



# **Energy Australia Yallourn**

## Yallourn Mine Fire Risk Assessment

July 2015



This "Fire Risk Assessment" (Report) has been prepared by GHD Pty Ltd (GHD) for Energy Australia Yallourn under the "Services Umbrella Agreement" (dated 16/07/2010) and the associated Supplementary Agreement for this project (dated 22 June 2015, PO #153215272). The Supplementary Agreement, and relevant sections in this report, provide a list of the information relied upon in preparing this report, and any limitations/assumptions made. This report may only be used or relied upon by:

- Energy Australia Yallourn and its related bodies corporate; or
- Any third parties engaged by Energy Australia Yallourn or any of its related bodies corporate in respect of activities the subject of such engagement.

# Executive summary

The Department of Economic Development, Jobs, Transport and Resources (DEDJTR) issued a new mine licence, Condition 1A – Risk Management on 7 May 2015, which requires Energy Australia Yallourn (EAY) to undertake a risk assessment and prepare a risk assessment, management plan and implementation plan for submission to DEDJTR by 31 August 2015.

The new mine licence condition required EAY to conduct a risk assessment for the work done, or proposed to be done under approved mine licence work plan. The risk assessment process was to assess the current level of risk to public safety and the environment associated with fire, geotechnical and environmental related hazards.

Condition 1A requires that where the assessed level of current risk is greater than “medium” then additional controls must be identified so as to reduce the current level of risk to an acceptable level. Condition 1A requires an implementation plan is developed and submitted to DEDJTR by 31 August 2015, which provides the necessary details of the additional controls identified and the program for their development and implementation.

This report provides details of the risk assessment completed for fire. Separate risk assessment reports have been produced to document the findings of the risk assessment processes for geotechnical and environment.

In summary, the fire risk assessment process consisted of two facilitated risk assessment workshops. The first risk workshop was completed on 18 June 2015 and was attended by EAY personnel and representatives from EAY’s Alliance partners from the mine and emergency services. The second risk workshop was held on 2 July 2015 and was also attended by EAY personnel and their Alliance partners and also subject matter experts from the CFA and Latrobe City Council.

Risks were ranked using the principle of ‘Maximum Reasonable Consequence’ (MRC) and so realistic worst case scenario outcomes were considered. This principle is a conservative approach to risk assessment, and encourages detailed consideration of controls suitable for MRC and also lesser outcomes.

The purpose of the fire risk workshops was to identify and quantify the risks to public safety and the environment associated with the operation of the mine as described within the mine licence approved work plan. Where the current level of risk is assessed as being greater than “medium” then additional controls were to be identified to reduce the current level of risk to an acceptable level.

Within the scope of the risk assessment, the fire risk assessment was separated into five areas of the mine licence area, so as to facilitate a structured approach to the risk assessment process. The areas considered were:

1. The working area of the mine;
2. The worked out areas of the mine;
3. Where associated mining operations (monitoring and access) take place;
4. Where work is still to be done (approved in work plan but not yet carried out); and
5. Perimeter area of the mine.

Within each of the site areas, various fire hazard causes were discussed, including the following:

- Off-site ignition source (e.g. approaching bushfire or airborne ember resulting from: arson, lightning, train brake sparks, train boiler, vehicle crashes, industry fires, farmers, households, powerline sparks, timber plantation activities, Government burn offs).
- On-site environmental ignition (e.g. lightning, tornado, earthquake).
- On-site mining ignition (e.g. plant / friction / hot work / fuel).
- On-site non-mining ignition (e.g. electricity infrastructure / transmission lines failure or malfunction).
- Deliberate (e.g. internal and external arson, trespass).
- Other cause (spontaneous combustion, underground fire, hot spots).

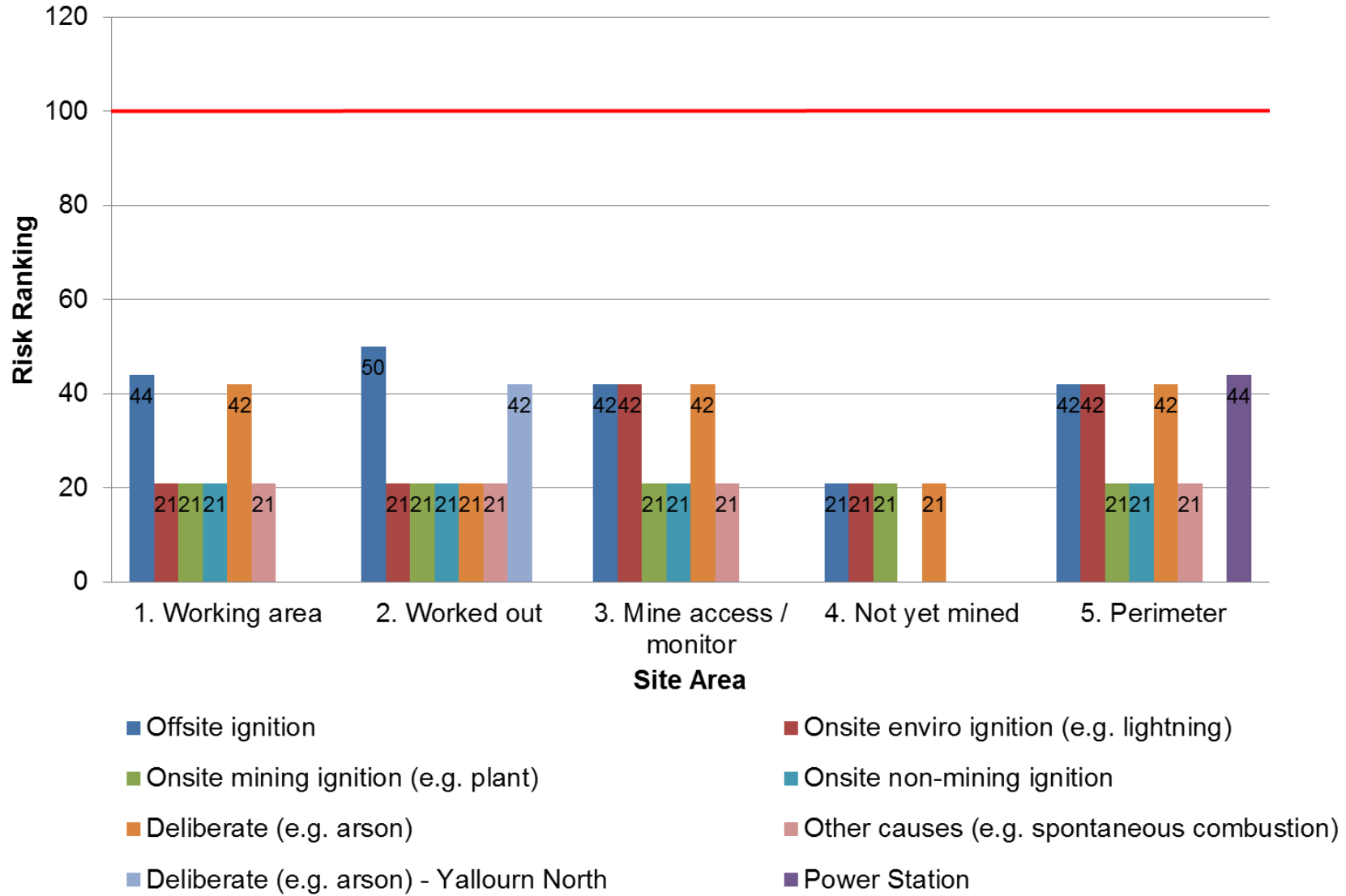
Public health impacts, including chronic long-term health effects (physiological and psychological trauma), were recognised during the risk assessments but not assessed due to the lack of information that will ultimately be provided through an epidemiology study from Monash Health (see Appendix C) . However, public safety implications associated with fire, e.g. smoke across road, were assessed.

A generic risk assessment of a major fire event involving the Latrobe Valley coal mines, which included the three mine operators and external agencies was conducted in April 2015. The intention was that this generic risk assessment would support site specific risk assessments in compiling their overall fire risk management plan. As part of the generic mine fire risk assessment, bowtie diagrams were generated for each mine site as an outcome of the risk assessment. Refer to Appendix B for the Yallourn bowties generated. Refer to the GHD report titled: “Energy Australia Yallourn, GDF Suez Hazelwood, AGL Loy Yang, Latrobe Valley Mine Fire, Risk Assessment, Workshop Summary report, June 2015 – GHD Reference: 31/27070/15/242732 from the generic mine fire risk assessment.

A summary of the current risk ranking results from the fire risk assessment is shown in Figure 1.

The risk assessment process determined that the current level of risk for all scenarios is below the DEDJTR Condition 1A threshold of “medium” which corresponds to a risk score of “99” in the EAY’s Yallourn Mine Alliance risk assessment procedure and associated risk ranking scheme – refer to Appendix G. Therefore the risk assessment concluded that no additional controls are required to reduce the current level of risk to an acceptable level.

**Figure 1 Current Fire Risk Ranking Summary**



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# 1. Introduction

## 1.1 Project Overview

The Department of Economic Development, Jobs, Transport & Resources (DEDJTR) introduced a new mine licence condition 1A – Risk Management of Mining Licence 5003 (MIN5003) via a memorandum dated 7 May 2015.

The Mining Licence Condition 1A requires Energy Australia Yallourn to conduct a risk assessment and prepare a risk assessment, management plan and implementation plan for submission to DEDJTR by 31 August 2015.

DEDJTR's Condition 1A requires that the risk assessment consider the risks to public safety and the environment, associated with:

1. Geotechnical hazards (including ground stability, earthquake and flood);
2. Fire; and
3. Environmental (including noise, dust, etc.).

In accordance with Condition 1A, the risk assessment considered the risks associated with work completed under the mine licence approved work plan, associated with:

1. The working area of the mine;
2. The worked out areas of the mine;
3. Where associated mining operations (monitoring and access) take place;
4. Where work is still to be done (approved in work plan but not yet carried out); and
5. Perimeter area of the mine.

This report covers the fire risk assessment component only. Separate risk assessments have been completed to address the risks to public safety and the environment associated with geotechnical and the environment and the findings of these risks assessments have been reported separately.

This risk assessment process for fire, considered the risks to public safety and the environment for:

- A fire that started within the mine and breaking out of the mine licence area, into the adjacent community; and
- An external fire entering the mine licence area.

The risk assessment process for fire also considered the controls for the prevention, mitigation and suppression of a fire, irrespective of the source of the fire.

The existing EAY site layout, AusNet Services electrical assets, and the risk areas considered during the risk assessment are shown in Appendix A.

To assist in responding to DEDJTR's Condition 1A – Risk Management, in conjunction with GDF Suez Hazelwood and AGL Loy Yang, Energy Australia Yallourn engaged GHD to conduct two facilitated risk workshops to consider the risks associated with a generic fire in a mine.

The first workshop which was held on 2 April 2015 considered the various risks and controls, whilst the second risk workshop held on 17 April 2015 completed a further review of the risks and controls including quantifying the risks, to finalise the generic risk assessment.

For the first workshop held on 2 April 2015, the following representatives from external agencies attended the workshop:

- Mr Duncan Pendrigh – Director, DEDJTR Earth Resources Regulation; and
- Ms Anne Bignell – District Operations Manager for Gippsland, DEDJTR Earth Resources Regulation.

For the second workshop held on 17 April 2015, the following representatives from external agencies attended the workshop:

- Mr Peter Schmidt – Director, Emergency Management Taskforce;
- Ms Anne Bignell – District Operations Manager for Gippsland, DEDJTR Earth Resources Regulation;
- Messrs Bill Johnstone – Operations Manager, CFA;
- Shane Mynard – Operations Officer, CFA; and
- Peter Lockwood – Operations Officer, CFA.

The findings of the risk assessment were recorded in GHD report titled:

Energy Australia Yallourn

GDF Suez Hazelwood

AGL Loy Yang

Latrobe Valley Mine Fire

Risk Assessment

Workshop Summary Report

June 2015

GHD Ref: 31/27070/15/242732

A key objective of the generic mine fire risk assessment process was that it would support site specific risk assessment processes. The generic risk assessment process also developed bow tie diagrams for each mine as part of the risk assessment process. Refer to Appendix B of this report for the Energy Australia Yallourn bowties generated.

The key learnings resulting from the generic fire risk assessment process were adopted in the Yallourn Mine fire risk assessment process.

## **1.2 Scope**

As discussed above under Section 1.1 – Project Overview, the scope of work was to conduct a fire risk assessment to assess the risk to public safety and the environment associated with the work done or proposed to be done under the Mine Licence approved work plan.

In accordance with DEDJTR's Condition 1A – Risk management, where the current level of risk is assessed as being greater than “medium” (equivalent to “99” in the YMA Risk Assessment process) then the risk assessment process was to identify those additional controls necessary to reduce the current level of risk to an “acceptable” level.

The risk assessment process involved subject matter experts in the risk assessment process and also in fire prevention, mitigation and suppression, as required by Condition 1A – Risk Management.

### 1.3 Purpose of this Report

The purpose of this report is to document the risk assessment methodology used to conduct the risk assessment and to also record the findings of the risk assessment.

### 1.4 Scope and Limitations

As discussed above under Section 1.1 – Project Overview, to comply with the Condition 1A – Risk Management, the risk assessment considered the risks to the environment and public safety as a result of the operation of the mine. The risk assessment considered the work performed under the mine licence approved work plan, within the following areas of the mine:

1. The working area of the mine;
2. The worked out areas of the mine;
3. Where associated mining operations (monitoring and access) take place;
4. Where work is still to be done (approved in work plan but not yet carried out); and
5. Perimeter area of the mine.

The fire risk assessment process considered the controls for the prevention, mitigation and suppression of the fire, irrespective of the source and location of a fire.

Within each of the site areas, various fire hazard causes were discussed, including the following:

- Off-site ignition source (e.g. approaching bushfire or airborne ember resulting from: arson, lightning, train brake sparks, train boiler, vehicle crashes, industry fires, farmers, households, powerline sparks, timber plantation activities, Government burn offs).
- On-site environmental ignition (e.g. lightning, tornado, earthquake).
- On-site mining ignition (e.g. plant / friction / hot work / fuel).
- On-site non-mining ignition (e.g. electricity infrastructure / transmission lines failure or malfunction).
- Deliberate (e.g. internal and external arson, trespass).
- Other cause (spontaneous combustion, underground fire, hot spots).

Public health impacts, including chronic long-term health effects (physiological and psychological trauma), were recognised during the risk assessments but not assessed due to the lack of information that will ultimately be provided through an epidemiology study from Monash Health.

Refer to Appendix C for supporting evidence on long-term health risk assessment data, not yet available. However, public safety implications associated with fire, e.g. smoke across road, were considered during the assessments.

Appendix D provides a copy of the following EPA documents:

- Publication 1600, June 2015 titled: “Hazelwood Recovery Program – Water, Soil and Ash Assessment – Morwell and Surrounds – February 2014 – May 2015; and
- Publication 1601, June 2015 titled: “Hazelwood Recovery Program – Air Quality Assessment – Morwell and Surrounds – February 2014 – May 2015.

EAY provided GHD with the above mentioned EPA reports which based on review appear to reflect no long term environmental risks resulting from the Hazelwood mine fire. The reports also suggest that the short terms risks were also limited.

## 2. Methodology

### 2.1 Workshop Approach

The risk assessment process comprised the following five key phases:

**Phase 1** – Pre-planning and preparation works, including the development of a fire control matrix (refer to Appendix E) which identified the existing fire risk controls for the various scenarios to be considered in the risk assessment process, including those controls relevant to prevention, mitigation and suppression for both an off-site initiated fire, or an on-site (mine) initiated fire.

The fire risk register was pre-populated prior to the first risk assessment workshop, based on the fire control matrix.

**Phase 2** – The first risk assessment workshop was held on 18 June 2015, which comprised EAY personnel and representatives from EAY's Alliance contractors including the mine and emergency services, to complete the initial risk assessment. The workshop attendees represented a range of disciplines and included personnel from management, engineering, emergency services and operations.

The risk workshop attendees were considered to comprise sufficient disciplines, knowledge and experience to enable the workshop to be an effective forum for both the identification and quantification of the risks. While the facilitator provided guidance, the workshop process is one of consensus and hence the outcomes of the workshop are the product of the whole group.

The first workshop involved reviewing and updating the fire risk register, in preparation for the workshop with external agencies.

This first risk assessment workshop identified that some additional information was required from various agency groups. Questions for the agencies were determined during the first workshop in preparation for the second workshop and letters were prepared.

**Phase 3** – Letters sent to various agency groups seeking additional information in relation to their procedures and processes for the management of fire (refer to Appendix F). Responses were received from some of these agency groups.

**Phase 4** – The second risk assessment workshop which was held on 2 July 2015 which comprised EAY personnel and representatives from EAY's Alliance contractors including the mine and emergency services. This second risk assessment workshop was also attended by subject matter experts from the CFA and also Latrobe City Council.

The second risk assessment workshop involved:

- A risk review of the scenarios, consequences and risk rankings undertaken on 18 June 2015 (first workshop), and update as appropriate;
- Each agency outlined their emergency response protocols;
- Review with agencies additional controls; and
- Review smoke and ash pathways for additional controls.

**Phase 5** – Preparation and issue of the risk assessment report.

The risk assessment process was conducted using the Yallourn Mine Alliance (YMA) Risk Assessment Procedure: YMA-OPS-PR-0313 and the YMA Risk Assessment Template: YMA-OPS-FO-0312.

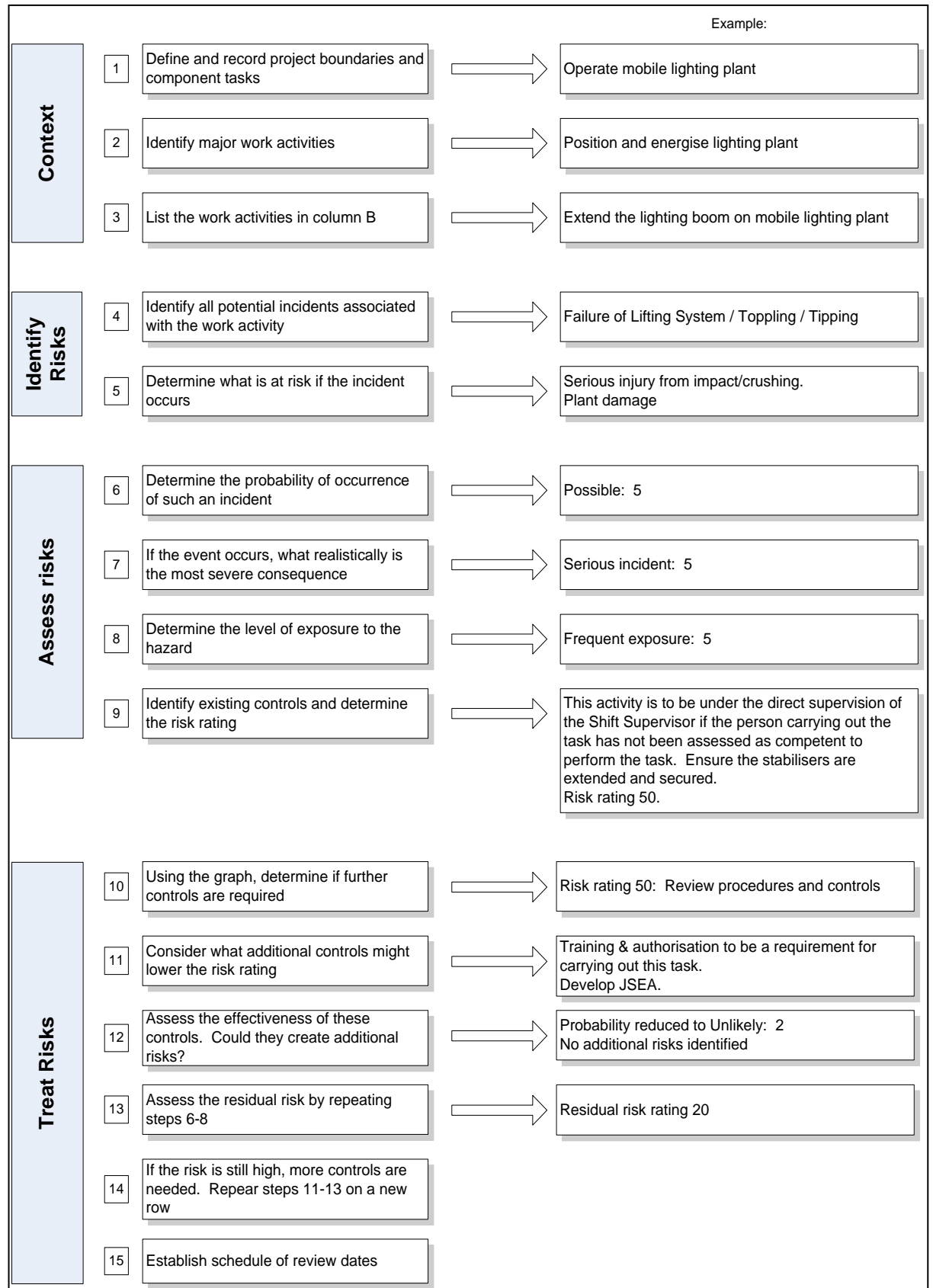
The risk assessment methodology adopted YMA's risk ranking scheme. These steps are presented in a process flow chart provided in Figure 2.

A standardised scheme for measuring risk thresholds was adopted from the YMA Internal Procedure for Risk Assessment. This scheme is shown in Appendix G.

The purpose of the risk assessment was to identify hazards associated with particular activities and tasks, so that appropriate control measures can be implemented to enable risks associated with the work to be kept as low as reasonably practicable.

Risks were ranked using the principle of 'Maximum Reasonable Consequence' (MRC) and so realistic worst case scenario outcomes were considered. This principle is a conservative approach to risk assessment, and encourages detailed consideration of controls suitable for MRC and also lesser outcomes.

**Figure 2 Process Flow Chart**



## 2.2 Recording of Findings

The findings were recorded during the workshop using the MS Excel spreadsheet provided by YMA. The risk assessment findings are attached in Appendix H.

## **2.3 Workshop Attendees**

As discussed in this report, the fire risk assessment process consisted of two facilitated risk assessment workshops.

The first risk assessment workshop was held on 18 June 2015 and comprised Energy Australia Yallourn personnel and representatives from their Alliance contractors including the Yallourn Mine Alliance (YMA) and the Emergency Services provider.

The second risk assessment workshop was held on 2 July 2015 and comprised similar Energy Australia Yallourn personnel and Alliance contractors who attended the first risk assessment workshop, and agency groups comprising representatives from the CFA and Latrobe City.

Both risk workshops included a GHD facilitator and co-facilitator.

A list of the attendees and their roles can be found in Appendix I.

Appendix J provides a copy of the CVs for the GHD facilitators and co-facilitator.

### 3. Findings

A summary of the current risk ranking results from the fire risk assessment is shown in Figure 3. The current risk assessment rankings for the various scenarios were all below the DEDJTR Condition 1A risk score of “medium” and also the Yallourn Mine Alliance’s (YMA) risk score threshold of “99”.

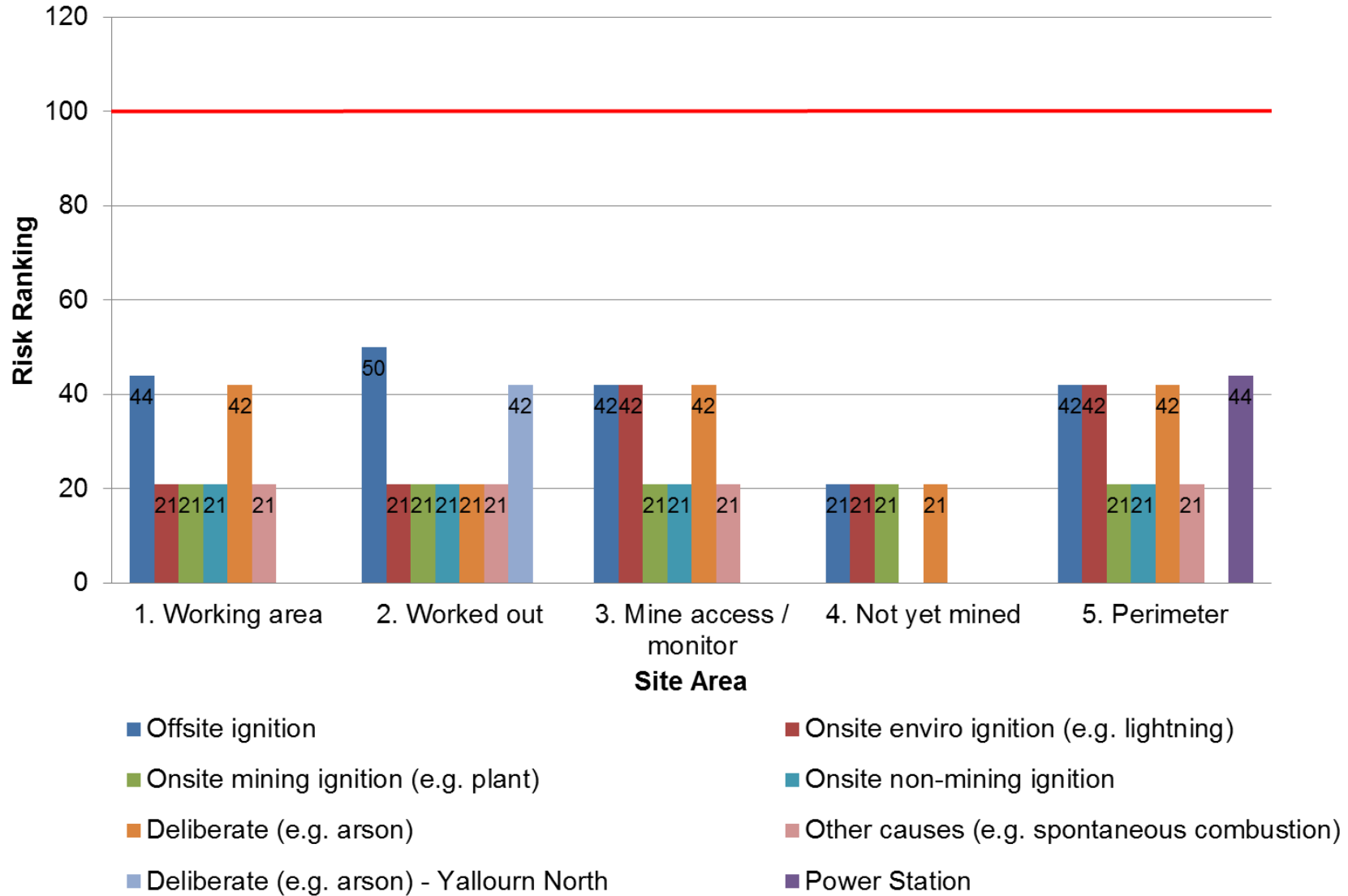
Therefore, based on Condition 1A – Risk Management and also the YMA Risk Assessment Procedure: YMA-OPS-PR-0313 and associated risk ranking scheme (refer to Appendix G), no further actions are required to reduce the current level of risk to an “acceptable” level.

The findings generated from the workshop are provided in Appendix H. A list of controls generated is provided in Appendix E.

**Note:** Risks were ranked using the principle of ‘Maximum Reasonable Consequence’ (MRC) and so realistic worst case scenario outcomes were considered.



**Figure 3 Current Fire Risk Ranking Summary**



## 4. Glossary

Acronym	Meaning
CFA	Country Fire Authority
DEDJTR	Department of Economic Development, Jobs, Transport and Resources
DELWP	Department of Environment, Land, Water & Planning
EAY	Energy Australia Yallourn
EPA	Environmental Protection Authority
FCMP	Fire Control Management Plan
GAPP	Gippsland Arson Prevention Patrol
GCMP	Ground Control Management Plan
JSOP	Joint Standard Operation Procedures
MOU	Memorandum of Understanding
MRC	Maximum Reasonable Consequence
SOP	Standard Operation Procedures
TFB	Total Fire Ban
YMA	Yallourn Mine Alliance
YNOC	Yallourn North Open Cut

# Appendices

# Appendix A – Site Plans

ORIGINAL SCALE 1: 17 500

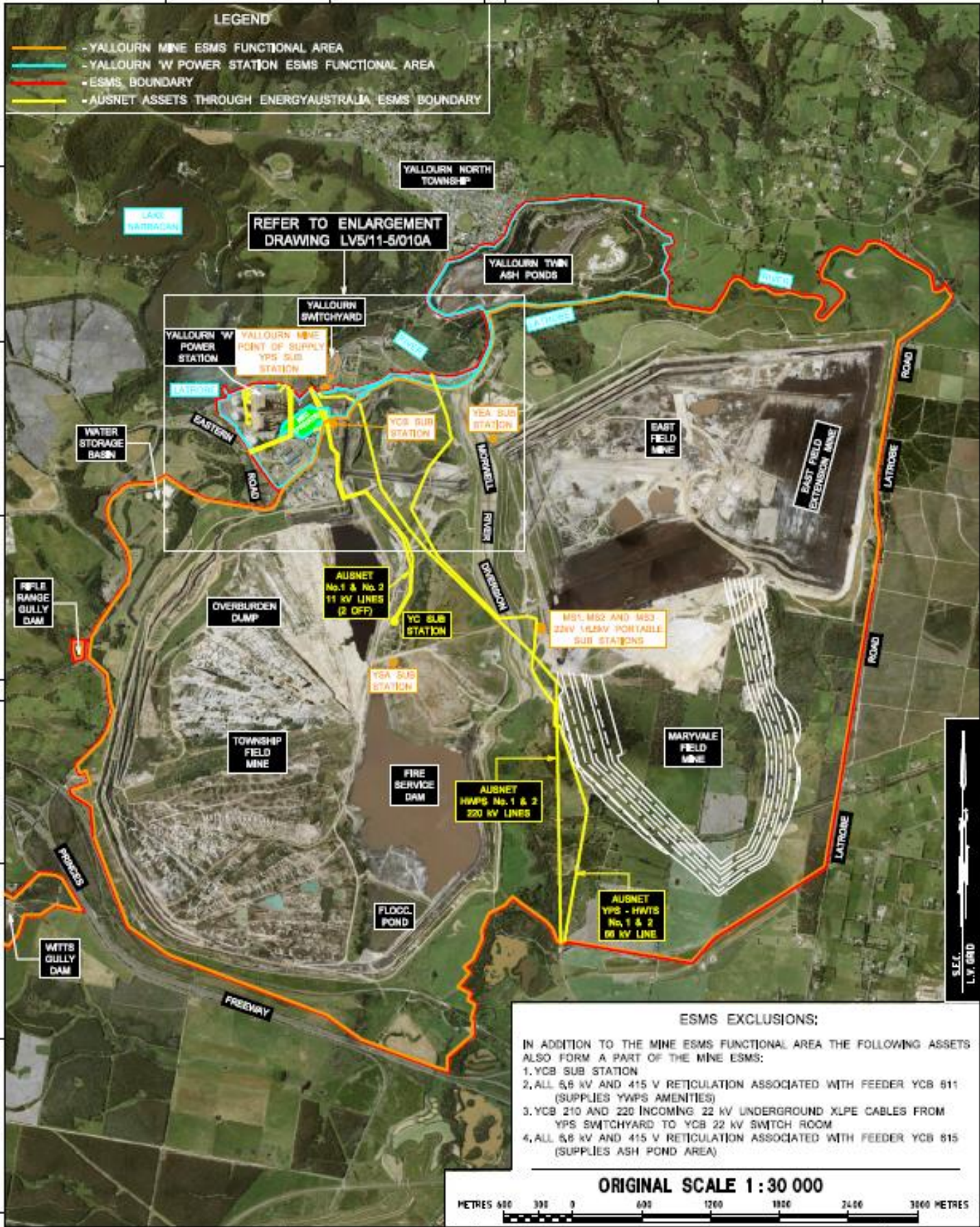
METRES 200 0 250 500 1000 1500



# ENERGYAUSTRALIA - YALLOURN GENERAL SITE PLAN

PAGE THREE OF TWO (SEE PREVIOUS)





**ESMS EXCLUSIONS:**

IN ADDITION TO THE MINE ESMS FUNCTIONAL AREA THE FOLLOWING ASSETS ALSO FORM A PART OF THE MINE ESMS:

1. YCB SUB STATION
2. ALL 6.6 KV AND 415 V RETICULATION ASSOCIATED WITH FEEDER YCB 811 (SUPPLIES YWPS AMENITIES)
3. YCB 210 AND 220 INCOMING 22 KV UNDERGROUND XLPE CABLES FROM YPS SWITCHYARD TO YCB 22 KV SWITCH ROOM
4. ALL 6.6 KV AND 415 V RETICULATION ASSOCIATED WITH FEEDER YCB 815 (SUPPLIES ASH POND AREA)

DATE	REV	DESCRIPTION	DRAWN
23-08-15	B	Plan updated with EA drawing error, the location and level of the bridge.	BR
14-02-12	A	Plan updated with changes to alignment of AUSNET 66 KV power line to YPS.	BR

DRAWN B. RUSSELL  
 CHECKED P. LEVISTON  
 DATE SEPT, 2010

MARK PEARSON  
 MINE PLANNING MGR.(Y)

**EnergyAustralia - Yallourn**

DRG N° LV5/11-5/009 REV B

**YALLOURN**  
 ELECTRICAL SAFETY MANAGEMENT SYSTEM - ESMS  
 FUNCTIONAL AREA BOUNDARIES  
 SITE PLAN

ORIGINAL SCALE 1:20 000

METRES 0 200 400 600 800 1000 1200 1400 1600 1800 METRES

LEGEND

- ▭ ZONE 1 - WORKING AREA OF THE MINE
- ▭ ZONE 2 - WORKED OUT AREA OF THE MINE
- ▭ ZONE 3 - WHERE ASSOCIATED MINING OPERATIONS (MONITORING AND ACCESS) TAKE PLACE
- ▭ ZONE 4 - AREAS WHERE WORK IS YET TO BE DONE (WORK THAT HAS BEEN APPROVED IN THE WORK PLAN, BUT NOT YET CARRIED OUT)
- ▭ ZONE 5 - PERIMETER AREA (WHICH INCLUDES THE AREA OUTSIDE MINE AREA BUT WITHIN THE MINE (GENCO) BOUNDARY)



FILENAME: YALL MINE FIRE RISK DOMAINS  
SCALE: 1:20,000 (D1 A2 S/W)

DRAWN: R. RUSSELL  
CHECKED: D. MILLER  
DATE: JUNE 2010  
L. WALLACE  
MINE PLANNING MGR. (V)

EnergyAustralia - Yallourn

DRG NO: YMP105-105

ENERGYAUSTRALIA - YALLOURN MINE  
FIRE RISK DOMAINS IDENTIFICATION  
SITE PLAN

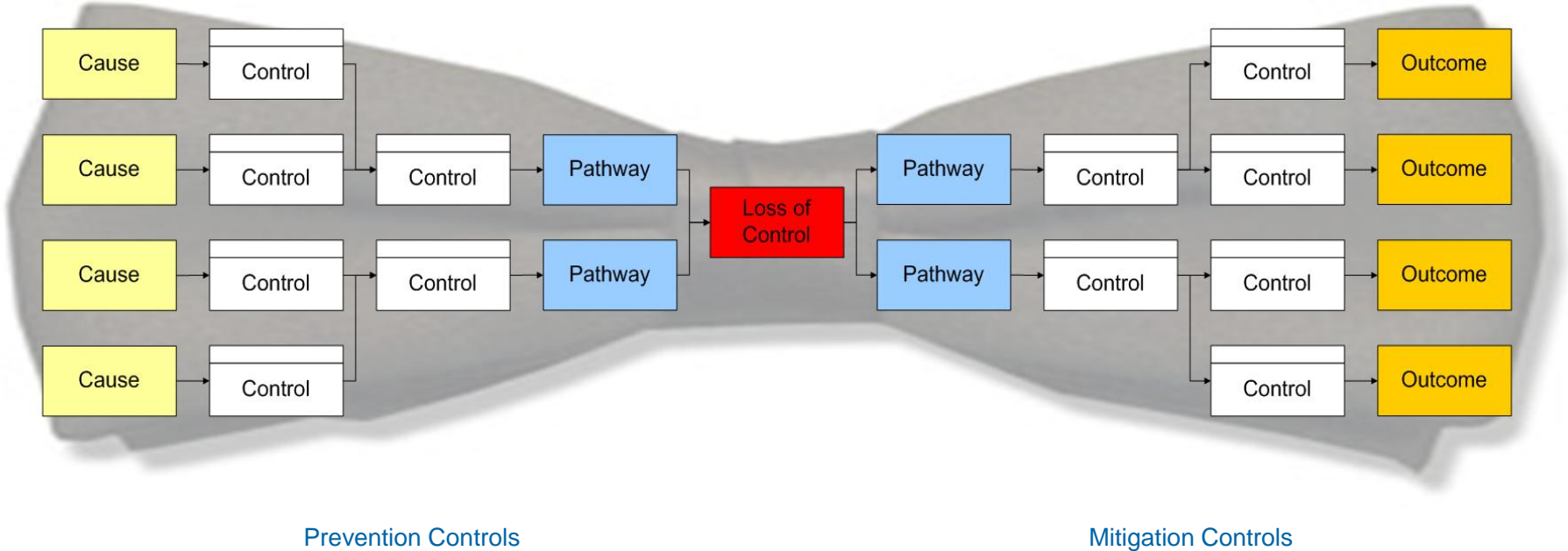


DATE	REV	REV BY	DESCRIPTION	DRAWN	CHECKED

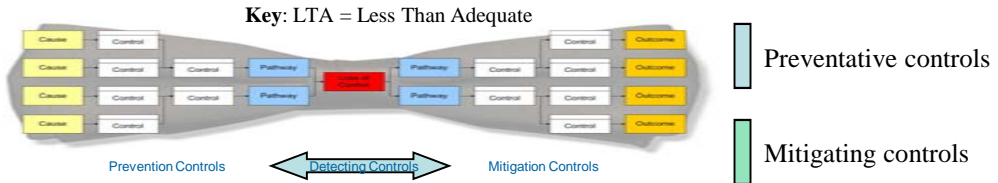
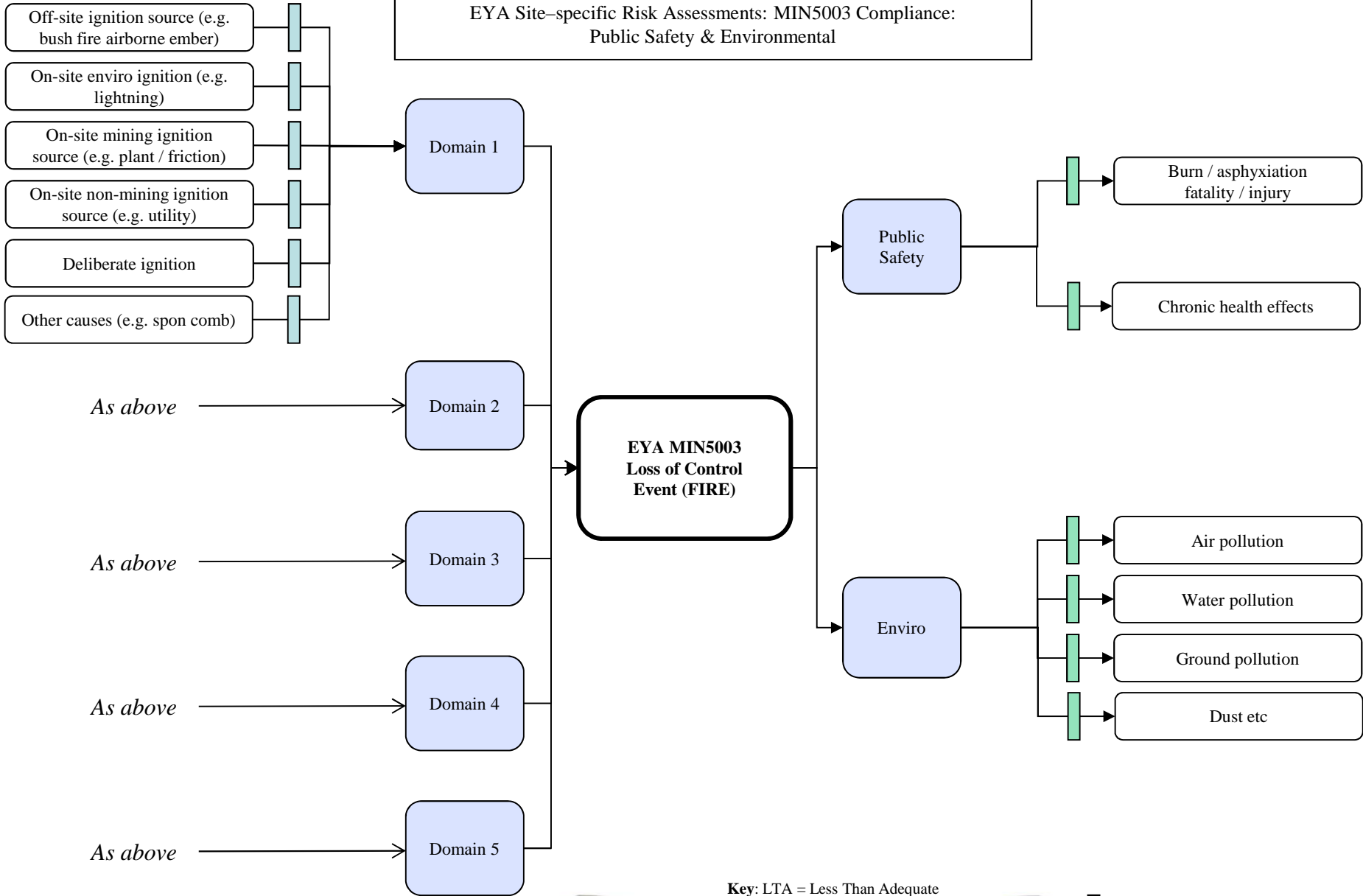
# Appendix B – Bowties

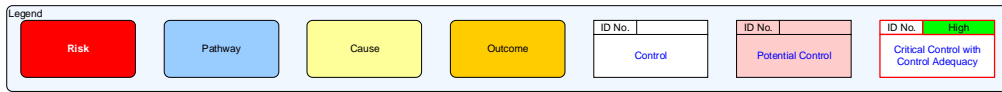


# Typical bowtie (cause-consequence diagram)

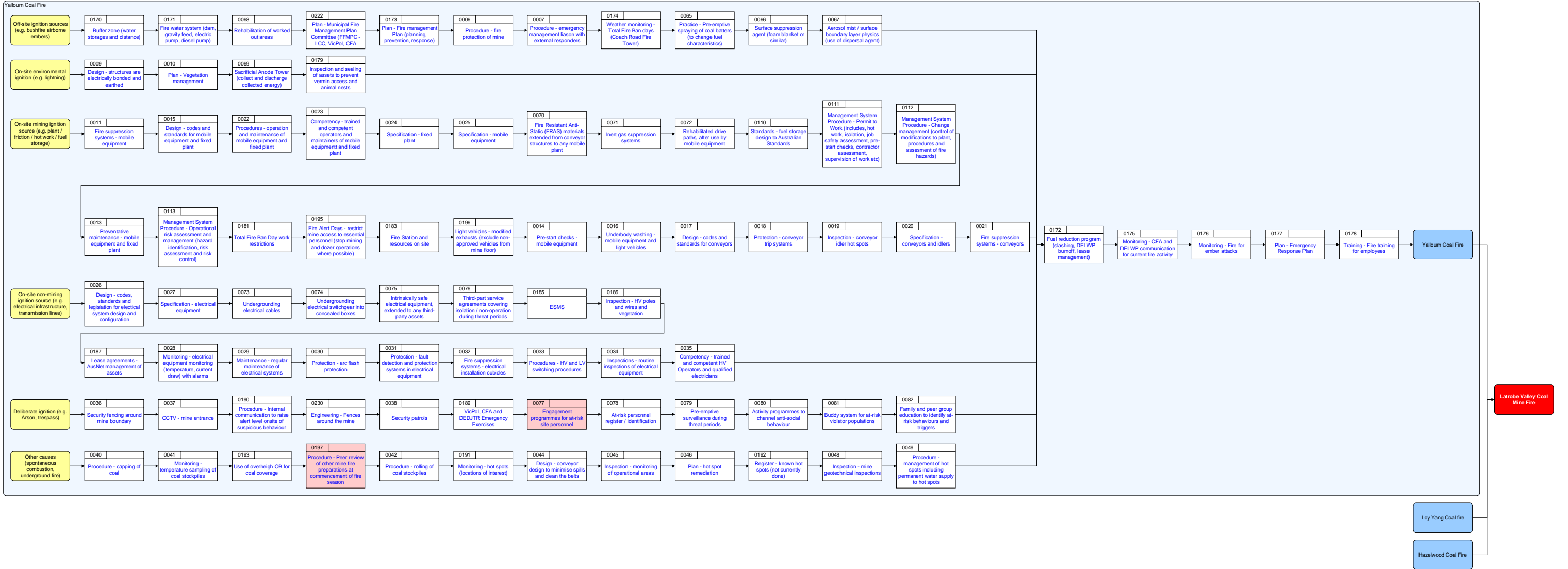


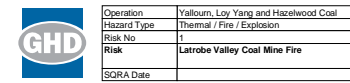
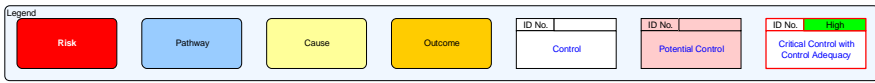
EYA Site-specific Risk Assessments: MIN5003 Compliance:  
Public Safety & Environmental



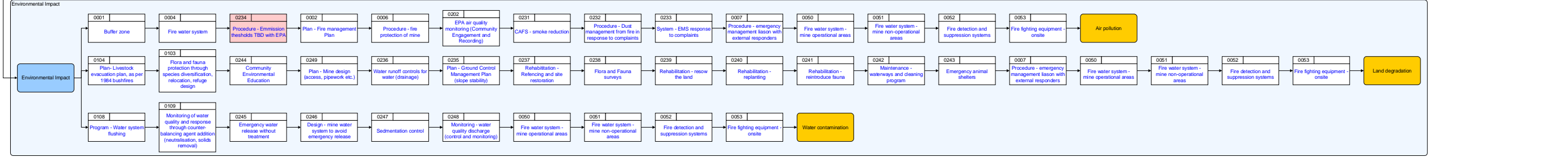
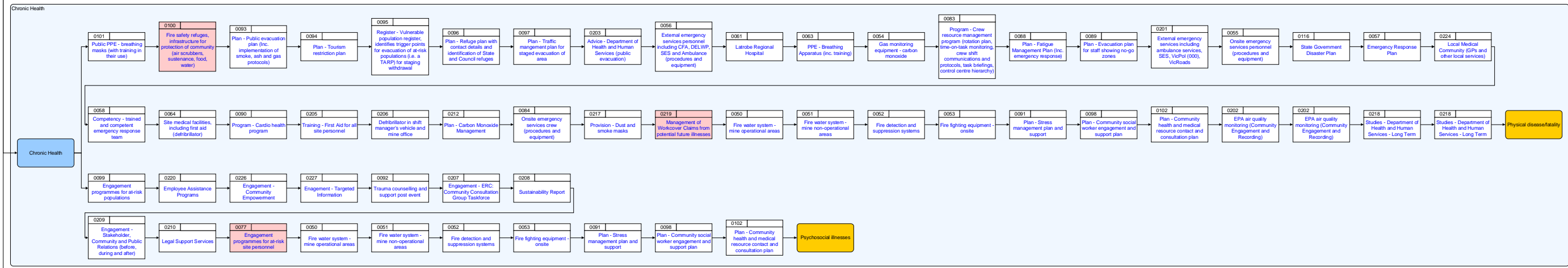
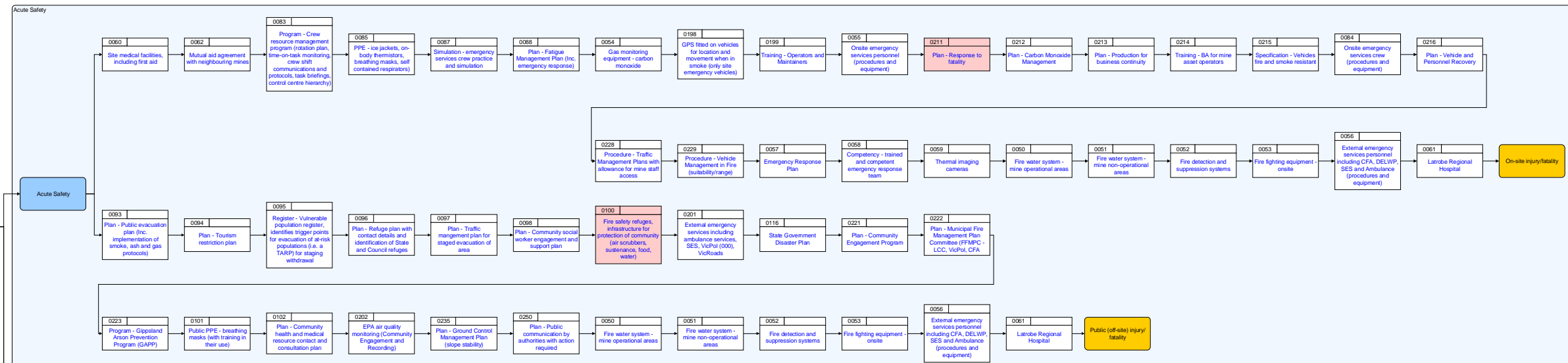
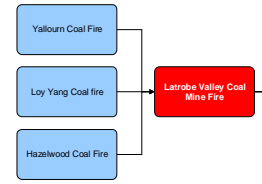


Operation	Yalloom, Loy Yang and Hazelwood Coal
Hazard Type	Thermal / Fire / Explosion
Risk No.	1
Risk	Latrobe Valley Coal Mine Fire
SCRA Date	
Drawn By:	Russell Mills
Reviewed By:	Edward Smelt
Approved By:	Henry Reynolds
Revision	Rev 4 Issued
Date	11 June 2015





Operation	Yalourm, Loy Yang and Hazelwood Coal
Hazard Type	Thermal / Fire / Explosion
Risk No	1
Risk	Latrobe Valley Coal Mine Fire
SCORA Date	
Drawn By:	Russell Mills
Reviewed By:	Edward Smeit
Approved By:	Henry Reynolds
Revision	Rev 4 Issued
Date	11 June 2015



## Appendix C – Monash Health Advice

A communication to the Project Manager of the current Hazlewood Mine Fire Study, Gillian Ormond, was made during the week commencing 1 June 2015 in preparation for this report.

