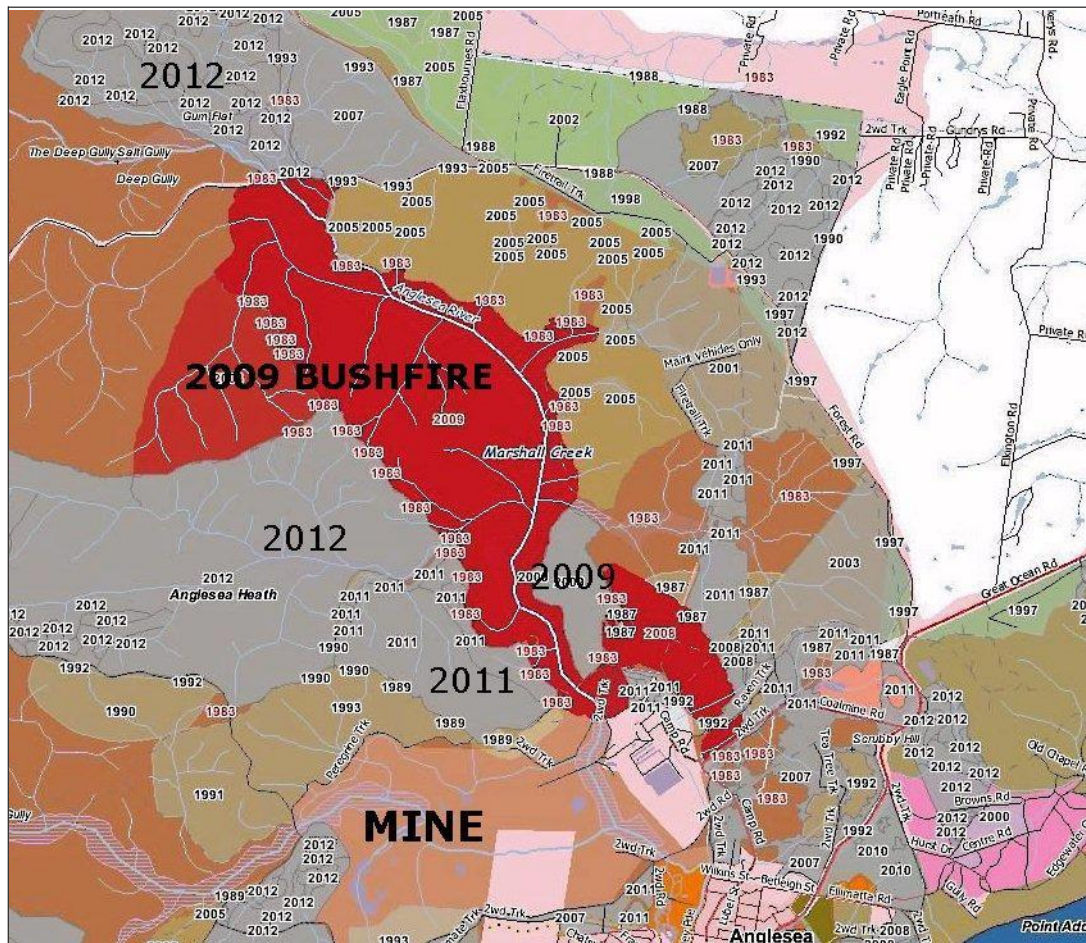


Figure 12: Recent DELWP prescribed burning in the vicinity of Anglesea coal mine<sup>37</sup>

101. Reduced spring rainfall and the possible early onset of the 2015/16 fire danger period has been forecast due to the presence of an "El Nino" event.
102. Even so a worst case scenario bushfire as described in para. 91 is unlikely to be experienced in the 2015/16 fire danger period, due to the age and extent of the prescribed burning shown in Figure 12.
103. In view of this, the likelihood of a high intensity bushfire impacting the mine during the 2015/16 fire season is considered to be rare ("*unlikely to occur*").
104. The consequences of such an event within the mine site could be "moderate" (\$1-5 million) subject to the impact on rehabilitation works, vehicles, plant and personnel on site at the time.