Health risk assessment from coal fire smoke and ash is currently underway through a long-term study, and Ms. Ormond directed us to the 2014 Hazlewood Mine Fire Enquiry Report.

In this study, in section 4.5, the following evidence was located:

*“The Department of Health and the EPA agreed that managing the health and environmental impacts of the Hazelwood mine fire was challenging, as there is a knowledge gap about the health effects of medium-term exposure to smoke and ash from a fire in a coal mine.”*

*“The Department of Health has committed to undertake a long-term health study into the potential long-term health impacts of smoke and ash from the mine fire on affected communities.”*

# **Appendix D** – EPA Technical Reports

# Hazelwood Recovery Program water, soil and ash assessment – Morwell and surrounds

February 2014 – May 2015



Publication 1600 June, 2015.  
 Authorised and published by Environment Protection Authority Victoria.  
 200 Victoria Street, Carlton, 3053.

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## 1 About this report

This report is based on the Hazelwood Recovery Program's water, soil and ash sampling data collected by the Environment Protection Authority (EPA) Victoria during the Hazelwood mine fire and in the 14-month period since the fire was declared safe on 25 March 2014. For the purpose of this report, the collection of data has been classified into two phases: the Response Phase (mid-February to 7 April 2014) and the Recovery Phase (8 April 2014 to 21 May 2015).

The data in this report has already been made available on EPA's website:

[www.epa.vic.gov.au/hazelwood/environmental-reporting](http://www.epa.vic.gov.au/hazelwood/environmental-reporting)

[www.epa.vic.gov.au/hazelwood/hazelwood-mine-fire/testing-during-the-hazelwood-fire](http://www.epa.vic.gov.au/hazelwood/hazelwood-mine-fire/testing-during-the-hazelwood-fire)

As part of the writing process, this report has been reviewed by EPA, external scientific experts and relevant government agencies. A draft of this report was also reviewed by members of the Latrobe Valley community at an EPA engagement event on 10 June 2015. Following this event changes were made to the text and overall community feedback about the report has been included in the appendices.

**This publication is a technical report. For further details about any aspect of this report, or to access data, please contact EPA Victoria on 1300 372 842 or email [contact@epa.vic.gov.au](mailto:contact@epa.vic.gov.au)**

## 2 Aim of water, soil and ash monitoring program

The aim of the Hazelwood Recovery water, soil and ash assessment was to demonstrate if there have been any changes to the chemical composition of water and soil in the Morwell region as a result of the Hazelwood mine fire. In order to do this, EPA has compared the water and soil sampling data collected during the Recovery Phase, with the water, soil and ash data collected during the Response Phase. To better understand the extent of any impacts, this report also compares data from sites close to the fire with a site that was further away from the fire.

This report also aims to give the community an overview of the water, soil, and ash sampling and analysis processes used by EPA during the Response and Recovery Phases. The report focuses on the pollutants that had the potential to be released into the environment from ash during and after the coal mine fire.

## 3 Background

The Hazelwood Recovery Program is a state government-funded EPA initiative in response to the Hazelwood mine fire that occurred in February and March 2014. As part of EPA's commitment to the Hazelwood recovery effort, EPA has conducted air, water and soil testing across Morwell and the Latrobe Valley throughout the Recovery Phase. Information about air quality over the same period is available in a companion report ([EPA publication 1601: Air quality assessment - Morwell and surrounds February 2014 - May 2015](#)).

During the Hazelwood mine fire, EPA Victoria conducted regular water and soil sampling at a number of sites surrounding the fire as well as at sites expected to be outside of the area impacted by the fire. Ash samples were also collected when ash was found in sufficient quantities during the Response Phase.

After the fire was declared safe on 25 March 2015, EPA designed a year-long environmental monitoring program as part of the Recovery Phase. The sampling locations, the extent of the area monitored, and the main chemicals analysed (known as analytes) were kept largely the same as those during the mine fire. This consistency has allowed EPA to compare water and soil data from the Recovery Phase to data collected during the Response Phase.

## 4 Overview of water and soil Environmental sampling program

EPA tested the waterways and soils in and around Morwell for chemicals which may have come from the mine fire, including those from the ash. These chemicals can be deposited on the soil and in the water when the ash falls to the ground. This report considers ash as the larger, visible particles, released during the fire, which fell from the air column and were deposited in and around Morwell. For information regarding the particles which remained airborne, see [EPA publication 1601: Air quality assessment - Morwell and surrounds February 2014 - May 2015](#). EPA tested for a range of chemicals that potentially could be associated with brown coal, the burning of the brown coal and the chemicals used for fire extinguishment. They included heavy metals (such as zinc and lead), organic compounds from incomplete combustion (such as polycyclic aromatic hydrocarbons, known as PAHs), surfactants and many other compounds. In all, EPA tested the water and soil for up to 90 different chemicals.

During the Response Phase EPA tested water and soil from a number of locations further away from Morwell for the same chemicals. These results were used to compare water and soils from locations that were not expected to be impacted by the ash from the fire with the results from those areas where ash was known to have been deposited.



The intention of this Recovery Phase sampling program was to indicate any potential changes caused by the fire. At times, the sampling program was modified (for example, some site locations were changed slightly and the testing of some chemicals ceased when the laboratory analyses of these substances were too low to measure). Sampling locations for the Recovery Phase can be seen in Figure 1.

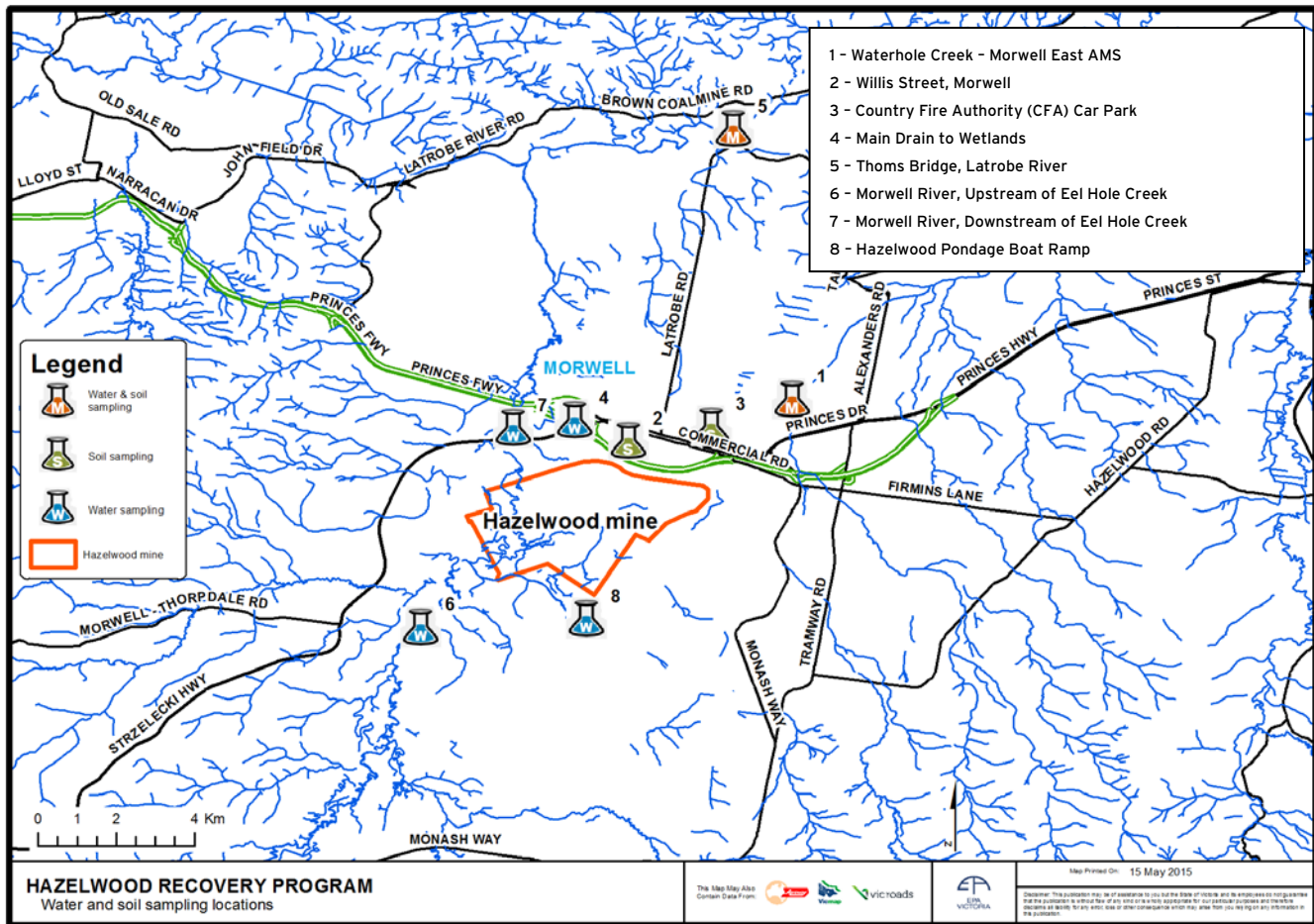
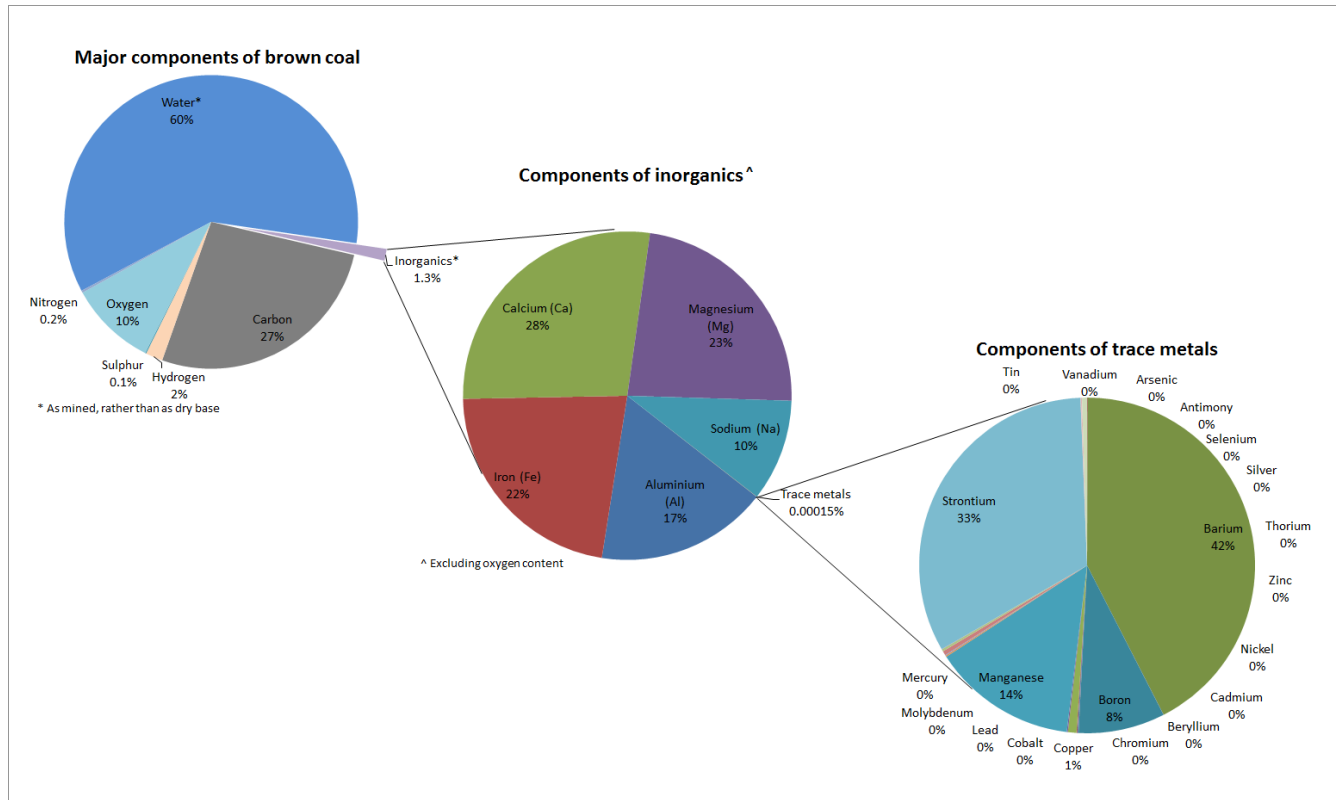


Figure 1. Water and soil sites sampled during the Hazelwood Recovery Program (September 2014 onwards)

Hazelwood brown coal contains many chemicals that had the potential to be released into the environment from the ash during the fire. Figure 2 shows the typical composition of brown coal from the Hazelwood coal mine along with its average inorganic and trace metal proportions.



**Figure 2. Typical composition in brown coal at Hazelwood Coal Mine and its average proportions of inorganic and trace metals (Durie, 1991)**

## 5 Sampling design

During the Response Phase, from February to April 2014, EPA sampled surface and subsurface soils both within and outside the affected area at weekly intervals while the mine fire was burning, and for a number of weeks after the mine fire was declared safe. Ash samples were also collected during the fire at locations where there were significant deposits of ash. These deposits were predominantly in sheds, driveways and under eaves. Until 18 March 2014, a total of 12 ash samples were collected. After this date, the fire was no longer producing sufficient ash for collection.

EPA also sampled waterways during the Response Phase at various locations both within and outside the zone affected by the fire. This occurred at weekly intervals from late February until 7 April 2014, after the mine fire was declared safe. Sampling was conducted both before and after significant rainfall events, to detect if rain had washed any contaminants from the land into waterways.

### 5.1 Recovery Phase sampling locations

Environmental sampling in the Recovery Phase consisted of quarterly sampling of water and soil (surface and subsurface) from the Morwell area (See Figure 1).

#### 5.1.1 Soil

Sampling of surface soil and subsurface soil occurred at key sites based on a variety factors including their proximity or distance to the mine, and whether they were areas of local concern. These sites include:

- Morwell East Air Quality Monitoring Station (AMS)
- Willis Street – adjacent reserve
- Morwell Country Fire Authority (CFA) car park
- Thoms Bridge on the Latrobe River.

Quarterly monitoring occurred in September/October, December, and March. These results are available on the EPA website: [www.epa.vic.gov.au/hazelwood/environmental-reporting](http://www.epa.vic.gov.au/hazelwood/environmental-reporting). The final round of sampling took place in May and June 2015. These

results will be made available on EPA's website in July 2015.

The Willis Street site in Morwell is a residential property. Between April and September 2014, this sampling site was relocated to an adjacent reserve (20–30 metres away) to minimise impact on residents.

Thoms Bridge was considered to be outside the area affected by ash deposition and was included to provide comparative results for the area. Figure 1 shows the sample locations for soil sampling during the Recovery Phase.

Subsurface soil was sampled to provide a basis for comparison for the surface soil samples; if the chemical composition was similar in both the surface and subsurface soil samples, it was likely to be representative of the normal variation in soil at that site. It also allowed us to assess whether chemicals from the ash had moved into the subsurface soils over time.

It must be noted that some of these sites have a potential for contamination from other sources. For example, the CFA car park was initially chosen due to its accessibility and the presence of ash deposits; however, this site is used for storing heavy machinery and fire-fighting equipment, raising the potential for heightened readings of metals, fire-fighting chemicals and hydrocarbons.

## 5.1.2 Water

Water sampling occurred at six key sites based on a variety factors including their proximity or distance to the mine, and whether they were areas of local concern. These sites include:

- Waterhole Creek – adjacent to Morwell East AMS
- Hazelwood Pondage boat ramp – adjacent to the entrance to Eel Hole Creek
- Thoms Bridge on the Latrobe River
- The main drain to the Morwell Wetlands
- Morwell River – upstream of Eel Hole Creek
- Morwell River – downstream of Eel Hole Creek.

Quarterly monitoring occurred in September, December, and March. These results are available on the EPA website: [www.epa.vic.gov.au/hazelwood/environmental-reporting](http://www.epa.vic.gov.au/hazelwood/environmental-reporting). The final round of sampling took place in May and June 2015. These results will be made available on EPA's website in July 2015

Water sampling was complemented by passive sampling in April 2014 using granular activated carbon (GAC) bags, which absorb dissolved contaminants and metals in water. Sampling was conducted at the same sample sites as above.

The Latrobe River at Thoms Bridge was considered outside of the area affected by ash deposition and was included to provide comparative results for the area. While all sites could potentially have received flows from ash-affected water, Thoms Bridge is approximately 15 km downstream from the fire, and as such should have received delayed or diminished effects if ash had been present in the water. Also, the Latrobe River is a large waterway and its size would have a diluting effect against possible changes in water quality.

## 5.2 Sampling methods

The samples were collected by EPA staff according to EPA's documented processes and in line with a data quality management plan. Sampling was conducted under EPA's *Sampling and Analysis of Waters, Wastewaters, Soils and Wastes Guidelines*.

Once collected, the samples were analysed by independent laboratory service providers, who are accredited by the National Association of Testing Authorities (NATA).

## 5.3 Sample analytes

The analytes EPA tested for were based on groups of chemicals that may be common in the environment, as well as those associated with the coal, the burning of the coal and the chemicals used for fire extinguishment. These included:

### Soil and ash:

- 27 metals suite (including sampling for Chromium VI)
- 16 polycyclic aromatic hydrocarbons (PAHs)
- 7 monocyclic aromatic hydrocarbons (MAHs)
- 34 halogenated volatile organic compounds
- 6 solvents.

### Water:

- 25 total metals (including sampling for Chromium VI)
- 16 polycyclic aromatic hydrocarbons (PAHs)
- 7 monocyclic aromatic hydrocarbons (MAHs)
- 34 halogenated volatile organic compounds
- 6 solvents
- 4 nutrients.

This program was not conducted to assess the overall water and soil quality in the area but to demonstrate whether any changes occurred due to the Hazelwood mine fire event. We are therefore not reporting on commonly used water quality measures such as pH, salinity or dissolved oxygen.

Polycyclic aromatic hydrocarbons (PAHs) and monocyclic aromatic hydrocarbons (MAHs) are produced as a result of the incomplete combustion of organic matter, such as brown coal. The Hazelwood mine fire burned at varying temperatures and fluctuating oxygen concentrations, which potentially resulted in the production of aromatic hydrocarbons, such as benzene, toluene, benzo[a]pyrene and naphthalene.

Concentrations of the organic compounds and metals relevant to the combustion process were measured, including the heavy metals and metalloids – arsenic, cadmium, chromium, lead and mercury.

Semi-volatile compounds (semivolts), which include solvents and halogenated volatile organic compounds, are found in a wide variety of industrial substances including fire-fighting chemicals, pesticides, degreasers and paint thinners.

## 5.4 Guidelines and standards

The following guidelines were used for guidance and reference during the Response Phase to assess potential health considerations. However, as these guidelines do not assist in determining if the water or soils had been directly impacted by the ash from the Hazelwood mine fire, they have not been used as a basis for comparison to results in this report.

### Soil and ash:

- National Environment Protection (Assessment of Site Contamination) Measure (ASC NEPM)
- EPA Victoria, Soil Hazard Categorisation and Management (IWRG 621).

### Water:

- Australia and New Zealand Guidelines for fresh and marine water quality, 95% species protection level (ANZECC/ARMCANZ – 95% species protection level) relating to slightly-moderately disturbed systems
- Australian Recreational Water Quality Guidelines (ARWQG)
- Australian Drinking Water Quality Guidelines (ADWG).

The above-mentioned guidelines provide the following values for metal concentrations in water. These have been included in this report to provide context and a point of comparison for the water sampling results, rather than to assess if ash from the mine fire has impacted on water quality.

**Table 1. Water Quality Guidelines values**

		ANZECC/ARMCANZ – 95% species protection	Australian Drinking Water Quality	Australian Recreational Water Quality
Aluminium	mg/L	0.055	-	-
Antimony	mg/L	-	0.003	0.03
Arsenic	mg/L	0.024 (as As III)	0.01	0.1
Barium	mg/L	-	2	20
Beryllium	mg/L	-	0.06	0.6
Boron	mg/L	0.37	4	40
Cadmium	mg/L	0.0002	0.002	0.02
Chromium	mg/L	0.001 (as Cr VI)	0.05	0.5
Cobalt	mg/L	-	-	-
Copper	mg/L	0.0014	2	20
Iron	mg/L	-	-	-
Lead	mg/L	0.0034	0.01	0.1
Manganese	mg/L	1.9	0.5	5
Mercury	mg/L	0.0006	0.001	0.01
Molybdenum	mg/L	-	0.05	0.5
Nickel	mg/L	0.011	0.02	0.2
Selenium	mg/L	0.011	0.01	0.1
Silver	mg/L	0.00005	0.1	1
Strontium	mg/L	-	-	-
Thallium	mg/L	-	-	-
Tin	mg/L	-	-	-
Titanium	mg/L	-	-	-
Vanadium	mg/L	-	-	-
Zinc	mg/L	0.008	-	-

## 6 Sampling results and discussion

To assess whether there have been any impacts to the local waterways and soils in the Morwell region, this report focused on the comparisons of sites within and outside the ash deposition area (or the impact zone). This report also compares surface and subsurface soils. To track any mine fire impacts, the metals barium, boron, manganese and strontium were identified as key analytes as they were found in significant percentages in early mine fire ash samples, and are common trace metals found in brown coal.

Although semivolts were tested for during the Response Phase and into the Recovery Phase, very few semivolt compounds were detected in the environmental sampling program. One example of a semivolt that was detected was acetone, a solvent that is found both naturally in soils as a by-product of bacterial processes and in air as a product of combustion. It can also be found in a variety of industrial processes. Acetone was found in small amounts in a number of water, soil and ash samples.

Whilst very few semivolts were found in the water and soil sampling program, the broad screen that resulted from the initial investigation of the samples yielded a large and diverse group of compounds. While not concerned, EPA is conducting supplementary investigations into understanding the extended semivolt compounds identified. As this investigation is ongoing, semivolts will be discussed in future reports.

The results for the water, soil and ash samples are discussed below.

### 6.1 Ash

A number of metals and organic compounds, including PAHs, were found in the ash samples. These compounds were expected as they are either known to be present in brown coal or are products of incomplete coal combustion. The ash samples that were collected are thought to be a combination of ash from the coal mine fire, soil and dust from the ground and ash from nearby bush fires which were happening at the same time. Further research is being undertaken by EPA to understand these ashes and how they can be compared to the materials burned to produce them.

The soil sampling program was established to compare the ash samples with soils at the surface and subsurface within and outside the zone affected by the fire.

#### 6.1.1 Metals

A number of metals (for example, boron, barium, manganese, strontium and zinc) were identified in the ash samples.

This was expected, given these metals are found in brown coal, as well as being present in the soils in the region. The metal results – between the ash and surface and subsurface soil samples, both within and outside the affected zone – show that there has been no significant change on the soils in the region as a result of the ash deposition. Further research is underway by EPA to quantify this natural variability of metals in the soils across Victoria.

#### 6.1.2 Polycyclic aromatic hydrocarbons (PAHs) and other organic compounds

A number of PAHs were detected in the ash samples. PAHs were also seen in an initial surface soil sample taken at Willis Street, Morwell on 18 February 2014. This sample is expected to be mostly ash with a small amount of soil. In contrast, soil samples taken after this time detected only a small number of PAHs. These were at levels far below those originally recorded. These results indicate that while the Morwell region was exposed to ash deposition early on in the fire, it was not sufficient enough to cause any significant changes in the composition of local soils.

#### 6.1.3 Ash comparison to soil

Figure 3 and Table 2 below compare the soil collected in the Response and Recovery phases with ash samples collected during the Response Phase (the last ash sample was collected on 18 March 2014). They compare the chemical compositions by looking at the metal concentrations (Figure 3) and the presence or absence of various PAHs (Table 2).

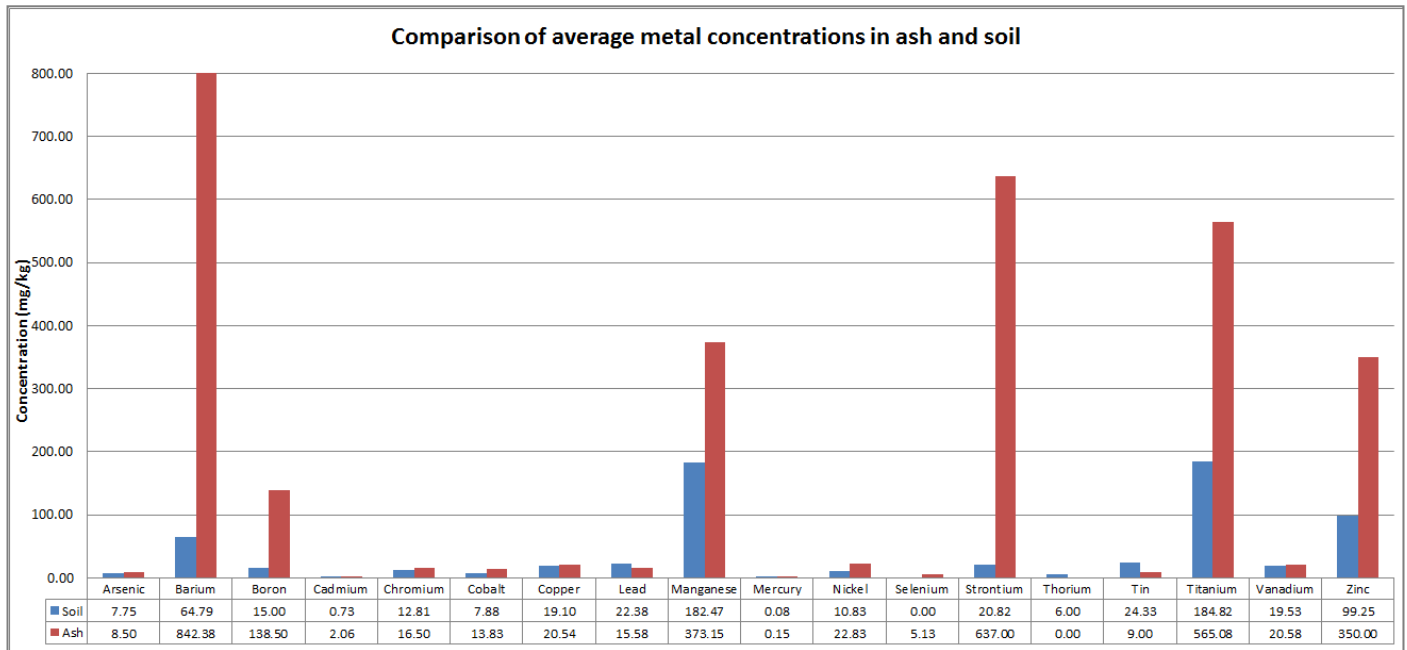


Figure 3. Comparison of metal concentration in soil and ash samples (excluding aluminium and iron for graphical purposes)

Figure 3 uses the surface and subsurface soil samples taken during the Recovery and Response Phases. It does not include the surface soil sample taken during the mine fire at Willis Street on 18 February 2014 which is now believed to have been composed of mine fire ash. This has been included in the ash results instead.

Aluminium and iron were detected in high quantities in both the ash (aluminium: 8,054 mg/kg; iron: 27,469 mg/kg) and the soil (aluminium: 5,726 mg/kg; iron: 10,664 mg/kg). This was expected in the ash due the high percentage of these metals in brown coal, as well as being naturally present in the soils. For graphical reasons, they have not been represented in Figure 3.

Table 2 provides representative data for ash and soil samples taken during the Response Phase. Although soil samples in the table were taken during the Response Phase, they are considered representative of soil samples taken during both phases as PAHs were generally not detected.

The area shaded grey shows that the compound tested was either not present, or was below the level of laboratory detection.

Table 2. Comparison of PAH concentrations between ash and surface soils during the Response Phase.

	Bushfire ash	Mine fire ash						Ash collected on surface soil	Surface soil		
	Club Astoria	Club Astoria	Morwell FC	Hazelwood Rd	Wallace St	Morwell Bowls Club	Willis St	Willis St	Willis St	Thoms Bridge	CFA car park
	13/03/14	13/03/14	13/03/14	18/03/14	13/03/14	13/03/14	3/03/14	18/02/14	24/02/14	10/03/14	17/03/14
Acenaphthene	<0.1	0.2	0.2	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	0.4	0.7	0.8	<0.2	<0.4	<0.1	0.2	0.4	<0.1	<0.1	<0.1
Anthracene	0.3	1.1	1	0.5	0.6	0.1	0.2	0.6	<0.1	<0.1	<0.1
Benzo(a)anthracene	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3
Benzo(a)pyrene	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3
Benzo(b)fluranthene	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.4
Benzo(ghi)perylene	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2
Benzo(k)fluranthene	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3
Chrysene	0.6	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.4
Dibenz(ah)anthracene	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	1.4	1.2	0.8	0.4	0.7	0.3	0.1	0.4	<0.1	<0.1	0.9
Fluorene	0.2	1.9	1.8	<0.6	1.5	0.1	0.5	0.1	<0.1	<0.1	<0.1
Indeno(123)pyrene	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2
Naphthalene	0.5	7.5	9.8	3.5	6.3	0.4	5.2	6.5	<0.1	<0.1	0.2
Phenanthrene	1.6	7.6	6.1	3.1	3.9	0.8	1.3	3.7	<0.1	<0.1	0.5
Pyrene	1.2	0.9	0.7	0.3	0.6	0.2	0.1	0.3	<0.1	<0.1	0.7
Total PAHs	11	21	21	7.8	14	2	7.6	13	<0.1	<0.1	4.4

The results in Table 2 show that the majority of ash samples collected during the event have similar PAH compositions but different to the surface and subsurface soil samples. This suggests that any ash deposited on the surface has not changed either the surface or subsurface soils.

An exception to this has been from a surface soil sample taken on Willis Street, Morwell on 18 February 2014, which, as discussed above, had a chemical composition more similar to the mine fire ash samples collected. This sample appears to have been mostly composed of ash, which supports the observation made at the time of sampling that ash was on the surface of the soils at this site.

In contrast, the ash sample from Club Astoria, collected on 13 March 2014, has a different PAH content to both the ash and soil samples and appears to have come from the bush fire that burned around the club rather than from the mine fire.

The right-hand column shows the results from surface soil sample taken from the CFA car park on 17 March 2014 (a result which was replicated again on 7 April 2014). This sample contains a different pattern of PAHs: however, as the CFA complex houses heavy machinery exposed to fires and fire-fighting equipment, the differences in their chemical composition are being attributed to site contamination rather than as a direct result of ash deposition.

Overall, the comparison of soil and ash data demonstrated that most of the soil samples have a similar chemical composition. Importantly, soil samples collected from the surface were not dissimilar from those collected below the surface. By contrast, the chemical composition of ash samples was significantly dissimilar to soil. This suggests that ash deposition did not affect the chemical composition of surface soil.

## 6.2 Soil

Evidence of ash deposition on surface soil was recorded at Willis Street, close to the mine fire, on 18 February 2014. As discussed above, this sample was determined to be predominantly ash. This sample showed peaks in metals and PAHs that were also high in the mine fire ash samples. These levels were not observed in the other soil samples, which had lower levels which were observed for the rest of the Response Phase and throughout the Recovery Phase. In addition, the results showed no evidence of the chemical constituents found in ash samples moving into the subsoil, as the high levels of these metals and PAHs were not reflected in either the subsequent surface or subsurface soil results.

Whilst the heavy metals and metalloids (arsenic, cadmium, chromium, lead and mercury) and PAHs (benzo[a]pyrene and naphthalene) were found within the soil samples, they were consistently at low levels across surface and subsurface soils. This is considered representative of the local soil composition rather than as a result of the mine fire.

Results from the soil sampling program show that soil has not been significantly changed by ash deposition from of the Hazelwood mine fire event.

### 6.2.1 Metals

A number of metals (for example, boron, barium, manganese, and strontium) were identified in the soil. They were also found in the ash and are major constituents of Latrobe Valley brown coal. The comparison of metal results - between the ash and surface and subsurface soil samples, within and outside the affected zone - show that the ash deposition has not resulted in significant changes in the soils in the region.

Zinc was found in higher concentrations in many ash and soil samples from Willis Street and CFA car park taken during the Response Phase (with a peak concentration of 1,200 mg kg<sup>-1</sup>). As Willis Street and the CFA car park sites are closer to the Hazelwood mine fire than Morwell East AMS and Thoms Bridge, it is likely that these higher zinc levels are linked to the high levels found in the ash samples, showing that ash deposition occurred at sample sites closer to the mine fire. However, the zinc levels at all sites decreased to consistently lower levels during the Recovery Phase, indicating that the ash did not change the zinc levels in the soil.

A comparison was conducted between the average concentrations of metals found in ash (Figure 4) and soil samples at Willis Street, Morwell East AMS and Thoms Bridge sites (Figures 5, 6 and 7). The average ash analysis excluded the ash sample from Club Astoria on 13 March, as it is not considered indicative of mine fire ash (as discussed above). Similarly, the soil sample from Willis Street (18 February 2014), which has been determined to be predominantly ash, has been included in the average ash analysis.

Figures 4-7 show that comparative levels of barium, strontium and boron (common metals found in Latrobe Valley brown coal) were high in ash samples, and lower in soil samples. While manganese, another common metal in brown coal, appears to have higher concentrations in soils than in the ash samples collected, particularly at Thoms Bridge.

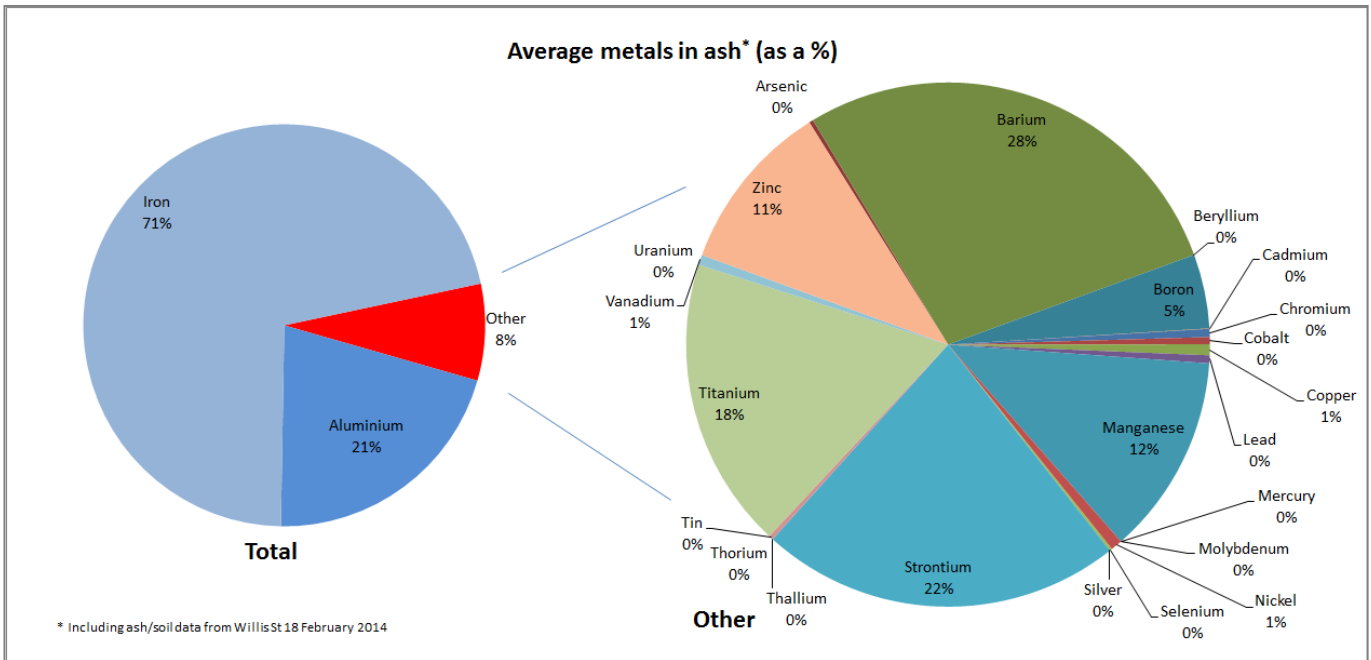


Figure 4. Average concentrations (as a percentage) of the metal component of ash samples during the Response Phase

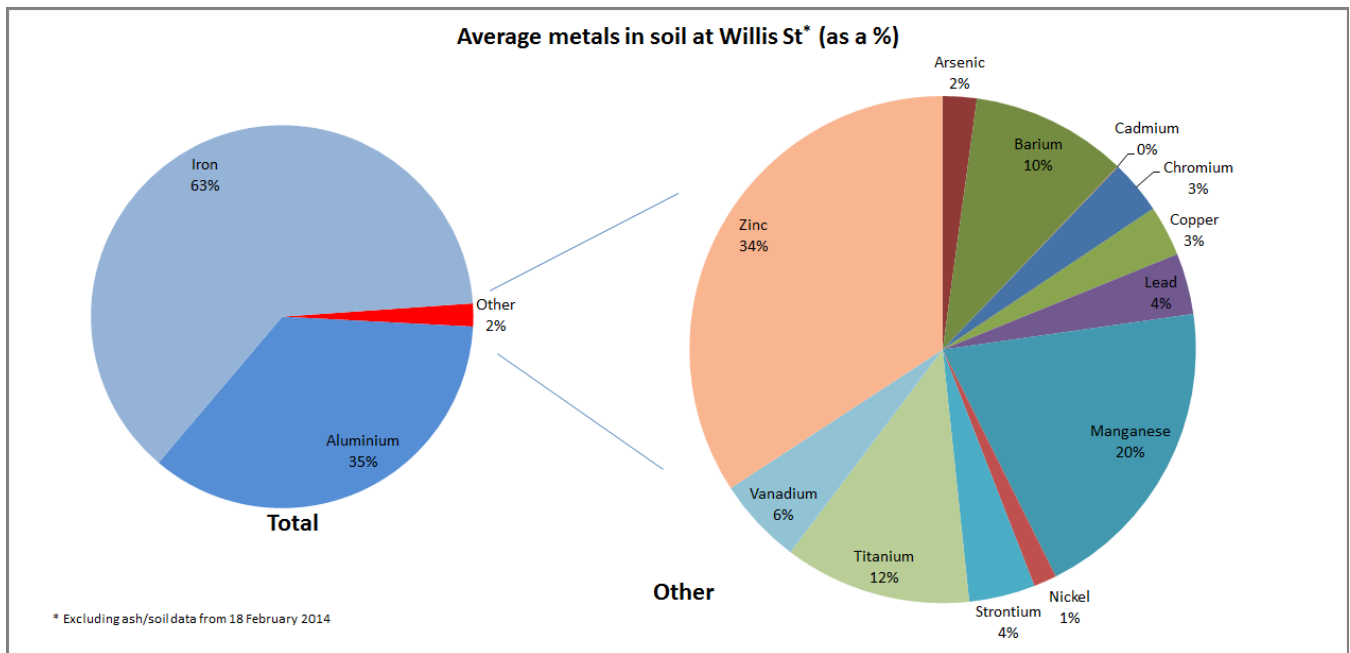


Figure 5. Average concentrations (as a percentage) of the metal component of soil and subsoil samples taken from Willis Street during the Response and Recovery phases



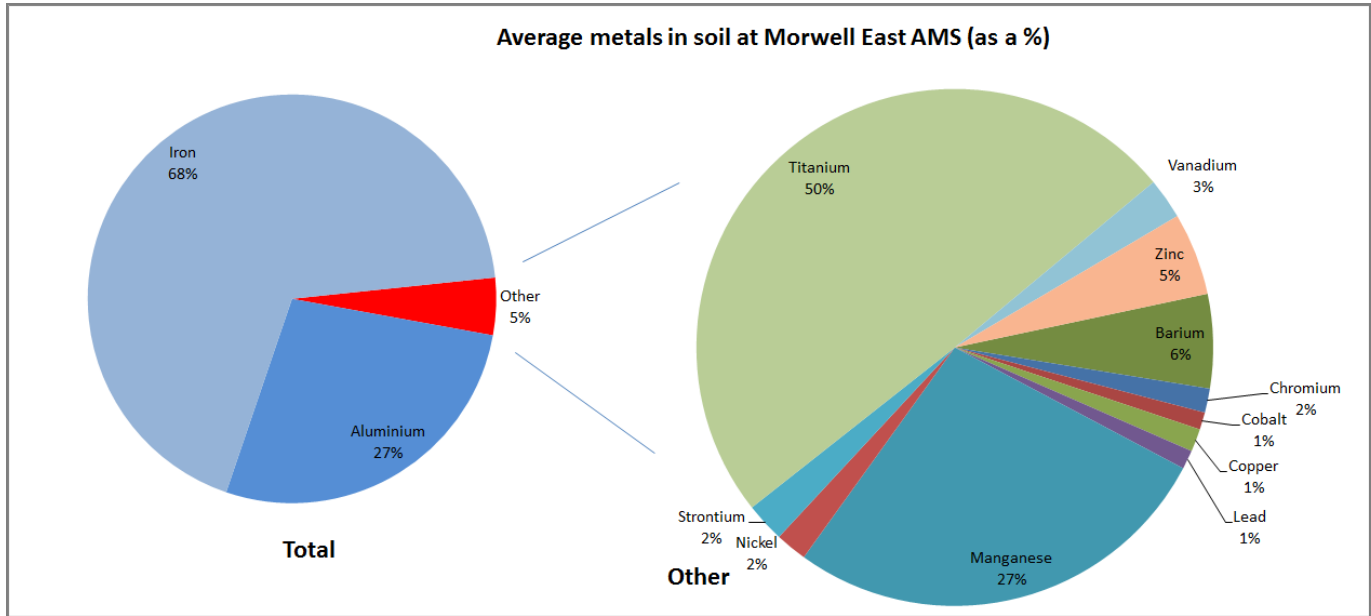


Figure 6. Average concentrations (as a percentage) of the metal component of soil and subsoil samples taken from Morwell East AMS during the Response and Recovery phases