<sup>37</sup> Base map: DELWP Forest Explorer 5 online





Figure 13: "Extreme" overall fire hazard, 300m east of Anglesea power station



Figure 14: "Moderate" overall fire hazard, fuel reduced heath north east of mine<sup>38</sup>

---

<sup>38</sup> Images recorded 17 July 2015

105. A bushfire in local vegetation could spread into the mine site during the 2015/16 fire season. Since only one local fire, an escape from DELWP prescribed burning in March 2008, has been recorded in 46 years this is considered to be "unlikely" (*not impossible, more likely not to occur than occur*).
106. Should this happen, the consequences are estimated at the same as in the event of 1 March 2008, "insignificant" (costs below \$250,000).

LIKELIHOOD OF FIRE	CONSEQUENCES				
	INSIGNIFICANT	MINOR	MODERATE	MAJOR	CATASTROPHIC
ALMOST CERTAIN					
LIKELY					
POSSIBLE					
UNLIKELY	<b>2</b>				
RARE		<b>1</b>			

**1 = fire impact by high intensity fire; 2 = fire impact by local bushfire**

Table Four: Likelihood and consequences of a fire impact on the Anglesea Mine after 31 August

107. The analysis of fire risk on the mine site after 31 August 2015 has indicated that at the worst case, a fire outbreak in coal or vegetation at the mine after shutdown is "unlikely", and should an incident occur, any risk of fire spread beyond the mine is insignificant.



## THE SUSTAINABILITY, PRACTICALITY AND EFFECTIVENESS OF THE MEASURES TAKEN AND PLANNED TO BE TAKEN BY THE MINE OPERATOR

*The sustainability, practicality and effectiveness of the measures taken and planned to be taken by the mine operator to mitigate the risk of fire arising from or impacting the Anglesea mine following its closure, including its internal policies and procedures, staffing and resources, and its relationships with external agencies such as the CFA and the Surf Coast Shire Council, are considered as follows.*

### Internal policies and procedures

108. The Anglesea mine will be managed from the mine operator's Point Henry office after operations cease on 31 August 2015. The present mine manager will become the Anglesea asset manager, working from Point Henry, thus ensuring continuity of management and accountability.
109. A series of commitments has been made by the mine operator. These are reflected in the Supplementary Witness Statement of Warren Sharp dated 14 July 2015.
110. This statement indicates that plans and procedures are currently being reviewed and updated to suit the changed conditions at the mine. This will ensure fire prevention, protection, mitigation and response plans are in place prior to 31 August 2015.
111. Plans and procedures being reviewed include the Emergency Response Plan, the Hot Coal Safe Work Instruction, and the CFA Pre- Incident Plan.
112. A regime of daily inspections is to be introduced to detect potential issues or events as early as possible.
113. From an emergency management viewpoint, these arrangements follow a rational path and appear to be both sustainable and practical. As to their effectiveness, the sole comment is that the contribution an experienced senior manager makes in an emergency was highlighted by less than effective management when senior managers were not available in the early stages of the Hazelwood mine fire. This should be borne in mind when planning incident response at Anglesea.

## Staffing and resources

114. The Company states that it will have the resources required to provide appropriate site and fire management knowledge in place at the Anglesea mine following cessation of operations. This is essential as mining operations personnel require a high level of site specific knowledge and expertise.
115. The Company will retain control over the site by employing a 24 hour, 7 days a week contracted security service. The Company has undertaken to ensure these personnel have appropriate training for fire identification, fire fighting and emergency responses. This includes control of site entry.
116. The equipment the mine operator currently uses to mitigate fires in the mine will be retained for fire mitigation. This comprises one excavator, one wheeled dozer and one 60,000 litre water cart. The equipment will be located on site. An appropriate maintenance and testing regime will be implemented for this equipment.
117. Contract resources with appropriate response times for a mine incident are to be engaged to operate the equipment, and will be in place by 31 August 2015. It was expected that these measures will remain in place until long term rehabilitation commences.
118. Use of contract resources in this situation is sustainable and practical. Whether it is effective raises the issue of the competence of contract plant operators in an open cut mining environment. This issue needs to be resolved within the Company's Occupational Health and Safety structure.

## Water supply

119. The following water supply will be available for fire fighting over the 2015/2016 summer period:
- the mine fire service dam (30 megalitres)
  - the town water supply tank (80 kilolitres)
  - ash pond No. 2 (170 megalitres)
120. The CFA's view was that this water supply was adequate. The process for accessing the water is to be further developed, including provision of appropriate connecting points.

121. Whether this water can be used effectively raises the recurring saga of thread compatibility between fire services, that emerged yet again at the Hazelwood coal mine fire.