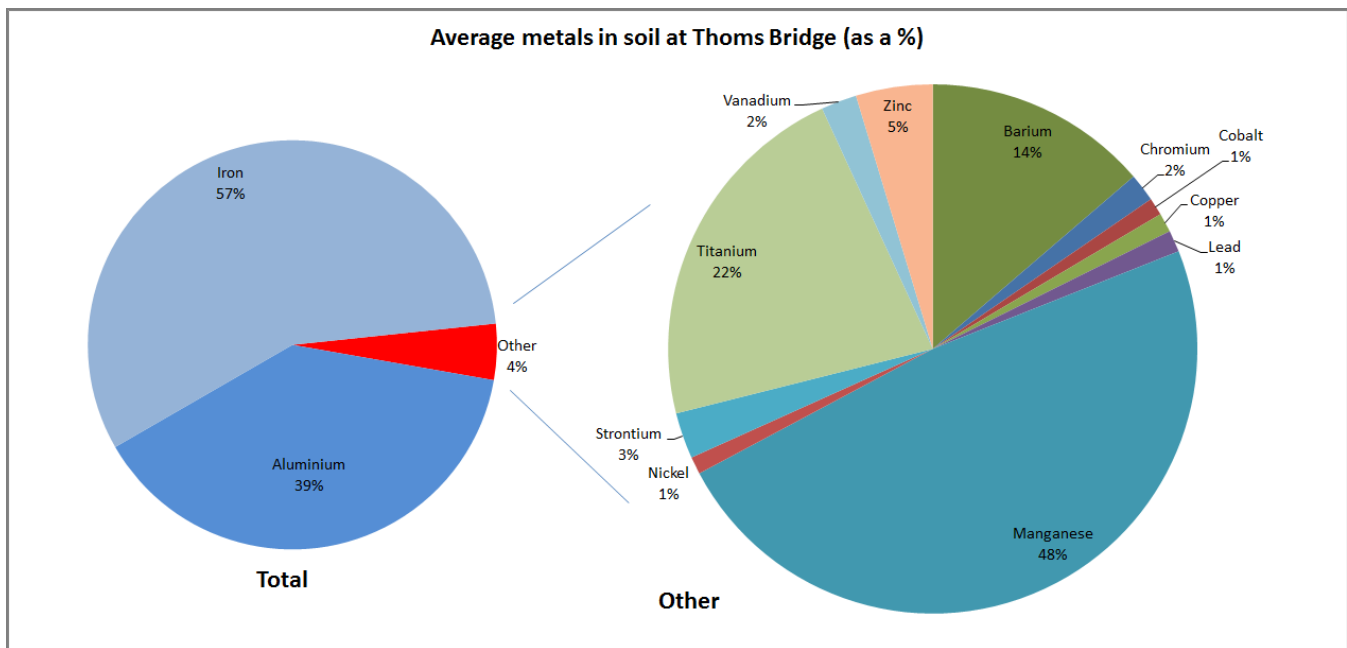
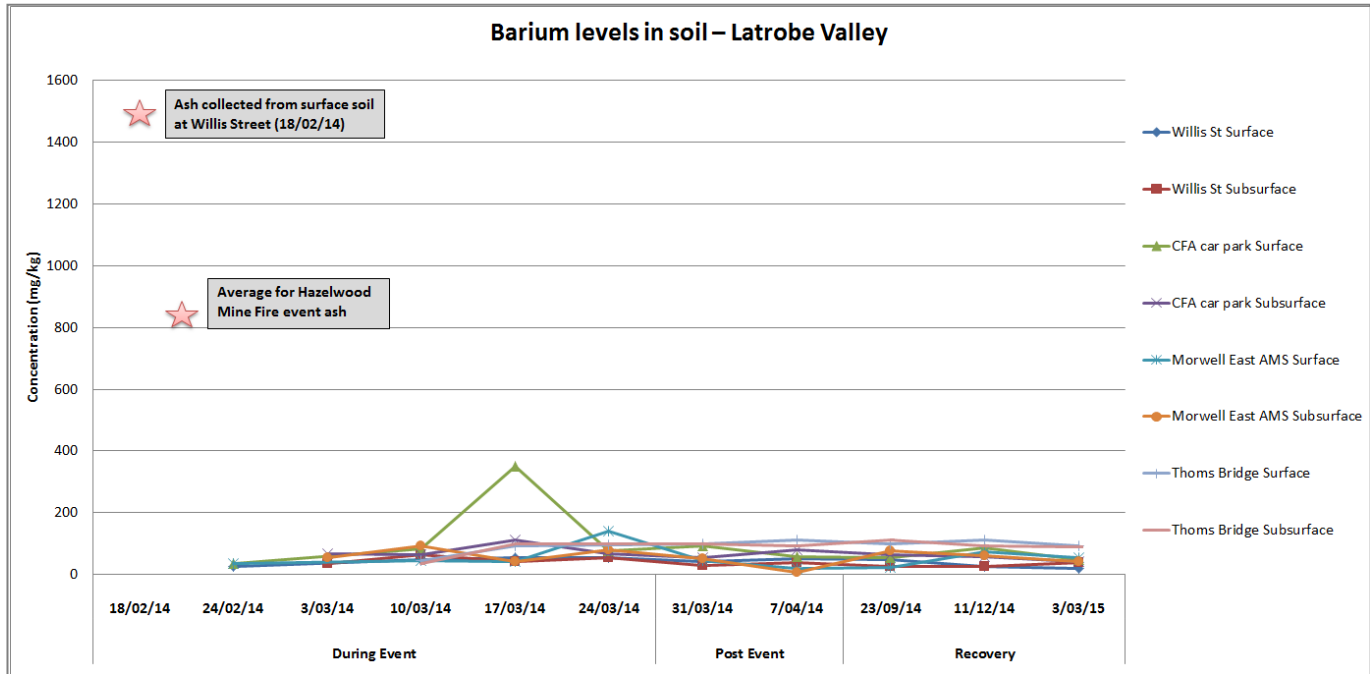
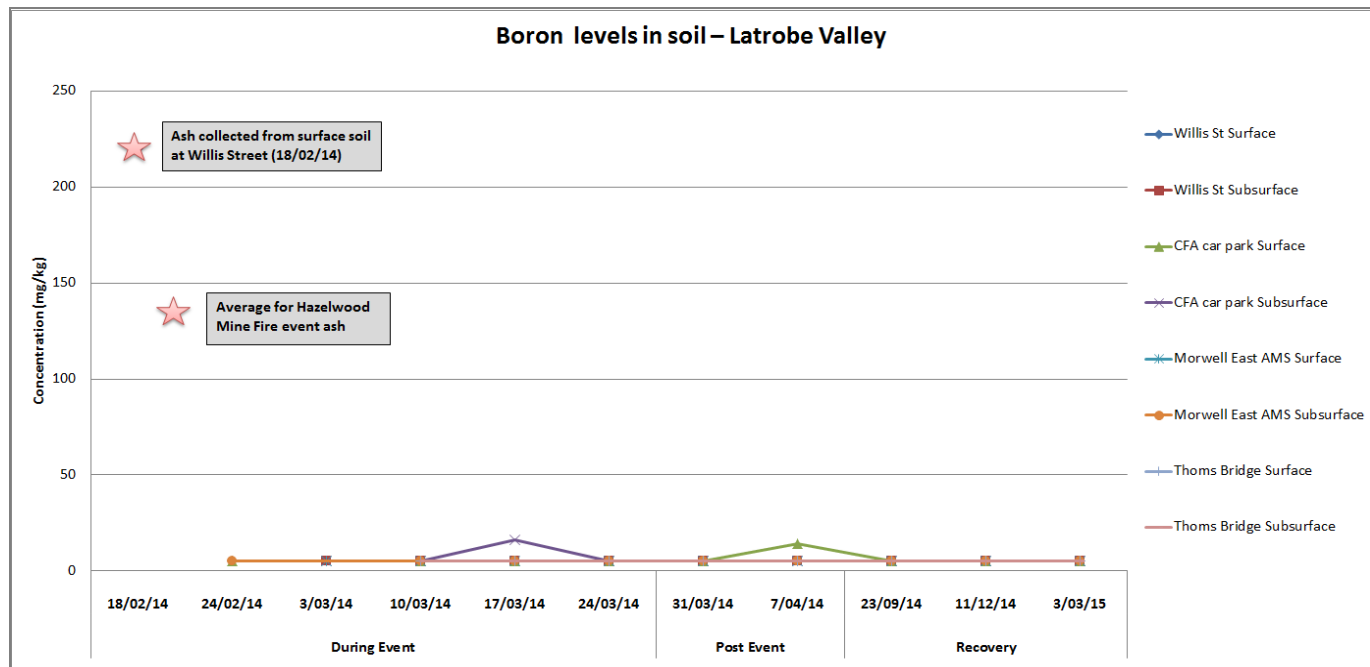


Figure 7. Average concentrations (as a percentage) of the metal component of soil and subsoil samples taken from Thoms Bridge during the Response and Recovery phases

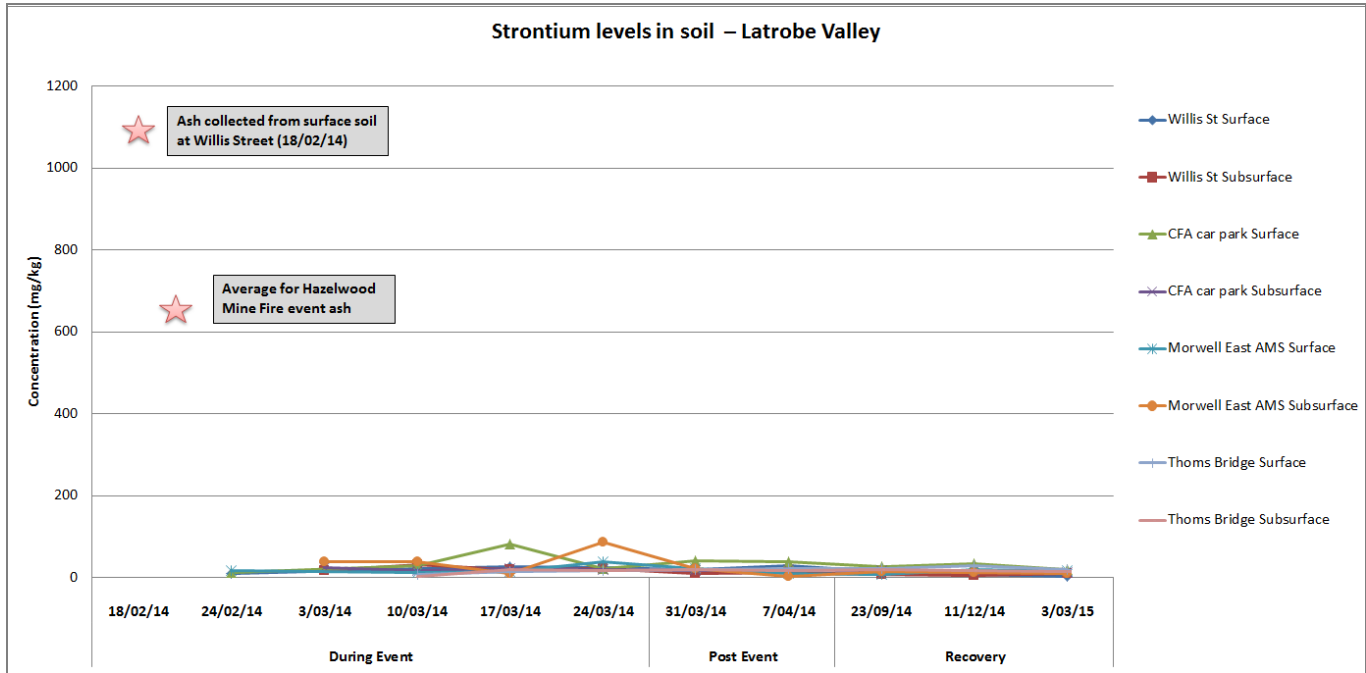
Figures 8-11 show trends for the metals barium, boron, strontium and manganese across the Response and Recovery Phases. These metals were chosen as they were found in significant proportions in the mine fire ash samples and are common trace metals found in brown coal. As a comparison, the result for the ash collected from the surface soil at Willis Street on 18 February 2014 and the average concentration of ash have been included in the figures. This demonstrates the difference between the ash and the soils and further shows that the ash deposition did not significantly impact the soils.



**Figure 8. Barium concentrations during and after the Hazelwood mine fire at Recovery Phase soil sample sites**

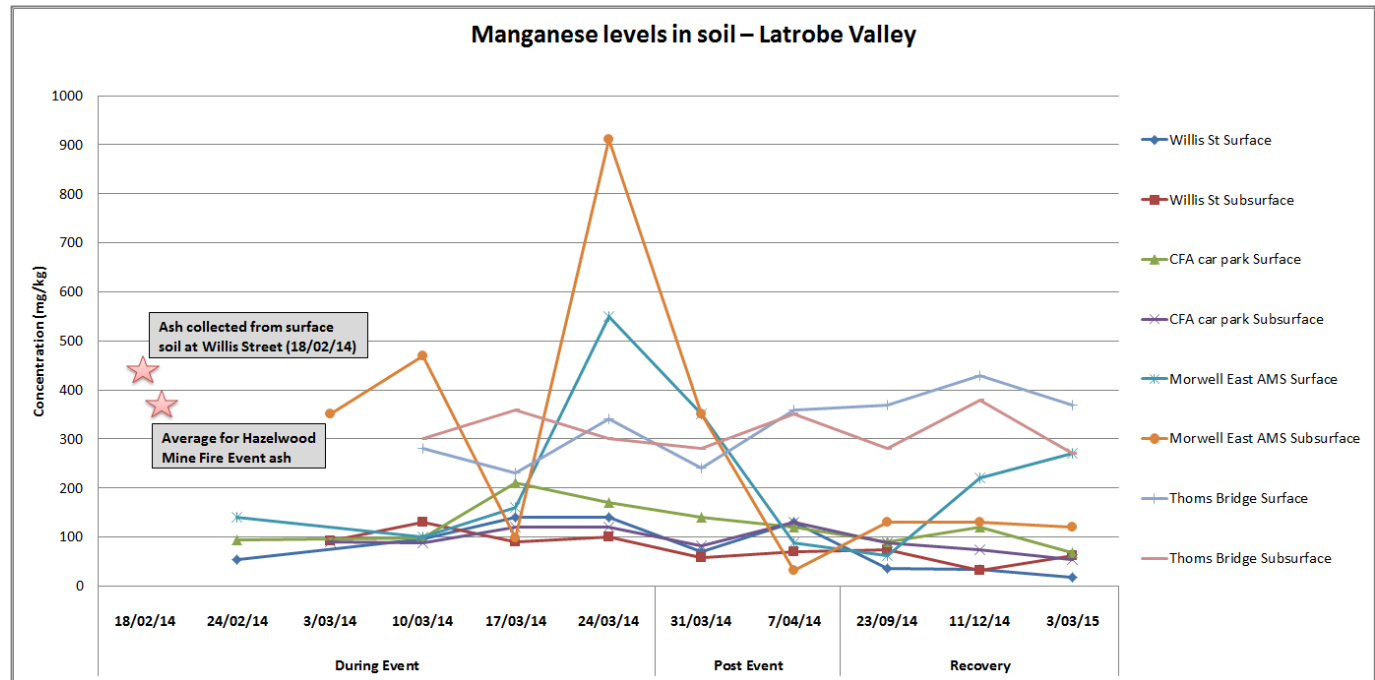


**Figure 9. Boron concentrations during and after the Hazelwood mine fire at Recovery Phase soil sample sites**  
 Note: Laboratory detection limit is 10 mg/kg. Concentrations below this detection limit are assigned a value of 5 mg/kg for graphical purposes



**Figure 10. Strontium concentrations during and after the Hazelwood mine fire at Recovery Phase soil sample sites**  
**Note: Laboratory detection limit is 5 mg/kg. Concentrations below this detection limit are assigned a value of 2.5 mg/kg for graphical purposes**

While figures 8-10 show similar patterns of levels of barium, boron and strontium, manganese concentrations fluctuated across many sites and showed less of a trend (see Figure 11). For example, manganese levels peaked at 900 mg/kg at Morwell East AMS on 24 March 2014. However, as levels were high in both the surface and subsurface samples average concentrations of manganese across soil sampling sites were high (see figures 5, 6 and 7). Note that the higher levels were seen in subsurface samples. In addition, a few results are higher than those recorded in the ash. Hence these results are considered to be representative of the natural variation of manganese in soils rather than a direct impact from ash deposition.



**Figure 11. Manganese concentrations during and after the Hazelwood mine fire at Recovery Phase soil sample sites**

## 6.2.2 PAHs, MAHs and semi-volatile organic compounds

As discussed in Section 6.1.2, PAHs were detected in some early soil samples, but these levels quickly diminished. PAHs were detected three times in the surface soil at CFA car park, once in subsurface soil at Willis Street, and once at Morwell East AMS across March and April 2014.

Aside from four detections of acetone at four sampling sites, semivolts and MAHs were not detected in the soil samples. This could be that they were either not present or were consistently below the levels of laboratory detection.

## 6.3 Water

Results from the water sampling program indicate that mine fire ash has not impacted the chemistry of the local waterways. PAHs, semivolts and MAHs were not detected in the water samples. This could be that they were either not present or were consistently below the levels of laboratory detection. Metal concentrations show no indication of having been affected by ash deposition or run-off; when detected, the levels are typical of urban run-off in streams.

### 6.3.1 Metals

The metal results (from both active and passive sampling methods) show no clear trend that would indicate that ash deposition or run-off from ash-affected land has caused impacts to local waterways, as key analyte concentrations (metals commonly found in brown coal and coal mine fire ash) have remained relatively stable since March 2014. This can be seen in Figures 12–15 below where barium, boron, manganese and strontium concentrations in sampled waterways have remained steady since the start of the mine fire and into the Recovery Phase. Slight peaks and troughs occurred, such as peaks of barium and manganese at Thoms Bridge in September 2014 and December 2014, respectively. However, these peaks, which were well below guideline values, were recorded well after the ash deposition and so are unlikely to be due to ash from the mine fire. Of the heavy metals tested, only arsenic, chromium and lead were detected in the water samples, all at low levels and below guideline values. Cadmium and mercury were not detected at all during the sampling program. Other metals that were found (such as zinc and copper) are typical of streams receiving urban run-off.

The levels of barium, boron and strontium were consistently higher (during both Response and Recovery Phases) at the Hazelwood Pondage site than other water sample sites. It is possible that these levels are due to the presence of artesian water which is regularly pumped into Hazelwood Pondage as part of the mine's dewatering process.

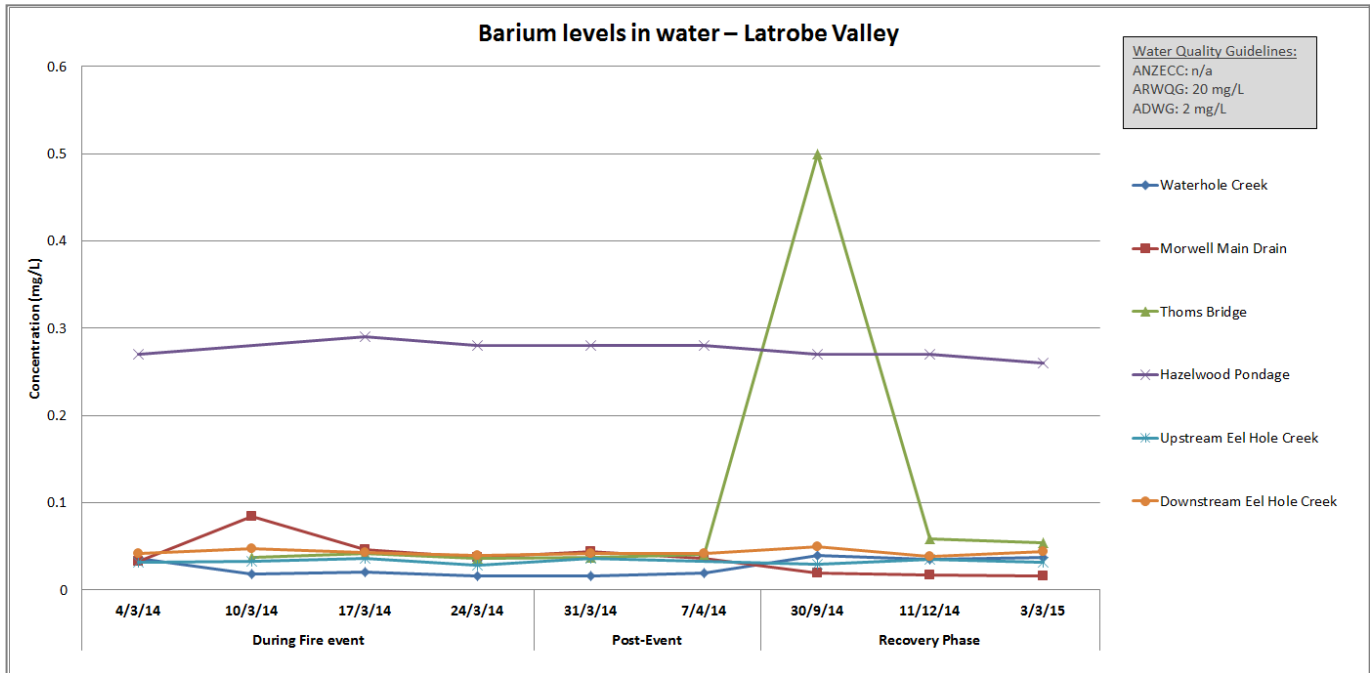


Figure 12. Barium concentrations during and after the Hazelwood mine fire at Recovery Phase water sample sites

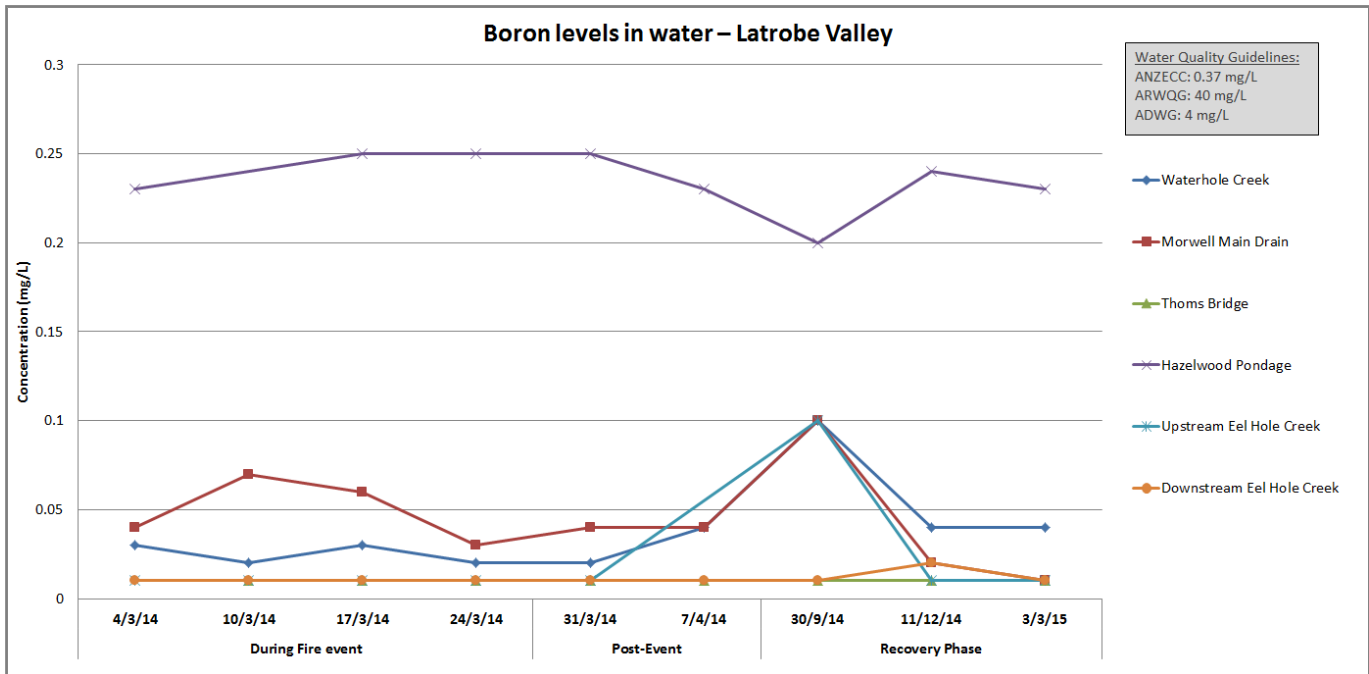


Figure 13. Boron concentrations during and after the Hazelwood mine fire at Recovery Phase water sample sites  
 Note: Laboratory detection limit is 0.02 mg/L. Concentrations below this detection limit are assigned a value of 0.01 mg/L for graphical purposes

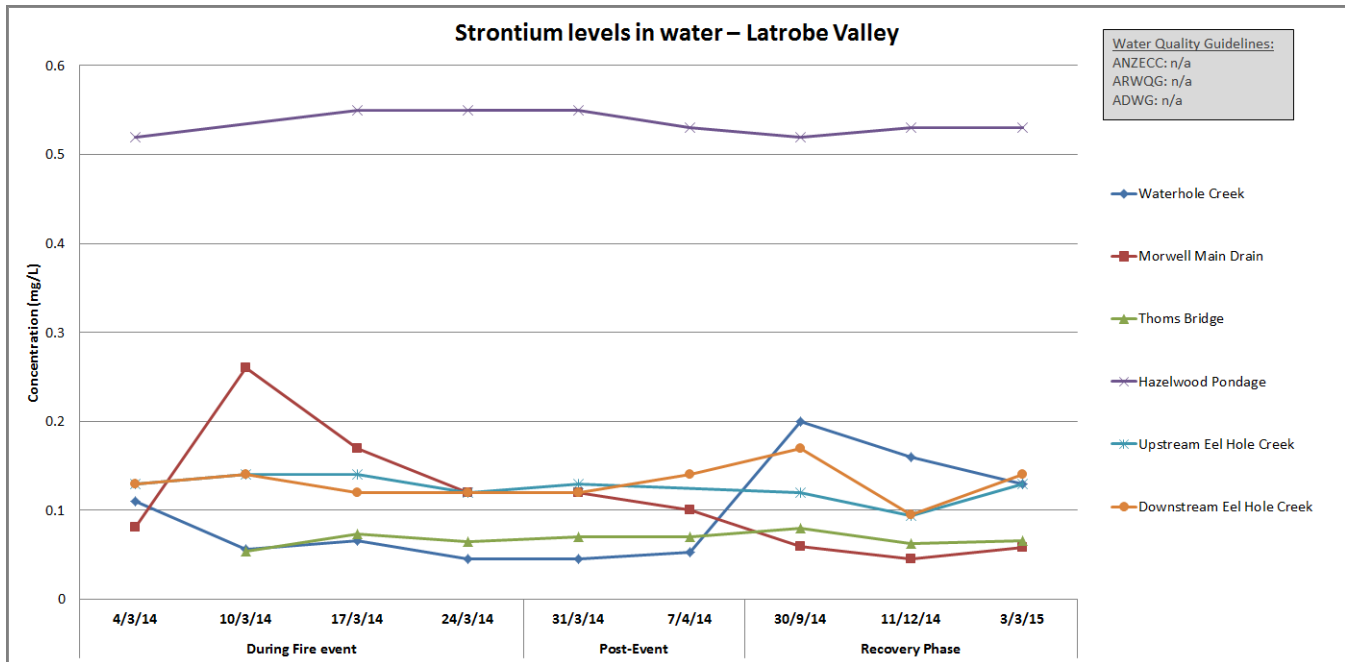


Figure 14. Strontium concentrations during and after the Hazelwood mine fire at Recovery Phase water sample sites

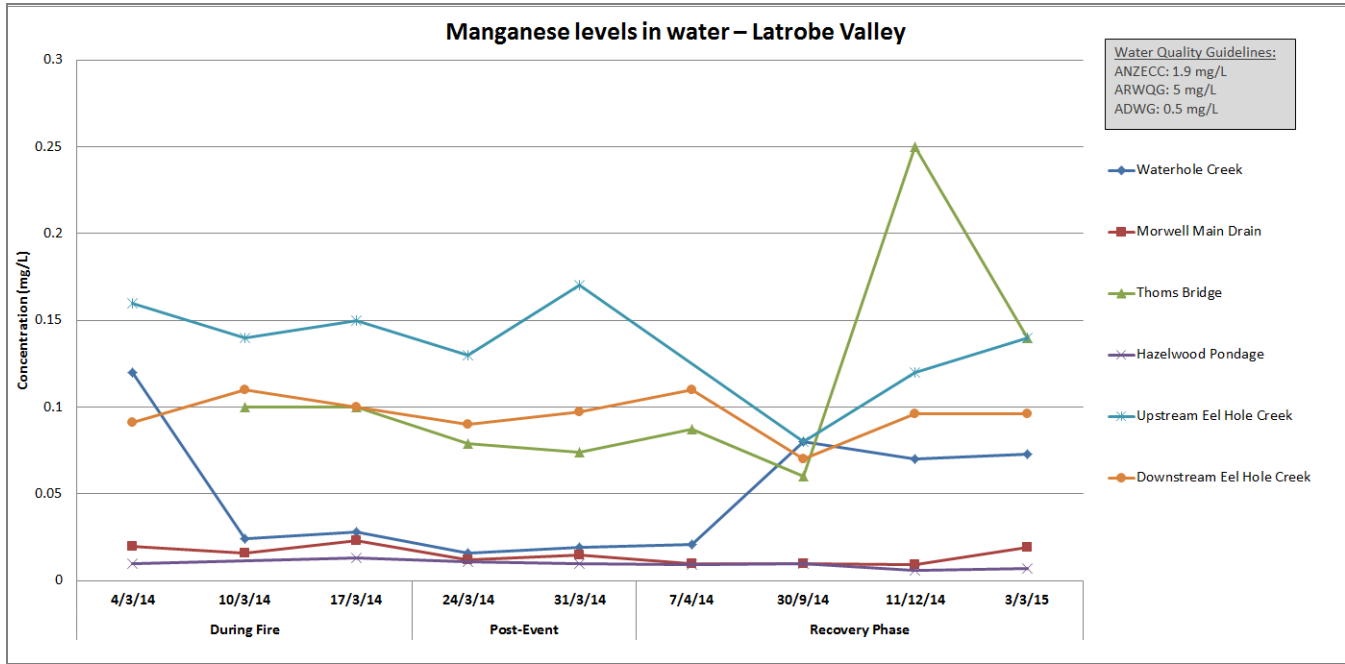


Figure 15. Manganese concentrations during and after the Hazelwood mine fire at Recovery Phase water sample sites

**6.3.2 Polycyclic aromatic hydrocarbons (PAHs) and other organic compounds**

Analysis of water samples has seen PAHs, semivolts and MAHs consistently undetected. Acetone was detected at two sites; however as discussed previously, it is attributed to natural or other sources of acetone in urban and rural environments.

## 7 Conclusion

The ash collected during the Hazelwood mine fire, including the ash collected from the surface soil at Willis Street on 18 February 2014, have been shown to have different chemical profiles than the surface and subsurface soils within and outside the ash deposition area.

The surface and subsurface soil results for a number of key chemicals showed consistently lower values when compared to the results of these chemicals in the ash.

The ash deposition on the soil was not sufficient to change the soil chemical composition.

No chemical evidence of ash was found in the waterways in the Morwell region at any stage during the sampling period.

Overall, the comparison of water and soil sampling data collected during the Recovery Phase with the data collected during the Response Phase shows that water and soil quality in the region do not appear to have been changed by the Hazelwood coal mine fire.

To see the full set of water and soil sampling data collected during the Hazelwood fire, go to:  
[www.epa.vic.gov.au/hazelwood/hazelwood-mine-fire/testing-during-the-hazelwood-fire](http://www.epa.vic.gov.au/hazelwood/hazelwood-mine-fire/testing-during-the-hazelwood-fire)

To see the full set of water and soil sampling collected during the recovery period, go to:  
[www.epa.vic.gov.au/hazelwood/environmental-reporting](http://www.epa.vic.gov.au/hazelwood/environmental-reporting)

## 8 References

Durie, R.A., (1991) *The Science of Victorian Brown Coal: Structure, Properties and Consequences for Utilization*, 1, North Ryde: CSIRO

## Appendices – Community Feedback

On 10 June 2015, EPA held a community engagement event to seek feedback from Latrobe Valley community members about draft versions of the reports: *Hazelwood Recovery Program Air Quality Assessment – Morwell and Surrounds, February 2014 – May 2015* (publication 1601) and *EPA Hazelwood Recovery Program water, soil and ash assessment – Morwell and surrounds, February 2014 – May 2015* (publication 1600). EPA received a wealth of excellent and detailed feedback on the draft publications. The community feedback received that is directly relevant to these reports is listed in the table below.

Community Feedback	EPA Comments
EPA should explain more clearly about the ash that was airborne during the fire, and the ash that settled on the ground. For example, particle size explanation in report would be helpful.	In response to this feedback, EPA has further clarified about the size of ash particles on page 2 of the water, soil and ash report (publication 1600).
Further explanation is needed for some graphs in the water, soil and ash graphs.	In response to this feedback, graphs on pages 9-15 of water, soil and ash report (publication 1600) were modified to make them easier to understand, or in some cases, more text was added to explain the meaning of the graphs.
Showing only trace metals components of brown coal is confusing.	In response to this feedback, further charts were added on page 4 and figure 2 of the water, soil and ash report (publication 1600) to show the other components of brown coal.
Could drinking water and recreational standards be included in the reports, either on graphs or listed separately?	In response to this feedback, figures have been updated on pages 13-15 of the water, soil and ash report (publication 1600).
Heavy metals detected at very low levels, zinc, lead, arsenic – why aren't they included in graphs?	In response to this feedback, text has been modified to page 13 of the water, soil and ash report (publication 1600) to explain why these metals haven't been included in the graph.
Clearer explanation is needed for some of the metal graphs in the water results section	In response to this feedback, figures have been updated on pages 13-15 of the water, soil and ash report (publication 1600).
Is there is a World Health Organization (WHO) standard that can be included in the graphs in the report?	EPA reports against the relevant national or state environmental guidelines for air, water and soil. There are also standards set by WHO or the Department of Health and Human Services. Often they influence national or state environmental standards. For more information about the standards EPA reports against, visit: <a href="http://www.epa.vic.gov.au/about-us/legislation/air-legislation">http://www.epa.vic.gov.au/about-us/legislation/air-legislation</a>
Where is the information about the history of air monitoring data in the Latrobe Valley?	See information given by then CEO John Merritt as evidence during the Hazelwood Mine Fire enquiry for a discussion of the history of air monitoring in the Latrobe Valley <a href="http://report.hazelwoodinquiry.vic.gov.au/part-four-health-wellbeing/environmental-effects-response/epa-latrobe-valley">http://report.hazelwoodinquiry.vic.gov.au/part-four-health-wellbeing/environmental-effects-response/epa-latrobe-valley</a>
Where is the detailed information about what EPA did during the mine fire?	This has been published in a separate report that focuses on EPA's response and air quality data during the mine fire: <i>Summarising the air monitoring and conditions during the Hazelwood mine fire, 9 February to 31 March 2014</i> (publication 1598). <a href="http://www.epa.vic.gov.au/our-work/publications/publication/2015/june/1598">http://www.epa.vic.gov.au/our-work/publications/publication/2015/june/1598</a>
What lessons have EPA learnt from the mine fire?	In accordance with specific recommendations from the Hazelwood Mine Inquiry, EPA has made a number of changes to its procedures and procedures about how we monitor air quality and communicate that data with the community: <a href="http://www.parliament.vic.gov.au/file_uploads/_Hazelwood_Mine_Fire_Inquiry_Report_dprsnQjH.pdf">http://www.parliament.vic.gov.au/file_uploads/_Hazelwood_Mine_Fire_Inquiry_Report_dprsnQjH.pdf</a>  The approach taken with engaging the community early with the results from these publications is another concrete example of learning and doing things differently.



Some of the metal graphs in the air report are difficult to understand	In response to this feedback, some text has been added to figures 11-13 pages 21-22 of the air report (publication 1601), and some graphs have been modified or removed.
Some annual guidelines were missing on the metal tables in the air report	In response to this feedback, the guideline values were added to page 7 of the air report (publication 1601).
Why is only PM <sub>2.5</sub> been monitored at the Moe and Churchill air monitoring stations?	In response to this feedback, a sentence has been added to page 3 the air report (publication 1601) to explain the decision behind monitoring PM <sub>2.5</sub> more clearly.
Some information about what happened with air monitoring during the fire is not clear, such as number of breaches of PM <sub>2.5</sub> and when monitoring started.	This has been published in a separate report that focuses on EPA's response and air quality data during the mine fire: <i>Summarising the air monitoring and conditions during the Hazelwood mine fire, 9 February to 31 March 2014</i> (publication 1598). <a href="http://www.epa.vic.gov.au/our-work/publications/publication/2015/june/1598">http://www.epa.vic.gov.au/our-work/publications/publication/2015/june/1598</a>
The report is technical and quite difficult to understand at times.	Publications 1600 and 1601 are technical reports. EPA will be looking at other ways to communicate the results to a general audience. EPA has asked for direct feedback from the community on what format this should take. To date ideas have included short plain-English information bulletins, short YouTube videos and public talks.

# Hazelwood Recovery Program air quality assessment – Morwell and surrounds

February 2014 – May 2015



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## 1. About this report

This report is a technical analysis of the Hazelwood Recovery Program's air quality data collected by Environment Protection Authority Victoria (EPA) during the Hazelwood mine fire, and in the 14-month period since the fire was declared safe on 25 March 2014. For the purpose of this report, the collection of data has been classified into two phases: the Response Phase (mid-February to 7 April 2014) and the Recovery Phase (8 April 2014 to 21 May 2015). The Recovery Phase start date was set at 8 April rather than 25 March to coincide with water and soil sampling time periods.

Air quality monitoring data from the fire has been available to the community since February 2014 on EPA's website:

[www.epa.vic.gov.au/hazelwood/environmental-reporting/air-quality/air-monitoring-results](http://www.epa.vic.gov.au/hazelwood/environmental-reporting/air-quality/air-monitoring-results)

As part of the writing process, this report has been reviewed by EPA, external scientific experts and relevant government agencies. A draft of this report was also reviewed by members of the Latrobe Valley community at an EPA engagement event on 10 June 2015. Following this event changes were made to the text and overall community feedback about the report has been included in the appendices.

**This publication is a technical report. For further details about any aspect of this report, or to access data, please contact EPA Victoria on 1300 372 842 or [contact@epa.vic.gov.au](mailto:contact@epa.vic.gov.au).**

## 2. Aim of air quality assessment

The aim of the Hazelwood recovery air quality assessment was to determine whether there have been any ongoing changes to air quality in the Latrobe Valley as a result of the Hazelwood mine fire. The assessment was not designed to analyse the overall air quality in the region. Information on water, soil and ash results can be found in a companion report – EPA publication 1600: [Water, soil and ash assessment – Morwell and surrounds February 2014 – May 2015](#).

In order to determine if the mine fire has impacted on ongoing air quality in the Latrobe Valley, EPA has compared air monitoring and sampling data collected during the Recovery Phase, with the data collected during the Response Phase. The air quality data has also been compared to historical data where it is relevant.

## 3. Background

The Hazelwood Recovery Program is a state government-funded, EPA initiative in response to the Hazelwood mine fire that occurred in February and March 2014. As part of EPA's commitment to the Hazelwood recovery effort, EPA conducted air, water and soil testing in the region over a 14-month period.

The aim of this environmental monitoring program was to determine if there have been any long-term changes to ambient air quality in the region as a result of the Hazelwood mine fire, and to inform the community of any identified changes.

The Hazelwood recovery environmental monitoring program also fulfilled EPA's obligation to have an air quality monitoring program and station in the south of Morwell for 12 months, in accordance with Affirmation 22 from the Hazelwood Mine Fire Inquiry Report<sup>1</sup>.

### 3.1. Response Phase

The response to the Hazelwood mine fire was a multi-agency effort. EPA's role was to measure, validate and assess the impacts of the smoke and ash on local air, water and soil. EPA provided data to the Department of Health (now the Department of Health and Human Services), whose role was to assess potential impacts on human health and to inform the community on appropriate actions to minimise health impacts. A summary of EPA air monitoring data collected during the Hazelwood mine fire is available in the publication [Summarising the air monitoring and conditions during the Hazelwood mine fire, 9 February to 31 March 2014](#) (publication 1598).

### 3.2. Primary air monitoring

During the Response Phase, EPA monitored air quality using sophisticated air monitoring equipment that was housed in air monitoring stations (AMSs). Temporary AMSs were located at strategic locations in the east and south of Morwell, in addition to the permanent air monitoring station in Traralgon. The different types of equipment used for this monitoring comply with Australian Standards (see Tables 1 and 4; and Sections 4.3 & 4.5). They provide data that can be directly compared with air quality standards (see Table 3).

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<sup>1</sup> <http://report.hazelwoodinquiry.vic.gov.au/>

### 3.3. Other air monitoring

As part of EPA’s rapid-response monitoring, mobile monitoring instruments were used to measure very small airborne particles (PM<sub>2.5</sub>). These instruments can be deployed quickly during a pollution event. Data from rapid-response monitoring is considered indicative. In this case it was used to inform some response-related activities, such as the development of air quality protocols. This indicative data was not, however, used for all operational decisions taken at the time. This is because at the time of the fire, EPA believed that further work was needed to understand how the indicative data could be compared to the air quality standards. The data has also been useful in the analysis conducted after the fire was declared safe by providing a better understanding of air quality conditions in the early days of the fire. Information about this process is available in the EPA publication 1599: [Estimating air quality in the early stages of the 2014 Hazelwood mine fire](#).

### 3.4. Air sampling

EPA also tested the air to Australian Standards for a wide range of other pollutants including metals, crystalline silica, volatile organic compounds (VOCs), dioxins and polycyclic aromatic hydrocarbons (PAHs), using periodic air sampling processes. This occurred at locations close to the Hazelwood mine site.

### 3.5. Recovery Phase

After the fire was declared safe on 25 March 2014, EPA designed a year-long environmental monitoring program as part of the Recovery Phase to determine if the fire had impacted on the quality of air, water and soil in the region. The air sampling and monitoring locations, the extent of the area monitored, and the main chemicals analysed were largely the same as those during the mine fire. This consistency has allowed EPA to compare air quality data from the Recovery Phase to data collected during the Response Phase. For the purposes of this report the Recovery Phase started on 8 April 2014. This is to be consistent with the classification of data from the water and soil sampling program presented in EPA publication 1600: [Water, soil and ash assessment – Morwell and surrounds February 2014 – May 2015](#).

## 4. Methods used in the Recovery Phase air quality assessment

### 4.1. Where did we sample and monitor air quality?

During the Hazelwood mine fire Response and Recovery phases, EPA monitored and sampled air quality using different types of equipment at various locations in and around Morwell (see Tables 1 and 2; and Figure 1). The main focus of the Recovery Phase air quality monitoring has been on very fine breathable airborne particles (PM<sub>2.5</sub>) as it is present in smoke and potentially poses the greatest risk to human health.

**Table 1. Location of air monitoring equipment during the Response and Recovery phases**

Site	Monitoring equipment *	What was measured?*	Sampling period
Traralgon air monitoring station	TEOM, BAM, gas analyser, nephelometer	PM <sub>10</sub> , PM <sub>2.5</sub> , CO, O <sub>3</sub> , NO <sub>2</sub> , SO <sub>2</sub> , visibility reduction	1981 – present
Morwell (South) air monitoring station <sup>1</sup>	DustTrak, BAM, gas analyser, nephelometer	PM <sub>2.5</sub> , CO, O <sub>3</sub> , NO <sub>2</sub> , SO <sub>2</sub> , visibility reduction	February 2014 – present
Morwell (East) air monitoring station	BAM, gas analyser, nephelometer	PM <sub>2.5</sub> , CO, SO <sub>2</sub> , visibility reduction	February 2014 – present
	Radiello	VOCs	February 2014 – present
Kernot Hall, Morwell	DustTrak	PM <sub>2.5</sub> , PM <sub>10</sub>	February 2014 – March 2015
St Luke’s Uniting Church, Morwell	DustTrak	PM <sub>2.5</sub> , PM <sub>10</sub>	February 2014 – March 2015
Churchill <sup>2</sup>	ADR 1500 BAM	PM <sub>2.5</sub>	February 2014 – present
Moe <sup>2</sup>	ADR 1500 BAM	PM <sub>2.5</sub>	February 2014 – present

\* See sections 4.2 and 4.3 for explanations of acronyms and equipment

<sup>1</sup> Located at Morwell Bowling Club until 6 October 2014 when it was relocated to Maryvale Crescent Preschool

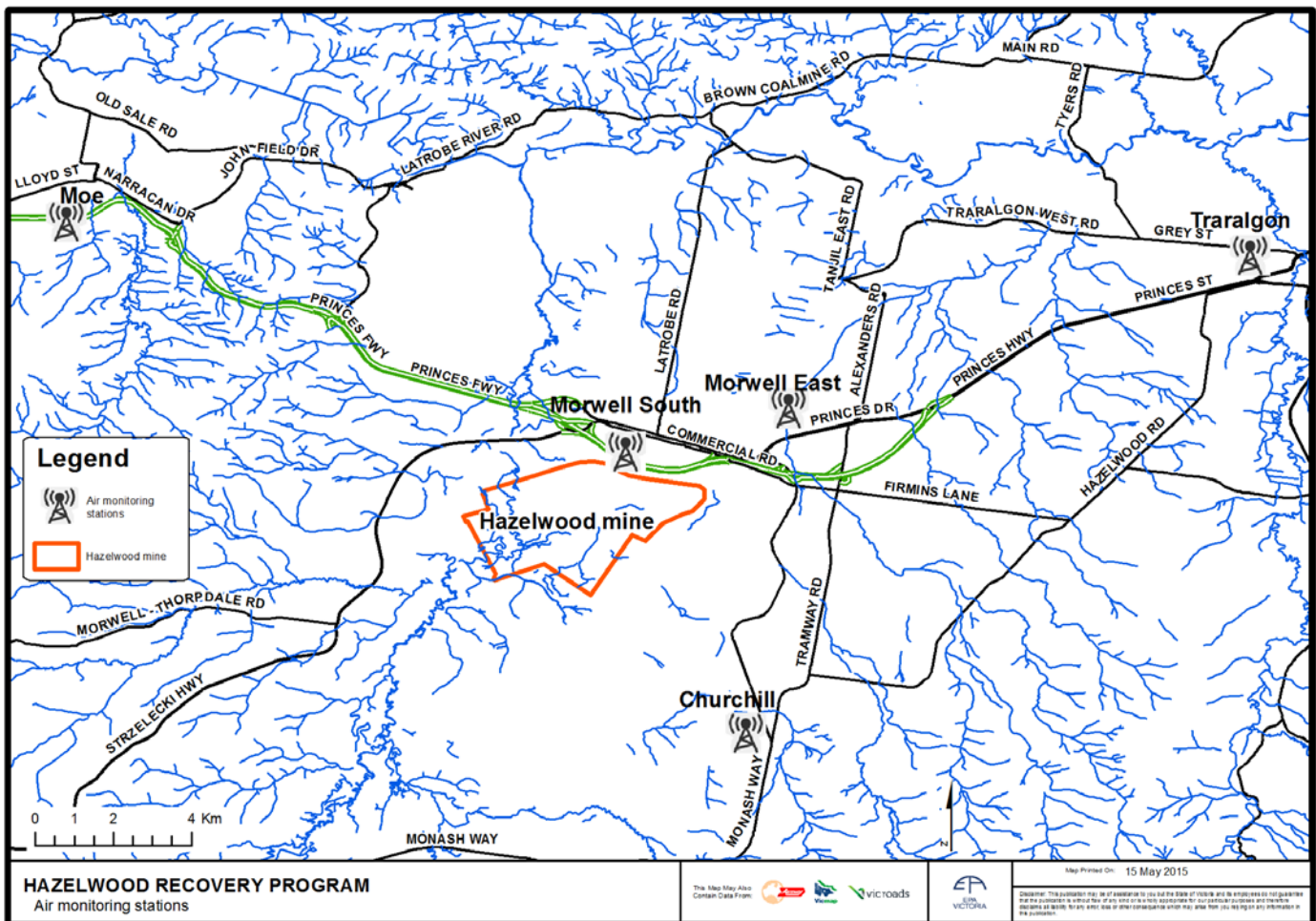
<sup>2</sup> Area dust monitors (ADRs) were in place at Moe and Churchill during the fire. These were replaced with air monitoring stations (which house beta attenuation monitors (BAMs)) in early 2015. As they did not become operational until late during the Recovery Phase, data from these stations have not been included in this report.

**Table 2. Location of air sampling equipment during the Response and Recovery phases**

Site	Sampling equipment *	What was measured? *	Operational from
<b>Morwell (East) air monitoring station</b>	Radiello	VOCs	26 February 2014 - present
<b>Morwell Bowling Club<sup>1</sup></b>	Radiello	VOCs	24 April 2014 - present
<b>Maryvale Crescent Preschool<sup>1</sup></b>	HiVol Partisol Radiello	PAHs and metals Respirable silica VOCs	21 May 2014 - present 09 April 2014 - present 26 February 2014 - present

\* See sections 4.2 and 4.3 for explanations of acronyms and equipment

<sup>1</sup> The site of Morwell (South) AMS was located at Morwell Bowling Club until 6 October 2014 when it was relocated to Maryvale Crescent Preschool



**Figure 1. Location of air monitoring stations (AMSs) in the Latrobe Valley at April 2015. Blue lines are drainage courses, not waterways.**

## 4.2. What pollutants did we monitor?

EPA tested for a number of pollutants during the Recovery Phase including breathable airborne particles (PM<sub>10</sub> and PM<sub>2.5</sub>), carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs). Information on each of these pollutants is provided below.

The pollutant of primary concern during the fire was breathable airborne particles (in particular PM<sub>2.5</sub>). Carbon monoxide was also raised as a concern, particularly for fire fighters during the early stage of the fire. While these pollutants were the focus of early monitoring, other pollutants were measured by EPA to assess the state of the air quality and assess community concerns.

Up-to-date information on the impacts of air pollution on human health can be found on the Department of Health and Human Service's Better Health Channel website.<sup>2</sup>

**Airborne particles** or particulate pollution is the presence of liquid droplets or solid particles (such as dust and smoke) in the air. Particles come in a wide range of sizes. They are measured in micrometres ( $\mu\text{m}$ ) – 1 micrometre is 0.001 millimetres (mm). EPA measures two categories of particle size:

- **PM<sub>2.5</sub>** are airborne particles with a diameter of less than 2.5  $\mu\text{m}$ . General sources of these particles include all types of combustion, including motor vehicles and power plant emissions and, in this case, a coal fire. Very fine particles pose the greatest risk to human health, as their very small size means they can be breathed deep into the lungs.
- **PM<sub>10</sub>** are particles less than 10  $\mu\text{m}$  in diameter. Sources of these particles include combustion sources, but also crushing or grinding operations, pollen, road dust and sea salt.

**Carbon monoxide (CO)** is a colourless and odourless gas that is produced when fuels are burned. The most common source of carbon monoxide in the outdoor environment is car exhaust emissions. As a result, low levels of carbon monoxide are always present in the air in Australian towns and cities. High levels of carbon monoxide are known to have toxic health effects.

**Sulfur dioxide (SO<sub>2</sub>)** is a strong-smelling, colourless gas that can irritate the lungs, and be particularly harmful for people with asthma. In this area, coal-fired power stations are a major source of sulfur dioxide in the air.

**Nitrogen dioxide (NO<sub>2</sub>)** is an invisible gas with a strong, unpleasant odour. It is produced by combustion. The most common source of nitrogen dioxide in the air is car exhaust emissions.

**Ozone (O<sub>3</sub>)** is a colourless gas with a strong, distinctive odour. Although ozone occurs naturally, a higher than normal concentration of ozone found closer to the ground is a main part of air pollution called smog. Ozone forms when other air pollutants combine on warm or hot days.

**Visibility reduction** measurements are a good indicator of smoke intensity: the greater the smoke intensity, the higher the visibility reduction measurement and the lower the visual range. Visibility is reported as an airborne particle index, which is based on the measurement of the amount of fine particles in the air.

**Silica** exists naturally in the environment in soils, rocks and sand and is a main component used in the construction industry. Environmental emissions of silica can arise from both natural and industrial activities, including crushing or grinding operations.

While the emission of crystalline silica from the coal mine fire was not specifically mentioned in the Hazelwood Inquiry Report as a pollutant of concern, community interest meant that EPA monitored levels of airborne silica (cristobalite and  $\alpha$ -quartz) in the vicinity of the Hazelwood mine as part of the 12-month sampling program. Respirable silica refers to the smaller airborne particles which are of a size that can be inhaled deep into the lungs.

**Metals** are contained within the brown coal found in the Latrobe Valley and can be released during combustion (Brockway, Ottrey & Higgins, 1991). EPA therefore had air samples analysed for numerous different metals, including arsenic, cadmium, chromium, lead and mercury.

**Polycyclic aromatic hydrocarbons (PAHs)** are found naturally in the environment but they can also be manmade. PAHs are produced as a result of incomplete combustion of organic matter, such as coal and other fossil fuels. The Hazelwood mine fire burned at varying temperatures and oxygen concentrations, which may have potentially produced PAHs such as benzo[a]pyrene, fluorene and naphthalene.

**Volatile organic compounds (VOCs)** are organic compounds that can be found both naturally in the environment and from manmade sources. Most scents and odours are made up of VOCs. Some VOCs are considered harmful to humans. One VOC that is a known human carcinogen is benzene, which is a chemical found in environmental tobacco smoke, stored fuels and exhaust from cars. Many VOCs are also known to react with nitrogen oxides to form ground-level ozone, a component of smog.

## Other

In addition to the pollutants listed above, meteorological conditions (wind speed, wind direction, relative humidity, barometric pressure and temperature) were measured at each air monitoring station.

### 4.3. How did we monitor air quality?

EPA's scientists measure air quality using rigorous monitoring systems and best practice technology. During the Response and Recovery phases, EPA used different types of automated and passive instruments to monitor air quality in the Latrobe Valley.

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<sup>2</sup> [www.betterhealth.vic.gov.au/bhcv2/bhcarticles.nsf/pages/Air\\_pollution](http://www.betterhealth.vic.gov.au/bhcv2/bhcarticles.nsf/pages/Air_pollution)

## 4.3.1. Continuous monitoring equipment

**BAM** – a standard beta attenuation monitor automatically measures and records airborne particles. This instrument works by measuring the absorption of beta radiation by particles collected on the filter tape. From this, the concentration of airborne particles is calculated.

**TEOM** – a tapered element oscillating microbalance monitor continually measures the concentration of airborne particles. It does this by collecting and weighing the particles using a very sensitive balance.

**Gas analysers** – these instruments are used to measure the concentrations of different gases in the air. Each gas is measured by a different digital analyser.

**Nephelometer** – this instrument measures the amount of particles in the air using highly sensitive light-scattering sensors and calculates a visibility reduction index.

**DustTrak™** – a portable, ‘rapid-response’ instrument which uses an optical sensor. The data produced by the DustTraks helped EPA map particle level variations and exposures. A summary of EPA air monitoring data collected during the Hazelwood mine fire is available in the publication [Summarising the air monitoring and conditions during the Hazelwood mine fire, 9 February to 31 March 2014](#) (publication 1598) and [EPA publication 1599: Estimating air quality in the early stages of the 2014 Hazelwood mine fire](#).

**ADR**– Area dust monitors use highly sensitive sensors, like nephelometers, to detect smoke particles in the air. A summary of EPA air monitoring data collected during the Hazelwood mine fire is available in the publication [Summarising the air monitoring and conditions during the Hazelwood mine fire, 9 February to 31 March 2014](#) (publication 1598); and [EPA publication 1599: Estimating air quality in the early stages of the 2014 Hazelwood mine fire](#).

## 4.3.2. Periodic sampling equipment

**Radiello tubes** – these solid, adsorbent tubes absorb volatile organic compounds (VOCs) in the air. They are a stand-alone, passively sampling tube deployed at different sites in Morwell.

**HiVol** – the high-volume sampler collects particles smaller than PM<sub>10</sub> on to a filter. External laboratories analyse these filters to measure the amount of metals and PAH particles in the air.

**Partisol** – an air sampler that provides samples of the concentrations of respirable silica in the air. Silica is collected on filters and sent away for laboratory analysis.

## 4.4. Guidelines

Air quality data collected by EPA is measured against the Australian *National Environment Protection (Ambient Air Quality) Measure*, commonly known as the Air NEPM. These national air quality standards have been used across Australia since 2002 and include a set of air quality goals and standards for a range of air pollutants (see Table 3).

The standards set out the acceptable levels of key air pollutants as agreed by all Australian jurisdictions. Further information about these standards can be found on the Australian Government Department of the Environment’s [air quality standards webpage](#)<sup>3</sup>. The number of allowable exceedances associated with the standards has been set to account for unusual meteorological conditions and, in the case of particles, natural events such as bushfires and dust storms that cannot be controlled through normal air quality management strategies.

To find out more about how EPA Victoria carries out its responsibilities under the standards, see [Victoria’s Air NEPM monitoring plan](#)<sup>4</sup>.

For other pollutants not covered in the Ambient Air NEPM, such as visibility-reducing particles (measured as visual distance, and reported as an index), EPA reports against air quality objectives defined in the [State Environmental Protection Policy \(Ambient Air Quality\)](#)<sup>5</sup> (Air SEPP AAQ). The Air SEPP AAQ sets air quality objectives and goals for the State of Victoria. It mirrors the requirements in the Ambient Air NEPM. EPA also uses the [State Environmental Protection Policy \(Air Quality Management\) \(Air SEPP AQM\)](#) for some objectives and monitoring. This SEPP provides a framework for managing air emissions in the air environment.

During the Response and Recovery phases, EPA primarily used the SEPP AAQ and the Ambient Air NEPM to assess the concentration of pollutants in the air.

NEPM and SEPP guidelines do not exist for a number of air pollutants that EPA tested for during both the Response and Recovery phases of the mine fire. Where available, alternative guidelines from other jurisdictions were used, including from the US Texas Commission on Environmental Quality (TCEQ); US Department of Health Agency for Toxic Substances and Disease Registry (ATSDR); and the US National Ambient Air Quality Standards (NAAQS). Relevant guidelines are presented with air assessment results in the Results and Discussion section of this report.

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<sup>3</sup> [www.environment.gov.au/protection/air-quality/air-quality-standards](http://www.environment.gov.au/protection/air-quality/air-quality-standards)

<sup>4</sup> [www.epa.vic.gov.au/our-work/publications/publication/2002/january/828](http://www.epa.vic.gov.au/our-work/publications/publication/2002/january/828)

<sup>5</sup> [www.epa.vic.gov.au/about-us/legislation/air-legislation](http://www.epa.vic.gov.au/about-us/legislation/air-legislation)

**Table 3. National Environment Protection Council (Ambient Air Quality) Measure (NEPM) and State Environmental Protection Policy (Ambient Air Quality) (SEPP) guidelines. Relevant guidelines not presented here can be found in the Results and Discussion section of this report.**

Pollutant	Averaging time #	Standard *	Origin	Maximum allowable exceedences
Particles as PM <sub>2.5</sub>	24 hours	25 µg/m <sup>3</sup>	Air NEPM (advisory)^	5 days a year^
	Annual	8 µg/m <sup>3</sup>		–
Particles as PM <sub>10</sub>	24 hours	50 µg/m <sup>3</sup>	Air NEPM	5 days a year
Carbon monoxide (CO)	8 hours	9 ppm	Air NEPM	1 day a year
Nitrogen dioxide (NO <sub>2</sub> )	1 hour	0.12 ppm	Air NEPM	1 day a year
	Annual	0.03 ppm		none
Ozone (O <sub>3</sub> )	1 hour	0.10 ppm	Air NEPM	1 day a year
	4 hours	0.08 ppm		1 day a year
Sulfur dioxide (SO <sub>2</sub> )	1 hour	0.20 ppm	Air NEPM	1 day a year
	24 hours	0.03 ppm		1 day a year
	Annual	0.02 ppm		none
Lead (Pb)	Annual	0.50 µg/m <sup>3</sup>	Air NEPM	none
Minimum visible distance	1 hour	20 km	Air SEPP	3 days a year

#Each pollutant has a specific averaging time. Averaging is done over defined time periods (1 hour, 8 hours, 24 hours and annually) to compare against the standards and criteria for health effects. Most air monitoring instruments measure air quality over minutes, and these are then averaged over longer time periods

\* µg/m<sup>3</sup> means micrograms per cubic metre; ppm means parts per million

^ Under the current Air NEPM, there is no direct standard for PM<sub>2.5</sub>; however, there is an agreed advisory standard of 25µg/m<sup>3</sup>. The Australian Government is currently leading work to finalise [agreement on a national standard for PM<sub>2.5</sub>](#).

## 4.5. What methods and standards did we follow?

EPA ensures the accuracy of its air quality data by using fit-for-purpose technologies and applying relevant standards for monitoring, sampling and analysis.

EPA staff collected air samples according to EPA’s documented processes and in line with internal data quality management plans. Once collected, the samples were analysed by independent laboratory service providers, who are accredited by the National Association of Testing Authorities (NATA).

### 4.5.1. Air monitoring

#### NATA status

Traralgon air monitoring station is part of EPA’s ambient air quality network and is set up, maintained and operated in accordance with EPA’s NATA accreditation (Number 15119).

Morwell (South) and Morwell (East) AMSs are investigative monitoring stations so are not part of EPA’s NATA accreditation. However, some parameters are monitored in accordance with approved NATA procedures, including: SO<sub>2</sub>, CO, NO<sub>x</sub> (from which concentrations of NO<sub>2</sub> are calculated), O<sub>3</sub> and visibility.

Thermo Fisher Beta Attenuation Monitor (BAM) 5014i instruments are not part of EPA’s NATA accreditation. These instruments are newer so are still being integrated into EPA’s processes, and they may be included in EPA’s NATA accreditation in the future. BAMS at Traralgon, Morwell (South) and Morwell (East) are set up according to the relevant Australian Standard (AS 3580.9.12: 2013).

#### Data validation

All of the gaseous data (SO<sub>2</sub>, CO, NO<sub>2</sub>, O<sub>3</sub>) and visibility data presented in this report has been validated for Traralgon AMS, Morwell (South) AMS and Morwell (East) AMS to NATA accreditation standards.

All of the PM<sub>2.5</sub> and PM<sub>10</sub> data measured on BAMS and TEOMs presented in this report has been validated according to the relevant Australian Standards as set out in Table 4. TEOM PM<sub>10</sub> data has been adjusted according to the approved procedure <sup>6</sup>, as outlined in Appendix A.

<sup>6</sup> <http://www.scew.gov.au/system/files/resources/9947318f-af8c-0b24-d928-04e4d3a4b25c/files/aaqrctp10collectionandreporting200105final.pdf>



## 4.5.2. Air sampling

Sampling was carried out in accordance with relevant standards outlined in Table 4 and managed in accordance with EPA's accredited internal quality systems by trained EPA staff. The following NATA accredited laboratories were used for sample analysis:

- analysis of crystalline silica: WorkCover NSW (NATA Accredited Laboratory Number: 3726)
- analysis of metals, PAHs and VOCs: SGS Leeder Consulting (NATA Accredited Laboratory Number: 14429).

**Table 4. Methods used for air quality monitoring, sampling and analysing during the Recovery Phase period**

Pollutant		Standard	Title	Method Used
Particles	PM <sub>2.5</sub> *	AS/NZS 3580.9.12: 2013	Determination of suspended particulate matter - PM <sub>2.5</sub> beta attenuation monitors	Beta attenuation monitor (BAM)
	PM <sub>10</sub>	AS 3580.9.8: 2008	Determination of suspended particulate matter - PM <sub>10</sub> continuous direct mass method using a tapered element oscillating microbalance analyser	Tapered element oscillating microbalance (TEOM )
Carbon monoxide	CO	AS 3580.7.1: 2011	Ambient air - Determination of carbon monoxide - Direct reading instrument method	Gas filter correlation/infrared
Sulfur dioxide	SO <sub>2</sub>	AS 3580.4.1: 2008	Ambient air - Determination of sulfur dioxide. Direct reading instrument method	Pulsed fluorescence
Nitrogen dioxide	NO <sub>2</sub>	AS 3580.5.1: 2011	Ambient air - Determination of oxides of nitrogen - Chemiluminescence method	Gas phase chemiluminescence
Photochemical oxidant (ozone)	O <sub>3</sub>	AS 3580.6 .1: 2011	Ambient air - Determination of ozone. Direct reading instrument method	Non-dispersive ultraviolet
Visibility reduction		AS/NZS 3580.12.1: 2001 (R2014)	Determination of light scattering - Integrating nephelometer method	Integrating nephelometer method
Silica		Sampling: AS/NZS 3580.9.10: 2006	Determination of suspended particulate matter - PM <sub>2.5</sub> low volume sampler	Gravimetric method
		Analysis: WorkCover NSW method WCA.220	Determination of crystalline silica (Alpha-quartz & cristobalite) in respirable dust	X-Ray diffractometry
Metals		Sampling: AS/NZS 3580.9.6: 2003 (R2014)	Determination of suspended particulate matter - PM <sub>10</sub> high volume sampler with size-selective inlet	Gravimetric method
		Analysis: MA-1400.FL.02		
Polycyclic aromatic hydrocarbons (PAHs)		Sampling: AS/NZS 3580.16:2014	Determination of polycyclic aromatic hydrocarbons (PAH)	High-volume sampler - gravimetric method
		Analysis: MA-72.FL.01		
Volatile organic compounds (VOCs)#		Sampling: RAD120 <sup>7</sup>		
		Analysis: MA-5.RAD.02 <sup>8</sup>	Volatile organics in air	High-resolution gas chromatography - mass spectrometry

Air sampling units are expressed in concentrations at 0°C and one atmosphere pressure unless otherwise stated.

Particle concentration units of µg/m<sup>3</sup> refer to volumes at 0 °C and one atmosphere of pressure.

\* BAMS were set -up and maintained in accordance with AS/NZS 3580.9.12: 2013. Calibration schedules and techniques were done in accordance with manufacturer specifications <sup>9</sup>

# Concentrations are at 25°C and one atmosphere pressure

<sup>7</sup> [www.radiello.com/english/cov\\_chim\\_en.htm](http://www.radiello.com/english/cov_chim_en.htm)

<sup>8</sup> [www.leederconsulting.com/enviro\\_air\\_analysis\\_ambient\\_vocs\\_ma5.html](http://www.leederconsulting.com/enviro_air_analysis_ambient_vocs_ma5.html)

<sup>9</sup>

[www.thermoscientific.com/content/dam/tfs/ATG/EPD/EPD%20Documents/Product%20Manuals%20&%20Specifications/Air%20Quality%20Instruments%20and%20Systems/Particulate/EPM-manual-Model%205014i.pdf](http://www.thermoscientific.com/content/dam/tfs/ATG/EPD/EPD%20Documents/Product%20Manuals%20&%20Specifications/Air%20Quality%20Instruments%20and%20Systems/Particulate/EPM-manual-Model%205014i.pdf)

## 5. Results and discussion

This section summarises EPA’s air sampling and monitoring results from the Recovery Phase. This data has come from the monitoring and sampling instruments located around the Latrobe Valley as detailed in Tables 1 and 2.

To interpret these results, EPA has – where possible – compared the Recovery Phase data to other sources of data. This includes data gathered during the Response Phase and data collected prior to the mine fire.

The VOCs, metals and PAHs data collected since February 2015 has not been analysed and processed in time to present in this report.

### 5.1. PM<sub>2.5</sub>

Particulate matter was the major pollutant during the mine fire. Concentrations of PM<sub>2.5</sub> were recorded well above the NEPM advisory guideline, particularly at Morwell (South) where PM<sub>2.5</sub> levels exceeded the 24-hour guideline on 21 days during the fire. The highest peak was estimated to be up to 800 µg/m<sup>3</sup> (32 times the reporting standard), which occurred early during the fire.<sup>10</sup>

Figure 2 shows daily average PM<sub>2.5</sub> concentrations in the Latrobe Valley measured using BAMs since mid-February 2014. After a peak of 417 µg/m<sup>3</sup> at Morwell (South) on 21 February 2014, levels dropped off sharply over the following weeks as the fire was brought under control, and remained at a stable concentration at all three stations for the rest of the monitoring period, with the exception of a few exceedances. There current allowable number of exceedances per year of the NEPM 24-hour guideline is five, though this number has not been designated formally.<sup>11</sup>

These spikes, exceeding the NEPM daily advisory guideline of 25 µg/m<sup>3</sup>, were seen during two periods (31 µg/m<sup>3</sup> and 34 µg/m<sup>3</sup> at Traralgon in mid-May 2014; and 35 µg/m<sup>3</sup> and 33 µg/m<sup>3</sup> at Traralgon and Morwell (East), respectively, on 1 April 2015). These guideline breaches are associated with elevated smoke levels that may have originated from landholder burning off, forest regeneration burns and planned burning. Smoke is often persistent in the Latrobe Valley in autumn due to the stable atmospheric conditions at that time of year.

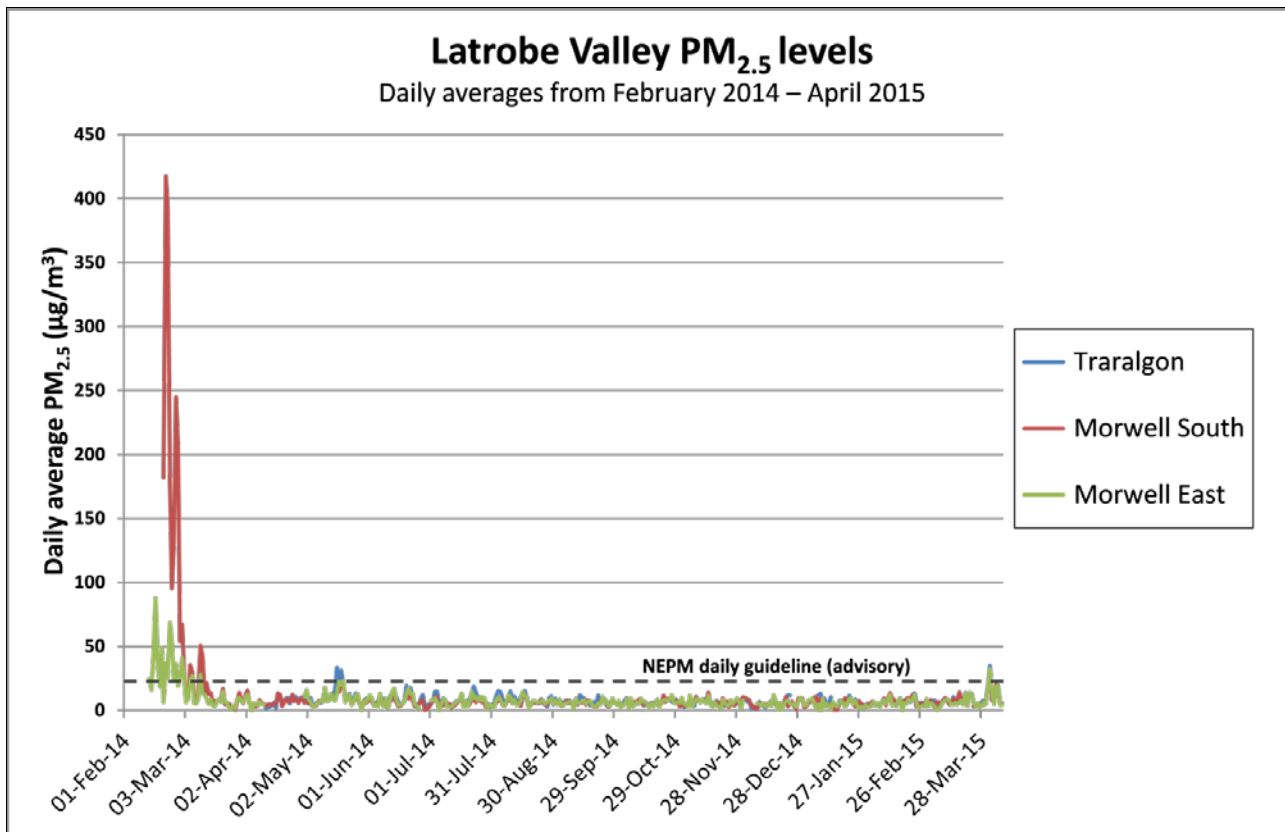


Figure 2. Daily 24-hour average PM<sub>2.5</sub> concentrations in the Latrobe Valley measured using BAMs from 13 February 2014 to 7 April 2015. Daily average is measured from midnight to midnight, in line with the NEPM standards.

<sup>10</sup> [www.epa.vic.gov.au/~media/Publications/1599.pdf](http://www.epa.vic.gov.au/~media/Publications/1599.pdf)

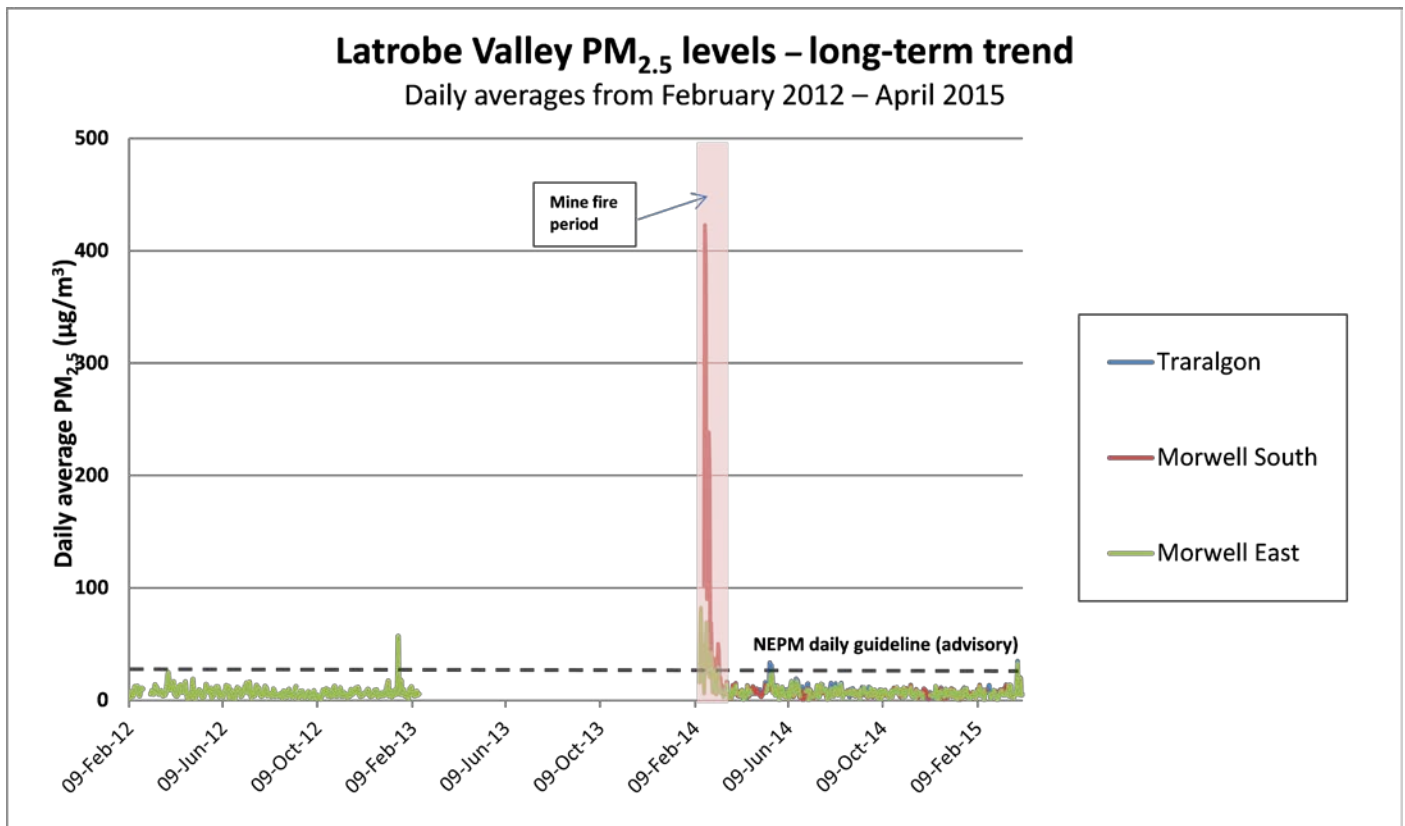
<sup>11</sup> [www.comlaw.gov.au/Details/C2004H03935](http://www.comlaw.gov.au/Details/C2004H03935)

Figure 3 shows long-term daily PM<sub>2.5</sub> concentrations in the Latrobe Valley since 9 February 2012. It can be seen from observation that pre-fire levels of PM<sub>2.5</sub> at Morwell (East) are generally consistent with Recovery Phase levels for all three stations. Concentrations remain consistently lower than 25µg/m<sup>3</sup> during both periods, occasionally rising above the guideline, but never above 50 µg/m<sup>3</sup>. There was only one pre-fire exceedance of the NEPM daily advisory guideline of 25µg/m<sup>3</sup> on 21 January 2013 due to bushfires at Aberfeldie. This is consistent with events causing exceedances in the Recovery Phase.

While Figure 3 looks at daily PM<sub>2.5</sub> averages, Table 5 compares longer averaging periods. It can be seen in Table 5 that there is a significant drop in the average concentration at Morwell (South) when comparing the incident (up to 25 March 2014) average, to that starting on 8 April 2014 (Recovery average). The Incident (to 25 March 2014) recorded an average PM<sub>2.5</sub> concentration of 68.5µg/m<sup>3</sup> compared to 6.5µg/m<sup>3</sup> for the Recovery Phase.

A regional comparison of annual Recovery Phase PM<sub>2.5</sub> concentrations reveals that Morwell (South) had the lowest annual average of the three stations. Traralgon's average of 7.7µg/m<sup>3</sup> came closest to the NEPM guideline of 8µg/m<sup>3</sup>, while Morwell (East) recorded an average of 6.8µg/m<sup>3</sup>. The starting point of 8 April 2014 as the beginning of the Recovery Phase does little to influence post-fire averages, where it can be seen that if a starting point of 25 March 2014 (the day the fire was declared safe) is used, 12-month PM<sub>2.5</sub> averages are 6.6µg/m<sup>3</sup>, 6.5µg/m<sup>3</sup> and 7.6µg/m<sup>3</sup> for Morwell (East), Morwell (South) and Traralgon, respectively, which are comparable to Recovery Phase values.

A comparison of these Recovery Phase averages with pre-fire data shows that post-fire concentrations have returned to generally normal values for the region. Pre-fire data is taken from a BAM at Morwell (East) from 8 February 2012 to 18 February 2013<sup>12</sup>. The average PM<sub>2.5</sub> level during this period is 7.8µg/m<sup>3</sup>. This number is consistent with Recovery Phase averages as shown in Table 5.



**Figure 3. Long-term trend of daily average PM<sub>2.5</sub> concentrations in the Latrobe Valley during the time period from 9 February 2012 to 8 April 2015. No PM<sub>2.5</sub> monitors were in place in the Latrobe Valley between 18 February 2013 and 13 February 2014.**

*NB: This figure records data from 9 Feb 2012 instead of 8 Feb 2012 as less than 18 hours of data is available from 8 Feb 2012. Seventy-five per cent of a day's data is necessary for computing a daily average.*

<sup>12</sup> [www.epa.vic.gov.au/our-work/publications/publication/2013/sepember/1547](http://www.epa.vic.gov.au/our-work/publications/publication/2013/sepember/1547)

Table 5. Comparison of Latrobe Valley PM<sub>2.5</sub> average concentrations for varying time periods between 2012 and 2015.

<b><u>Long-term PM<sub>2.5</sub> averages – Latrobe Valley</u></b>
<b>Pre-fire</b> Morwell East (8 Feb 12 – 18 Feb 13) – <b>7.8 µg/m<sup>3</sup></b>
<b>Incident*</b> Morwell South (20 Feb 14 – 25 Mar 14) – <b>68.5 µg/m<sup>3</sup></b>
<b>Post-fire (all 8 Apr 14 – 8 Apr 15)</b> Traralgon – <b>7.7 µg/m<sup>3</sup></b> Morwell East – <b>6.8 µg/m<sup>3</sup></b> Morwell South – <b>6.5 µg/m<sup>3</sup></b>
<b><i>NEPM annual guideline (advisory) – 8 µg/m<sup>3</sup></i></b>
<small>* Morwell South averages are from 20 February 2014, when validated data was first available.</small>

5.2. PM<sub>10</sub>

Figure 4 shows a long-term trend of PM<sub>10</sub> levels in the Latrobe Valley since 2013, including part of a BAM deployment at Morwell (East) to mid-2013. Three periods recorded exceedances of the NEPM daily guideline of 50µg/m<sup>3</sup>: January 2013 - due to local bushfires at Aberfeldie<sup>13</sup>, May 2013 - due to private and public planned burning; and February 2014 during the mine fire. The mine fire in February-March 2014 saw three guideline exceedances at Traralgon. The NEPM guideline has a stated goal of less than or equal to five exceedances per year, allowing Traralgon to meet the goal for 2014. During the Recovery Phase, there were no guideline breaches.

Aside from the 2013 bushfire and 2014 mine fire, the long-term trend of PM<sub>10</sub> in the Latrobe Valley is one of reasonably consistent, low levels with a few instances of peaks during public and private planned burns (May 2013 and April 2015). The trend of the graph shows that by April 2014 PM<sub>10</sub> decreased back to pre-fire levels. This pre-fire average for 2013 was 14.2µg/m<sup>3</sup>, where for 2014 it was 16.1µg/m<sup>3</sup>; indicating that the mine fire did not cause average PM<sub>10</sub> to be much above the normal concentrations for the area (PM<sub>10</sub> annual averages for Traralgon in 2011 and 2012 were 14.6µg/m<sup>3</sup> and 13.9µg/m<sup>3</sup>, respectively; and 15µg/m<sup>3</sup> in 2012 for Morwell (East)). These annual averages were all below the draft, preferred NEPM PM<sub>10</sub> annual standard of 20µg/m<sup>3</sup>.<sup>14</sup>

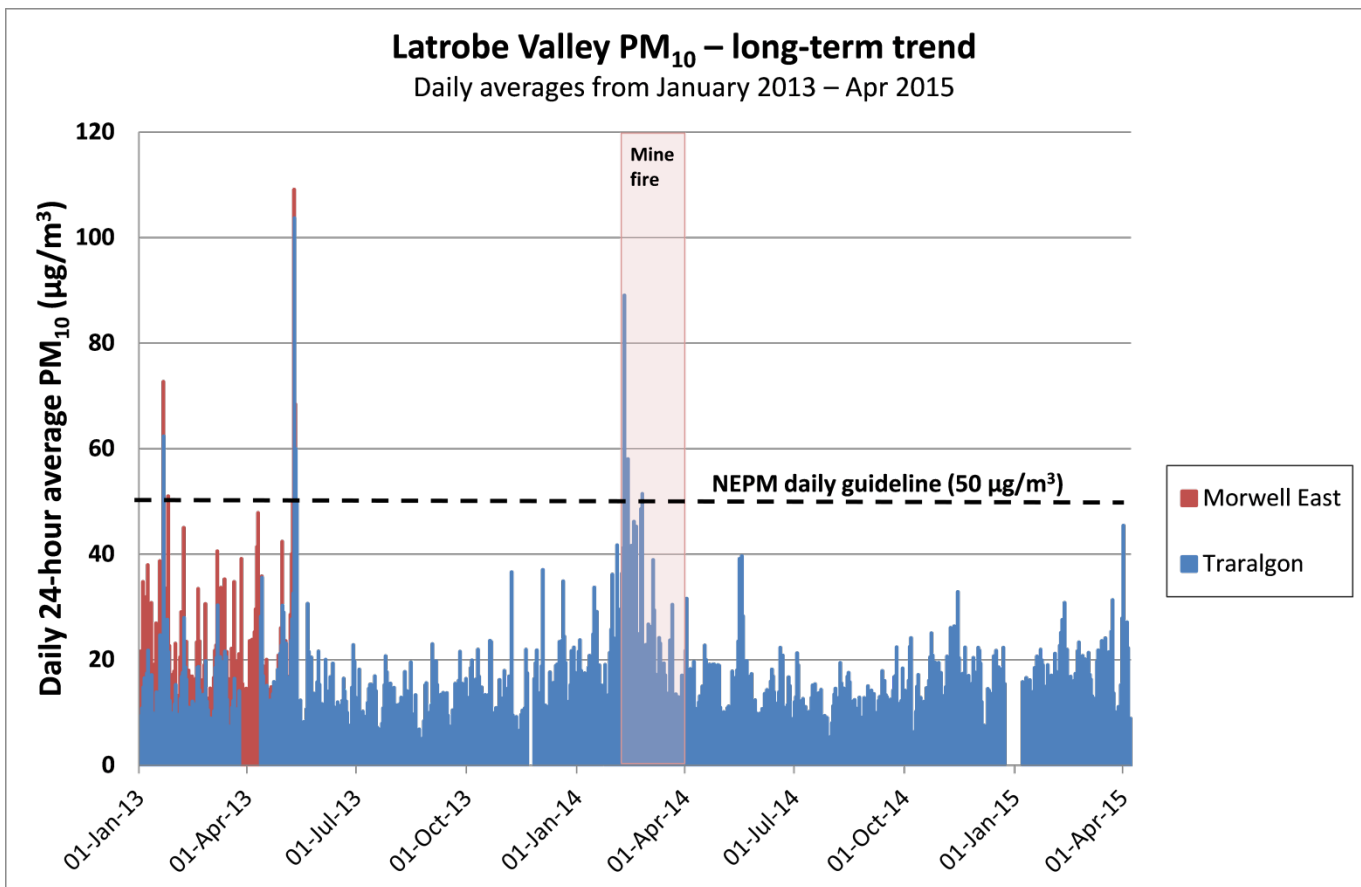


Figure 4. Long-term trend of daily average PM<sub>10</sub> concentrations in the Latrobe Valley measured using a BAM at Morwell (East) and a TEOM at Traralgon. The graph records the time period from January 2013 to April 2015.

<sup>13</sup> [www.epa.vic.gov.au/our-work/publications/publication/2013/september/1547](http://www.epa.vic.gov.au/our-work/publications/publication/2013/september/1547)

<sup>14</sup> <http://www.environment.gov.au/protection/nepc/nepms/ambient-air-quality/variation-2014/impact-statement>

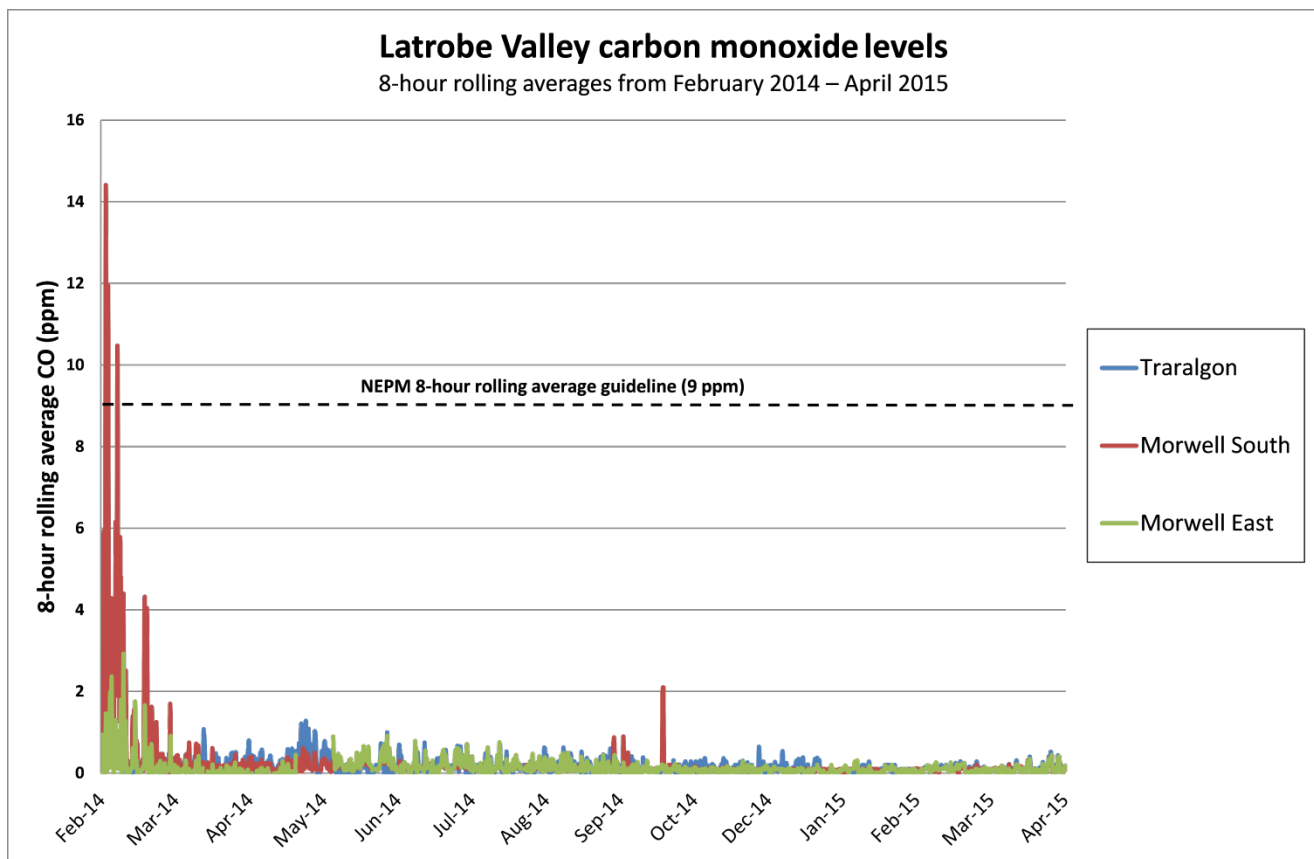
**5.3. Carbon monoxide**

The area experienced higher than normal concentrations of carbon monoxide (CO) during the mine fire, particularly in the early period. CO monitoring at the fixed air monitoring sites was complemented with a network of portable AreaRAE™ monitors undertaken by the fire services and EPA. These AreaRAE monitors were not used during the Recovery Phase so were not included in the analysis here.

Figure 5 shows CO trends since instruments were installed during the mine fire in February 2014. The NEPM guideline for CO was exceeded on three days at Morwell (South) during February 2014. The higher than normal levels recorded at Morwell (South) AMS during the fire rapidly decreased to low, stable levels by April 2014 and have since stayed low, relative to the NEPM guideline.

Historical ambient carbon monoxide levels in the Latrobe Valley are low, so there was no need for EPA to have CO monitors installed until the mine fire started. The low CO levels during the Recovery Phase mirror these low historical levels..

Figure 5 shows that there have been no breaches of the NEPM eight-hour rolling average guideline of 9 ppm during the Recovery Phase. The average eight-hour CO level during the Recovery Phase was 0.2 ppm, 0.1 ppm and 0.1 ppm at Traralgon, Morwell (South) and Morwell (East), respectively.



**Figure 5. Eight-hour rolling carbon monoxide averages in the Latrobe Valley monitored from February 2014 to April 2015.**

**5.4. Sulfur dioxide**

Sulfur dioxide (SO<sub>2</sub>) concentrations were well below air quality standards during the mine fire: the peak one-hour reading since the mine fire started was at Morwell (East) on 23 February 2014 (63 ppb), was well below the hourly NEPM guideline of 200 ppb. Possible reasons for these low levels are that the coal in the Hazelwood mine has low sulfur content (Brockway, Ottrey & Higgins, 1991); and the total amount of coal burned was probably not that great (Fisher, Torre & Marshall, 2015).

An analysis of long-term SO<sub>2</sub> trends in the Latrobe Valley, as seen in Figure 6, shows a lack of discernible impact due to the mine fire. Monthly averages at all three stations show slight seasonal trends, with rising levels during the warmer months, but the mine fire has not impacted on this stable trend. All long-term annual averages are well below the annual NEPM guideline of 20 ppb.

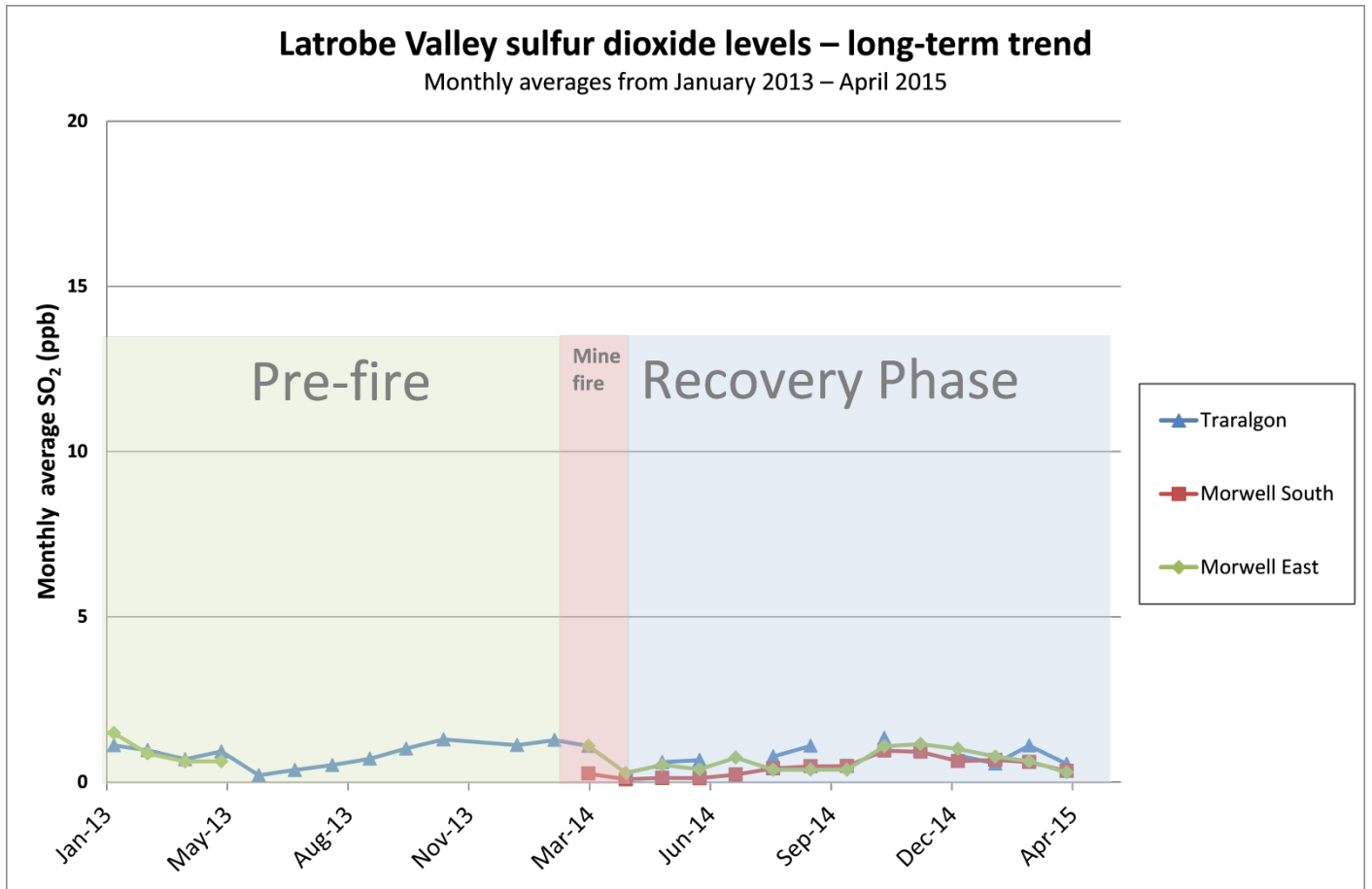


Figure 6. Monthly sulfur dioxide averages in the Latrobe Valley from January 2013 to April 2015.

**5.5. Nitrogen dioxide**

Although brown coal found in the Latrobe Valley had low nitrogen concentrations compared to other large brown coal reserves in the world (Brockway, Ottrey & Higgins, 1991), nitrogen dioxide (NO<sub>2</sub>) was emitted in the smoke from the mine fire and was subsequently monitored at Morwell (South) and Traralgon during and after the fire.