## Relationships with external agencies such as the CFA and the Surf Coast Shire Council

### **COUNTRY FIRE AUTHORITY**

122. The Country Fire Authority (CFA) is the statutory authority with fire prevention and suppression responsibility for Anglesea, while the Department of Environment, Lands, Water and Planning (DELWP) is responsible for fire prevention and suppression on public lands abutting the town.
123. The Mines (Aluminum Agreement) Act 1961 removed the leased area occupied by the Company from (then) State Forest, and hence from the fire protection responsibility of the (present) DELWP. While enjoying excellent relations with the CFA Anglesea Fire Brigade (and the DELWP), and having established a Pre-Incident Plan with the brigade, the Company has been self sufficient for fire prevention and suppression for the 46 years of its operation.
124. The CFA has a Pre-Incident Plan for back-up in the event of a major incident that details the working relationship with the Company, and has input into the Site Emergency Response Plan.
125. A process to review the Emergency Response Plan and the Pre-Incident Plan was discussed with the CFA on 8 July 2015. It was agreed that Alcoa and the CFA would conduct a joint review of the updated plans on 3 August 2015.
126. A site visit by Anglesea CFA would take place after this review for re-familiarisation, and to review the changed arrangements that will be in place after 31 August 2015.
127. It is expected that all the detailed issues, arrangements, and procedures will be resolved in the review of the Emergency Plan and the Pre-Incident Plan.
128. The cooperation evident between the Company and the Anglesea Fire Brigade has been at the practical, local level and will produce sustainable outcomes that are effective.

## **SURF COAST SHIRE**

129. The Surf Coast Shire convened a Fire Planning Meeting between the Company, the Shire, and the CFA on 13 May at which plans for fire protection post closure were tabled and discussed. The Shire has also kept in touch with the closure process through attendance at a range of other departmental and community meetings.
130. Emergency arrangements for the Anglesea mine are not included in the Surf Coast Council Municipal Emergency Management Plan 2014-2017.

## **OTHER DEPARTMENTS**

131. The Company has provided updates on the current shutdown status and future fire risk mitigation and response strategies to a series of meetings including representatives from the Department of Economic Development, Jobs, Transport and Resources, the Department of Environment, Lands, Water and Planning, the Environment Protection Authority, and Worksafe Victoria.
132. According to the Supplementary Statement of Warren Sharp, no significant concerns were raised about fire management at the mine or the overburden strategy.
133. The company also attended a Surf Coast Mine Task Force meeting facilitated by Emergency Management Victoria, which included the Country Fire Authority, Victorian WorkCover Authority, Environment Protection Authority, Department of Economic Development, Jobs, Transport and Resources, Department of Premier and Cabinet and the Surf Coast Shire. The minutes of this meeting are not yet available.

## **COMMUNITY**

134. On 18 May 2015 the Company held a Community Consultation Network meeting at the Anglesea Senior Citizens Club. The meeting was held to communicate the closure announcement to the community, and provide an opportunity for the community to raise concerns. During this meeting the fire risk was raised by a number of individuals. A subsequent meeting was held on Monday 13 July; the minutes are not yet available.
135. The mine operator was represented at Anglesea Community Consultation meetings hosted by the Hazelwood Coal Mine Fire Inquiry on 28 June 2015. This provided insight into a range of community concerns including fire risk, and fire management of the mine.

## COMPANY WEBSITE

136. The Company website is a resource many individuals would consult for current details of the mine closure. There are recent postings (May 12, announcing the closure, and July 13, providing the 2011 closure plan for 2061), however neither of these postings would answer the concerns of the individuals at the Community meetings on 28 June 2015.
137. The extent and nature of the mine operator's attendance at meetings to provide details of the shutdown of mining operations at Anglesea mine has met the expectations of stakeholders like government agencies and the Anglesea Fire Brigade. Several attendees at the Anglesea Community Consultation meetings hosted by the Hazelwood Coal Mine Fire Inquiry on 28 June 2015 were emphatic that the availability of information about the mine closure did not meet their needs.

## GAPS OR SHORTCOMINGS IN THE FRAMEWORK FOR MITIGATING THE RISK OF FIRE

*Whether there are any gaps or shortcomings in the existing framework for mitigating the risk of fire arising from or impacting the Anglesea mine following its closure that should be addressed.*

### Control of vegetation growth within the mine

195. Germination of residual and wind-borne seed is possible on the newly spread overburden areas during the spring and early summer of 2015.