Figure 7 displays long-term NO<sub>2</sub> trends in the Latrobe Valley since January 2013. It can be seen that NO<sub>2</sub> levels have been relatively consistent across the time period. Seasonal peaks were observed at Traralgon through autumns and winters, followed by seasonal dips in summer. The complete effect of the mine fire on NO<sub>2</sub> levels at Morwell (South) AMS cannot be confirmed as valid data only began arriving on 6 March 2014. However, the data we have indicates that any contribution from the fire was still well under the guideline (March monthly average of 8.47 ppb at Morwell (South)). Concentrations at Morwell (South) then fell in April 2014, following Traralgon AMS trends through the Recovery Phase.

NO<sub>2</sub> annual averages for 2014 were well below the NEPM annual guideline of 30ppb, with Morwell (South) recording 6.6ppb and Traralgon recording 6.5ppb. Morwell (South)'s annual average would have been different had the instrument been present from the start of the fire (validated data only became available from 6 March 2014).

A brief period of the Morwell (East) AMS 2012-13 station deployment is captured in the graph. The data accords well with that of Traralgon for the same period.

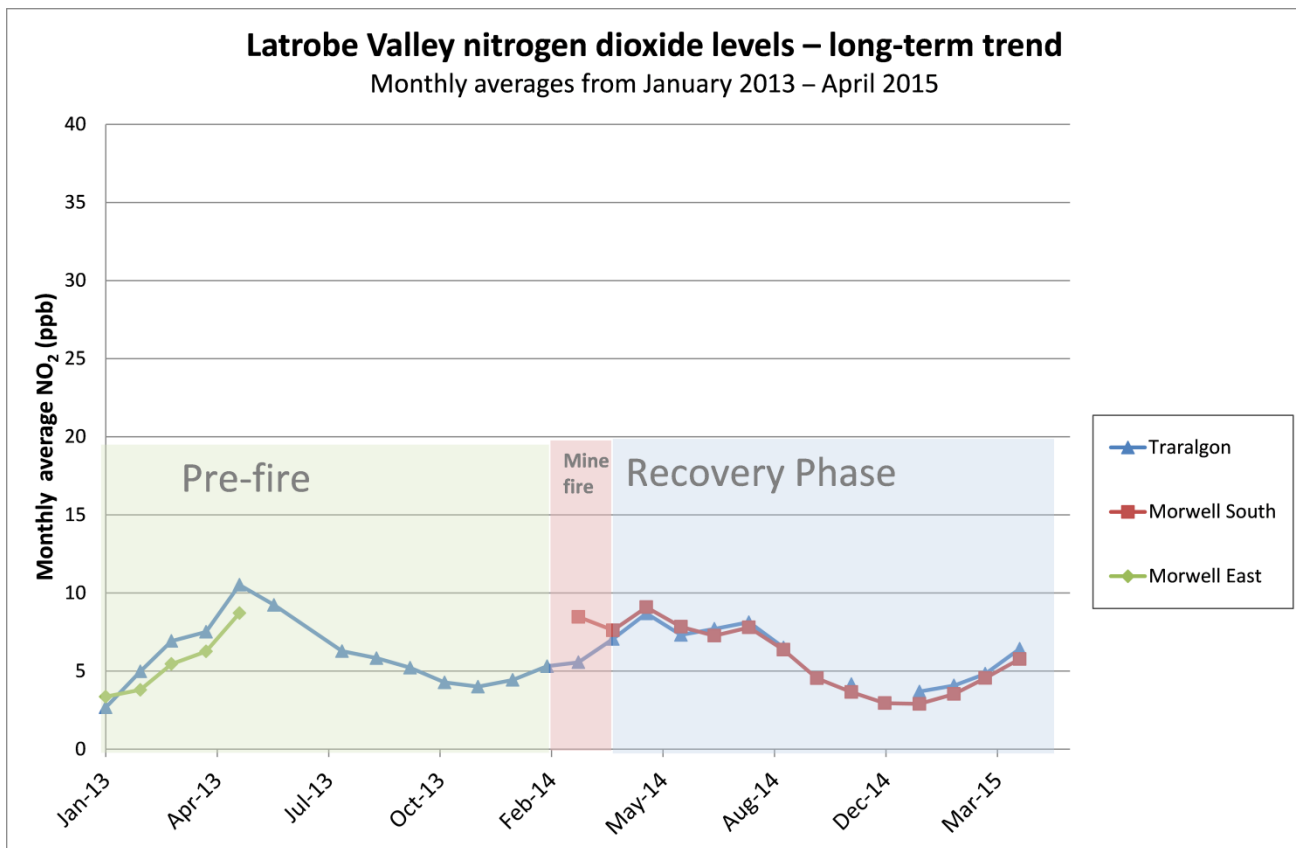


Figure 7 Monthly average nitrogen dioxide concentrations in the Latrobe Valley from January 2013 to April 2015.

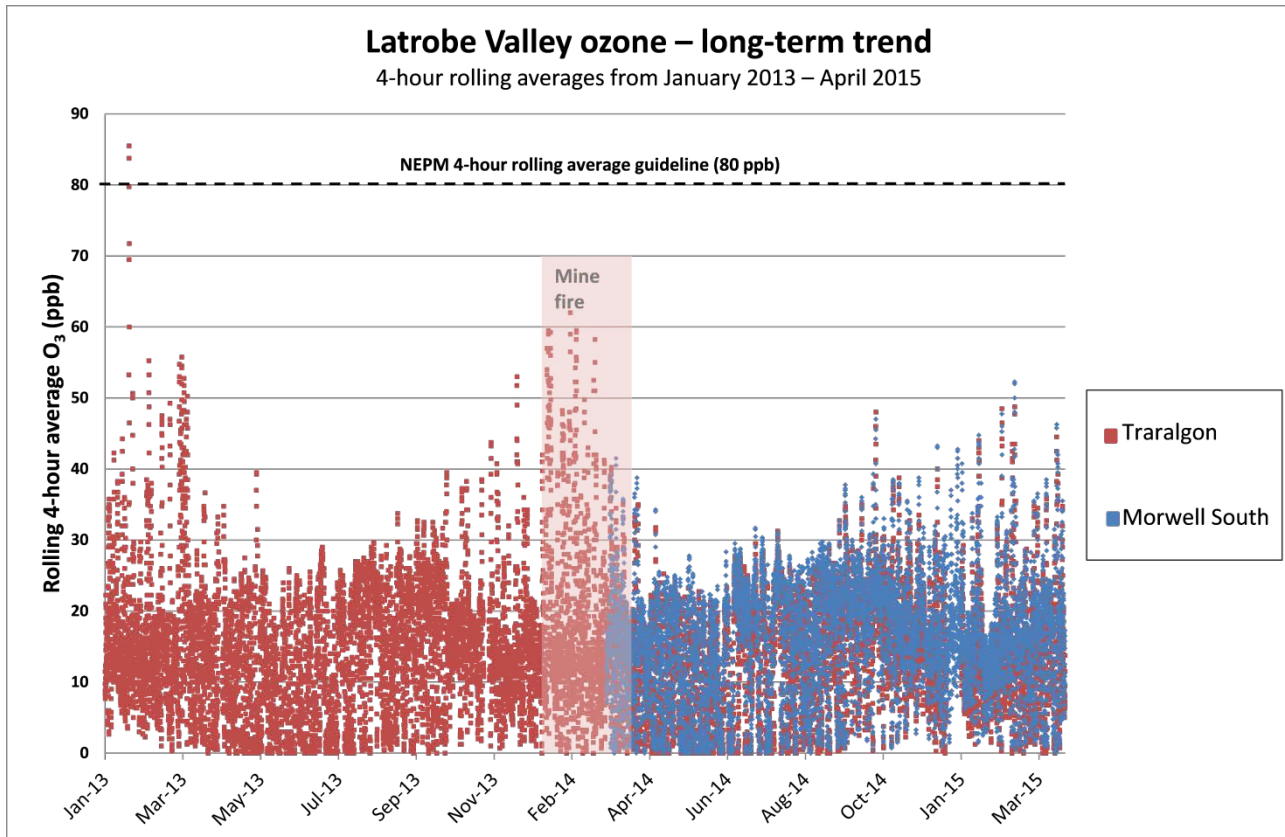


**5.6. Ozone**

Ozone (O<sub>3</sub>) concentrations at Traralgon during February 2014 came close to exceeding the four-hour NEPM guideline (Figure 8). However, the peaks were recorded before the start of the mine fire, so were likely due to bushfires in the local area, not the mine fire. After the February peaks a sharp drop in concentrations at Morwell (South) and Traralgon was seen into autumn 2014, as smoke production from the mine fire and bushfire ceased, and sunlight diminished, before seasonal increases started again into summer 2014-15.

Morwell (South) had an ozone monitor in place later during the incident period.

A number of breaches of the four-hour NEPM guideline can be seen to have occurred in January 2013. These were due to bushfires near Aberfeldy, north of the Latrobe Valley.



**Figure 8 Long-term ozone trends in the Latrobe Valley from January 2013 to April 2015.**

**5.7. Visibility**

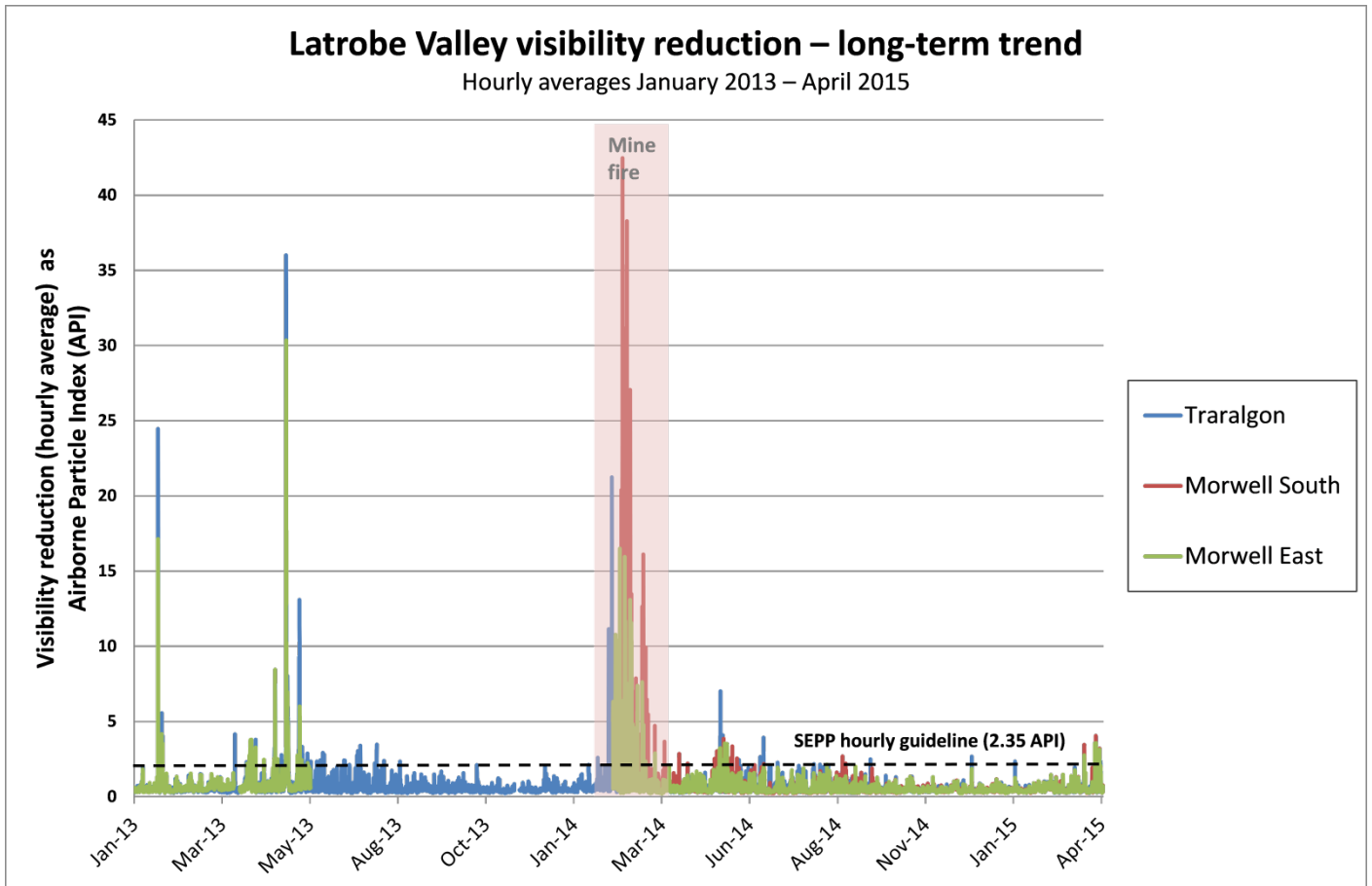
Concentrations of visibility-reducing particles can correlate well with PM<sub>10</sub> and PM<sub>2.5</sub> concentrations and therefore can be helpful as an indicative measure of relative levels of these pollutants.

Figure 9 shows long-term visibility reduction in the Latrobe Valley between January 2013 and April 2015. The large reduction in visibility, particularly at Morwell (South), during high smoke days can be clearly seen in the area shaded pink. A sharp reduction in concentrations occurred in the weeks following the mine fire, with a relatively steady state through the Recovery Phase. This steady state is similar to average Airborne Particle Index (API) levels recorded in the 13 months before the fire. Significant peaks in January 2013 and May 2013 were due to bushfires near Aberfeldy and planned burns, respectively.

API values were much lower in the Recovery Phase when compared to the Response Phase; however, the SEPP hourly guideline was still breached periodically in this post-fire period as seen in Figure 9. The SEPP (Ambient Air Quality) guideline states that the maximum allowable days per year with guideline breaches for visibility reducing particles is three (SEPP (Ambient Air Quality), 1999. During 2014 Traralgon had 29 days breaching the guideline; Morwell (East) had 25; and Morwell (South) had 32.

While most breaches happened during the mine fire, a significant proportion happened in the Recovery Phase: Morwell (South) recorded 11 days breaching the SEPP guideline post-fire. Many of the Recovery Phase breaches can be attributed to These guideline breaches are associated with elevated smoke levels that may have originated from landholder burning off, forest regeneration burns and planned burning activities in the region; or wood heater use at the start of winter (when unburned chimney residue is expelled for the first time in months).

The SEPP guideline shown in Figure 9 is a one-hour average guideline: no guideline exists in the SEPP for a longer averaging period.



**Figure 9. Long-term visibility reduction trends in the Latrobe Valley from January 2013 to April 2015. An API of 2.35 = 20 km visibility. 42.5API recorded at Morwell (South) on 21 February 2014 is equal to a visible distance of 1.1 km.**

## 5.8. Respirable silica

Silica ( $\alpha$ -quartz and cristobalite) particles smaller than  $PM_{2.5}$  (respirable) have been sampled at Morwell (South) since 9 April 2014. All samples analysed so far (to 28 April 2015) have returned values less than the laboratory detection limit ( $<1.77\mu\text{g}/\text{m}^3$ ). The guideline being used for comparison states that a maximum allowable annual average for each polymorph of silica (with a diameter less than  $2.5\mu\text{m}$ ) is  $3\mu\text{g}/\text{m}^3$ .<sup>15</sup>

The sampling instrument used for this testing is a Partisol, which takes one 24-hour air sample every six days. An annual average is computed from these one-in-six day results.

Samples from during the fire recorded detectable levels of silica; however, the instrument used only filtered particles to smaller than  $PM_{10}$ . The guideline (and the Recovery phase level) was used for particles smaller than  $PM_{2.5}$ . As such, these detections cannot be compared to either the SEPP guideline or to the Recovery Phase results. However, respirable silica ( $<2.5\mu\text{m}$ ) has not been detected in the 12 months since 9 April 2014.

## 5.9. Metals

The majority of metals decreased in concentration from the Response Phase to the Recovery Phase as seen in metals samples results from Morwell (South) in Table 6.

Arsenic, antimony, cadmium, silver and tungsten recorded slight increases between these two periods. The reason for the increases in these particular metals is not clear. The unexpected readings seem to be heightened from April to October 2014 (Recovery Phase 1), when in addition to arsenic, antimony, silver and tungsten, copper and thorium also recorded higher levels than during the Response Phase. Again, a reasonable explanation for this trend is unclear. However, the results indicate that the mine fire was not a major contributor to the levels of these metals in the air at Morwell (South).

A comparison of all of the metals to their appropriate annual guideline shows that there have been no guideline breaches for any of the elements during any of the time periods.

Note that the Recovery Phase sampling is broken into two periods due to the move of the Morwell (South) AMS from the Morwell Bowling Club, Hazelwood Rd to Maryvale Crescent Preschool on 6 October 2014.

The equipment used (a Hi-Vol sampler) takes one 24-hour sample of air every six days and an annual average is computed from these one-in-six day results.

**Table 6. (previous page) shows the average concentrations in  $\text{ng}/\text{m}^3$  for a range of metals measured in ambient air at Morwell (South). Guidelines are taken from the TCEQ with the exception of lead, which is taken from the NAAQS.**

Compound	Annual average ( $\text{ng}/\text{m}^3$ ) (26 Feb 14 - 26 Feb 15)	Response ( $\text{ng}/\text{m}^3$ ) (26 Feb 14 - 8 Apr 14)	Recovery (1 & 2) ( $\text{ng}/\text{m}^3$ ) (8 Apr 14 - 4 Feb 15)	Recovery 1 ( $\text{ng}/\text{m}^3$ ) (8 Apr 14 - 1 Oct 14)	Recovery 2^ ( $\text{ng}/\text{m}^3$ ) (29 Oct 14 - 3 Feb 15)	Annual guideline~ ( $\text{ng}/\text{m}^3$ )
Aluminium	218.42	409.2	63.2	31.9	99.1	5000
Antimony	0.21	0.11	0.23	0.31	0.13	500
Arsenic	0.49	0.37	0.52	0.72	0.27	67
Barium	8.45	47.9	1.10	0.90	1.34	500
Beryllium	0.06	0.06	0.06	0.06	0.05	2
Bismuth	0.06	0.08	0.05	0.08	0.01	5000
Boron	6.36	24.0	3.09	5.41	0.42	5000
Cadmium	0.03	0.02	0.03	0.05	0.01	10
Calcium	764.2	1582	98.4	51.14	152.8	5000
Cerium~	0.36	1.08	0.23	0.13	0.35	-
Chromium	0.91	1.55	0.39	0.07	0.76	41
Cobalt	0.61	1.11	0.20	0.24	0.15	20
Copper	1.25	1.32	1.20	2.16	0.11	1000
Gallium	1.29	7.19	0.19	0.16	0.23	2000
Gold	0.22	0.35	0.20	0.31	0.07	2500
Iron	428.3	758.0	159.9	105.7	222.2	5000
Lanthanum	0.16	0.25	0.14	0.10	0.18	5000
Lead	1.68	2.26	1.20	1.77	0.54	150*

<sup>15</sup> <http://www.epa.vic.gov.au/~media/Publications/1191.pdf>

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Lithium	0.26	0.40	0.24	0.34	0.11	1000
Magnesium~	520.0	2534.0	145.3	71.6	230.0	-
Manganese	7.12	12.7	2.60	1.05	4.38	200
Mercury	0.02	0.05	0.01	0.01	0.01	25
Molybdenum	0.10	0.18	0.09	0.09	0.08	3000
Nickel	0.72	1.02	0.48	0.31	0.67	59
Phosphorus	6.21	8.70	4.19	0.42	8.52	100
Potassium	93.2	133.2	60.6	46.2	77.1	2000
Rubidium	0.20	0.26	0.19	0.20	0.18	2500
Selenium	1.15	2.40	0.13	0.09	0.19	200
Silver	0.22	0.06	0.25	0.40	0.09	10
Sodium~	1360	3287	1002	538.4	1534	-
Strontium	8.71	17.8	1.31	0.73	1.98	2000
Sulfur	653.5	1272	150.35	46.0 <sup>#</sup>	270.3	5000
Tellurium	0.06	0.06	0.06	0.06	0.06	100
Thallium	0.06	0.06	0.06	0.06	0.06	100
Thorium~	0.27	0.31	0.26	0.36	0.15	-
Tin	0.32	0.43	0.30	0.23	0.37	2000
Titanium	36.6	72.5	7.49	3.10	12.5	5000
Tungsten	0.77	0.73	0.78	1.39	0.07	1000
Uranium	0.05	0.06	0.05	0.06	0.03	50
Vanadium	0.72	0.94	0.54	0.58	0.51	50
Yttrium	0.23	0.30	0.21	0.04	0.41	1000
Zinc	10.3	13.4	7.87	8.03	7.69	2000
Zirconium	0.66	2.16	0.38	0.46	0.28	5000

Values below the laboratory detection limit are given a value above the maximum detection value. I.e., <0.001 ng/m<sup>3</sup> is assumed to be 0.001 ng/m<sup>3</sup> for the purpose of calculating averages.

<sup>^</sup> Recovery 2 begins on 29 October 2014 rather than 8 October 2014 due to delays caused by a change of sampling location from Morwell Bowling Club to Maryvale Crescent.

~There are no TCEQ guidelines for thorium, sodium, magnesium and cerium

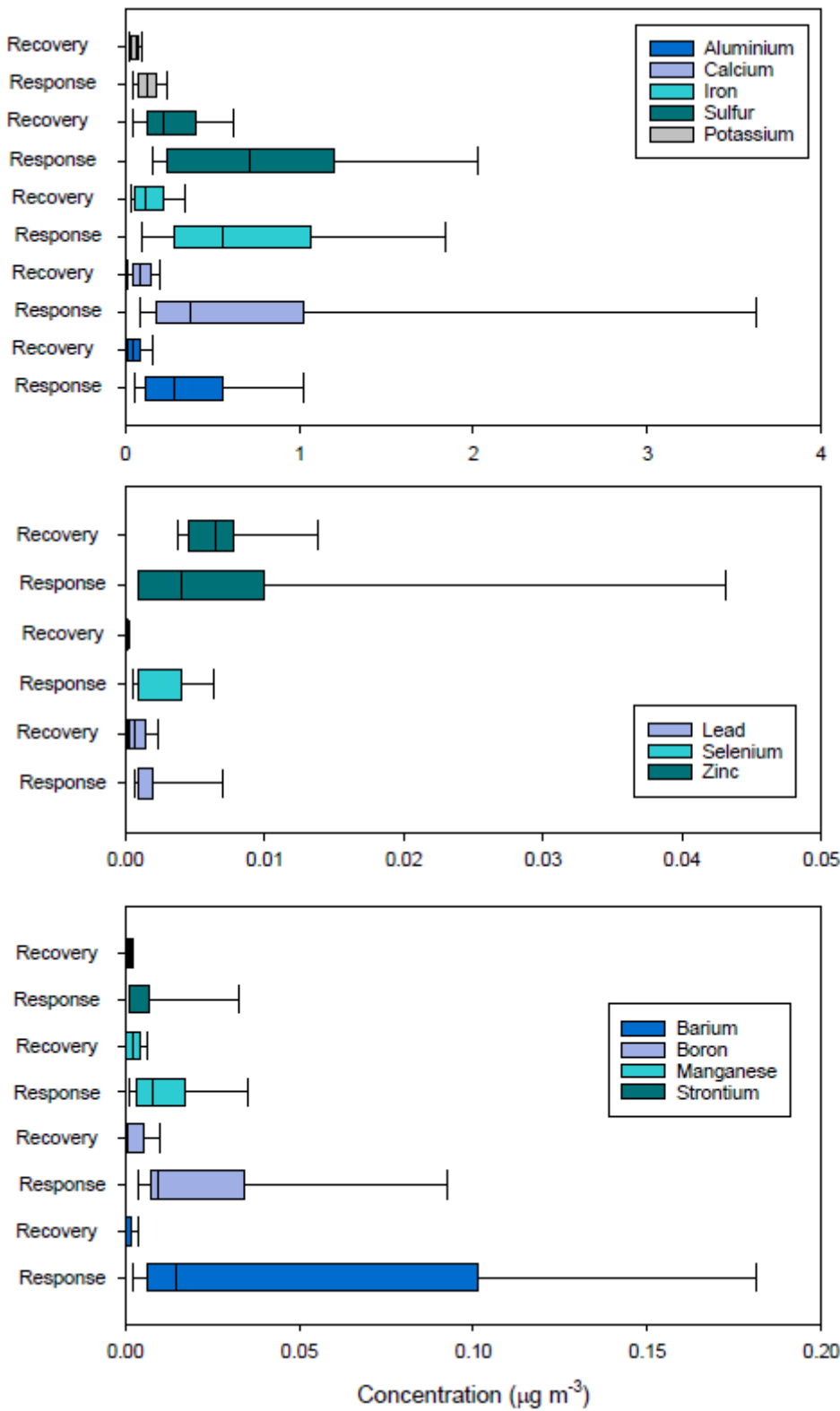
<sup>#</sup> Sulfur was not detected in samples collected between 8 June 2014 and 1 October 2014 likely due to analysis problems. Therefore the averaged value for sulfur during the Recovery Phase (1 & 2) period is likely to be incorrect

\* National Ambient Air Quality Standards (NAAQS)-Rolling three-month average

Figure 10 shows the differences in metal distributions between the Response and the Recovery phases. Overall, the upper percentiles (75th and 90th percentiles) for the selected metals are consistently higher in the Response Phase when compared to Recovery; while the median values between the Response and Recovery phases generally decrease with time. Zinc is an exception to this trend in median values; however, the increase in median value has been calculated as being statistically non-significant (using a Mann-Whitney U test). Furthermore, the average zinc levels across the two periods shows a decrease (Table 6), indicating the lack of clear upward or downward trend in the data.

The metals in Figure 10 were chosen for analysis as some of them are known to make up significant proportions of the major and trace metals of Hazelwood brown coal (Brockway, Ottrey & Higgins, 1991), and were found in significant proportions in mine fire ash collected during the Response phase.

The concentration ranges of each metal observed during the Response Phase is quite large. This is due to the elevated levels of metals measured in February 2014, followed by significant decrease in concentrations by late March 2014.

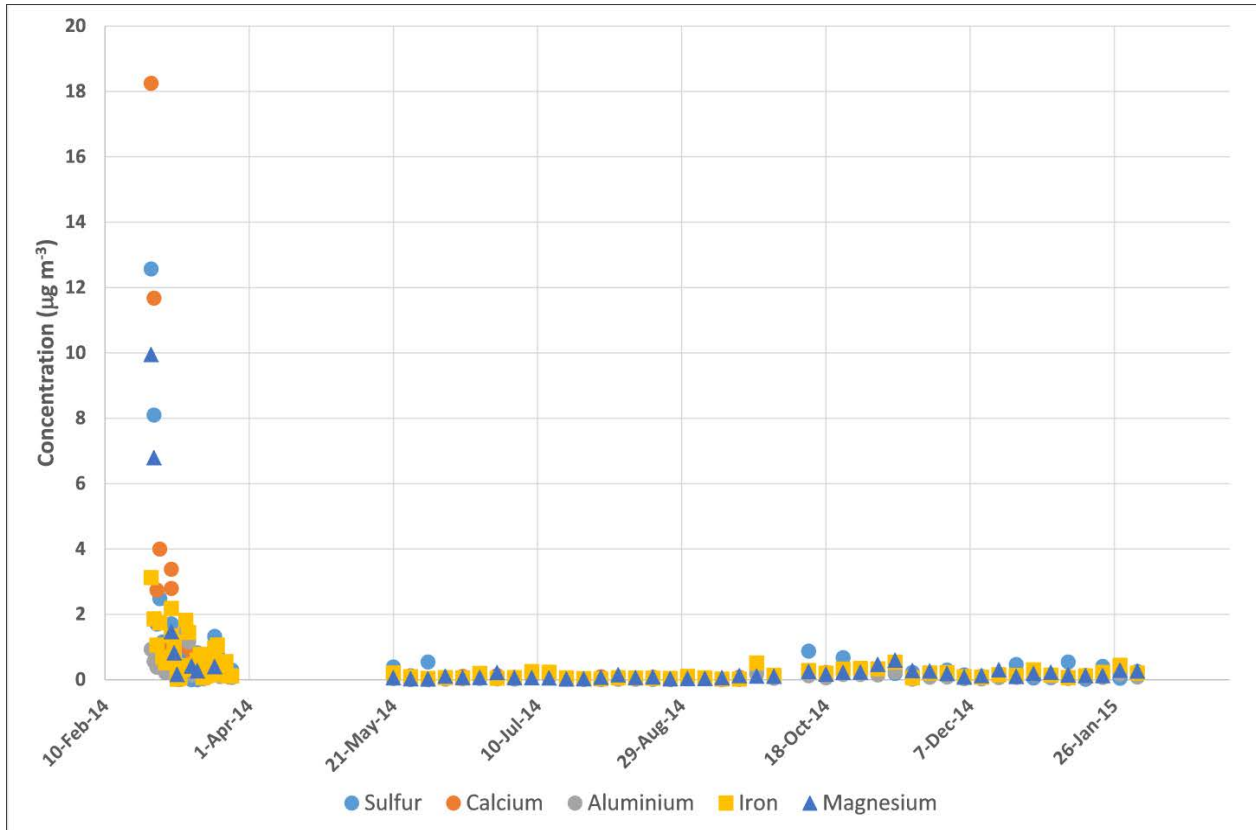


**Figure 10. Modified boxplots of trace metals measured in ambient air during and after the Hazelwood mine fire. The ends of the boxes define the 25th and 75th percentiles, with a line at the median and bars defining the 10th and 90th percentiles.**

*NB: For sulfur, Recovery Phase data only covers October 2014 until February 2015 as it was not detected in samples collected between 8 June 2014 and 1 October 2014, likely due to analysis problems. The Recovery Phase covers samples collected to 3 February 2015. Results post-February 2015 are still being processed. Where concentrations were below the detection limit, the practical quantification limit (PQL) was used for analysis purposes.*

Figures 11-13 show time series plots of selected metals at Morwell (South) AMS since February 2014. The plots allow for higher resolution of metals trends to be identified than do Table 6 and Figure 10, which treat the Response and Recovery data as homogenous groups, potentially failing to pick up information on potential fluctuations caused by seasonal variations, temperature changes and meteorological impacts.

The metals in the plots below were selected based on the fact that they were measured at levels above the detection limit for the majority of samples. It can be seen from the plots that there is generally a significant decrease in concentrations observed between the end of February 2014 and the beginning of April 2014, as ash and smoke production decreased and eventually stopped. Concentrations after the mine fire remained consistently low for all metals displayed, except for potassium, boron and phosphorous. These three metals (see Figures 12 and 13) had variable concentrations during the Recovery Phase, with no clear trends observed. Nevertheless, each of them recorded a decrease in average concentrations since the Response Phase.



**Figure 11. Time series of ambient concentrations (in  $\mu\text{g}/\text{m}^3$ ) for sulfur, calcium, aluminium, iron and magnesium at Morwell (South) AMS from 26 February 2014 to 3 February 2015**

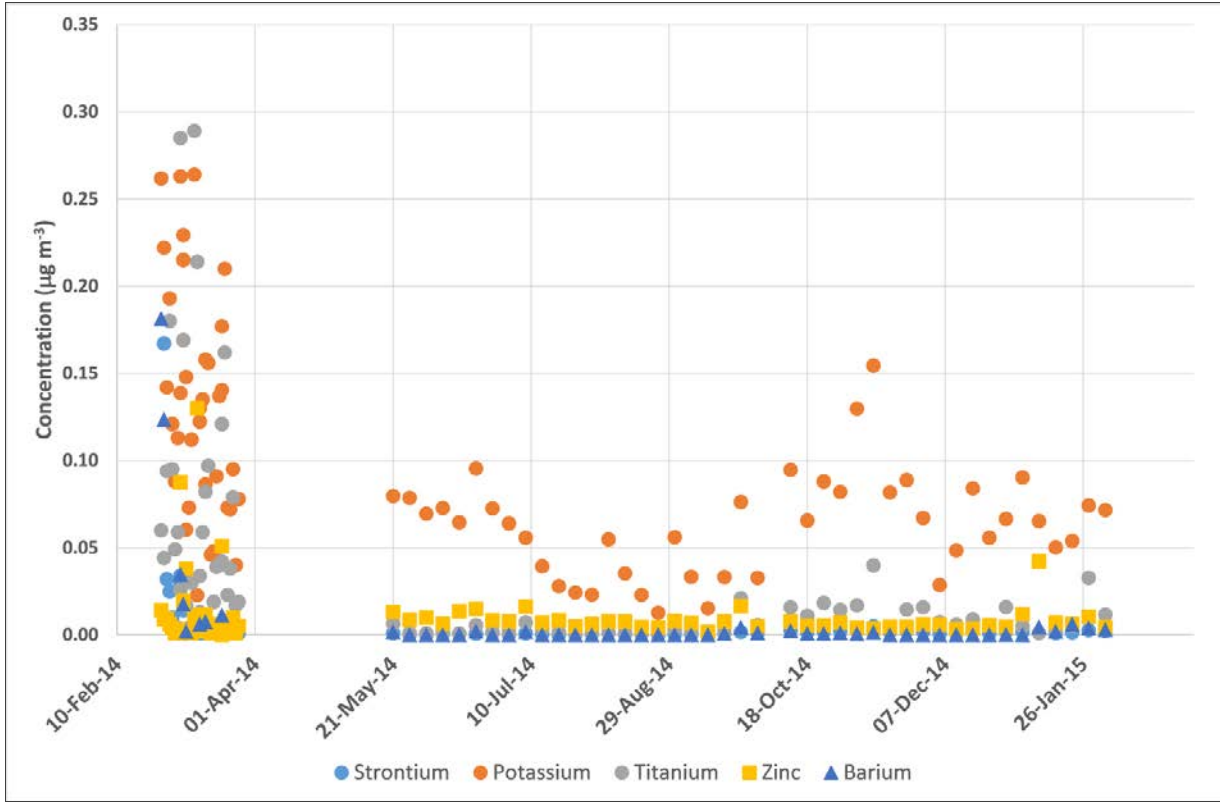


Figure 12. Time series of ambient concentrations (in  $\mu\text{g}/\text{m}^3$ ) for strontium, potassium, titanium, zinc and barium at Morwell (South) AMS from 26 February 2014 to 3 February 2015

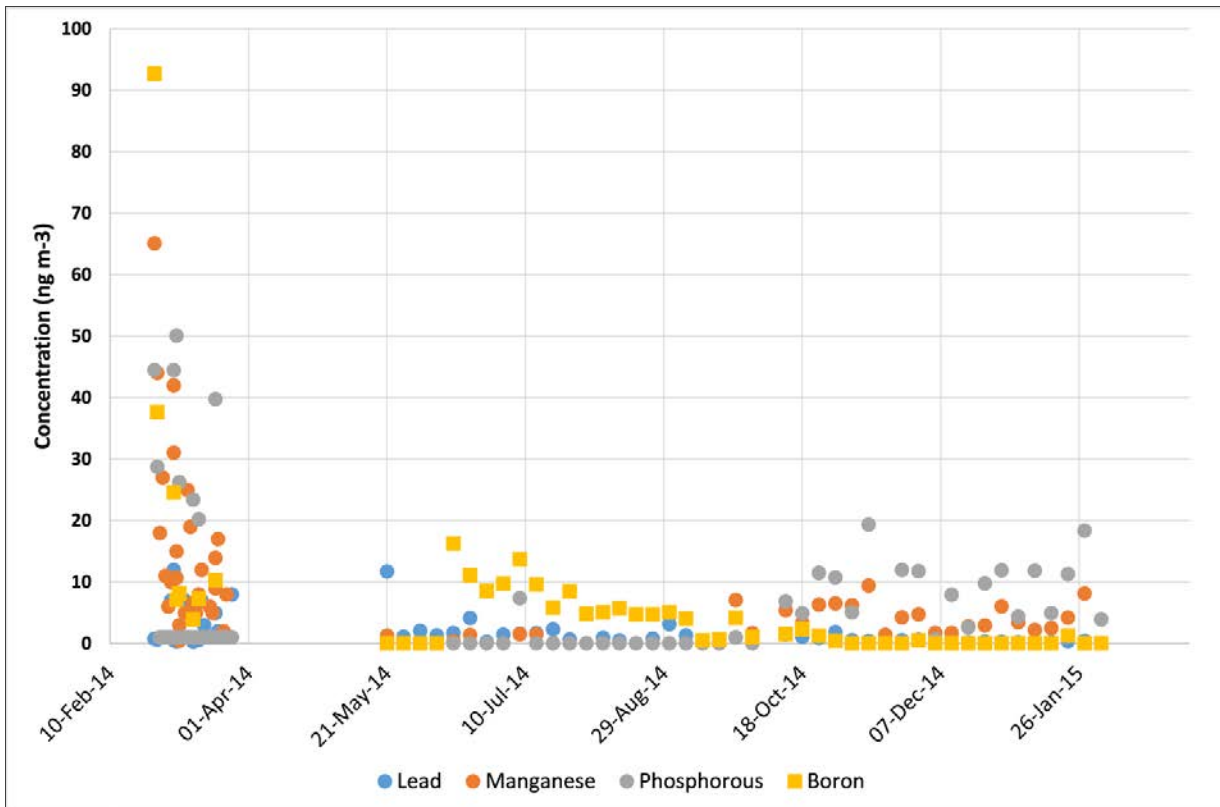


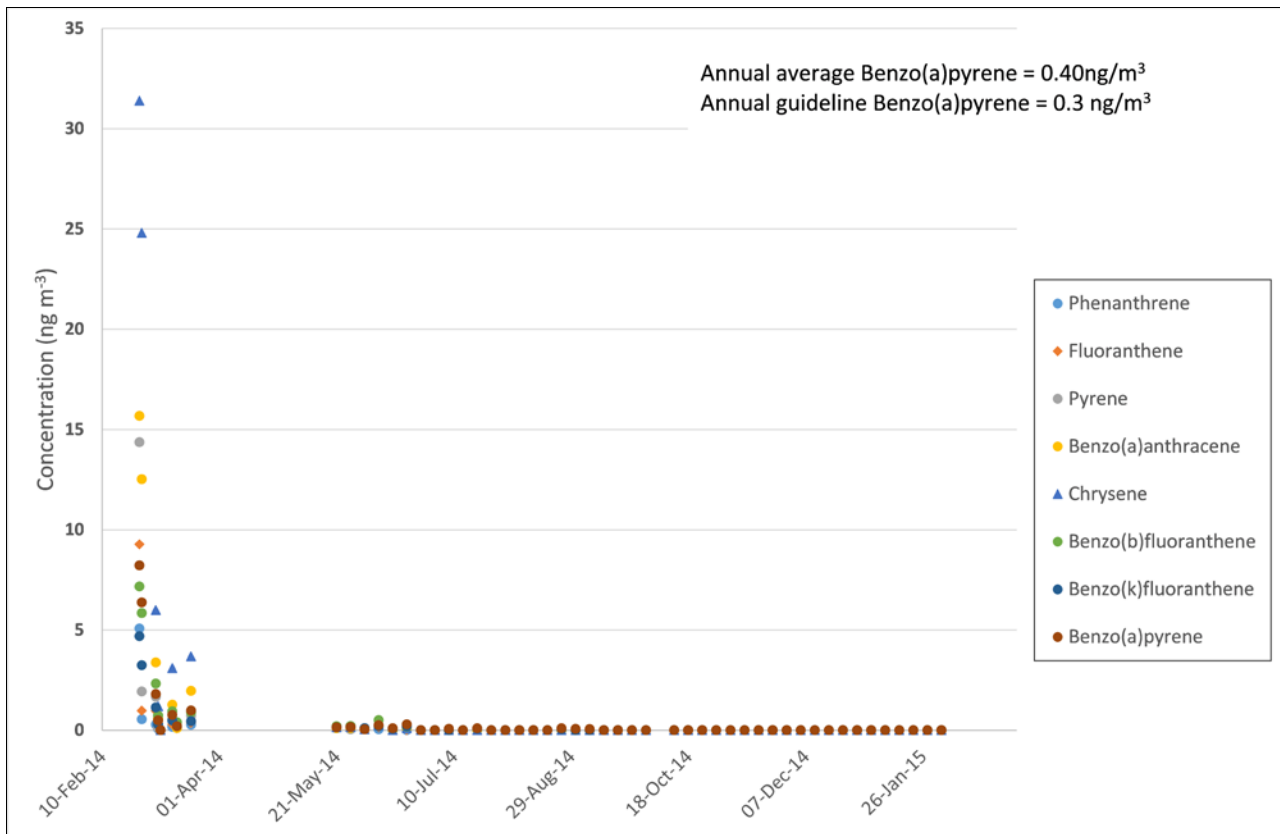
Figure 13. Time series of ambient concentrations (in  $\text{ng}/\text{m}^3$ ) for lead, manganese, phosphorus and boron at Morwell (South) AMS from 26 February 2014 to 3 February 2015

**5.10. Polycyclic aromatic hydrocarbons (PAHs)**

During the mine fire, the community expressed concerns about the potential effects of the toxic components of the smoke - especially PAHs. Short-term concentrations of PAHs (as B(a)P equivalents) were a little higher than some historical peak measurements made in Melbourne, however, these peak values only appeared in measurements made during the mine fire when smoke emission was particularly intense (Fisher, Torre & Marshall, 2015).

Figure 14 shows trends in selected PAHs since mine fire sampling began on 26-27 February 2014. The compounds were chosen either because they have associated guidelines, or they recorded relatively high concentrations during the mine fire. PAH peaks in chrysene and benzo(a)anthracene in particular rapidly dropped away once smoke production reduced. Concentrations of the selected PAHs have been consistently below laboratory detection limit, or only slightly above, during the Recovery Phase of sampling.

For total PAHs (as B(a)P equivalents), the NEPM assessment annual concentration is 0.3 ng/m<sup>3</sup>. This is the only NEPM guideline for particle-bound PAHs in air. Table 7 shows that the average annual concentration of B(a)P was 0.4 ng/m<sup>3</sup> from February 2014 to February 2015, exceeding the guideline. However, the Response Phase average of 2.36ng/m<sup>3</sup> was largely responsible for this guideline breach. Recovery Phase average B(a)P levels have been less than the laboratory detection limit of 0.026 ng/m<sup>3</sup>, far lower than Response Phase concentrations. It is predicted (based on 10 months of data) that B(a)P levels for the year post-fire will not exceed this guideline; however, final analysis results will confirm this.



**Figure 14. Concentrations of selected PAHs (in ng/m<sup>3</sup>) measured at Morwell (South) AMS during the Response and Recovery phases to 3 February 2015.**

*NB: For graphing purposes, where levels were less than the laboratory detection limit, the maximum detection limit was used.*

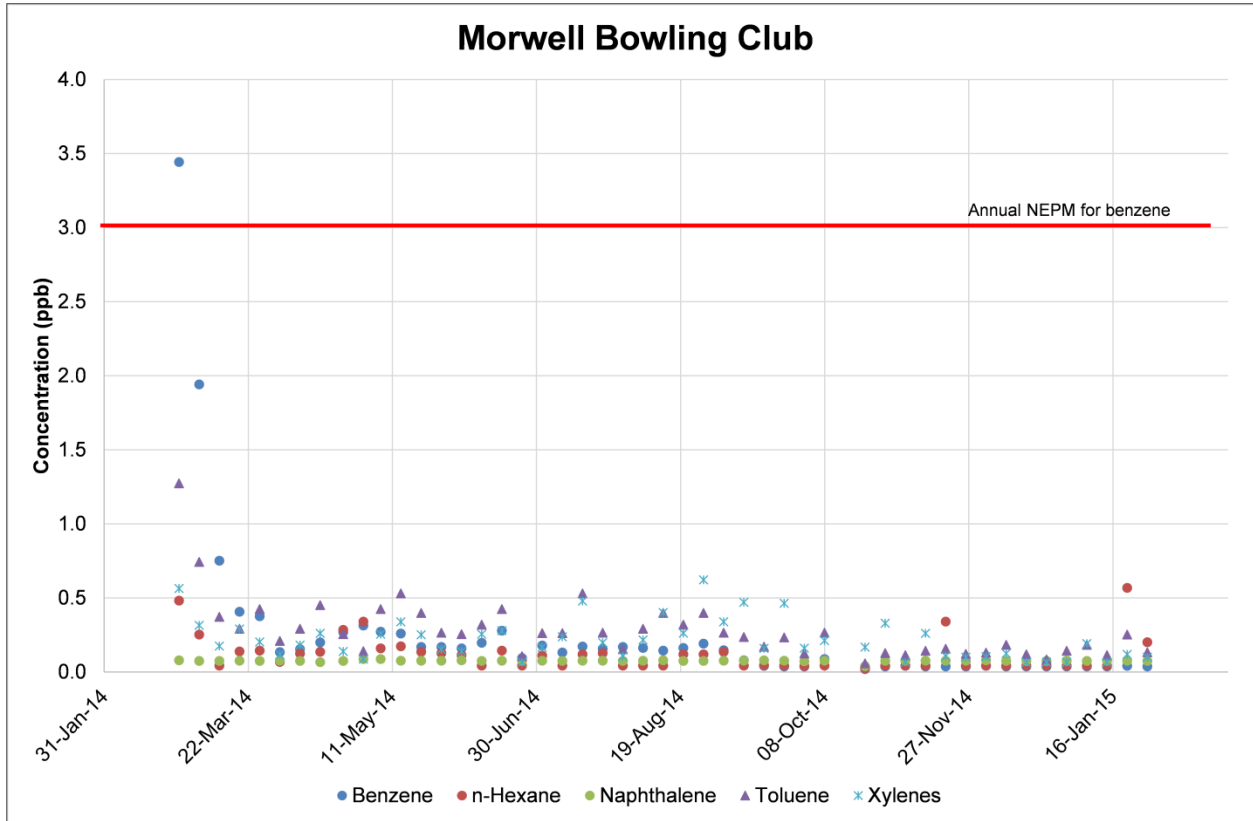
**Table 7. Concentrations of PAHs (in ng/m<sup>3</sup>) measured at Morwell (South) AMS during the Response and Recovery phases to 3 February 2015. This table includes data to February 2015.**

Compound	Annual	Response Phase	Recovery Phase	Annual guideline
Phenanthrene	0.14	0.82	< 0.006	-
Fluoranthene	0.24	1.51	< 0.006	-
Pyrene	0.40	2.45	< 0.008	-
Benzo(a)anthracene	0.71	4.44	< 0.009	-
Chrysene	1.40	8.82	< 0.009	-
Benzo(b)fluoranthene	0.39	2.29	< 0.016	-
Benzo(k)fluoranthene	0.23	1.32	< 0.016	-
Benzo(a)pyrene	0.40	2.36	< 0.026	0.3



**5.11. Volatile organic compounds (VOCs)**

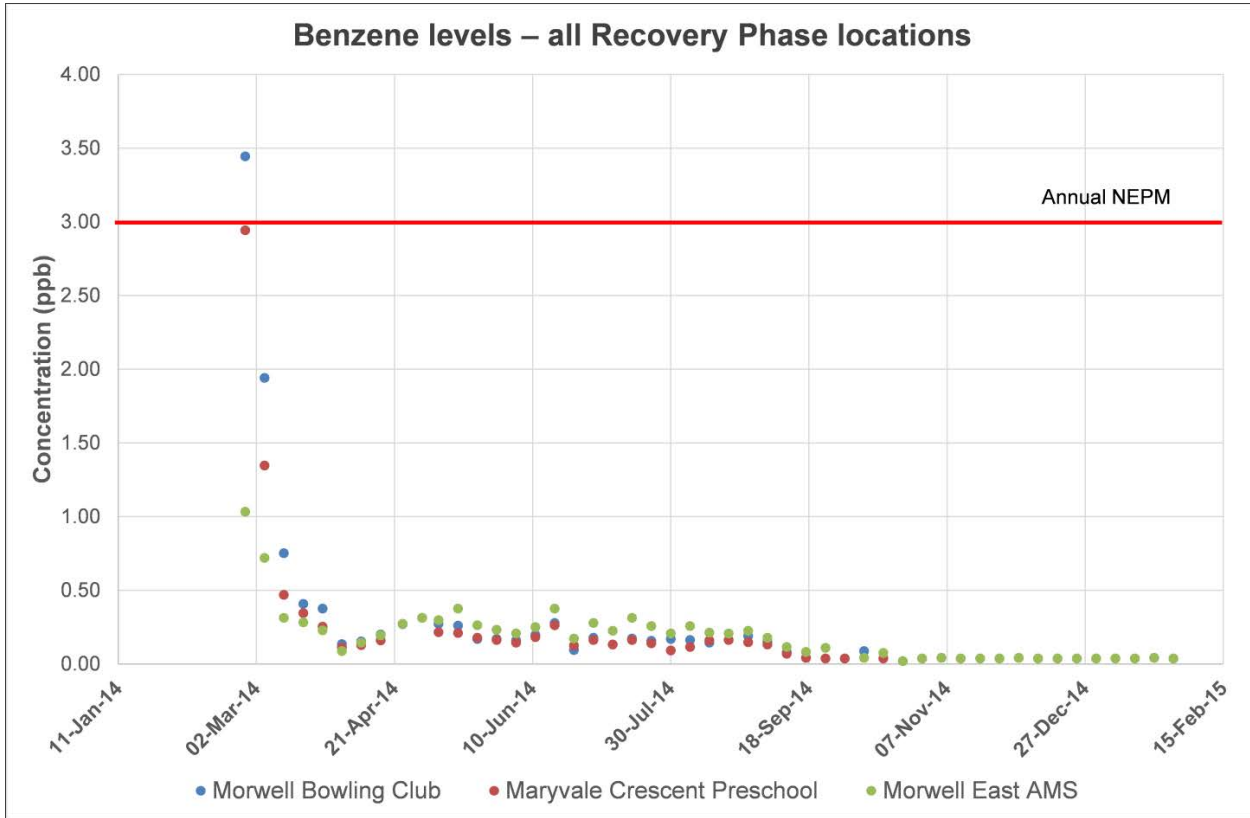
Benzene was the only VOC found to exceed guidelines during the Response Phase, recording a number of breaches of the 24-hour NEPM standard in late February 2014 at the sampling sites in the south of Morwell, close to the mine. These breaches were recorded using 24-hour sampling canisters on high-smoke days. Along with these canisters, EPA deployed solid adsorbent tubes to sample VOCs over seven-day periods during the fire and continuing through the Recovery Phase. Figures 15 and 16, and Table 9 show that while higher concentrations were recorded for some VOCs during the mine fire, concentrations have dropped to consistently low levels during the Recovery Phase. Annual averages are all well below guidelines (where present). VOCs without guidelines, or not presented below, have similar, consistently low concentrations during the Recovery Phase. Overall, the concentrations of VOCs tested have decreased since the mine fire.



**Figure 15. Time series of weekly ambient measurements (in ppb) of benzene, n-hexane, naphthalene, toluene and xylenes taken using solid adsorbent tubes at Morwell Bowling Club to 11 February 2015.**

Figure 15 shows the time series of selected VOCs known to be combustion products (benzene, n-hexane, naphthalene, toluene and xylenes - o-xylene and m&p-xylene) at Morwell Bowling Club (previously Morwell (South) AMS) observed during the mine fire and on into the Response Phase. Benzene was found in a concentration higher (3.44 ppb) than the NEPM annual guideline (3 ppb) early in the Response Phase; however, it quickly fell to consistently low levels, leading to an annual average concentration of 0.251 ppb (Table 8). Toluene followed a similar pattern, but does not have an annual guideline for comparison.

Figure 16 shows benzene concentrations at the three VOC sampling locations in Morwell: Morwell Bowling Club (Morwell (South)), Maryvale Crescent Preschool, and Morwell (East) AMS. The highest concentrations were measured at the two locations closest to the mine, indicative of both the source and extent of benzene dispersion in the air during the mine fire. Benzene levels fell at all three locations by early April, and have since remained lower than 0.5 ppb for the Recovery Phase.



**Figure 16. Time series of weekly ambient concentrations (in ppb) of benzene measured at three sites in Morwell to 11 February 2015.**

Table 8 shows a comparison of selected average VOC concentrations in the Latrobe Valley during the Response and Recovery phases. All VOCs recorded a fall in concentrations between the two time periods apart from the xylenes at Morwell (East) Air Monitoring Station, which rose slightly. It is unknown as to the cause of these increases; however, o-xylene averages are orders of magnitude lower than the annual guideline, suggesting that it could be normal background fluctuations rather than caused by point source emissions. The distance of the Morwell (East) AMS from the mine means that significant xylene emissions from the fire may have simply not reached this part of Morwell.

The Latrobe Valley data shows three different time periods for benzene, n-hexane, naphthalene, toluene and xylenes at the three sample locations. The three time periods are: the year from 26 February 2014 (when sampling began); the Response Phase (26 February 2014 to 7 April 2014); and the Recovery Phase (7 April 2014 onwards). All VOC annual averages (including the Response Phase) were less than the corresponding guideline.

Naphthalene was not found above the level of laboratory detection at the three Latrobe Valley sites; for analysis purposes it was given the value of the detection limit in each analysis.

**Table 8 Average concentrations of selected VOCs for varying time periods at Latrobe Valley sampling sites to 11 February 2015. Annual NEPM guidelines are provided where available.**

Compound (ppb)	Morwell Bowling Club			Maryvale Crescent Preschool			Morwell (East) AMS			Annual guideline
	Annual	Response	Recovery	Annual	Response	Recovery	Annual	Response	Recovery	
Benzene	0.251	1.384	0.121	0.208	1.071	0.108	0.190	0.515	0.152	3
n-Hexane	0.118	0.212	0.105	0.085	0.190	0.073	0.104	0.112	0.103	-
Naphthalene	0.075	0.076	0.075	0.075	0.076	0.075	0.075	0.076	0.075	-
Toluene	0.280	0.621	0.242	0.222	0.455	0.195	0.336	0.367	0.332	100
o-Xylene	0.061	0.088	0.059	0.052	0.062	0.051	0.068	0.044	0.071	200
m&p-Xylenes	0.158	0.222	0.152	0.123	0.136	0.122	0.181	0.123	0.188	-

## 6. Conclusion

An extensive program of air sampling and monitoring conducted during the Recovery Phase of the Hazelwood mine fire showed that any air quality impacts recorded during the mine fire have now dissipated. All of the compounds tested during the incident returned to background, or low, stable concentrations shortly after emissions from the fire ceased. This has remained the case for the duration of the Recovery Phase.

Any further changes in Latrobe Valley air quality into the future are not expected to be linked to the mine fire. Traralgon air monitoring station will continue as a long-term monitoring site within EPA's Ambient Air Quality Network, allowing observation of key pollutants into the future.

## 7. References

Brockway, D.J., Ottrey, A.L. and Higgins, R.S. (1991) Inorganic Constituents. In *The Science of Victorian Brown Coal: Structure, Properties and Consequences for Utilization*, edited by R.A. Durie. Butterworth-Heinemann.

Fisher, G.W., Torre, P. and Marshall, A. (2015). Hazelwood Open-Cut Coal Mine Fire. *Air Quality and Climate Change*. 49 (1) Feb 2015.pp 23-27.

NEPM (2003). National Environment Protection (Ambient Air Quality) Measure. [www.comlaw.gov.au/Details/C2004H03935](http://www.comlaw.gov.au/Details/C2004H03935). Accessed 20/05/15.

USEPA (2015a) Particulate Matter (PM). [www.epa.gov/pm/](http://www.epa.gov/pm/). Accessed 4/5/15.

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USEPA (2015c) Nitrogen oxides. [www.epa.gov/oaqps001/nitrogenoxides/](http://www.epa.gov/oaqps001/nitrogenoxides/). Accessed 13/4/15.

USEPA (2015d) Ozone. [www.epa.gov/ozone/](http://www.epa.gov/ozone/). Accessed 12/5/15.

## 8. Appendix A

### TEOM PM<sub>10</sub> data validation

PM<sub>10</sub> data measured on the TEOM at Traralgon AMS has been adjusted using a temperature-dependent formula with a constant value of K equal to 0.04. The resulting adjustments vary from no change to PM<sub>10</sub> concentrations at average daily temperatures, when they are at or above 15 °C, to an increase in PM<sub>10</sub> concentrations of 40 per cent at a temperature of 5 °C. This process is in line with the approved procedure: <http://www.scew.gov.au/system/files/resources/9947318f-af8c-0b24-d928-04e4d3a4b25c/files/aaqrctp10collectionandreporting200105final.pdf>

## 9. Appendix B – Community Feedback

On 10 June 2015, EPA held a community engagement event to seek feedback from Latrobe Valley community members about draft versions of the reports: *Hazelwood Recovery Program Air Quality Assessment – Morwell and Surrounds, February 2014 – May 2015* (publication 1601) and *EPA Hazelwood Recovery Program water, soil and ash assessment – Morwell and surrounds, February 2014 – May 2015* (publication 1600). EPA received a wealth of excellent and detailed feedback on the draft publications. The community feedback received that is directly relevant to these reports is listed in the table below.

Community Feedback	EPA Comments
EPA should explain more clearly about the ash that was airborne during the fire, and the ash that settled on the ground. For example, particle size explanation in report would be helpful.	In response to this feedback, EPA has further clarified about the size of ash particles on page 2 of the water, soil and ash report (publication 1600).
Further explanation is needed for some graphs in the water, soil and ash graphs.	In response to this feedback, graphs on pages 9–15 of water, soil and ash report (publication 1600) were modified to make them easier to understand, or in some cases, more text was added to explain the meaning of the graphs.
Showing only trace metals components of brown coal is confusing.	In response to this feedback, further charts were added on page 4 and figure 2 of the water, soil and ash report (publication 1600) to show the other components of brown coal.
Could drinking water and recreational standards be included in the reports, either on graphs or listed separately?	In response to this feedback, figures have been updated on pages 13–15 of the water, soil and ash report (publication 1600).

Heavy metals detected at very low levels, zinc, lead, arsenic - why aren't they included in graphs?	In response to this feedback, text has been modified to page 13 of the water, soil and ash report (publication 1600) to explain why these metals haven't been included in the graph.
Clearer explanation is needed for some of the metal graphs in the water results section	In response to this feedback, figures have been updated on pages 13-15 of the water, soil and ash report (publication 1600).
Is there is a World Health Organization (WHO) standard that can be included in the graphs in the report?	EPA reports against the relevant national or state environmental guidelines for air, water and soil. There are also standards set by WHO or the Department of Health and Human Services. Often they influence national or state environmental standards. For more information about the standards EPA reports against, visit: <a href="http://www.epa.vic.gov.au/about-us/legislation/air-legislation">http://www.epa.vic.gov.au/about-us/legislation/air-legislation</a>
Where is the information about the history of air monitoring data in the Latrobe Valley?	See information given by then CEO John Merritt as evidence during the Hazelwood Mine Fire enquiry for a discussion of the history of air monitoring in the Latrobe Valley <a href="http://report.hazelwoodinquiry.vic.gov.au/part-four-health-wellbeing/environmental-effects-response/epa-latrobe-valley">http://report.hazelwoodinquiry.vic.gov.au/part-four-health-wellbeing/environmental-effects-response/epa-latrobe-valley</a>
Where is the detailed information about what EPA did during the mine fire?	This has been published in a separate report that focuses on EPA's response and air quality data during the mine fire: <i>Summarising the air monitoring and conditions during the Hazelwood mine fire, 9 February to 31 March 2014</i> (publication 1598). <a href="http://www.epa.vic.gov.au/our-work/publications/publication/2015/june/1598">http://www.epa.vic.gov.au/our-work/publications/publication/2015/june/1598</a>
What lessons have EPA learnt from the mine fire?	In accordance with specific recommendations from the Hazelwood Mine Inquiry, EPA has made a number of changes to its procedures and procedures about how we monitor air quality and communicate that data with the community: <a href="http://www.parliament.vic.gov.au/file_uploads/_Hazelwood_Mine_Fire_Inquiry_Report_dprsnQjH.pdf">http://www.parliament.vic.gov.au/file_uploads/_Hazelwood_Mine_Fire_Inquiry_Report_dprsnQjH.pdf</a> <u>The approach taken with engaging the community early with the results from these publications is another concrete example of learning and doing things differently.</u>
Some of the metal graphs in the air report are difficult to understand	In response to this feedback, some text has been added to figures 11-13 pages 21-22 of the air report (publication 1601), and some graphs have been modified or removed.
Some annual guidelines were missing on the metal tables in the air report	In response to this feedback, the guideline values were added to page 7 of the air report (publication 1601).
Why is only PM <sub>2.5</sub> been monitored at the Moe and Churchill air monitoring stations?	In response to this feedback, a sentence has been added to page 3 the air report (publication 1601) to explain the decision behind monitoring PM <sub>2.5</sub> more clearly.
Some information about what happened with air monitoring during the fire is not clear, such as number of breaches of PM <sub>2.5</sub> and when monitoring started.	This has been published in a separate report that focuses on EPA's response and air quality data during the mine fire: <i>Summarising the air monitoring and conditions during the Hazelwood mine fire, 9 February to 31 March 2014</i> (publication 1598). <a href="http://www.epa.vic.gov.au/our-work/publications/publication/2015/june/1598">http://www.epa.vic.gov.au/our-work/publications/publication/2015/june/1598</a>
The report is technical and quite difficult to understand at times.	Publications 1600 and 1601 are technical reports. EPA will be looking at other ways to communicate the results to a general audience. EPA has asked for direct feedback from the community on what format this should take. To date ideas have included short plain-English information bulletins, short YouTube videos and public talks.

# Appendix E – Controls Matrix

# Fire Controls Matrix

Revision: 13 July 2015

No.	Description of Controls	Internal			External (Prevent fire entering mine)		
		Prevention	Mitigation	Suppression	Prevention	Mitigation	Suppression
1	FCMP	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5
2	YMA-OPS-PR-0239 - Management Instruction Fire Services	1, 2, 3, 4	1, 2, 3, 4	1, 2, 3, 4			
3	YMA-OPS-PR-0100 - Fire Procedure	1, 2, 3	1, 2, 3	1, 2, 3	?		
4	Early response and notification via CFA / Estate Services radios						
5	YMA-OPS-PR-0401 - Training, Competence & Authorisation	1, 2, 3	1, 2, 3	1, 2, 3		1, 2, 3, 4, 5	1, 2, 3, 4, 5
6	SHEMS06-SHE-P110 - Training and Competence Records	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	4-5		
7	Communications		1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5
8	Auditing		1, 2, 3, 4, 5		NA		
9	Routine Inspections & Checklists	1, 2			NA		
10	YMA-OPS-PR-0313 - Risk Assessment Process	1, 2, 3, 4			4-5		
11	YMA-OPS-PR-0312 - YMA Risk Assessment Template						
12	Mine Planning / Fire Service Planning	1, 2, 3, 4			1, 2, 3		
13	Fire Service Drawings / Labelling		1, 2, 3			1, 2, 3, 4, 5	1, 2, 3, 4, 5
14	YMA-OPS-PR-0383 - RCB Deluge System Testing & Cleaning	1	1	1	NA		
15	Automated fire detection & deluge systems, and engine shutdown on high risk plant		1	1		1	1
16	SHEMS13-SHE-L03 - Ground Control Management Plan		1, 2, 3				
17	Fire Service System - Water Supply, Fire Service Network - Pipes, sprays, pumps, header tanks inc all water infrastructure	1, 2, 3, 4	1, 2, 3, 4	1, 2, 3, 4	1, 2, 3		
18	Tanker Fill Points		1, 2, 3	1, 2, 3		1, 2, 3, 4, 5	1, 2, 3, 4, 5
19	FS Pump - Dual Electrical Supply		1, 2	1, 2		1, 2, 3, 4, 5	1, 2, 3, 4, 5
20	Diesel Pumps - Backup		1, 2	1, 2		1, 2, 3, 4, 5	1, 2, 3, 4, 5
21	Latrobe River Pumps - Backup		1, 2	1, 2		1, 2, 3, 4, 5	1, 2, 3, 4, 5
22	Testing of Fire Service System	1, 2			1, 2, 3		
23	YMA-OPS-PR-0425 - Cathodic Protection of Fire Service Pipelines	1, 2, 3	1, 2, 3	1, 2, 3		1, 2, 3, 4, 5	1, 2, 3, 4, 5
24	D11 Dozers on Sloping Coal Face - Responding to Fire on Mine Slope		1	1		1	1
25	Access to increased Mobile Plant Resources available during Summer season (Overheight Operations, etc.	1, 2, 3, 4	1, 2, 3, 4	1, 2, 3, 4			
26	Fire Breaks						
27	Morwell River Diversion (MRD)		1	1		1	1
28	Latrobe River		1	1		1	1
29	East Field OB Dump		1,2	1,2		1,2	1, 2
30	Township Field OB Dump		2	2		2	2
31	Fire Service Pond		2	2		2	2
32	Lake Placid		2	2		2	2
33	Princes Freeway & Marriots Rd		1, 2, 4	1, 2, 4		1,2 4	1,2 4
34	Maryvale Field Overheight Removal (acts as a brake)		1, 4	1, 4		1, 4	1, 4
35	Latrobe Road		1, 4	1, 4		1, 4	1, 4
36	BCM Road		1	1		1	1
37	Leasee Management		4, 5	4, 5		4, 5	4, 5
38	Slashing program		1, 2, 3, 4	1, 2, 3, 4		1, 2, 3, 4, 5	1, 2, 3, 4, 5
39	Mine Perimeter Road		1, 2, 3, 4	1, 2, 3, 4		1, 2, 3, 4	1, 2, 3, 4
40	Land Rehab - Rehab Master Plan	2			2		

# Fire Controls Matrix

Revision: 13 July 2015

No.	Description of Controls	Internal			External (Prevent fire entering mine)		
		Prevention	Mitigation	Suppression	Prevention	Mitigation	Suppression
41	YMA-OPS-LIB-0060 - Guidelines for Land Rehabilitation Construction	2	2				
42	AusNet On-Site Assets (Lease Agreement for Assets through Mine)	1, 2, 4	1, 2, 4				
43	SHEMS11-SHE-P001 - Applying for CFA Permits & Internal Permits to Carry out Hot Works on Days of Total Fire Ban	1, 2, 3, 4, 5			NA		
44	SHEMS11-ESV-P001-I02 - Opening of Total Fire Boards and Placement of Total Fire Ban Flags	1, 2, 3, 4, 5					
45	Coach Rd Tower - Manned on Days of TFB		1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5
46	Increased Security Patrols on Days of TFB	1, 2, 3, 4, 5	1, 2, 3, 4, 5		1, 2, 3, 4, 5	1, 2, 3, 4, 5	
47	Fire Alert in Mine	1, 2			1-2		
48	Total Fire Ban Displays	1, 2, 3, 4, 5			1-2		
49	SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days	1, 2, 3, 4, 5			1, 2, 3, 4, 5		
50	SHEMS12-ESV-P011 - CFA Notification of Fire		1, 2, 3, 4, 5			1, 2, 3, 4, 5	1, 2, 3, 4, 5
51	SHEMS12-ESV-P001 - Responding to Fire Alarms		1, 2			1, 2, 3, 4, 5	1, 2, 3, 4, 5
52	YMA-OPS-WI-0129 - Carrying Out Works on Days of Total Fire Ban (Yallourn Mine)	1, 2	1, 2				
53	YMA-OPS-PR-0154 - Fire Precautions	1, 2, 3, 4	1, 2, 3, 4	1, 2, 3, 4			
54	YMA-OPS-PR-0217 - Control Centre Fire Alert	1, 2, 3	1, 2, 3	1, 2, 3	1, 2, 3, 4, 5		
55	SHEMS12-ESV-P001-I01 - Management of VESDA During Periods of Heavy Smoke Pollution	1					
56	SHEMS11-ESV-P003 - Hose Tower	1, 2, 3, 4	1, 2, 3, 4				
57	SHEMS14-ESV-P003 - Fire Hoses - Pressure Cleaning	1, 2, 3, 4	1, 2, 3, 4				
58	YMA-OPS-PR-0101 - Fire Extinguisher Replacement	1	1	1			
59	YMA-OPS-PR-0151 - Water Truck		1, 2, 3, 4	1, 2, 3, 4			
60	YMA-OPS-PR-0099 - Management of Water Systems - Flocculation Pond Waste Water Treatment Plant	N/A					
61	Weather forecast information	1, 2, 3, 4, 5	1, 2, 3, 4, 5		1, 2, 3, 4, 5	1, 2, 3, 4, 5	
62	SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yallourn Site	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	
63	SHEMS11-ESV-P001 - Wildfire Risk Mitigation	1, 2, 3, 4, 5			1, 2, 3, 4, 5		
64	SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan	1, 2, 3, 4, 5			1, 2, 3, 4, 5		
65	SHEMS11-SHE-P015-L01 - Bushfire Management Plan	1, 2, 3, 4, 5			1, 2, 3, 4, 5		
66	SHEMS11-SHE-P502 - Management of Electrical Work on site	1, 2, 3, 4, 5			NA		
67	SHEMS11-SHE-L01 - Electrical Safety Line Clearance Plan	1, 2, 3, 4, 5			NA		
68	YMA-OPS-SOP-0374 - Management of LV & HV Overhead Distribution System	1, 2, 3, 4	1, 2, 3, 4		NA		
69	SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site	1, 2, 3, 4, 5	1, 2, 3, 4, 5				
70	Latrobe City supported by CFA - Annual Inspection of Fire Preparedness Prior to Summer Fire Season (joint inspection initiated by Latrobe City with Estate Services)	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5			
71	SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station)		1, 2, 3, 4, 5	1, 2, 3, 4, 5		1, 2, 3, 4, 5	1, 2, 3, 4, 5
72	SHEMS12-SHE-L01-A07 - Emergency Response Plan - Appendix 07 - Fire in Mine		1, 2, 3, 4, 5	1, 2, 3, 4, 5		1, 2, 3, 4, 5	1, 2, 3, 4, 5

# Fire Controls Matrix

Revision: 13 July 2015

No.	Description of Controls	Internal			External (Prevent fire entering mine)		
		Prevention	Mitigation	Suppression	Prevention	Mitigation	Suppression
73	Emergency Response Trial Exercises (involving Combat Agencies)		1, 2, 3, 4, 5	1, 2, 3, 4, 5		1, 2, 3, 4, 5	1, 2, 3, 4, 5
74	YMA-OPS-PR-0281 - Immediate Incident Reporting		1, 2, 3	1, 2, 3	NA		
75	Terrorism Plan	1, 2, 3, 4, 5			1, 2, 3, 4, 5		
76	Perimeter Security Fence	1, 2, 3, 4			1, 2, 3, 4		
77	SHEMS12-ESV-P004 - Emergency Response Control Room		1, 2, 3, 4, 5			1, 2, 3, 4, 5	1, 2, 3, 4, 5
78	Vehicle Checks - Approval to Enter Mine	1, 2			NA		
79	No Smoking within the Mine	1, 2, 3, 4			NA		
80	Dredgers / TS3 - Safety Device Testing	1, 2			NA		
81	VicRoads						
82	DEDJTR						
83	CFA (District 27)						
84	Latrobe city						
85	V/Line						
86	Hancocks (HVP)						
87	Electrical protection systems for ground movement						
88	Pin movement surveys						
89	Plant and Equipment Checks - Approval to Enter Mine						
90	Mine Batter Design allows access on operating faces						
91	Dedicated mine fire service team						
92	D11 Dozer Manual Deluge System						
93	Site wide 24/7 emergency response teams						
94	CCTV cameras located around the mine (linked to operating centre)						
95	CFA surveillance activity - Forward Looking Infrared (FLIR) (Thermal hot spot imaging monitoring of the mine area by CFA)						
96	CFA to estate services direct radio contact regarding response management						
97	Onsite Hot Spot Management						
98	Thermographic overhead monitoring survey						
99	Maintenance of vegetation						
100	Progressive rehabilitation						
101	Yallourn maps supplied to CFA on water truck filling stations, and CFA are escorted on site						
102	Additional droppers and spray lines installed at various locations in proximity to V/Line						
103	Progressive capping of coal areas on selected coal floor areas and batters						
104	Agricultural leasee control						
105	Public roads access control within EAY power; road can be closed on extreme fire danger conditions						
106	Lease agreement with agricultural leasee (including accommodation)						
107	Lease agreement with gun club						
108	AusNet Certified Electrical Safety Management Scheme						
109	Call 000						
110	Remote cameras can be positioned according to the threat						
111	VicRoads Integrated Fire Management Planning Working Group Outcome (shared by VicRoads, Latrobe and CFA)						



# Fire Controls Matrix

Revision: 13 July 2015

No.	Description of Controls	Internal			External (Prevent fire entering mine)		
		Prevention	Mitigation	Suppression	Prevention	Mitigation	Suppression
112	Mutual aid arrangements with other essential industries (e.g. water authorities and other brown coal mines)						
113	Yallourn participating in multi-agency exercises						
114	EAY full induction process including access control (e.g. AusNet and Gippsland Water)						
115	Warning signs on perimeter regarding unauthorised access						
116	YMA-OPS-PR-343 - Hot Works Procedure	1, 2, 3, 4			NA		
117	Operations and maintenance personnel constant vigilance and experience						
118	CFA (MOU with Yallourn site) includes Victorian Fire Risk Register to be updated annually; CFA/Yallourn regular monthly meetings during year and fortnightly during summer period						
119	Latrobe City Council officers attend the Bush Fire Risk Mitigation, Monthly Meetings held at Estate Services Fire Station Training Room this provides direct linkages to the Municipal Fire Management Plan (MFMP) which is a sub plan to the Municipal Emergency Management Plan (MEMP)						
120	Legislative criteria (e.g. dwellings, grass control, vehicles, hazmat, farmland, holding of flammable goods, social events)						
121	V/Line train brakes include classic rollingstock (configuration changes are subject to Change Management Procedures)						
122	VicRoads are responsible for vegetation near roads under their control						
123	VicPol including prosecution of arsonists						
124	SES						
125	AusNet responsible for maintenance of assets (including easements, vegetation control, infrastructure)						
126	Timber plantation (HVP) includes aerial support (e.g. fire towers, helicopters), inventories, fire break down, and are a registered fire brigade force						
127	Gippsland Arson Prevention Patrol (GAPP) through VicPol including media influence						
128	Government burn offs - Dept Enviro, Land, Water & Planning (DELWP)						
129	Plantation digging of waste						
130	Lightning arrestors protect vulnerable plant to prevent spark						
131	Patrols conducted by estate services and power station operations						
132	Remote surveillance (10 site specific cameras plus portable cameras)						
133	Motion alarms to estate services control room						
134	Ash dump area has very low combustibility						
135	New water pipes at twin ash ponds						
136	Lease agreements with recreational clubs						
137	Alliance agreement in terms of protective services and facilities management						
138	AusNet certified safety electrical management system						
139	Patrol around site perimeter including security aspects (increased to match threat)						
140	Witts Gully fire service patrol including security (3-4 times a week)						
141	Witts Gully water body						
142	Operating procedures						
143	Power station design e.g. furnace negative pressure						
144	Standardisation of coupling points						
145	EAY Safety Health and Environment Management systems (SHEMS)						
146	Location of power station to mine operations (outside mine area)						
147	Fire detection and suppression systems for all key areas						
148	Safe shutdown procedures						

# Fire Controls Matrix

Revision: 13 July 2015

No.	Description of Controls	Internal			External (Prevent fire entering mine)		
		Prevention	Mitigation	Suppression	Prevention	Mitigation	Suppression
149	Perimeter clearances (e.g. concrete apron)						
150	Power station manuals specifying standards						
151	Suppression systems						
152	AusNet Bushfire Mitigation Plan provided to YMA mitigation committee						
153	VicRoads construction and hot work activities						
154	CFA Act (1958) and Regulations (2014)						
155	State planning						
156	VicPol works with VicRoads (traffic plans are formulated in conjunction with VicRoads and CFA)						
157	First response by onsite mine personnel (escalated to Estate Services and subsequently to CFA)						
158	Emergency Management Act						
159	Emergency Management Manual						
160	CFA Act						
161	Emergency Management Joint Standard Operating Procedures (incl. Line of Control)						
162	State Response Control						
163	Draft joint SOP for impacts of smoke on community under Emergency Management Victoria						
164	CFA fly over during fire season						
165	VicPol liaison						
166	Access to additional resources during fire season						
167	External contractors safety management procedures including inspections						
168	Job safety observation of contractor's works						
169	Leasee included in Bushfire mitigation committee						
170	Higher numbers to provide surveillance during bushfire season						
171	Defined areas of power station with active supervision						
172	VESDA fire detection system						
173	Power station inspection and maintenance programs						
174	Additional supervision on TFB days						
175	Routine cleaning of power station to prevent built up of product						
176	Contractor SHE management						
177	Power station hot works procedure including permit						
178	Risk management procedures including JSEAs						
179	Municipal fire management committee (VicRoads and Gippsland Water attend meetings) (More applicable to the municipal level)						
180	Work undertaken at state level (CO and PM 2.5)						
181	EPA study (12 months) post Hazelwood (no long term impact on environment)						
182	Latrobe City Council - hazardous materials release from a facility (CO)						

Legend
1 - Working Area of the Mine
2 - Worked Out Areas of the Mine
3 - Associated Mining Operations (Monitoring & Access)
4 - Mine Area - Work Approved But Not Carried Out
5 - Perimeter Area External to Mine Area

## Appendix F – Agency Letters & Responses

The following questions were determined during the first workshop in preparation for the second workshop with the agencies.

No.	Questions to Agency	Agency	Response Received
1	<ul style="list-style-type: none"> <li>• Procedure for application of brakes (braking mechanism for rolling stock)</li> <li>• Procedure for track maintenance/upgrades</li> <li>• Procedure for fire suppression</li> <li>• Procedure for control for high risk days</li> </ul>	Vline	25 June 2015
2	<ul style="list-style-type: none"> <li>• Inspection and reporting regimes</li> <li>• Follow up maintenance</li> </ul>	AusNet	No response received to date
3	<ul style="list-style-type: none"> <li>• Evacuation procedures</li> <li>• Smoke procedures</li> <li>• TARPs</li> </ul>	Latrobe City Council	25 June 2015
4	<ul style="list-style-type: none"> <li>• Road and traffic management plans during emergency incidents</li> </ul>	VicPol	26 June 2015
5	<ul style="list-style-type: none"> <li>• Vegetation control procedures</li> </ul>	VicRoads	Not issued
6	<ul style="list-style-type: none"> <li>• Coal industry practices and suggestions, fire management</li> </ul>	CFA	No response, however CFA representatives attended the workshop
7	<ul style="list-style-type: none"> <li>• Mine perimeter road function in relation to fire brakes vs access</li> </ul>	CFA	No response, however CFA representatives attended the workshop
8	<ul style="list-style-type: none"> <li>• Quality of e.g. air, ground, water threshold limits and what has occurred after similar fires</li> </ul>	EPA	Not issued



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24<sup>th</sup> June 2015

Mr David Osborne  
Ausnet Services  
[david.osborne@ausnetservices.com.au](mailto:david.osborne@ausnetservices.com.au)

David,

EnergyAustralia is required to prepare a risk assessment and management plan for submission to the Department of Economic Development, Jobs, Transport and Resources for hazards resulting from the mining activities of Yallourn Mine. In working through the fire hazards risk assessment process a need for further information in a number of area's was identified. For completeness of the activity it would be appreciated if you could respond to the following request for information including reference to procedure numbers where possible. We are not seeking copies of procedures but would like to understand the processes that are in place to manage the nominated activity.

Given the AusNet assets located within the Yallourn mine site a number of controls were nominated which we believe AusNet would have in place, as follows:

- i) For the AusNet assets within the Yallourn Mine site does AusNet have documented procedures for the maintenance, inspection and reporting of defects, and for vegetation management. Are records of these inspections available to Yallourn,
- ii) Can you provide records of follow-up maintenance activities

We would be happy to meet with you to discuss this request in more detail. For further information or to arrange a meeting please contact Mr Peter Leviston on 0419 390 766, or [peter.leviston@energyaustralia.com.au](mailto:peter.leviston@energyaustralia.com.au).

Your prompt response by Tuesday 30<sup>th</sup> June 2015 would be appreciated.

Regards,

Ron Mether  
Manager, Mining



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24<sup>th</sup> June 2015

Lance King  
Latrobe City Council  
[Lance.King@latrobe.vic.gov.au](mailto:Lance.King@latrobe.vic.gov.au)

Lance,

EnergyAustralia is required to prepare a risk assessment and management plan for submission to the Department of Economic Development, Jobs, Transport and Resources for hazards resulting from the mining activities of Yallourn Mine. In working through the fire hazards risk assessment process a need for further information in a number of area's was identified. For completeness of the activity it would be appreciated if you could respond to the following request for information including reference to procedure numbers where possible. We are not seeking copies of procedures but would like to understand the processes that are in place to manage the nominated activity.

Given the proximity of the community to Yallourn Mine a number of controls were nominated which we believe Latrobe City would have in place, as follows:

- i) In the event of a major brown coal mine fire does Latrobe City have a plan to evacuate the community should it be deemed necessary,
- ii) Does Latrobe City have procedures to manage public welfare in the event of heavy smoke pollution from a brown coal mine fire,
- iii) Does Latrobe City have Trigger, Action, Response Plans (TARPS) to manage the impacts of a brown coal mine fire on the Latrobe community

We would be happy to meet with you to discuss this request in more detail. For further information or to arrange a meeting please contact Mr Peter Leviston on 0419 390 766, or [peter.leviston@energyaustralia.com.au](mailto:peter.leviston@energyaustralia.com.au).

Your prompt response by Tuesday 30<sup>th</sup> June 2015 would be appreciated.

Regards,

Ron Mether

Manager, Mining

**From:** [Leviston, Peter](#)  
**To:** [Daniela Abela](#)  
**Cc:** [David Crawford \(InTouch\)](#); [Mark Andrew](#); [Ron Mether \(InTouch\)](#)  
**Subject:** FW: Yallourn Risk Workshop information  
**Date:** Monday, 29 June 2015 1:41:19 PM  
**Attachments:** [image003.png](#)  
[1458\\_002.pdf](#)

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Daniela

Please find attached response from Latrobe City to the questions we sent out resulting from the risk workshop

We have not yet had a response from AusNet or the CFA from the questions we issued.

I'll send through a copy of the letters issues to the various agencies for your information

Regards

Peter

---

**From:** Lance King [mailto:Lance.King@latrobe.vic.gov.au]  
**Sent:** Thursday, 25 June 2015 4:02 PM  
**To:** Miller, Brad; Mether, Ron  
**Cc:** Leviston, Peter; Steven Tong; Sara Rhodes-Ward  
**Subject:** RE: Yallourn Risk Workshop information

Hello Gents,

In response to these requests please see the following:

- In the event of a major brown coal fire does Latrobe City have a plan to evacuate the community should it become necessary?  
*Victoria Police is the responsible authority for evacuation as identified in section 7 of the EMMV. So no Latrobe City as a support agency does not have an evacuation plan for communities abutting the Yallourn Mine interface.*
- Does Latrobe City have procedures to manage public welfare in the event of heavy smoke pollution from a brown coal mine fire.  
*The relevant Incident controller is the responsible authority during the response phase of an impact from a mine fire and it that authority that would be able to assist with these types of response plans. Section 7 of the EMMV also identifies who is the responsible agency for hazardous materials. So no as a support agency to this type of impact Latrobe City does not manage public welfare as recently experienced in the Hazelwood Mine Fire.*
- Does Latrobe City have Trigger, Action, Response Plans (TARPS) to manage the impacts of a brown coal mine fire on the Latrobe Community.  
*No Latrobe City does not have a TARPS as this is a response plan that would be a plan undertaken by the Incident Controller/control authority.*

As a result of the Hazelwood Mine Fire Latrobe City's Municipal Emergency Management Planning (MEMP) Committee through the Risk Sub Committee reviewed the municipal risk profile, as a result Hazardous Material Release from a Facility was deemed by the committee through the Community Emergency Risk Assessment (CERA) process to be

classified as high Risk.

The consequence of this high rating is that a Hazardous Material Release from a Facility sub plan is required to be developed. This is currently in the development stage and will rely on the appropriate agency to facilitate the planning process.

I hope this helps

Regards

**Lance King**  
**Coordinator Emergency Management**  
**Latrobe City Council**

---

[mailto: Lance.King@latrobe.vic.gov.au](mailto:Lance.King@latrobe.vic.gov.au)

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141 Commercial Rd, Morwell 3840



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---

**From:** Miller, Brad [<mailto:Brad.Miller@energyaustralia.com.au>]

**Sent:** Wednesday, 24 June 2015 5:28 PM

**To:** Lance King

**Cc:** Mether, Ron; Leviston, Peter

**Subject:** Yallourn Risk Workshop information

Lance,

A risk workshop was held at Yallourn recently to assess the fire hazards at Yallourn Mine.

Attached is a letter requesting some information from Latrobe City Council to support the risk assessment process.

Please feel free to contact myself or Peter Leviston on 0419 390 766 should you require any further information.

Regards,

**Brad Miller**

Mine Alliance | EnergyAustralia Yallourn Pty Ltd  
Eastern Road, Yallourn Victoria 3825

☎ Ph 03 5128 2747 | 📱 Mob 0400 876 325

[brad.miller@energyaustralia.com.au](mailto:brad.miller@energyaustralia.com.au)

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24<sup>th</sup> June 2015

Mr Bill Johnstone  
CFA  
[b.johnstone@cfa.vic.gov.au](mailto:b.johnstone@cfa.vic.gov.au)

Bill,

EnergyAustralia is required to prepare a risk assessment and management plan for submission to the Department of Economic Development, Jobs, Transport and Resources for hazards resulting from the mining activities of Yallourn Mine. In working through the fire hazards risk assessment process a need for further information in a number of area's was identified. For completeness of the activity it would be appreciated if you could respond to the following request for information including reference to procedure numbers where possible. We are not seeking copies of procedures but would like to understand the processes that are in place to manage the nominated activity.

- i) From CFA experience with brown coal mine fires, are there any best practice fire prevention or mitigation activities you would like to be considered for Yallourn Mine?
- ii) Comment on CFA's view of the prime function of the mine perimeter road:- to limit the spread of fire or to provide a safe access corridor for fire fighting vehicles and equipment

We would be happy to meet with you to discuss this request in more detail. For further information or to arrange a meeting please contact Mr Peter Leviston on 0419 390 766, or [peter.leviston@energyaustralia.com.au](mailto:peter.leviston@energyaustralia.com.au).

Your prompt response by Tuesday 30<sup>th</sup> June 2015 would be appreciated.

Regards,

Ron Mether  
Manager, Mining



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24<sup>th</sup> June 2015

Mr Ricky Ross  
Victoria Police  
[ricky.ross@police.vic.gov.au](mailto:ricky.ross@police.vic.gov.au)

Ricky,

EnergyAustralia is required to prepare a risk assessment and management plan for submission to the Department of Economic Development, Jobs, Transport and Resources for hazards resulting from the mining activities of Yallourn Mine. In working through the fire hazards risk assessment process a need for further information in a number of area's was identified. For completeness of the activity it would be appreciated if you could respond to the following request for information including reference to procedure numbers where possible. We are not seeking copies of procedures but would like to understand the processes that are in place to manage the nominated activity.

Given the proximity of major roads infrastructure to the Yallourn Mine a number of controls were nominated which we believe Victoria Police would have in place, as follows:

- i) Does Victoria Police have road and traffic management plans for a major brown coal mine fire emergency event?

We would be happy to meet with you to discuss this request in more detail. For further information or to arrange a meeting please contact Mr Peter Leviston on 0419 390 766, or [peter.leviston@energyaustralia.com.au](mailto:peter.leviston@energyaustralia.com.au).

Your prompt response by Tuesday 30<sup>th</sup> June 2015 would be appreciated.

Regards,

Ron Mether  
Manager, Mining

**From:** [Leviston, Peter](#)  
**To:** [Daniela Abela](#)  
**Cc:** [David Crawford \(InTouch\)](#); [Ron Mether \(InTouch\)](#); [Mark Andrew](#)  
**Subject:** FW: TRAFFIC MANAGEMENT PLANS  
**Date:** Monday, 29 June 2015 1:34:32 PM  
**Attachments:** [image001.png](#)

---

Daniela / Mark

In response to the questions we sent out, please find below the Police response.

Regards

Peter

---

**From:** Miller, Brad  
**Sent:** Monday, 29 June 2015 8:41 AM  
**To:** Ross, Ricky; Watson, David  
**Cc:** Blair, Cameron; Thomas, Dean; Leviston, Peter; Nash, Mark  
**Subject:** RE: TRAFFIC MANAGEMENT PLANS

Ricky / David / Cameron,

Thanks for the prompt and comprehensive response to this request.  
This information will be a useful reference for our fire risk assessment for hazards regarding traffic management.

Regards,  
Brad Miller

---

**From:** Ross, Ricky [<mailto:ricky.ross@police.vic.gov.au>]  
**Sent:** Friday, 26 June 2015 12:29 PM  
**To:** Watson, David; Miller, Brad  
**Cc:** Blair, Cameron; Thomas, Dean  
**Subject:** RE: TRAFFIC MANAGEMENT PLANS

Thanks

In line with management of TMP's for Class 1 emergencies, deployment of Traffic Management Manager to ICC and Implementation of Incident Traffic Management Plan as required to escalation of event.

Concur with comments

Ricky

-----Original Message-----

**From:** Watson, David  
**Sent:** Friday, June 26, 2015 10:49 AM AUS Eastern Standard Time  
**To:** 'brad.miller@energyaustralia.com.au'  
**Cc:** Ross, Ricky; Blair, Cameron; Thomas, Dean  
**Subject:** FW: TRAFFIC MANAGEMENT PLANS

Hello Brad,

I agree with Cameron's comments below.

In an emergency such as a fire, traffic management points (TMP's) are initially established by Vic Pol as a matter of safety to keep people out of a particular (dangerous) area. These TMP's will be reassessed by the ICC (incident controller) in collaboration with Vic Roads, Local Councils, Vic Pol and other members of an EMT and are either maintained, moved to a more effective/efficient location or the number of points increased/decreased. As Cameron alludes to it is difficult to plan due to the unpredictable nature of these events. (location/weather) In protracted situations a Traffic Management Plan will be prepared and implemented as required.

Regards

**David Watson \ Acting Inspector**

Eastern Region \ Division 5 – Latrobe Local Area Commander

**Phone:** 5131 5002 \ **Mobile:** 0408 599 707 \ **Fax:** 5131 5015

**Email:** [david.watson@police.vic.gov.au](mailto:david.watson@police.vic.gov.au)



---

**From:** Blair, Cameron  
**Sent:** Friday, 26 June 2015 09:21  
**To:** 'Brad.Miller@energyaustralia.com.au'  
**Cc:** Fusinato, Peter; Watson, Peter  
**Subject:** TRAFFIC MANAGEMENT PLANS

Morning Brad,

There is no standing traffic management plans specifically detailed when responding to a mine fire event. All traffic plans are formulated in conjunction with Vic-Roads & the CFA to ensure the optimum route / diversion is implemented taking into account emergency access & egress, also heavy vehicle use.

There was discussion following the mine fire last year surrounding the creation of permanent traffic plans. The unpredictability of such a scenario requires any traffic management plan to remain fluid as circumstances constantly evolve and change with limited notice, hence no standing plans were developed specifically for these events.

I can be contacted via the attached detail if anything further is required.

Regards,

Cameron.

Cameron Blair | Senior Sergeant | Moe Police Station- | Victoria Police

email:cameron.blair@police.vic.gov.au | web address: [www.police.vic.gov.au](http://www.police.vic.gov.au)

telephone: 51281100 | mobile: 0418-302-507

address: 3-5 Anzac St Moe 3825

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24<sup>th</sup> June 2015

Shane Cooper  
V/Line  
[Shane.Cooper@vline.com.au](mailto:Shane.Cooper@vline.com.au)

Dear Shane,

EnergyAustralia is required to prepare a risk assessment and management plan for submission to the Department of Economic Development, Jobs, Transport and Resources for hazards resulting from the mining activities of Yallourn Mine. In working through the fire hazards risk assessment process a need for further information in a number of area's was identified. For completeness of the activity it would be appreciated if you could respond to the following request for information including reference to procedure numbers where possible. We are not seeking copies of procedures but would like to understand the processes that are in place to manage the nominated activity.

Due to the proximity of the railway line to the Yallourn Mine a number of controls were nominated which we believe V/Line would have in place, as follows:

To prevent the ignition of fire, does V/Line have a procedure(s) for;

- i) the application of brakes and for the selection of brake materials or components for rolling stock,
- ii) the control of hot works activities for track maintenance and upgrades works,
- iii) fire suppression, &
- iv) controls for high fire risk days.

We would be happy to meet with you to discuss this request in more detail. For further information or to arrange a meeting please contact Mr Peter Leviston on 0419 390 766, or [peter.leviston@energyaustralia.com.au](mailto:peter.leviston@energyaustralia.com.au).

Your prompt response by Tuesday 30<sup>th</sup> June 2015 would be appreciated.

Regards,

Ron Mether  
Manager, Mining

**From:** [Leviston, Peter](#)  
**To:** [Daniela Abela](#)  
**Cc:** [David Crawford \(InTouch\)](#); [Mark Andrew](#); [Ron Mether \(InTouch\)](#)  
**Subject:** FW: Yallourn Risk Workshop information  
**Date:** Monday, 29 June 2015 1:38:20 PM  
**Attachments:** [image001.png](#)

---

Daniela

Please find below response from V/Line to our questions from the risk workshop

Regards

Peter

---

**From:** Cooper, Shane [mailto:Shane.Cooper@vline.com.au]  
**Sent:** Thursday, 25 June 2015 5:08 PM  
**To:** Miller, Brad  
**Cc:** Mether, Ron; Leviston, Peter; Hunter, Jim; Jangamareddy, Abhi  
**Subject:** RE: Yallourn Risk Workshop information

Dear Brad,

I acknowledge receipt of your letter requesting information relating to V/Line's Safety Management System. Specific to your four questions, I offer the following advice:

- i) *The application of brakes and for the selection of brake materials or components for rollingstock:* V/Line has an extensive SMS relating to maintenance of rollingstock and the management of rollingstock configuration, including changes to configuration. Our fleet consists of classic rollingstock which includes locomotive hauled services which legacy wheel friction brakes and Diesel Multiple Units (DMUs) with disc brakes, and more modern high speed VLocity DMU's. All changes to the configuration of rolling-stock, including brake components are subject to change management procedures, which include a full assessment of risk including fire hazard. In addition to technical engineering standards in respect of maintenance of brake systems, there are specific operational procedures for train crew to manage brake faults. Some of the relevant procedures are as follows:
- ii) *The Control of hot works activities for track maintenance and upgrades works.* V/Line has specific procedures and requirements for the control of hot work, including additional requirements during the summer period and on days of total fire ban. The systemic process includes specific fire prevention requirements and authorisation for hot works.
- iii) *Fire Suppression.* Specific requirements exist for fire suppression and prevention equipment for site works, depots and rolling stock. As V/Line is not an emergency service organisation, for active fire which cannot be safely suppressed, procedures are in place to promptly alert emergency services.
- iv) *Controls for High fire risk days.* Specific controls for high risk days are included in our safety management system, inclusive of works permits, presence of fire suppression and prevention equipment, and limits on the type of works which may be performed.