### Stability of overburden and maintenance of soil depth

196. Grades and irregularities in the newly filled mine surface may channel runoff and cause soil erosion after heavy rain. This could uncover coal in some areas.

### Access track network

197. The existing track network may not serve the needs of fire patrol on the overburden fill areas.

### Mine Fire Alert

198. The probability of coal heating and vegetation fire spread increases as the temperature and surface wind rises and the relative humidity falls.

### Infrared sensor

199. Heated coal areas may develop undetected.

### Total Fire Ban and Internal Patrol

200. The probability of a fire incident rises on a declared total fire ban day.

### Self sufficiency of personnel

201. An incident is most likely to occur when bushfires are burning elsewhere, so the Anglesea Fire Brigade will be fully committed and unable to attend to an incident the mine.

### Availability of senior managers

202. Experienced senior managers may not be available on Total Fire Ban days when fire development is most likely.

### Catalytic converters on vehicles

203. Even though the coal floor has been covered with fresh earth, vehicles fitted with catalytic converters may start vegetation fires in other areas.

### Thread compatibility

204. Hose thread compatibility issues have been experienced by CFA Brigades when assisting other parties.



## Public information

205. Individuals from the Anglesea Community have raised issues about access to current information on the mine closure process.

## Statutory responsibility

206. The issue of statutory responsibility for fire protection of the site following the withdrawal of the Company needs to be resolved

## **MEASURES THAT COULD BE TAKEN TO ADDRESS ANY IDENTIFIED GAPS OR SHORTCOMINGS**

*The measures that could be taken to address any identified gaps or shortcomings and the sustainability, practicality and effectiveness of these measures.*

### Control of vegetation growth within the mine

196. Germination of residual and wind-borne seed is possible on the newly spread overburden areas during the spring and early summer of 2015.
197. Growth should be monitored and reduced to regulation height before the 2015/16 fire danger period if necessary.

### Stability of overburden and maintenance of soil depth

198. Grades and irregularities in the newly filled mine surface may channel runoff and cause soil erosion after heavy rain. This could uncover coal in some areas.
199. Inspection of all fill over coal and remediation of soil erosion should be carried out after rainfall.

### Access track network

200. The existing track network may not serve the needs of fire patrol on the overburden fill areas.
201. The track network should be reviewed in terms of the pit locations and track constructed as indicated.

### Mine Fire Alert

- 206. The probability of coal heating and vegetation fire spread increases as the temperature and surface wind rises and the relative humidity falls.
- 207. Suitable weather parameters and a set of appropriate responses should be set up as a local mine fire alert and monitored on site.

### Infrared sensor

- 208. Heated coal areas may develop undetected.
- 209. Details of GDF Suez's experience with hand held infrared heat detection should be sought.

### Total Fire Ban and Internal Patrol

- 210. The probability of a fire incident rises on a declared total fire ban day.
- 211. The level of patrol activity should be set higher for a Total Fire Ban Day.

### Self sufficiency of personnel

- 212. An incident is most likely to occur at the mine when bushfires are burning elsewhere, in which case the CFA will be fully committed and unable to attend to an incident the mine.
- 213. Additional Company personnel should be on standby on extreme fire danger days to turn out to the mine if required.

### Availability of senior managers

- 214. Experienced senior managers may not be available on Total Fire Ban days when fire development is most probable.
- 215. Managers should be rostered for availability on Total Fire Ban days.

### Catalytic converters on vehicles

- 216. Even though the coal floor has been covered with fresh earth, vehicles fitted with catalytic converters may start vegetation fires in other areas.
- 217. Vehicles fitted with catalytic converters should be excluded from the mine site.

### Thread compatibility

- 218. Hose thread compatibility issues have been experienced by CFA Brigades when assisting other parties.
- 219. Hose thread compatibility with mine water points must be verified prior to the fire danger period.

### Public information

- 220. Individuals from the Anglesea Community have raised issues about access to current information on the mine closure process.
- 221. To enhance the Company's reputation in the community a public information strategy should be drawn up and implemented.

### Statutory responsibility

- 222. The issue of statutory responsibility for fire protection of the site following the withdrawal of the Company needs to be resolved.
- 223. Clarification of statutory responsibility for fire protection needs to be included in the final rehabilitation plan.