A subset of procedures relating to brakes and configuration change on rolling stock (note there are substantial other examination and maintenance procedures implemented by V/Line and our contractor Bombardier).

Procedure	
<b>VEPR-1</b>	Train Lined Park Brake – Country Cars – Operation & Maintenance Information
<b>VEPR-7</b>	Brake Equipment & Auxiliary Pneumatic Maintenance Requirements ‘Sprinter’ ‘D’ Exam
<b>VEPR-8</b>	Carriage Brake Piston Travels
<b>VEFO-16</b>	Brake Force Record
<b>VEFO-20</b>	VLocity Brake Pad Condition Report
<b>VEFO-35</b>	VLocity Split Brake Disc Installation Check Sheet - Trailer Bogie
<b>VEWI-46</b>	V/Line Passenger - Removal of the 26L Brake Pipe Non-Maintaining Feature from all VLP Locomotives
<b>OPWI-108</b>	Dealing with Reported Brake Faults
<b>VEWI-151</b>	Isolation of VLocity Friction Brakes
<b>VEWI-169</b>	Locomotive 26L Brake Changeout
<b>VEWI-197</b>	Instructions for operating the Tension Spring Park Brake (TSPB)
<b>VEPR-3</b>	Vehicle Configuration, Maintenance and Supplier Change Process

A subset of relevant procedures for fire prevention management and management of works and rollingstock during hot days:

### Standards and Procedures

Procedure	Provides Guidance to:
Book of Rules and Operating Procedures (1994): Section 30 – Paragraph 30	<ul style="list-style-type: none"> <li>• Management of ‘WOLO’ operating restrictions</li> </ul>
Network Service Plan	<ul style="list-style-type: none"> <li>• The Threshold Temperatures and corresponding operating (‘WOLO’) restrictions for each line section.</li> </ul>
<b>NIPR-2010</b> Business Continuity Management (BCM) Plan – Asset Management	<ul style="list-style-type: none"> <li>• Maintaining business continuity through: <ul style="list-style-type: none"> <li>○ Response, and</li> <li>○ Recovery</li> </ul> </li> </ul>
<b>NIPR-2656</b> Installation, Inspection and Maintenance of Bolted Joints	<ul style="list-style-type: none"> <li>• Responses to bolted joint defects both in preparation for and during summer for the maintenance of lateral stability.</li> </ul>
<b>NIPR-2708</b> Inspection and Assessment of Lateral Stability	<ul style="list-style-type: none"> <li>• Inspection and assessment of track lateral stability</li> <li>• Inspection and assessment of rail creep</li> </ul>
<b>NIWI-2729</b> Infrastructure Failure, Fault and Incident Reporting	<ul style="list-style-type: none"> <li>• Reporting Responsibilities</li> <li>• Reporting Requirements for</li> <li>• Incident Analysis</li> </ul>
<b>NIPR-2750</b> Maintenance of Lateral Stability	<ul style="list-style-type: none"> <li>• The Definition of the Summer period</li> <li>• Track Disturbance Events</li> <li>• Working in the Summer Season <ul style="list-style-type: none"> <li>○ Maintenance Restrictions</li> </ul> </li> </ul>



		<ul style="list-style-type: none"> <li>○ Precautions when undertaking works</li> <li>○ Management of temporary speed restrictions following a track disturbance event.</li> <li>○ Track surfacing operations (tamping)</li> </ul>
<b>NIPR-2751</b>	Management of Infrastructure During Hot Weather	<ul style="list-style-type: none"> <li>● Management of track misalignment</li> <li>● Obtaining temperature forecasts</li> <li>● The setting of threshold temperatures for 'WOLO' operational restrictions</li> <li>● The management of 'WOLO' speed restrictions</li> <li>● When heat patrols are conducted.</li> <li>● Precautions for track maintenance in hot weather</li> </ul>
<b>NIMG-2760</b>	Fire Prevention Management Information	<ul style="list-style-type: none"> <li>● V/Lines fire management objectives</li> <li>● Annual fire management responsibilities</li> <li>● Hot Work authorisation and management during the fire danger period.</li> <li>● Maintenance precautions and restrictions during the fire danger period.</li> </ul>
<b>NIMG-2760.1</b>	Fire Prevention Management Information Summary Works Program	<ul style="list-style-type: none"> <li>● Broad schedule for fire prevention works by line section.</li> <li>● Priority of fire prevention works</li> </ul>
<b>NIPR-2761</b>	Fire Prevention Management	<ul style="list-style-type: none"> <li>● The requirement for fire prevention works planning.</li> <li>● Proposed schedule and responsibilities for fire prevention events.</li> </ul>
<b>NIWI-2751.1</b>	Removing a WOLO	<ul style="list-style-type: none"> <li>● Provides instructions for unplanned removal of WOLO heat speed restriction</li> </ul>
<b>NIWI-2751.2</b>	Applying a Late Notice WOLO	<ul style="list-style-type: none"> <li>● Outlines the duties of all staff in applying a late notice WOLO.</li> </ul>
<b>NOWI-17</b>	Train Control Method for Applying Total Fire Bans	<ul style="list-style-type: none"> <li>● The receiving and communication of advice to there being a day of Total Fire Ban</li> </ul>
<b>NOPR-70</b>	Severe Weather Restrictions	<ul style="list-style-type: none"> <li>● Definition of a severe weather event</li> <li>● Management of rail operations during and following a severe weather event</li> <li>● Inspections following severe weather events</li> </ul>
<b>SAPR-7</b>	Prevention of Skin Cancer in Outdoor Workers	<ul style="list-style-type: none"> <li>● Protection and work management practices to prevent skin cancer.</li> </ul>
<b>SAPR-33</b>	Incident Reporting	<ul style="list-style-type: none"> <li>● The process for reporting incidents</li> <li>● Responsibilities of staff in reporting incidents.</li> </ul>
<b>SAPR-34</b>	Emergency and Crisis Management Plan	<ul style="list-style-type: none"> <li>● Provides guidance to the management of Crisis, Emergency and Incidents, including in relation to: <ul style="list-style-type: none"> <li>○ Operational Incidents; and</li> <li>○ Fire</li> </ul> </li> </ul>
<b>SAPR-69</b>	Working in Extreme Weather Conditions	<ul style="list-style-type: none"> <li>● The requirements and risk control measures for staff working in extreme weather including: <ul style="list-style-type: none"> <li>○ Hot Weather, and</li> <li>○ Outdoors</li> </ul> </li> </ul>
<b>VEWI-164</b>	N Carriages AGS Settings – Pre Summer Check	<ul style="list-style-type: none"> <li>● Provides instructions for checking and setting the N class carriages fitted with the Heinzmann PLC Automatic generator System prior to the summer period.</li> </ul>
<b>OPWI-81</b>	VLocity Fire Protection System	<ul style="list-style-type: none"> <li>● VLocity Fire prevention system</li> </ul>

<b>VEWI-133</b>	Clean up & Recommissioning of VLocity Fire Protection System	<ul style="list-style-type: none"> <li>Clean up and reset a discharged fire system</li> </ul>
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### Forms and Tools

Form/Tool	Provides Guidance to:
<b>NIFO-2002.4</b> Pre Job Start Briefing	<ul style="list-style-type: none"> <li>Assessment and management of Extreme Weather Hazards</li> <li>Assessment and management of fire hazards and potential ignition</li> <li>Emergency Preparedness</li> </ul>
<b>NIFO-2002.4</b> Plant Maintenance – Pre Job Start Safety Checklist	<ul style="list-style-type: none"> <li>Undertaking field maintenance in summer months</li> <li>Hot work requirements</li> </ul>
<b>NIFO-2751.1</b> Cancellation of WOLO Heat Speed Restrictions	<ul style="list-style-type: none"> <li>Record of advice from the Senior Train Controller to the Maintenance Supervisor of cancellation of 'WOLO' heat speed restrictions</li> </ul>
<b>NIFO-2751.2</b> Authority to Cancel WOLO	<ul style="list-style-type: none"> <li>Record of advice from the Track Maintenance Supervisor to the Senior Train Controller that the track is fit for cancellation of 'WOLO' heat speed restrictions.</li> </ul>
<b>NIFO-2751.3</b> Advice of Late Notice WOLO – Between Train Controller/Signaller & Driver	<ul style="list-style-type: none"> <li>Record of advice from the Train Controller/Signaller to a train driver of late imposed 'WOLO' heat speed restrictions.</li> </ul>
<b>NIFO-2751.4</b> Advise of late Notice WOLO – Between Maintenance Manager & Senior Train Controller	<ul style="list-style-type: none"> <li>Record of advice to the Senior Train Controller of the requirement for 'WOLO' heat speed restrictions to be immediately applied.</li> </ul>
<b>NIFO-2760.2</b> Fire Prevention Management Information – Supervisors Fortnightly Report Template.	<ul style="list-style-type: none"> <li>Supervisors record of planned fire prevention works undertaken fortnightly.</li> </ul>
<b>NIFO-2760.3</b> Hot Work Authorisation on a Day of Total Fire Ban	<ul style="list-style-type: none"> <li>Managers authorisation to undertake hot work on a day of total fire ban subject to permit conditions.</li> </ul>
<b>NOFO-49</b> Total Fire Ban Advice Form	<ul style="list-style-type: none"> <li>Advice of a day of total for ban for one or more districts.</li> </ul>

Should you require further information, please feel free to contact me.

Regards  
**Shane Cooper** | Engineer Manager Track and Civil  
V/Line Pty Ltd  
L9 750 Collins St  
Docklands VIC  
GPO Box 5343 Melbourne VIC 3001

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**From:** Miller, Brad [<mailto:Brad.Miller@energyaustralia.com.au>]  
**Sent:** Wednesday, 24 June 2015 5:24 PM  
**To:** Cooper, Shane  
**Cc:** Mether, Ron; Leviston, Peter  
**Subject:** Yallourn Risk Workshop information

Shane,

A risk workshop was held at Yallourn recently to assess the fire hazards at Yallourn Mine. Attached is a letter requesting some information from V/Line to support the risk assessment process. Please feel free to contact myself or Peter Leviston on 0419 390 766 should you require any further information.

Regards,

**Brad Miller**

Mine Alliance | EnergyAustralia Yallourn Pty Ltd  
Eastern Road, Yallourn Victoria 3825

☎ Ph 03 5128 2747 | 📱 Mob 0400 876 325

[brad.miller@energyaustralia.com.au](mailto:brad.miller@energyaustralia.com.au)

[energyaustralia.com.au](http://energyaustralia.com.au)



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## Appendix G – YMA Risk Ranking Scheme

YMA's risk ranking scheme is based upon the following three components of a loss scenario (or unwanted event).

- Probability of the event occurring.
- Exposure. The time a person(s) is potentially exposed to a particular hazard (combination of duration and occurrence).
- Severity. The consequences of the event.

The risk rating is then computed as follows:

$$\text{Risk Rating} = \text{Probability} \times (\text{Exposure} + \text{Severity})$$

Each of these ranking components are shown as scales overleaf.

### Probability Scales

Description	Typically...	Examples	Score
Conceivable	It is possible but extremely unlikely - once in 20 years or longer. No knowledge of it occurring in industry.	Rupture and explosion of oxy/acetylene cylinders in ute resulting in multiple fatalities. Ingestion of herbicide resulting in death.	1
Unlikely	It happens once or twice a year in industry, however because of design differences and/or additional controls implemented at Yallourn mine, it is unlikely to happen.	Fall from elevated walkway /stairway resulting in death. Noise induced hearing loss from regular exposure to noise greater than 85dB(A) i.e. continual failure to wear hearing protection.	2
Possible	It happens once or twice a year in industry, however because of design and operational similarities, it could happen at Yallourn mine.	Loss of limb due to hand held tool, e.g. chainsaw. Fatality due to electrocution. Fatality from contaminated / unsafe atmosphere during confined space entry.	5
Highly possible	It has happened at Yallourn mine in the short term (for example in the last 1 - 3 years). No additional controls have been implemented. E.g. Required PPE not worn.	Injuries sustained from vehicle rollover in mine. Laceration to hand while using inappropriate tool to strip cable.	10
Highly probable	Foreseeable and has happened at Yallourn mine in the last 12 months. No additional controls have been implemented.	Muscular strain due to lifting, e.g. gas cylinders Burns due to hot slag during oxy / acetylene cutting. Eye injury caused by foreign object, e.g. dust particle.	15
Definite	It will happen - It is continuous and/or certain to happen.	Minor injury to eye due to foreign body. Minor injury resulting from slips, trips and falls.	20

### Exposure Scales

Description	Duration	Occurrence	Score
Very Rare	Yearly for less than 5 minutes	Once in five or more years	1
Rare	Weekly walking past the hazard but not working near or with it Monthly for less than 5 minutes Yearly for less than one hour	One or two times in five years	2
Seldom	Daily walking past the hazard but not working near or with it Weekly for less than 5 minutes Monthly between 5 and 20 minutes Yearly for between 1 hour and 1 day	One or two times a year	5
Occasional	Daily between 1 and 10 minutes a day Weekly between 5 minutes and 1 hour Monthly between 20 minutes and 4 hours Yearly between 1 day and 10 days	One time in 10 days	10
Frequent	Daily between 10 minutes and 4 hours a day Weekly between 1 hour and 4 days Monthly between 1 day and 15 days Yearly between 10 days and 180 days	One or more times a day	15
Continuous	Daily for more than 4 hours every day Weekly for more than 4 days Monthly for more than 15 days Yearly for more than 180 days	More than 4 consecutive hours each day	20

### Severity Scales

For Major Mining Hazards, only one severity level is relevant (or rather, qualifies as a Major Mining Hazard) and that is a multiple fatality, which has a severity score of 20 using the YMA risk scale (on a scale of 1 = benign to 20 = catastrophic).

Description	Health and Safety	Plant damage / Lost production	Environmental	Score
Minor	Has the potential to cause minor injuries that may require first aid treatment but with no lost time from work.	Minor Plant/equipment damage requiring minimal repairs e.g. immediate return to service following on the job corrective work. Down time less than 1 hour. Financial loss less than \$1000. No production loss.	Minor environmental impact requiring minimal corrective action to address the incident - e.g. confined to small area with clean up by one person. Less than 20 litres spilt. One off complaint. Financial loss less than \$1000.	1
Incident	Has the potential to result in a Medical Treatment or a Lost Time Injury with no permanent disability.	Minor plant/equipment damage requiring workshop repairs. Plant/equipment down time more than 1 hour, less than 12 hours. Financial loss between \$1,000 and \$50,000. Production not affected.	Low environmental impact with release 20 litres or more of substance confined to a local area and immediately containable with rapid clean up possible. Occasional complaints from local residents. Financial loss between \$1,000 and \$50,000.	2
Serious Incident	Normally associated with very serious incidents resulting in permanent disability e.g. loss of a limb, noise induced hearing loss, lung function impairment. Potential for multiple medical treatment cases, e.g. large chemical spill such as ammonia.	Significant plant / equipment damage. Plant/equipment down time more than 12 hours and less than 1 week. Significant financial loss - greater than \$50,000 and less than \$500,000. Production affected, raw coal bunker reserves at risk.	Moderate environmental with the release of substances confined within the site but not requiring external agencies to be notified. Negative reaction and complaints by residents surrounding the facility. Significant financial loss - greater than \$50,000 and less than \$500,000.	5

Description	Health and Safety	Plant damage / Lost production	Environmental	Score
Disaster	Incident resulting in fatality - e.g. MRD bridge collapse due to overloading. Potential for a number of people to incur serious injuries requiring hospitalisation, e.g. vehicle rollover.	Serious damage to critical plant. Critical plant/equipment down time greater than 12 hours. Serious financial loss - greater than \$500,000. Production seriously affected, power station offline.	High environmental impact with the release of substances requiring external agencies to be notified. Legal / licence breach or non-compliance with a signed agreement. Negative reaction and frequent complaints by local residents and local media coverage. Concerns raised by regulatory / statutory authorities requiring corrective action to satisfy authorities. Serious financial loss - greater than \$500,000.	10
Catastrophe	The worst possible case involving multiple fatalities.	Permanent damage to critical plant. Major financial loss - greater than \$5,000,000. Production stopped, power station offline for significant period of time.	The release of substances off-site with detrimental effect and major financial loss. Major impact on a regional scale requiring extensive clean up and remediation.	20



# Appendix H – Risk Assessment Findings

Risk Identification and Analysis				Current Risk Rating P x (S + E) = Total				Proposed Control Strategy (if Current Risk >99)		Accountability for additional controls, due date.	Residual Risk Rating P x (S + E) = Total				Comments / Review						
No	Domain	Fire hazard cause	Potential consequence / Impact (MRC)	Current preventative critical controls	Current mitigating & suppression critical controls	Current control effectiveness	P	S	E	T	Additional preventative critical controls	Additional mitigating & suppression critical controls	P	S	E	T					
1	1 of 5: Working area of the mine.	Off-site ignition source (e.g. approaching bushfire or airborne ember resulting from train brake sparks, train boiler, vehicle crashes, industry fires, farmers, households, powerline sparks, timber plantation activities, Government burn offs).	External source leads to mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	70. Latrobe City supported by CFA - Annual Inspection of Fire Preparedness Prior to Summer Fire Season (joint inspection initiated by Latrobe City with Estate Services) 112. Mutual aid arrangements with other essential industries (e.g. water authorities and other brown coal mines) 115. Warning signs on perimeter regarding unauthorised access 118. CFA (MOU with Yallourn site) includes Victorian Fire Risk Register to be updated annually; CFA/Yallourn regular monthly meetings during year and fortnightly during summer period 119. Latrobe City Council officers attend the Bush Fire Risk Mitigation, Monthly Meetings held at Estate Services Fire Station Training Room this provides direct linkages to the Municipal Fire Management Plan (MFMP) which is a sub plan to the Municipal Emergency Management Plan (MEMP) 120. Legislative criteria (e.g. dwellings, grass control, vehicles, hazmat, farmland, holding of flammable goods, social events) 121. VLine train brakes include classic rollingstock (configuration changes are subject to Change Management Procedures) 122. VicRoads are responsible for vegetation near roads under their control 123. VicPol including prosecution of arsonists 124. SES 125. AusNet responsible for maintenance of assets (including easements, vegetation control, infrastructure) 126. Timber plantation (HVP) includes aerial support (e.g. fire towers, helicopters), inventories, fire break down, and are a registered fire brigade force 127. Gippsland Arson Prevention Patrol (GAPP) through VicPol including media influence 128. Government burn offs - Dept Enviro, Land, Water & Planning (DELWP) 129. Plantation digging of waste 152. AusNet Bushfire Mitigation Plan provided to YMA mitigation committee 153. VicRoads construction and hot work activities 154. CFA Act (1958) and Regulations (2014) 155. State planning	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 4. Early response and notification via CFA / Estate Services radios 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 17. Fire Service System - Water Supply, Fire Service Network - Pipes, sprays, pumps, header tanks inc all water infrastructure 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 51. SHEMS12-ESV-P001 - Responding to Fire Alarms 54. YMA-OPS-PR-0217 - Control Centre Fire Alert 55. SHEMS12-ESV-P001-I01 - Management of VESDA During Periods of Heavy Smoke Pollution 57. SHEMS14-ESV-P003 - Fire Hoses - Pressure Cleaning 58. YMA-OPS-PR-0101 - Fire Extinguisher Replacement 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yallourn Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 72. SHEMS12-SHE-L01-A07 - Emergency Response Plan - Appendix 07 - Fire in Mine 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 113. Yallourn participating in multi-agency exercises 156. VicPol works with VicRoads (traffic plans are formulated in conjunction with VicRoads and CFA) 157. First response by onsite mine personnel (escalated to Estate Services and subsequently to CFA) 158. Emergency Management Act 159. Emergency Management Manual 160. CFA Act 161. Emergency Management Joint Standard Operating Procedures (incl. Line of Control) 162. State Response Control	Improving	2	20	2	44										0	
2		On-site environmental ignition (e.g. lightning, tornado, earthquake).	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	130. Lightning arrestors protect vulnerable plant to prevent spark	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 4. Early response and notification via CFA / Estate Services radios 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 17. Fire Service System - Water Supply, Fire Service Network - Pipes, sprays, pumps, header tanks inc all water infrastructure 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 51. SHEMS12-ESV-P001 - Responding to Fire Alarms 54. YMA-OPS-PR-0217 - Control Centre Fire Alert 55. SHEMS12-ESV-P001-I01 - Management of VESDA During Periods of Heavy Smoke Pollution 57. SHEMS14-ESV-P003 - Fire Hoses - Pressure Cleaning 58. YMA-OPS-PR-0101 - Fire Extinguisher Replacement 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yallourn Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 68. YMA-OPS-SOP-0374 - Management of LV & HV Overhead Distribution System 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 72. SHEMS12-SHE-L01-A07 - Emergency Response Plan - Appendix 07 - Fire in Mine 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 87. Electrical protection systems for ground movement 88. Pin movement surveys 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 113. Yallourn participating in multi-agency exercises 156. VicPol works with VicRoads (traffic plans are formulated in conjunction with VicRoads and CFA) 157. First response by onsite mine personnel (escalated to Estate Services and subsequently to CFA) 158. Emergency Management Act 159. Emergency Management Manual 160. CFA Act 161. Emergency Management Joint Standard Operating Procedures (incl. Line of Control) 162. State Response Control	Satisfactory	1	20	1	21										0	
3		On-site mining ignition (e.g. plant / friction / hotwork / fuel).	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	15. Automated fire detection & deluge systems, and engine shutdown on high risk plant 43. SHEMS11-SHE-P001 - Applying for CFA Permits & Internal Permits to Carry out Hot Works on Days of Total Fire Ban 44. SHEMS11-ESV-P001-I02 - Opening of Total Fire Boards and Placement of Total Fire Ban Flags 46. Increased Security Patrols on Days of TFB 48. Total Fire Ban Displays 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 52. YMA-OPS-WI-0129 - Carrying Out Works on Days of Total Fire Ban (Yallourn Mine) 53. YMA-OPS-PR-0154 - Fire Precautions 66. SHEMS11-SHE-P502 - Management of Electrical Work on site 67. SHEMS11-SHE-L01 - Electrical Safety Line Clearance Plan 78. Vehicle Checks - Approval to Enter Mine 79. No Smoking within the Mine 80. Dredgers / TS3 - Safety Device Testing 89. Plant and Equipment Checks - Approval to Enter Mine 92. D11 Dozer Manual Deluge System 98. Thermographic overhead monitoring survey 112. Mutual aid arrangements with other essential industries (e.g. water authorities and other brown coal mines) 116. YMA-OPS-PR-343 - Hot Works Procedure 117. Operations and maintenance personnel constant vigilance and experience	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 4. Early response and notification via CFA / Estate Services radios 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 17. Fire Service System - Water Supply, Fire Service Network - Pipes, sprays, pumps, header tanks inc all water infrastructure 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 45. Coach Rd Tower - Manned on Days of TFB 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 51. SHEMS12-ESV-P001 - Responding to Fire Alarms 54. YMA-OPS-PR-0217 - Control Centre Fire Alert 55. SHEMS12-ESV-P001-I01 - Management of VESDA During Periods of Heavy Smoke Pollution 57. SHEMS14-ESV-P003 - Fire Hoses - Pressure Cleaning 58. YMA-OPS-PR-0101 - Fire Extinguisher Replacement 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yallourn Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 72. SHEMS12-SHE-L01-A07 - Emergency Response Plan - Appendix 07 - Fire in Mine 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 94. CCTV cameras located around the mine (linked to operating centre) 113. Yallourn participating in multi-agency exercises 156. VicPol works with VicRoads (traffic plans are formulated in conjunction with VicRoads and CFA) 157. First response by onsite mine personnel (escalated to Estate Services and subsequently to CFA) 158. Emergency Management Act 159. Emergency Management Manual 160. CFA Act 161. Emergency Management Joint Standard Operating Procedures (incl. Line of Control) 162. State Response Control	Satisfactory	1	20	1	21										0	

Risk Identification and Analysis					Current Risk Rating P x (S + E) = Total				Proposed Control Strategy (if Current Risk >99)		Accountability for additional controls, due date.	Residual Risk Rating P x (S + E) = Total				Comments / Review						
No	Domain	Fire hazard cause	Potential consequence / impact (MRC)	Current preventative critical controls	Current mitigating & suppression critical controls	Current control effectiveness	P	S	E	T	Additional preventative critical controls	Additional mitigating & suppression critical controls		P	S	E	T					
4		On-site non-mining ignition (e.g. electricity infrastructure / transmission lines failure or malfunction).	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	46. Increased Security Patrols on Days of TFB 66. SHEMS11-SHE-P502 - Management of Electrical Work on site 67. SHEMS11-SHE-L01 - Electrical Safety Line Clearance Plan 98. Thermographic overhead monitoring survey	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 4. Early response and notification via CFA / Estate Services radios 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 17. Fire Service System - Water Supply, Fire Service Network - Pipes, sprays, pumps, header tanks inc all water infrastructure 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 45. Coach Rd Tower - Manned on Days of TFB 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 51. SHEMS12-ESV-P001 - Responding to Fire Alarms 54. YMA-OPS-PR-0217 - Control Centre Fire Alert 55. SHEMS12-ESV-P001-I01 - Management of VESDA During Periods of Heavy Smoke Pollution 57. SHEMS14-ESV-P003 - Fire Hoses - Pressure Cleaning 58. YMA-OPS-PR-0101 - Fire Extinguisher Replacement 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yalourm Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 72. SHEMS12-SHE-L01-A07 - Emergency Response Plan - Appendix 07 - Fire in Mine 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 94. CCTV cameras located around the mine (linked to operating centre) 95. CFA surveillance activity - Forward Looking Infrared (FLIR) (Thermal hot spot imaging monitoring of the mine area by CFA) 113. Yalourm participating in multi-agency exercises 156. VicPol works with VicRoads (traffic plans are formulated in conjunction with VicRoads and CFA) 157. First response by onsite mine personnel (escalated to Estate Services and subsequently to CFA) 158. Emergency Management Act 159. Emergency Management Manual 160. CFA Act 161. Emergency Management Joint Standard Operating Procedures (incl. Line of Control) 162. State Response Control 164. CFA fly over during fire season	Satisfactory	1	20	1	21										0		
5		Deliberate (e.g. internal and external arson, trespass).	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	15. Automated fire detection & deluge systems, and engine shutdown on high risk plant 43. SHEMS11-SHE-P001 - Applying for CFA Permits & Internal Permits to Carry out Hot Works on Days of Total Fire Ban 44. SHEMS11-ESV-P001-I02 - Opening of Total Fire Boards and Placement of Total Fire Ban Flags 46. Increased Security Patrols on Days of TFB 48. Total Fire Ban Displays 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 52. YMA-OPS-WI-0129 - Carrying Out Works on Days of Total Fire Ban (Yalourm Mine) 53. YMA-OPS-PR-0154 - Fire Precautions 66. SHEMS11-SHE-P502 - Management of Electrical Work on site 67. SHEMS11-SHE-L01 - Electrical Safety Line Clearance Plan 78. Vehicle Checks - Approval to Enter Mine 79. No Smoking within the Mine 80. Dredgers / TSS - Safety Device Testing 89. Plant and Equipment Checks - Approval to Enter Mine 92. D11 Dozer Manual Deluge System 94. CCTV cameras located around the mine (linked to operating centre) 98. Thermographic overhead monitoring survey 112. Mutual aid arrangements with other essential industries (e.g. water authorities and other brown coal mines) 115. Warning signs on perimeter regarding unauthorised access 116. YMA-OPS-PR-343 - Hot Works Procedure 117. Operations and maintenance personnel constant vigilance and experience 123. VicPol including prosecution of arsonists 165. VicPol liaison	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 4. Early response and notification via CFA / Estate Services radios 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 17. Fire Service System - Water Supply, Fire Service Network - Pipes, sprays, pumps, header tanks inc all water infrastructure 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 51. SHEMS12-ESV-P001 - Responding to Fire Alarms 54. YMA-OPS-PR-0217 - Control Centre Fire Alert 55. SHEMS12-ESV-P001-I01 - Management of VESDA During Periods of Heavy Smoke Pollution 57. SHEMS14-ESV-P003 - Fire Hoses - Pressure Cleaning 58. YMA-OPS-PR-0101 - Fire Extinguisher Replacement 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yalourm Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 72. SHEMS12-SHE-L01-A07 - Emergency Response Plan - Appendix 07 - Fire in Mine 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 113. Yalourm participating in multi-agency exercises 156. VicPol works with VicRoads (traffic plans are formulated in conjunction with VicRoads and CFA) 157. First response by onsite mine personnel (escalated to Estate Services and subsequently to CFA) 158. Emergency Management Act 159. Emergency Management Manual 160. CFA Act 161. Emergency Management Joint Standard Operating Procedures (incl. Line of Control) 162. State Response Control	Satisfactory	2	20	1	42												0
6		Other cause (spontaneous combustion, u/g fire, hot spots).  Includes outside parties conducting work under e.g. easements and interface agreements that do not require and EAY risk assessment.	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	95. CFA surveillance activity - Forward Looking Infrared (FLIR) (Thermal hot spot imaging monitoring of the mine area by CFA) 96. CFA to estate services direct radio contact regarding response management 97. Onsite Hot Spot Management 164. CFA fly over during fire season	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 4. Early response and notification via CFA / Estate Services radios 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 17. Fire Service System - Water Supply, Fire Service Network - Pipes, sprays, pumps, header tanks inc all water infrastructure 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 51. SHEMS12-ESV-P001 - Responding to Fire Alarms 54. YMA-OPS-PR-0217 - Control Centre Fire Alert 55. SHEMS12-ESV-P001-I01 - Management of VESDA During Periods of Heavy Smoke Pollution 57. SHEMS14-ESV-P003 - Fire Hoses - Pressure Cleaning 58. YMA-OPS-PR-0101 - Fire Extinguisher Replacement 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yalourm Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 72. SHEMS12-SHE-L01-A07 - Emergency Response Plan - Appendix 07 - Fire in Mine 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 113. Yalourm participating in multi-agency exercises 156. VicPol works with VicRoads (traffic plans are formulated in conjunction with VicRoads and CFA) 157. First response by onsite mine personnel (escalated to Estate Services and subsequently to CFA) 158. Emergency Management Act 159. Emergency Management Manual 160. CFA Act 161. Emergency Management Joint Standard Operating Procedures (incl. Line of Control) 162. State Response Control	Satisfactory	1	20	1	21											0	



Risk Identification and Analysis				Current Risk Rating P x (S + E) = Total				Proposed Control Strategy (if Current Risk >99)		Accountability for additional controls, due date.	Residual Risk Rating P x (S + E) = Total				Comments / Review						
No	Domain	Fire hazard cause	Potential consequence / impact (MRC)	Current preventative critical controls	Current mitigating & suppression critical controls	Current control effectiveness	P	S	E	T	Additional preventative critical controls	Additional mitigating & suppression critical controls		P	S	E	T				
7	2 of 5: Worked out area of mine.	Off-site ignition source (e.g. approaching bushfire or airborne ember resulting from: train brake sparks, train boiler, vehicle crashes, industry fires, farmers, households, electric fences, powerline sparks, timber plantation activities, cigarette butts, Government burn offs).  Worked out areas have less coal, more vegetation, reduced infrastructure for fire fighting, and the batter areas are old dredger batters.  There are more sources of potential ignition e.g. train sparks.	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	70. Latrobe City supported by CFA - Annual Inspection of Fire Preparedness Prior to Summer Fire Season (joint inspection initiated by Latrobe City with Estate Services) 112. Mutual aid arrangements with other essential industries (e.g. water authorities and other brown coal mines) 115. Warning signs on perimeter regarding unauthorised access 118. CFA (MOU with Yalourm site) includes Victorian Fire Risk Register to be updated annually; CFA/Yalourm regular monthly meetings during year and fortnightly during summer period 119. Latrobe City Council officers attend the Bush Fire Risk Mitigation, Monthly Meetings held at Estate Services Fire Station Training Room this provides direct linkages to the Municipal Fire Management Plan (MFMP) which is a sub plan to the Municipal Emergency Management Plan (MEMP) 120. Legislative criteria (e.g. dwellings, grass control, vehicles, hazmat, farmland, holding of flammable goods, social events) 121. V/Line train brakes include classic rollingstock (configuration changes are subject to Change Management Procedures) 122. VicRoads are responsible for vegetation near roads under their control 123. VicPol including prosecution of arsonists 124. SES 125. AusNet responsible for maintenance of assets (including easements, vegetation control, infrastructure) 126. Timber plantation (HVP) includes aerial support (e.g. fire towers, helicopters), inventories, fire break down, and are a registered fire brigade force 127. Gippsland Arson Prevention Patrol (GAPP) through VicPol including media influence 128. Government burn offs - Dept Enviro, Land, Water & Planning (DELWP) 129. Plantation digging of waste	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 17. Fire Service System - Water Supply, Fire Service Network - Pipes, sprays, pumps, header tanks inc all water infrastructure. 18. Tanker Fill Points 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yalourm Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 72. SHEMS12-SHE-L01-A07 - Emergency Response Plan - Appendix 07 - Fire in Mine 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 99. Maintenance of vegetation 100. Progressive rehabilitation 101. Yalourm maps supplied to CFA on water truck filling stations, and CFA are escorted on site 102. Additional droppers and spray lines installed at various locations in proximity to V/Line 103. Progressive capping of coal areas on selected coal floor areas and batters	Improving	2	20	5	50										0	
8		On-site environmental ignition (e.g. lightning, tornado, earthquake).  Some worked out areas are more remote.	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	130. Lightning arrestors protect vulnerable plant to prevent spark	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 17. Fire Service System - Water Supply, Fire Service Network - Pipes, sprays, pumps, header tanks inc all water infrastructure. 18. Tanker Fill Points 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yalourm Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 68. YMA-OPS-SCOP-0274 - Management of LV & HV Overhead Distribution System 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 72. SHEMS12-SHE-L01-A07 - Emergency Response Plan - Appendix 07 - Fire in Mine 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 87. Electrical protection systems for ground movement 88. Pin movement surveys 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 99. Maintenance of vegetation 100. Progressive rehabilitation 101. Yalourm maps supplied to CFA on water truck filling stations, and CFA are escorted on site 102. Additional droppers and spray lines installed at various locations in proximity to V/Line 103. Progressive capping of coal areas on selected coal floor areas and batters	Improving	1	20	1	21									0		
9		On-site mining ignition (e.g. plant / friction / hotwork / fuel).	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	15. Automated fire detection & deluge systems, and engine shutdown on high risk plant 43. SHEMS11-SHE-P001 - Applying for CFA Permits & Internal Permits to Carry out Hot Works on Days of Total Fire Ban 44. SHEMS11-ESV-P001-I02 - Opening of Total Fire Boards and Placement of Total Fire Ban Flags 116. YMA-OPS-PR-343 - Hot Works Procedure 45. Coach Rd Tower - Manned on Days of TFB 46. Increased Security Patrols on Days of TFB 48. Total Fire Ban Displays 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 52. YMA-OPS-WI-0129 - Carrying Out Works on Days of Total Fire Ban (Yalourm Mine) 53. YMA-OPS-PR-0154 - Fire Precautions 66. SHEMS11-SHE-P502 - Management of Electrical Work on site 67. SHEMS11-SHE-L01 - Electrical Safety Line Clearance Plan 78. Vehicle Checks - Approval to Enter Mine 79. No Smoking within the Mine 80. TS3 - Safety Device Testing 89. Plant and Equipment Checks - Approval to Enter Mine 98. Thermographic overhead monitoring survey 117. Operations and maintenance personnel constant vigilance and experience	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 17. Fire Service System - Water Supply, Fire Service Network - Pipes, sprays, pumps, header tanks inc all water infrastructure. 18. Tanker Fill Points 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yalourm Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 72. SHEMS12-SHE-L01-A07 - Emergency Response Plan - Appendix 07 - Fire in Mine 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 99. Maintenance of vegetation 100. Progressive rehabilitation 101. Yalourm maps supplied to CFA on water truck filling stations, and CFA are escorted on site 102. Additional droppers and spray lines installed at various locations in proximity to V/Line 103. Progressive capping of coal areas on selected coal floor areas and batters	Satisfactory	1	20	1	21									0		

Risk Identification and Analysis				Current Risk Rating P x (S + E) = Total				Proposed Control Strategy (if Current Risk >99)		Accountability for additional controls, due date.	Residual Risk Rating P x (S + E) = Total				Comments / Review								
No	Domain	Fire hazard cause	Potential consequence / impact (MRC)	Current preventative critical controls	Current mitigating & suppression critical controls	Current control effectiveness	P	S	E	T	Additional preventative critical controls	Additional mitigating & suppression critical controls		P	S	E	T						
10		On-site non-mining ignition (e.g. electricity infrastructure / transmission lines failure or malfunction).	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	15. Automated fire detection & deluge systems, and engine shutdown on high risk plant 43. SHEMS11-SHE-P001 - Applying for CFA Permits & Internal Permits to Carry out Hot Works on Days of Total Fire Ban 44. SHEMS11-ESV-P001-I02 - Opening of Total Fire Boards and Placement of Total Fire Ban Flags 116. YMA-OPS-PR-343 - Hot Works Procedure 45. Coach Rd Tower - Manned on Days of TFB 46. Increased Security Patrols on Days of TFB 48. Total Fire Ban Displays 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 52. YMA-OPS-WI-0129 - Carrying Out Works on Days of Total Fire Ban (Yallourn Mine) 53. YMA-OPS-PR-0154 - Fire Precautions 66. SHEMS11-SHE-P502 - Management of Electrical Work on site 67. SHEMS11-SHE-L01 - Electrical Safety Line Clearance Plan 78. Vehicle Checks - Approval to Enter Mine 79. No Smoking within the Mine 80. TS3 - Safety Device Testing 89. Plant and Equipment Checks - Approval to Enter Mine 98. Thermographic overhead monitoring survey 117. Operations and maintenance personnel constant vigilance and experience	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 17. Fire Service System - Water Supply, Fire Service Network - Pipes, sprays, pumps, header tanks inc all water infrastructure. 18. Tanker Fill Points 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yallourn Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 72. SHEMS12-SHE-L01-A07 - Emergency Response Plan - Appendix 07 - Fire in Mine 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 99. Maintenance of vegetation 100. Progressive rehabilitation 101. Yallourn maps supplied to CFA on water truck filling stations, and CFA are escorted on site 102. Additional droppers and spray lines installed at various locations in proximity to V/Line 103. Progressive capping of coal areas on selected coal floor areas and batters	Satisfactory	1	20	1	21											0		
11		Deliberate (e.g. arson, trespass).	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	15. Automated fire detection & deluge systems, and engine shutdown on high risk plant 43. SHEMS11-SHE-P001 - Applying for CFA Permits & Internal Permits to Carry out Hot Works on Days of Total Fire Ban 44. SHEMS11-ESV-P001-I02 - Opening of Total Fire Boards and Placement of Total Fire Ban Flags 46. Increased Security Patrols on Days of TFB 48. Total Fire Ban Displays 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 52. YMA-OPS-WI-0129 - Carrying Out Works on Days of Total Fire Ban (Yallourn Mine) 53. YMA-OPS-PR-0154 - Fire Precautions 66. SHEMS11-SHE-P502 - Management of Electrical Work on site 67. SHEMS11-SHE-L01 - Electrical Safety Line Clearance Plan 78. Vehicle Checks - Approval to Enter Mine 79. No Smoking within the Mine 80. Dredgers/ TS3 - Safety Device Testing 89. Plant and Equipment Checks - Approval to Enter Mine 92. D11 Dozer Manual Deluge System 94. CCTV cameras located around the mine (linked to operating centre) 98. Thermographic overhead monitoring survey 112. Mutual aid arrangements with other essential industries (e.g. water authorities and other brown coal mines) 116. YMA-OPS-PR-343 - Hot Works Procedure 117. Operations and maintenance personnel constant vigilance and experience	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 4. Early response and notification via CFA / Estate Services radios 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 17. Fire Service System - Water Supply, Fire Service Network - Pipes, sprays, pumps, header tanks inc all water infrastructure 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 45. Coach Rd Tower - Manned on Days of TFB 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 51. SHEMS12-ESV-P001 - Responding to Fire Alarms 54. YMA-OPS-PR-0217 - Control Centre Fire Alert 55. SHEMS12-ESV-P001-I01 - Management of VESDA During Periods of Heavy Smoke Pollution 57. SHEMS14-ESV-P003 - Fire Hoses - Pressure Cleaning 58. YMA-OPS-PR-0101 - Fire Extinguisher Replacement 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yallourn Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 72. SHEMS12-SHE-L01-A07 - Emergency Response Plan - Appendix 07 - Fire in Mine 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 94. CCTV cameras located around the mine (linked to operating centre) 113. Yallourn participating in multi-agency exercises 156. VicPol works with VicRoads (traffic plans are formulated in conjunction with VicRoads and CFA) 157. First response by onsite mine personnel (escalated to Estate Services and subsequently to CFA) 158. Emergency Management Act 159. Emergency Management Manual 160. CFA Act 161. Emergency Management Joint Standard Operating Procedures (incl. Line of Control) 162. State Response Control	Satisfactory	1	20	1	21												0	
11a		Deliberate (e.g. internal and external arson, trespass).  Yallourn North open cut ash pond area (trespass, arson, proximity to Yallourn North township).	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	76. Perimeter Security Fence 115. Warning signs on perimeter regarding unauthorised access 112. Mutual aid arrangements with other essential industries (e.g. water authorities and other brown coal mines) 131. Patrols conducted by estate services and power station operations 132. Remote surveillance (10 site specific cameras plus portable cameras) 133. Motion alarms to estate services control room 134. Ash dump area has very low combustibility 135. New water pipes at twin ash ponds	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 4. Early response and notification via CFA / Estate Services radios 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 17. Fire Service System - Water Supply, Fire Service Network - Pipes, sprays, pumps, header tanks inc all water infrastructure 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 45. Coach Rd Tower - Manned on Days of TFB 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 51. SHEMS12-ESV-P001 - Responding to Fire Alarms 54. YMA-OPS-PR-0217 - Control Centre Fire Alert 55. SHEMS12-ESV-P001-I01 - Management of VESDA During Periods of Heavy Smoke Pollution 57. SHEMS14-ESV-P003 - Fire Hoses - Pressure Cleaning 58. YMA-OPS-PR-0101 - Fire Extinguisher Replacement 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yallourn Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 72. SHEMS12-SHE-L01-A07 - Emergency Response Plan - Appendix 07 - Fire in Mine 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 94. CCTV cameras located around the mine (linked to operating centre) 113. Yallourn participating in multi-agency exercises 156. VicPol works with VicRoads (traffic plans are formulated in conjunction with VicRoads and CFA) 157. First response by onsite mine personnel (escalated to Estate Services and subsequently to CFA) 158. Emergency Management Act 159. Emergency Management Manual 160. CFA Act 161. Emergency Management Joint Standard Operating Procedures (incl. Line of Control) 162. State Response Control	Satisfactory	2	20	1	42													

Risk Identification and Analysis					Current Risk Rating P x (S + E) = Total				Proposed Control Strategy (if Current Risk >99)		Accountability for additional controls, due date.	Residual Risk Rating P x (S + E) = Total				Comments / Review				
No	Domain	Fire hazard cause	Potential consequence / impact (MRC)	Current preventative critical controls	Current mitigating & suppression critical controls	Current control effectiveness	P	S	E	T	Additional preventative critical controls	Additional mitigating & suppression critical controls	P	S	E	T				
12		Other cause (spontaneous combustion, u/g fire, hot spots).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	95. CFA surveillance activity - Forward Looking Infrared (FLIR) (Thermal hot spot imaging monitoring of the mine area by CFA) 96. CFA to estate services direct radio contact regarding response management 97. Onsite Hot Spot Management 164. CFA fly over during fire season	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 4. Early response and notification via CFA / Estate Services radios 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 17. Fire Service System - Water Supply, Fire Service Network - Pipes, sprays, pumps, header tanks inc all water infrastructure 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 51. SHEMS12-ESV-P001 - Responding to Fire Alarms 54. YMA-OPS-PR-0217 - Control Centre Fire Alert 55. SHEMS12-ESV-P001-I01 - Management of VESDA During Periods of Heavy Smoke Pollution 57. SHEMS14-ESV-P003 - Fire Hoses - Pressure Cleaning 58. YMA-OPS-PR-0101 - Fire Extinguisher Replacement 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yallourn Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 72. SHEMS12-SHE-L01-A07 - Emergency Response Plan - Appendix 07 - Fire in Mine 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 113. Yallourn participating in multi-agency exercises 156. VicPol works with VicRoads (traffic plans are formulated in conjunction with VicRoads and CFA) 157. First response by onsite mine personnel (escalated to Estate Services and subsequently to CFA) 158. Emergency Management Act 159. Emergency Management Manual 160. CFA Act 161. Emergency Management Joint Standard Operating Procedures (incl. Line of Control) 162. State Response Control	Satisfactory	1	20	1	21										0
13	3 of 5. Mine access and monitoring.	Off-site ignition source (e.g. approaching bushfire or airborne ember resulting from train brake sparks, train boiler, vehicle crashes, industry fires, farmers, households, powerline sparks, timber plantation activities, Government burn offs).	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	70. Latrobe City supported by CFA - Annual Inspection of Fire Preparedness Prior to Summer Fire Season (joint inspection initiated by Latrobe City with Estate Services) 111. VicRoads Integrated Fire Management Planning Working Group Outcome (shared by VicRoads, Latrobe and CFA) 112. Mutual aid arrangements with other essential industries (e.g. water authorities and other brown coal mines) 136. Lease agreements with recreational clubs 137. Alliance agreement in terms of protective services and facilities management 138. AusNet certified safety electrical management system 139. Patrol around site perimeter including security aspects (increased to match threat) 140. Wits Gully fire service patrol including security (3-4 times a week)	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 51. SHEMS12-ESV-P001 - Responding to Fire Alarms 54. YMA-OPS-PR-0217 - Control Centre Fire Alert 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yallourn Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 110. Remote cameras can be positioned according to the threat 113. Yallourn participating in multi-agency exercises 141. Wits Gully water body	Improving	2	20	1	42									0	
14		On-site environmental ignition (e.g. lightning).	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	As for Environmental ignition at any point on site, high points.  Fire spotting tower, although a lighting attractor, is not a fire risk.	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 51. SHEMS12-ESV-P001 - Responding to Fire Alarms 54. YMA-OPS-PR-0217 - Control Centre Fire Alert 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yallourn Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 110. Remote cameras can be positioned according to the threat 113. Yallourn participating in multi-agency exercises 141. Wits Gully water body	Improving	2	20	1	42								0		
15		On-site mining ignition (e.g. plant / friction / hotwork / fuel).	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	43. SHEMS11-SHE-P001 - Applying for CFA Permits & Internal Permits to Carry out Hot Works on Days of Total Fire Ban 44. SHEMS11-ESV-P001-I02 - Opening of Total Fire Boards and Placement of Total Fire Ban Flags 45. Coach Rd Tower - Manned on Days of TFB 46. Increased Security Patrols on Days of TFB 48. Total Fire Ban Displays 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 52. YMA-OPS-WI-0129 - Carrying Out Works on Days of Total Fire Ban (Yallourn Mine) 53. YMA-OPS-PR-0154 - Fire Precautions 70. Latrobe City supported by CFA - Annual Inspection of Fire Preparedness Prior to Summer Fire Season (joint inspection initiated by Latrobe City with Estate Services) 106. Lease agreement with agricultural leasee (including accommodation) 107. Lease agreement with gun club 108. AusNet Certified Electrical Safety Management Scheme 116. YMA-OPS-PR-343 - Hot Works Procedure 167. External contractors safety management procedures including inspections	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 18. Tanker Fill Points 26. Fire Breaks 42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days (Add this globally) 50. SHEMS12-ESV-P011 - CFA Notification of Fire 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yallourn Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 104. Agricultural leasee control 105. Public roads access control within EAY power; road can be closed on extreme fire danger conditions 109. Call 000	Improving	1	20	1	21									0	

Risk Identification and Analysis						Current Risk Rating P x (S + E) = Total				Proposed Control Strategy (if Current Risk >99)		Accountability for additional controls, due date.	Residual Risk Rating P x (S + E) = Total				Comments / Review		
No	Domain	Fire hazard cause	Potential consequence / impact (MRC)	Current preventative critical controls	Current mitigating & suppression critical controls	Current control effectiveness	P	S	E	T	Additional preventative critical controls		Additional mitigating & suppression critical controls	P	S	E		T	
16		On-site non-mining ignition (e.g. electricity infrastructure / transmission lines failure or malfunction).	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 68. YMA-OPS-SOP-0374 - Management of LV & HV Overhead Distribution System 108. AusNet certified safety electrical management system 114. EAY full induction process including access control (e.g. AusNet and Gippsland Water)	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 51. SHEMS12-ESV-P001 - Responding to Fire Alarms 54. YMA-OPS-PR-0217 - Control Centre Fire Alert 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yalloom Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 110. Remote cameras can be positioned according to the threat 113. Yalloom participating in multi-agency exercises 141. Wits Gully water body	Improving	1	20	1	21							0		
17		Deliberate (e.g. arson, trespass).	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	114. EAY full induction process including access control (e.g. AusNet and Gippsland Water) 115. Warning signs on perimeter regarding unauthorised access	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 51. SHEMS12-ESV-P001 - Responding to Fire Alarms 54. YMA-OPS-PR-0217 - Control Centre Fire Alert 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yalloom Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 110. Remote cameras can be positioned according to the threat 113. Yalloom participating in multi-agency exercises 141. Wits Gully water body	Improving	2	20	1	42							0		
18		Other cause (spontaneous combustion, u/g fire, hot spots).	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	178. Municipal fire management committee (VicRoads and Gippsland Water attend meetings) (More applicable to the municipal level)	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 4. Early response and notification via CFA / Estate Services radios 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 17. Fire Service System - Water Supply, Fire Service Network - Pipes, sprays, pumps, header tanks inc all water infrastructure 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 51. SHEMS12-ESV-P001 - Responding to Fire Alarms 54. YMA-OPS-PR-0217 - Control Centre Fire Alert 55. SHEMS12-ESV-P001-I01 - Management of VESDA During Periods of Heavy Smoke Pollution 57. SHEMS14-ESV-P003 - Fire Hoses - Pressure Cleaning 58. YMA-OPS-PR-0101 - Fire Extinguisher Replacement 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yalloom Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 72. SHEMS12-SHE-L01-A07 - Emergency Response Plan - Appendix 07 - Fire in Mine 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 113. Yalloom participating in multi-agency exercises 156. VicPol works with VicRoads (traffic plans are formulated in conjunction with VicRoads and CFA) 157. First response by onsite mine personnel (escalated to Estate Services and subsequently to CFA) 158. Emergency Management Act 159. Emergency Management Manual 160. CFA Act 161. Emergency Management Joint Standard Operating Procedures (incl. Line of Control) 162. State Response Control	Improving	1	20	1	21								0	

Risk Identification and Analysis				Current Risk Rating P x (S + E) = Total				Proposed Control Strategy (if Current Risk >99)		Accountability for additional controls, due date.	Residual Risk Rating P x (S + E) = Total				Comments / Review							
No	Domain	Fire hazard cause	Potential consequence / impact (MRC)	Current preventative critical controls	Current mitigating & suppression critical controls	Current control effectiveness	P	S	E	T	Additional preventative critical controls	Additional mitigating & suppression critical controls		P	S	E	T					
19	4 of 5: Not yet mined.  This area has vegetation, grassland, few access areas, no fire infrastructure, and no exposed coal. Includes Old Melbourne Rd power line. Includes agricultural leasee.	Off-site ignition source (e.g. approaching bushfire or airborne ember resulting from vehicle crashes, industry fires, lease arrangement to farmer company, households, powerline sparks, timber plantation activities, Government burn offs).	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	70. Latrobe City supported by CFA - Annual Inspection of Fire Preparedness Prior to Summer Fire Season (joint inspection initiated by Latrobe City with Estate Services) 76. Perimeter Security Fence 115. Warning signs on perimeter regarding unauthorised access [Add globally] 118. CFA (MOU with Yaloum site) includes Victorian Fire Risk Register to be updated annually; CFA/Yaloum regular monthly meetings during year and fortnightly during summer period 119. Latrobe City Council officers attend the Bush Fire Risk Mitigation, Monthly Meetings held at Estate Services Fire Station Training Room this provides direct linkages to the Municipal Fire Management Plan (MFMP) which is a sub plan to the Municipal Emergency Management Plan (MEMP) 120. Legislative criteria (e.g. dwellings, grass control, vehicles, hazmat, farmland, holding of flammable goods, social events) 122. VicRoads are responsible for vegetation near roads under their control 123. VicPol including prosecution of arsonists 124. SES 125. AusNet responsible for maintenance of assets (including easements, vegetation control, infrastructure) 126. Timber plantation (HVP) includes aerial support (e.g. fire towers, helicopters), inventories, fire break down, and are a registered fire brigade force 127. Gippsland Arson Prevention Patrol (GAPP) through VicPol including media influence 128. Government burn offs - Dept Enviro, Land, Water & Planning (DELWP) 129. Plantation digging of waste	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 18. Tanker Fill Points 26. Fire Breaks 42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 47. Fire Alert in Mine 50. SHEMS12-ESV-P011 - CFA Notification of Fire 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yaloum Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 72. SHEMS12-SHE-L01-A07 - Emergency Response Plan - Appendix 07 - Fire in Mine 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 101. Yaloum maps supplied to CFA on water truck filling stations, and CFA are escorted on site 104. Agricultural leasee control 105. Public roads access control within EAY power; road can be closed on extreme fire danger conditions 166. Access to additional resources during fire season	Satisfactory	1	20	1	21											0	
20		On-site environmental ignition (e.g. lightning, tornado, earthquake).	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	70. Latrobe City supported by CFA - Annual Inspection of Fire Preparedness Prior to Summer Fire Season (joint inspection initiated by Latrobe City with Estate Services)	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 26. Fire Breaks 42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 47. Fire Alert in Mine 50. SHEMS12-ESV-P011 - CFA Notification of Fire 51. SHEMS12-ESV-P001 - Responding to Fire Alarms 54. YMA-OPS-PR-0217 - Control Centre Fire Alert 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yaloum Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams	Satisfactory	1	20	1	21	1. Check with recreational clubs regarding shooting on fire ban days. Consider annual inspections.									0		
21		On-site mining ignition (e.g. plant / friction / hotwork / fuel).  Restricted to leasee's agricultural equipment.  Occasional drilling occurs.  Includes nearby gun clubs.	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	43. SHEMS11-SHE-P001 - Applying for CFA Permits & Internal Permits to Carry out Hot Works on Days of Total Fire Ban 44. SHEMS11-ESV-P001-I02 - Opening of Total Fire Boards and Placement of Total Fire Ban Flags 45. Coach Rd Tower - Manned on Days of TFB 46. Increased Security Patrols on Days of TFB 48. Total Fire Ban Displays 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 52. YMA-OPS-WI-0129 - Carrying Out Works on Days of Total Fire Ban (Yaloum Mine) 53. YMA-OPS-PR-0154 - Fire Precautions 70. Latrobe City supported by CFA - Annual Inspection of Fire Preparedness Prior to Summer Fire Season (joint inspection initiated by Latrobe City with Estate Services) 106. Lease agreement with agricultural leasee (including accommodation) 107. Lease agreement with gun club 108. AusNet Certified Electrical Safety Management Scheme 116. YMA-OPS-PR-343 - Hot Works Procedure 167. External contractors safety management procedures including inspections 168. Job safety observation of contractor's works 169. Leasee included in Bushfire mitigation committee	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 18. Tanker Fill Points 26. Fire Breaks 42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yaloum Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 104. Agricultural leasee control 105. Public roads access control within EAY power; road can be closed on extreme fire danger conditions 109. Call 000	Satisfactory	1	20	1	21												
22		On-site non-mining ignition (e.g. electricity infrastructure / transmission lines failure or malfunction).	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	N/A	N/A	N/A				0												
23		Deliberate (e.g. internal and external arson, trespass).  Access to a violator is easier because of lack of cyclone fencing.  Given its location, this area is a low risk target.	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	75. Terrorism Plan 76. Perimeter Security Fence 77. SHEMS12-ESV-P004 - Emergency Response Control Room 110. Remote cameras can be positioned according to the threat 115. Warning signs on perimeter regarding unauthorised access 127. Gippsland Arson Prevention Patrol (GAPP) through VicPol including media influence 170. Higher numbers to provide surveillance during bushfire season	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 18. Tanker Fill Points 26. Fire Breaks 42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yaloum Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 104. Agricultural leasee control 105. Public roads access control within EAY power; road can be closed on extreme fire danger conditions 109. Call 000 170. Higher numbers to provide surveillance during bushfire season	Satisfactory	1	20	1	21												





Risk Identification and Analysis						Current Risk Rating P x (S + E) = Total				Proposed Control Strategy (if Current Risk >99)		Accountability for additional controls, due date.	Residual Risk Rating P x (S + E) = Total				Comments / Review	
No	Domain	Fire hazard cause	Potential consequence / impact (MRC)	Current preventative critical controls	Current mitigating & suppression critical controls	Current control effectiveness	P	S	E	T	Additional preventative critical controls	Additional mitigating & suppression critical controls		P	S	E	T	
24		Other cause (spontaneous combustion, u/g fire, hot spots).  This is not a credible risk scenario.	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	N/A	N/A	N/A				0								
25	5 of 5: Perimeter.  Includes Wits Gully line, AusNet 66 kV and 220 kV powerlines, residential feeders, multiple roads through perimeter, recreational clubs leasing EAY land, powerstation, AusNet switch yard, town water basins, Coach Road tower communication.	Off-site ignition source (e.g. approaching bushfire or airborne ember resulting from train brake sparks, train boiler, vehicle crashes / breakdowns / mechanical failure, industry fires, farmers, households, electric fences, powerline sparks, timber plantation activities, Government burn offs).	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	70. Latrobe City supported by CFA - Annual Inspection of Fire Preparedness Prior to Summer Fire Season (joint inspection initiated by Latrobe City with Estate Services) 111. VicRoads Integrated Fire Management Planning Working Group Outcome (shared by VicRoads, Latrobe and CFA) 112. Mutual aid arrangements with other essential industries (e.g. water authorities and other brown coal mines) 136. Lease agreements with recreational clubs 137. Alliance agreement in terms of protective services and facilities management 138. AusNet certified safety electrical management system 139. Patrol around site perimeter including security aspects (increased to match threat) 140. Wits Gully fire service patrol including security (3-4 times a week)	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 51. SHEMS12-ESV-P001 - Responding to Fire Alarms 54. YMA-OPS-PR-0217 - Control Centre Fire Alert 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yalourm Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 110. Remote cameras can be positioned according to the threat 113. Yalourm participating in multi-agency exercises 141. Wits Gully water body	Improving	2	20	1	42		1. Confirm Bluegum plantation on EA land, and discuss with mitigation committee.						
26		On-site environmental ignition (e.g. lightning, tornado, earthquake).	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	As for Environmental ignition at any point on site, high points.  Fire spotting tower, although a lighting attractor, is not a fire risk.	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 51. SHEMS12-ESV-P001 - Responding to Fire Alarms 54. YMA-OPS-PR-0217 - Control Centre Fire Alert 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yalourm Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 110. Remote cameras can be positioned according to the threat 113. Yalourm participating in multi-agency exercises 141. Wits Gully water body	Improving	2	20	1	42								
27		On-site mining ignition (e.g. plant / friction / hotwork / fuel).  Restricted to leasee's agricultural and recreational equipment.  Occasional drilling occurs.  EAY works in this area.  Includes nearby gun clubs.	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	43. SHEMS11-SHE-P001 - Applying for CFA Permits & Internal Permits to Carry out Hot Works on Days of Total Fire Ban 44. SHEMS11-ESV-P001-I02 - Opening of Total Fire Boards and Placement of Total Fire Ban Flags 45. Coach Rd Tower - Manned on Days of TFB 46. Increased Security Patrols on Days of TFB 48. Total Fire Ban Displays 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 52. YMA-OPS-WI-0129 - Carrying Out Works on Days of Total Fire Ban (Yalourm Mine) 53. YMA-OPS-PR-0154 - Fire Precautions 70. Latrobe City supported by CFA - Annual Inspection of Fire Preparedness Prior to Summer Fire Season (joint inspection initiated by Latrobe City with Estate Services) 106. Lease agreement with agricultural leasee (including accommodation) 107. Lease agreement with gun club 108. AusNet Certified Electrical Safety Management Scheme 116. YMA-OPS-PR-343 - Hot Works Procedure 167. External contractors safety management procedures including inspections	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 18. Tanker Fill Points 26. Fire Breaks 42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days (Add this globally) 50. SHEMS12-ESV-P011 - CFA Notification of Fire 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yalourm Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 104. Agricultural leasee control 105. Public roads access control within EAY power; road can be closed on extreme fire danger conditions 109. Call 000	Improving	1	20	1	21								
27a		Power station.  Includes coal, heat, oil, combustibles, electricity, etc.  Includes dust extraction, conveyors, mechanical parts, coal drying, etc.	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yalourm Site 142. Operating procedures 143. Power station design e.g. furnace negative pressure 144. Standardisation of coupling points 145. EAY Safety Health and Environment Management systems (SHEMS) 146. Location of power station to mine operations (outside mine area) 147. Fire detection and suppression systems for all key areas 148. Safe shutdown procedures 149. Perimeter clearances (e.g. concrete apron) 150. Power station manuals specifying standards 171. Defined areas of power station with active supervision 172. VESDA fire detection system 173. Power station inspection and maintenance programs 174. Additional supervision on TFB days 175. Routine cleaning of power station to prevent built up of product 176. Contractor SHE management 177. Power station hot works procedure including permit 178. Risk management procedures including JSEAs	71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 151. Suppression systems	Satisfactory	2	20	2	44								

Risk Identification and Analysis						Current Risk Rating P x (S + E) = Total				Proposed Control Strategy (if Current Risk >99)		Accountability for additional controls, due date.	Residual Risk Rating P x (S + E) = Total				Comments / Review			
No	Domain	Fire hazard cause	Potential consequence / impact (MRC)	Current preventative critical controls	Current mitigating & suppression critical controls	Current control effectiveness	P	S	E	T	Additional preventative critical controls	Additional mitigating & suppression critical controls		P	S	E	T			
28		On-site non-mining ignition (e.g. electricity infrastructure / transmission lines failure or malfunction).  Includes AusNet 66 kV and 220 kV powerlines. Residential feeders.	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 68. YMA-OPS-SOP-0374 - Management of LV & HV Overhead Distribution System 108. AusNet certified safety electrical management system 114. EAY full induction process including access control (e.g. AusNet and Gippsland Water)	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 51. SHEMS12-ESV-P001 - Responding to Fire Alarms 54. YMA-OPS-PR-0217 - Control Centre Fire Alert 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yaloum Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 110. Remote cameras can be positioned according to the threat 113. Yaloum participating in multi-agency exercises 141. Wits Gully water body	Improving	1	20	1	21										
29		Deliberate (e.g. internal and external arson, trespass).	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	114. EAY full induction process including access control (e.g. AusNet and Gippsland Water) 115. Warning signs on perimeter regarding unauthorised access	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 51. SHEMS12-ESV-P001 - Responding to Fire Alarms 54. YMA-OPS-PR-0217 - Control Centre Fire Alert 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yaloum Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 110. Remote cameras can be positioned according to the threat 113. Yaloum participating in multi-agency exercises 141. Wits Gully water body	Improving	2	20	1	42										
30		Other cause (spontaneous combustion, u/g fire, hot spots).  Includes outside parties (e.g. VicRoads, water authority, Telstra) conducting work under e.g. easements and interface agreements that do not require and EAY risk assessment.	Mine fire extends to community > public safety impacted through direct harm (fire, heat, suffocation, entrapment).  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	178. Municipal fire management committee (VicRoads and Gippsland Water attend meetings) (More applicable to the municipal level)	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 4. Early response and notification via CFA / Estate Services radios 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 17. Fire Service System - Water Supply, Fire Service Network - Pipes, sprays, pumps, header tanks inc all water infrastructure 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-I01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 51. SHEMS12-ESV-P001 - Responding to Fire Alarms 54. YMA-OPS-PR-0217 - Control Centre Fire Alert 55. SHEMS12-ESV-P001-I01 - Management of VESDA During Periods of Heavy Smoke Pollution 57. SHEMS14-ESV-P003 - Fire Hoses - Pressure Cleaning 58. YMA-OPS-PR-0101 - Fire Extinguisher Replacement 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yaloum Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 72. SHEMS12-SHE-L01-A07 - Emergency Response Plan - Appendix 07 - Fire in Mine 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 113. Yaloum participating in multi-agency exercises 156. VicPol works with VicRoads (traffic plans are formulated in conjunction with VicRoads and CFA) 157. First response by onsite mine personnel (escalated to Estate Services and subsequently to CFA) 159. Emergency Management Act 159. Emergency Management Manual 160. CFA Act 161. Emergency Management Joint Standard Operating Procedures (incl. Line of Control) 162. State Response Control	Improving	1	20	1	21										

Risk Identification and Analysis					Current Risk Rating P x (S + E) = Total				Proposed Control Strategy (if Current Risk >99)		Accountability for additional controls, due date.	Residual Risk Rating P x (S + E) = Total				Comments / Review			
No	Domain	Fire hazard cause	Potential consequence / impact (MRC)	Current preventative critical controls	Current mitigating & suppression critical controls	Current control effectiveness	P	S	E	T	Additional preventative critical controls	Additional mitigating & suppression critical controls	P	S	E	T			
31	Environmental release	Products of combustion airborne to public	Smoke becomes part of the respiratory atmosphere and includes particulate matter: lung and cardiac disease  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	70. Latrobe City supported by CFA - Annual Inspection of Fire Preparedness Prior to Summer Fire Season (joint inspection initiated by Latrobe City with Estate Services) 112. Mutual aid arrangements with other essential industries (e.g. water authorities and other brown coal mines) 115. Warning signs on perimeter regarding unauthorised access 118. CFA (MOU with Yalourm site) includes Victorian Fire Risk Register to be updated annually; CFA/Yalourm regular monthly meetings during year and fortnightly during summer period 119. Latrobe City Council officers attend the Bush Fire Risk Mitigation, Monthly Meetings held at Estate Services Fire Station Training Room this provides direct linkages to the Municipal Fire Management Plan (MFMP) which is a sub plan to the Municipal Emergency Management Plan (MEMP) 120. Legislative criteria (e.g. dwellings, grass control, vehicles, hazmat, farmland, holding of flammable goods, social events) 121. V/Line train brakes include classic rollingstock (configuration changes are subject to Change Management Procedures) 122. VicRoads are responsible for vegetation near roads under their control 123. VicPol including prosecution of arsonists 124. SES 125. AusNet responsible for maintenance of assets (including easements, vegetation control, infrastructure) 126. Timber plantation (HVP) includes aerial support (e.g. fire towers, helicopters), inventories, fire break down, and are a registered fire brigade force 127. Gippsland Arson Prevention Patrol (GAPP) through VicPol including media influence 128. Government burn offs - Dept Enviro, Land, Water & Planning (DELWP) 129. Plantation digging of waste 152. AusNet Bushfire Mitigation Plan provided to YMA mitigation committee 153. VicRoads construction and hot work activities 154. CFA Act (1958) and Regulations (2014) 155. State planning	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 4. Early response and notification via CFA / Estate Services radios 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 17. Fire Service System - Water Supply, Fire Service Network - Pipes, sprays, pumps, header tanks inc all water infrastructure 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 51. SHEMS12-ESV-P001 - Responding to Fire Alarms 54. YMA-OPS-PR-0217 - Control Centre Fire Alert 55. SHEMS12-ESV-P001-01 - Management of VESDA During Periods of Heavy Smoke Pollution 57. SHEMS14-ESV-P003 - Fire Hoses - Pressure Cleaning 58. YMA-OPS-PR-0101 - Fire Extinguisher Replacement 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yalourm Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 72. SHEMS12-SHE-L01-A07 - Emergency Response Plan - Appendix 07 - Fire in Mine 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 113. Yalourm participating in multi-agency exercises 156. VicPol works with VicRoads (traffic plans are formulated in conjunction with VicRoads and CFA) 157. First response by onsite mine personnel (escalated to Estate Services and subsequently to CFA) 158. Emergency Management Act 159. Emergency Management Manual 160. CFA Act 161. Emergency Management Joint Standard Operating Procedures (incl. Line of Control) 162. State Response Control 163. Draft joint SOP for impacts of smoke on community under Emergency Management Victoria 180. Work undertaken at state level (CO and PM 2.5) 181. EPA study (12 months) post Hazelwood (no long term impact on environment) 182. Latrobe City Council - hazardous materials release from a facility (CO)	Ineffective	1	20	1	21									
32		Products of combustion land on domestic and retail etc. objects e.g. clothes.	Ash is deposited on households, gardens, clothes etc. and is an ingestion hazard  Chronic long-term health effects (physiological & psychological trauma) also recognised but not assessed due to lack of information due from longitudinal epidemiology study from Monash Health.	70. Latrobe City supported by CFA - Annual Inspection of Fire Preparedness Prior to Summer Fire Season (joint inspection initiated by Latrobe City with Estate Services) 112. Mutual aid arrangements with other essential industries (e.g. water authorities and other brown coal mines) 115. Warning signs on perimeter regarding unauthorised access 118. CFA (MOU with Yalourm site) includes Victorian Fire Risk Register to be updated annually; CFA/Yalourm regular monthly meetings during year and fortnightly during summer period 119. Latrobe City Council officers attend the Bush Fire Risk Mitigation, Monthly Meetings held at Estate Services Fire Station Training Room this provides direct linkages to the Municipal Fire Management Plan (MFMP) which is a sub plan to the Municipal Emergency Management Plan (MEMP) 120. Legislative criteria (e.g. dwellings, grass control, vehicles, hazmat, farmland, holding of flammable goods, social events) 121. V/Line train brakes include classic rollingstock (configuration changes are subject to Change Management Procedures) 122. VicRoads are responsible for vegetation near roads under their control 123. VicPol including prosecution of arsonists 124. SES 125. AusNet responsible for maintenance of assets (including easements, vegetation control, infrastructure) 126. Timber plantation (HVP) includes aerial support (e.g. fire towers, helicopters), inventories, fire break down, and are a registered fire brigade force 127. Gippsland Arson Prevention Patrol (GAPP) through VicPol including media influence 128. Government burn offs - Dept Enviro, Land, Water & Planning (DELWP) 129. Plantation digging of waste 152. AusNet Bushfire Mitigation Plan provided to YMA mitigation committee 153. VicRoads construction and hot work activities 154. CFA Act (1958) and Regulations (2014) 155. State planning	2. YMA-OPS-PR-0239 - Management Instruction Fire Services 3. YMA-OPS-PR-0100 - Fire Procedure 4. Early response and notification via CFA / Estate Services radios 5. YMA-OPS-PR-0401 - Training, Competence & Authorisation 17. Fire Service System - Water Supply, Fire Service Network - Pipes, sprays, pumps, header tanks inc all water infrastructure 26. Fire Breaks 40. Land Rehab - Rehab Master Plan 42. AusNet On-Site Assets (Lease Agreement for Assets through Mine) 47. Fire Alert in Mine 49. SHEMS11-ESV-P001-01 - Preparedness for Extreme Fire Danger and Total Fire Ban Days 50. SHEMS12-ESV-P011 - CFA Notification of Fire 51. SHEMS12-ESV-P001 - Responding to Fire Alarms 54. YMA-OPS-PR-0217 - Control Centre Fire Alert 55. SHEMS12-ESV-P001-01 - Management of VESDA During Periods of Heavy Smoke Pollution 57. SHEMS14-ESV-P003 - Fire Hoses - Pressure Cleaning 58. YMA-OPS-PR-0101 - Fire Extinguisher Replacement 59. YMA-OPS-PR-0151 - Water Truck 61. Weather forecast information 62. SHEMS11-SHE-P016 - Fire Mitigation Strategies for the EnergyAustralia Yalourm Site 63. SHEMS11-ESV-P001 - Wildfire Risk Mitigation 64. SHEMS11-SHE-P015 - Management of the Bushfire Mitigation Plan 65. SHEMS11-SHE-P015-L01 - Bushfire Management Plan 69. SHEMS10-SHE-P001 - Removal of Vegetation on the EnergyAustralia Site 71. SHEMS12-SHE-L01 - Emergency Response Plan (includes an appendix on post earthquake measures for the mine and power station) 72. SHEMS12-SHE-L01-A07 - Emergency Response Plan - Appendix 07 - Fire in Mine 73. Emergency Response Trial Exercises (involving Combat Agencies) 74. YMA-OPS-PR-0281 - Immediate Incident Reporting 91. Dedicated mine fire service team 93. Site wide 24/7 emergency response teams 113. Yalourm participating in multi-agency exercises 156. VicPol works with VicRoads (traffic plans are formulated in conjunction with VicRoads and CFA) 157. First response by onsite mine personnel (escalated to Estate Services and subsequently to CFA) 158. Emergency Management Act 159. Emergency Management Manual 160. CFA Act 161. Emergency Management Joint Standard Operating Procedures (incl. Line of Control) 162. State Response Control 163. Draft joint SOP for impacts of smoke on community under Emergency Management Victoria 180. Work undertaken at state level (CO and PM 2.5) 181. EPA study (12 months) post Hazelwood (no long term impact on environment) 182. Latrobe City Council - hazardous materials release from a facility (CO)	Ineffective	1	20	1	21									

## Appendix I – Attendance List

Name	Role	Company / Department	Years' Experience	Fire Risk Pre-Workshop (18 June 2015)	Fire Risk Workshop (2 July 2015)
	Facilitator			✓	
	Facilitator				✓
	Co-Facilitator			✓	✓
	Alliance Manager		10	✓	✓
	Mine Manager		30+		✓
	Engineer		15	✓	
	Leading Hand Fire Service		30	✓	
	Geotech Engineer, Resources Leader		23		✓
	Operations Officer		30+		✓
	Special Projects		40	✓	✓
	Electrical Engineer		20	✓	✓
	Emergency Services Manager		35	✓	✓
	Infrastructure Coordinator		40		✓
	Coordinator Emergency Management		40+		✓
	Mine Planning Team Leader		32		✓
	Contract Manager		32	✓	✓
	Safety Advisor		7	✓	

Name	Role	Company / Department	Years' Experience	Fire Risk Pre-Workshop (18 June 2015)	Fire Risk Workshop (2 July 2015)
	Mine Superintendent		30		✓
	Civil & Environmental Engineer		5	✓	✓
	Compliance		40	✓	✓
	Operations Officer		21		✓
	Manager Mining		40+	✓	✓
	OHST Coordinator		20		✓



## ATTENDANCE LIST

<b>Project:</b>	Yallourn Risk Assessment Workshops	<b>Job No:</b> 31-27070-15-38
<b>Workshop/Study:</b>	Fire Risk Pre-Workshop	
<b>Location:</b>	Strzelecki Meeting Room, Yallourn	
<b>Date:</b>	Thursday 18 June, 2015	

Name	Position/Role	Department/ Company	Years' Experience	Contact Number
	Compliance		40	
	ENGINEER		15	
	MANAGER MINING		40	
	ELECTRICAL ENGINEER		35	
	Safety Advisor		7	
	ENVIRONMENTAL ENGINEER		5	
	Leading hand <sup>FIRE</sup> SERVICE		30	
	Emergency Service manager		30	
	ALLIANCE MANAGER		10	
	SPECIAL PROJECTS		40	
	co-facilitator			
	Facilitator			
CONTRACT MGR	32			



## ATTENDANCE LIST

<b>Project:</b>	Yallourn Risk Assessment Workshops	<b>Job No:</b> 31-27070-15-38
<b>Workshop/Study:</b>	Fire Risk Workshop	
<b>Location:</b>	Strzelecki Meeting Room, Yallourn	
<b>Date:</b>	Thursday 2 July, 2015	

Name	Position/Role	Department/ Company	Years' Experience	Contact Number
	COMPLIANCE MANAGER		40	
	MANAGER MINING		40+	
	OPERATIONS OFFICER		21	
	COORDINATOR EMERGENCY MANAGEMENT		40+	
	Operations Officer		30+	
	Infrastructure Coordinator		40	
	GEOTECH. ENG. RESOURCES LEADER.		23	
	Mine Superintendent		30	
	OHST COORDINATOR		20	
	MINE ELECTRICAL ENGINEER		38	
	CIVIL & ENVIRONMENTAL ENGINEER		5	
	MINE MANAGER YALLOURN MINE ALLIANCE		30+	
	CONTRACT MGR		32	
	SPECIAL PROJECTS		40	
	ALLIANCE MANAGER		10	
	Estate Emergency, SA		35	
	MINE PLANNING TEAM LEADER		32	
	Co-Facilitator		3.5	
	Facilitator		28	

# Appendix J – CVs





# Curriculum Vitae

## Mark Andrew

<b>Profession:</b>	Risk Management
<b>Qualifications:</b>	BEng. (Hons)., MSc., CEng., CErgHF.
<b>Position in GHD:</b>	Principal Risk Consultant



Mark has over 25 years experience in risk management and human factors, which he has combined into an organisational risk capability. He has delivered ‘value through risk’ for hundreds of clients in industry, government and commerce by focusing on client needs to develop tailored approaches. He delivers risk solutions to mining, transport, humanitarian, utilities, health, technology and defence sectors, and specialises in integrating human factors into risk solutions.

Mark delivered project planning and facilitation exercises in Indonesia, Malaysia, Japan, Canada, USA, Holland, Ireland, England and Australia. He specialises in mining risk management methods and facilitation, and is an approved SQRA facilitator. He has conducted many risk assessment and safety audit assignments for Rio Tinto, BHPB, Energy Australia and Anglo American. He is a ticketed engineer, obtained when he worked for De Beers for five years in Namibia.

### Key Experience Areas

- Major Mining Hazards specialist for underground & surface mines.
- Business and Enterprise risk specialist, developing governance approaches.
- Security specialist for International Ship & Port Security.
- Business and organisational risk analyst for ATO, Infrastructure Australia and CommCare.
- Human error and organisational reliability specialist on industrial risk studies.

### Recent Experience

- Recent projects have been with the Energy Australia (Coal Fire risks), BHPB Illawarra (Catastrophic Risk Programme), Cannington SQRA programme, Loy Yang Power and Yallourn Mine (Operational risk assessments and Major Mining Hazards studies), and with the Victorian Electricity Distribution Businesses (Advanced Meter risk assessments and Bush fire analysis).
- Accepted risk techniques are frequently adapted to create novel hybrids, such as for systemic risk. These have been co-presented with clients at international risk conferences in twelve countries to date, and illustrate how Human Factors approaches can be integrated into risk engineering studies.
- Mark most recently assisted a regulatory body and a major Australian Corporate business with organisational risk maturity development, using Enterprise and Organisational culture change approaches.

### Selected Experience: Mining

Mark’s mining risk projects have been conducted over the last two decade in various coal and minerals extraction industries, and also in preparation and processing industries.

- Energy Australia – Fire, Geotechnical and Environmental assessments of Public Safety risks.
- Northparkes – project and operational risk studies.
- BHPB – Catastrophic risk management programme (Illawarra mines and Cannington).
- TRUenergy Yallourn – Geotechnical risk assessment, Major Mining Hazards, Electrical infrastructure risk assessment.



# Curriculum Vitae

- Loy Yang Mine – Geotechnical risk assessments.
- Hunter Valley Mines - Alluvial Mining Risk Review.
- Howick Coal - Completed risk reviews of the design and operations, and preliminary risk review of the programmable control system of an open cut mining shovel.
- Wambo Mining - Completed design and operational risk review of an underground "rapid development" coal mining system.
- Drayton Coal - Facilitated the team-based fault-finding of a control systems failure on an open cut mining shovel.
- Drayton Coal - Facilitated team-based investigation of a critical incident with an electrical drive haulage truck.
- Joy Manufacturing - Prepared safety assessment criteria for the programmable control system of a continuous miner and assessed same for compliance.
- Brimstone Colliery - Risk analysis for planning activities of long wall installation.
- SafetyMAP development (Lilydale quarry and various downstream manufacturing organisations).
- Camberwell Mine - Reclaim tunnel risk analysis during early specification and pre-construction phases, including follow up reviews of operational procedures.
- Wambo Mining - Dragline refit risk analysis, including transport, site installation, initial training and maintenance regime reviews.
- Ellalong Mine - Risk Analysis training, including hazard awareness, team-based risk reviews, and engineering risk assessment.
- Wongawilli Colliery - Risk Analysis of drift winder, including operability studies.
- Elouera Colliery - Risk Analysis training, including investigation skills.
- Tahmoor Colliery - Outburst risk study using limited data, to predict uncertainty levels in new mining regions.
- Tahmoor Colliery - Stage winder risk analysis.
- Tahmoor Colliery - Structure drilling risk analysis.
- Joint Coal Board - Development of risk / ergonomic guideline document.
- Oakdale Colliery - Accident investigation of coal transport winder incident, involving a multi-disciplinary team of regulators, engineers, operator and insurance adjusters.
- Wambo and Gretley Colliery - Accident investigations, including fatality investigation into the high-pressure hydraulic failure of an underground roof support.
- Longwall risk assessment - various longwall assessments, including ventilation and support risk reviews.
- South Bulga Colliery - Risk analysis on roof mounted conveyor structure.
- Hunter Valley Mine - Alluvial Mining risk analysis (flooding risks).
- Tahmoor Colliery - Structure drilling risk analysis.
- Arnot Colliery South Africa - Long wall installation planning exercise.
- East Dreifontein Gold Mine - Roof support installation risk analysis.



- South Bulga Colliery - Roof mounted conveyor risk review.

## **Selected Experience: Enterprise Risk**

These efforts include multiple stakeholders, such as suppliers, government regulators and environmental groups. Clients are increasingly sensitive to enterprise risks – not just as threats, but also as a means to capitalise on risk, and to profit from more extensive and longer-term risk treatments.

- Advanced Meter Infrastructure – Preliminary risk assessment for Victorian Distribution Businesses, for regulatory approval.
- Strategic Planning for RedR Australia (funded by AUSAid). A five-year plan was developed with the board to control organisational risk and achieve priority goals.
- Risk Product Development for Treasury Managed Funds division of GIO General Insurance. A suite of risk tools was developed to assist with NSW government enterprise risks.
- Corporate Governance development for the Strategic Rail Authority (UK). A framework for the strategic governance of infrastructure access was developed and communicated to rail operators and regulators.
- Infrastructure and asset protection for major transportation groups. A security regime was developed for several inter-modal freight services.
- Business risk assessments for public rail networks. Technology and communication risks were assessed and treated through the rollout of contingency planning exercises.
- Expert witness services in the form of legal risk analysis for public transport planning adjacent to major telecommunications assets. A key metropolitan rail development was successfully defended against competing telecoms interests.
- Taxation Office information threat and vulnerability assessment. A study of tax office records was conducted, leading to an overhaul of information management procedures.
- Defence procurement project risk assessment for a nine year supply agreement for the UK Ministry of Defence. A major supply agreement was defended against commercial threats.
- Electricity risk assessment for wineries and breweries facing significant input cost increases. Input costs accounting for over 50% of product costs were controlled through re-engineering risk processes.
- Tender adjudication for a metropolitan transport ticketing system. A State Government contract for ticketing was supported with public user input.

## **Selected Experience: Industrial, OHSE & Quality**

The basic principles of risk management still apply whether safety, or the quality of service provision is the prime concern, as shown by the following examples.

- Coronial enquiry services - ad hoc advice to government agencies and law firms for several fatalities, including high profile public accidents.
- Retail maintenance risk management assessment.
- Royal Melbourne Hospital - Secondary power supply risk analysis to support capital works budget process.
- Standards Australia – working member of standards committees.
- Legal risk support – expert witness for telecom / rail conflict in London.



# Curriculum Vitae

- Lachley Meats - Ergonomic review of architectural plans for a new abattoir.
- State Transit Authority (NSW) - Risk assessment and ergonomic review of bus cabin specifications for procurement standards for new fleet contract.
- TransPerth - Bus cabin ergonomic risk review.
- Brambles Shipping - business process analysis.
- Security Risk Assessments to meet International Ship and Port Security codes issued by the International Maritime Organisation.
- Transport and traffic research - numerous vehicle and highway risk and accident investigation projects.
- Management of an urban electrical utility from state ownership to market floatation in ten months by ensuring all business risk processes were formalised and approved by regulatory authorities.
- Nimrod long-range maritime search aircraft risk assessments & the Future Strategic Tanker Aircraft risk assessments (monte carlo simulations of project uncertainty).
- Military risk training workshops for MoD UK.
- Dept of Infrastructure - risk management programme development for executives.
- Australian Taxation Office - business process risk analysis, leading to a large programme of information security upgrades.
- Roads and Traffic Authority (NSW) - Risk assessment of their highway intercept and inspection procedures.
- Energy Management programme facilitation – various manufacturing plants including breweries, paper & can producers and wineries.
- Dept of Infrastructure – design and development of critical incident investigation policy and procedure.
- Y2K risk assessments for government and transport groups.
- Ford Motor Company of Australia - Manufacturing facility risk assessment.
- Ford Motor Company – development and delivery of Reliability and Maintainability training programme to engineers and suppliers.
- Various European risk studies (360 Networks, Tycom International, manufacturing plants).

## Recent Mining Clients:

Bernie Hyde      Mine Manager, RTL Alliance, Yallourn Mine  
[bhyde@rtl.com.au](mailto:bhyde@rtl.com.au) / 03 5136 1050 / 0419 364 758

Peter Leviston      Compliance Manager, TRUenergy Yallourn  
[Peter.leviston@truenergy.com.au](mailto:Peter.leviston@truenergy.com.au) / 03 5136 1042 / 0419 390 766



## Henry Reynolds Global Leader Risk Management



**Qualified.** Bachelor of Science, Nottingham University, 1982

**Connected.** Australian Institute of Company Directors

**Relevance to project.** Henry has held senior management roles in operations and business internationally in the oil, gas and energy industry in Europe, South America, Australasia and the Middle East. He has worked at senior levels in clients for many years on a variety of strategic risk assignments. He often acts as both a mentor to senior individuals and advisor to several Boards. Henry is also a member of GHD's Board Risk Management Committee.

### **Minas Rio Project | SQRA™ (Semi-Quantified Risk Assessment) Anglo Ferrous Brazil | Belo Horizonte and Rio de Janeiro**

Led a SQRA (Semi-Quantified Risk Assessment) on a US\$4bn project, which was Anglo's single largest investment globally in 2009. Two concurrent risk assessments were undertaken (project and future operations). Analysed the key risks to the project.

### **Rio Tinto Group Risk Finance | Speciality and Natural Catastrophe Programs | Iron Ore, Energy and Aluminium etc.**

Managed GHD's services to support Rio Tinto Group Risk Finance in a series of speciality reviews and Natural Catastrophe programs since 2009.

### **BHP Billiton Base Metals | Material Safety Risk Management | Chile, USA and Australia**

Led a significant risk management program across all Base Metals assets and new projects in South America, Australia and USA. Delivery in Spanish.

### **Group wide pilot SQRA™ program | BHP Billiton Ltd | Australia, South Africa and USA**

Group wide pilot SQRA program with a focus on catastrophic risk management (guidelines, training and site risk assessments). Prior to broader application across various CSG's (i.e. Iron Ore, Coal, Base Metals)

### **Energy Australia Yallourn / GDF Suez Hazelwood/ AGL Loy Yang**

Project Director for a combined La Trobe Valley mine fire risk assessment (of all three operators including regulator and emergency services).

### **Major Utility | California | USA**

Executive level business risk assessments to identify the key risks associated with the strategic service delivery obligations for reporting to the Board.

### **Ravensworth North Expansion Project | Xstrata Coal**

Led a series of project risk assessments for a \$1.5bn brownfield expansion project in the Hunter Valley.

### **International Resources Project | Bangladesh**

International mining and infrastructure project - risk assessment with the Board and executive of an international mining project in a sensitive political and social environment (project value >\$1bn).

### **Aluar | Aluminium Smelter | Puerto Madryn | Argentina**

Strategic business risk assessment with the Executive of one of South America's largest Aluminium smelters.

### **Key areas of experience**

- Enterprise-wide, risk management strategies and frameworks
- Risk management integration into organisations and business planning
- Report/monitor key business risks
- Board/executive level risk assessments
- Business assurance processes and governance development



## Daniela Abela

### Consultant, Risk Management



**Qualified.** RMIT University. BEng (Chemical) (Hons) / BBus (Management). 2011.

**Location.** Melbourne, Australia.

**Relevance to project.** Daniela is a member of GHD's Risk Management Team in Melbourne. She has been involved in qualitative and semi-quantitative risk assessments and workshops. She has also been involved in co-facilitating for various HAZOP and SMS workshops, involving process facilities and gas stations around Victoria

#### **Risk Assessment Co-Facilitator**

##### **Rio Tinto Group | Arandis, Namibia**

Co-facilitated Semi-Quantitative Risk Assessment (SQRA™) workshops for the plant and processing operations at the Rössing Uranium Limited (RUL) mine in Arandis in the Erongo Region of Namibia.

#### **Risk Assessment Co-Facilitator**

##### **MMG | Rosebery, Tasmania, Australia**

Co-facilitated safety SQRA™ workshops for the mining operations at Rosebery in Tasmania.

#### **Risk Assessment Co-Facilitator**

##### **PowerNet Limited | Invercargill, New Zealand**

Co-facilitated SQRA™ workshops for the power operations at Invercargill in New Zealand, and provided database training.

#### **Risk Assessment Co-Facilitator**

##### **Port of Melbourne Corporation | Port Melbourne, Victoria, Australia**

Co-facilitated marine risk assessment workshops of navigational activities in jurisdictional waters for the Port of Melbourne, using Bowtie analysis.

#### **Coordinator**

##### **CVC Venture Managers | Melbourne, Victoria, Australia**

Coordinate and central point of contact for pipeline Safety Management Study (SMS) workshops for Altona North Precinct 15 development and Newport Village development involving relevant pipeline owners.

#### **Risk Assessment Co-Facilitator**

##### **Energy Australia Yallourn | Yallourn Victoria, Australia**

Co-facilitated high level risk assessment workshops for the eastern ash landfill project, and the ash and return water system. Included subsequent reporting of the workshop outcomes.

#### **Risk Assessment Co-Facilitator Yarra Trams | Melbourne, Victoria, Australia**

Co-facilitated St Kilda Rd and Wellington Pde upgrade tram stop risk assessments with Yarra Trams and relevant stakeholders. Assessment considered the safety risks associated with the tram stop (passengers, pedestrians, adjacent road users and tram staff). Included initial pre-population of risk register and subsequent reporting of the workshop outcomes.

#### **Risk Assessment Co-Facilitator**

##### **BP Australia Pty Ltd | Australia**

Co-facilitated HAZOP workshops for the BP terminals in Hobart and Burnie in Tasmania, Largs North in South Australia, and Port Hedland in Western Australia. Included subsequent reporting of the workshop outcomes.

#### **Risk Assessment Co-Facilitator**

##### **Leighton Contractors Pty Ltd | Nowra, NSW, Australia**

Co-facilitated a HAZOP and Safety Management Study (SMS) workshop for the fuel hydrant system and pipeline design at the HMAS Albatross Redevelopment Hot Refuelling Facility in Nowra, NSW.



# Curriculum Vitae

## **Risk Assessment Co-Facilitator**

### **Thiess | East Sale, Victoria, Australia**

Co-facilitated 30% CDR and DDR HAZOP workshops for the new defence fuel installation at the RAAF Base East Sale, Victoria.

## **Risk Assessment Co-Facilitator**

### **APA Group | Victoria, Australia**

Co-facilitated Safety Management Study (SMS) risk workshop for St Germain Development, Victoria at the Dandenong office. Co-facilitated HAZOP and Safety Management Study (SMS) risk workshops for W.A.G., ESSO, Chryscos Flowers, Grandiflora Nurseries and Melbourne Water Pipeline Facilities, Victoria at the Thomastown office.

## **Risk Engineer**

### **Hamilton City Council | Hamilton, New Zealand**

Conducted quantitative risk assessment (QRA) for the chlorine storage facility located at Hamilton Water Treatment Station (WTS), located in New Zealand, including consequence modelling of risk contours.

## **Risk Engineer**

### **SP AusNet | Victoria, Australia**

Conducted QRAs of the pressure reduction stations including consequence modelling of risk contours for Heaths Road City Gate at Hoppers Crossing, and Winchelsea, Bannockburn and Avoca sites.

## **Risk Engineer**

### **Arrow Energy | Kogan-Dalby, Queensland, Australia**

Conducted coal seam gas QRA of the Daandine Expansion Project (DDEXP) Production Facilities, including wellheads and gathering network.

## **Risk Engineer**

### **SA Water | South Australia, Australia**

Conducted QRA of the chlorine facilities including consequence modelling of risk contours at Glenelg, Hope Valley, Kimba, Christies Beach and Heathfield.

## **Risk Engineer**

### **City of Port Adelaide Enfield | Lefevre Peninsula, South Australia, Australia**

Conducted a Hazard Risk Analysis including consequence modelling of risk contours for petrol, chlorine, ammonia, LPG, xylene, and ethanol dangerous goods at Lefevre Peninsula.

## **Risk Engineer**

### **Queensland Gas Company (QGC) | Queensland, Australia**

Conducted various coal seam gas QRAs for QGC's Upstream Operations including consequence modelling of risk contours for field compressor stations and optimised wellhead skids.

## **Other related areas of interest**

- **IT.** MS Office. Consequence and risk computer modelling using PHAST and SAFETI. PHA-Pro.
- **Training.** Undertaken Det Norske Veritas (DNV) Phast (Risk) Advanced Training.





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