IN THE MATTER OF
THE HAZELWOOD MINE FIRE INQUIRY

STATEMENT OF JIM GALVIN

I, James Maurice Galvin, of [redacted] say as follows:

Professional Background

1. I am an Emeritus Professor with a background in mining and geotechnical engineering, risk management and occupational health and safety. I have been a member of the Technical Review Board (TRB) since it was constituted in 2009 and its Chairman since 2011. A summary copy of my curriculum vitae is attached.

The Role of the TRB

2. The TRB was established following the Warden's Inquiry into the collapse of the North East Batter at the Yallourn Mine in 2007. A primary function of the TRB is to provide independent advice on mine and quarry stability to assist the Minister for Energy and Resources ('the Minister') and the Department of Economic Development, Jobs, Transport and Resources (DEDJTR / 'the Department').

3. Under the TRB's original Terms of Reference, the advice covers the following areas:

"(a) Strategy

- *Written and/or verbal advice on the Department's strategies and regulatory approach to mine and quarry stability and geotechnical issues.*

(c) Workplans

- Assess workplans and variations to workplans and provide written advice to the Department on mine and quarry stability and related geotechnical and hydrogeological issues.

- *Written and/or verbal advice on new developments in technology and science relating to the understanding, monitoring or management of mine and quarry stability and related geotechnical and hydrogeological issues.*

(b) Stability reports

- *Review and interpret mine and quarry stability reports including monitoring data, that has been submitted to the Department and provide written advice to the Minister.*

[INSERT]

(d) ~~(c)~~ *Other Activities*

- *Advise the Minister in formulating appropriate response to significant events relating to mine and quarry stability, and related geotechnical and hydrogeological issues.*
- *Advise the Minister on appropriate guidelines and educational initiative related to mine and quarry stability.*
- *With the knowledge and agreement of the Minister, interact directly with industry on mine and quarry stability and related geotechnical and hydrogeological issues, including participation in site visits, presentations and dialogue, particularly with respect to communicating findings of reviews with relevant stakeholders.*
- *In conjunction with the Department, interact directly with Monash University in relation to the Research and Development program on brown coal geotechnical and hydrogeological issues.*

4. The TRB's role includes interacting directly with the Geotechnical and Hydrogeological Engineering Research Group (GHERG), which is funded by the Government to undertake geotechnical and hydrogeological research focused on stability issues associated with the Latrobe Valley brown coal mines and to implement education and training for those working for and with the mines. This includes research in the area of mine rehabilitation.

5. The TRB submits a report to the Minister on an annual basis which outlines the activities of the TRB over that year and an overview of its advice.

Rehabilitation and the TRB's Terms of Reference

6. In August 2015, the TRB's Terms of Reference were expanded to include rehabilitation. The Terms of Reference now include a requirement to: *"provide written advice and guidance to the Department on any issues related to rehabilitation, including progressive rehabilitation within the mines and quarries."* Ms Corinne Unger, a specialist in rehabilitation policy and procedures, was appointed to the Board in September 2015.

7. As I understand it, rehabilitation was included in the Terms of Reference of the TRB because of the consequences of the Hazelwood Mine Fire. The fire created an awareness of the need to cover exposed coal in order to reduce the fuel load.

8. However, well prior to the expansion of the TRB's Terms of Reference to include rehabilitation, the TRB was providing advice to Government on rehabilitation issues and had already recommended that a person with a background in rehabilitation be appointed to the TRB at the commencement of its next term in September 2015.

Advice to Government on Rehabilitation in TRB Annual Reports

9. One longstanding and overarching concern of the TRB has been that the rehabilitation plans of the Latrobe Valley brown coal mines do not deal adequately with the complex stability issues that impact on both progressive and final rehabilitation.

10. In the 2011-2012 TRB Annual Report (attached), we advised Government that:

"The TRB is of the opinion that the measures which have been considered to date for the rehabilitation of a (brown coal) mine fall well short of what could reasonably be considered as adequate. There seems to be a general presumption and acceptance that the mines will simply become flooded to form inland lakes, with no consideration having been given to a range of

issues that include:

- *The ongoing stability of the batter slopes, many of which have a variety of forms of infrastructure relatively close to the crests of the mines;*
- *Ongoing movements of the areas adjacent to (and some distance from) these same batters and the consequences of these movements;*
- *The responsibility of the mine owners in these matters and who would be liable for any consequences;*
- *The effect that the water retained in the abandoned mine would have on the adjacent batters and their long term stability;*
- *The extent to which the mines would fill, the length of time taken to fill and the time when it would be appropriate to turn off the pumps currently depressurising the formations below and around the perimeter of the mines;*
- *The characteristics of the water that fills or partly fills each mine and safety aspects associated with its potential uses; and*
- *The influence that one mine closure may have on adjacent mines."*

11. In that report we also advised the Government that, *"in order to develop appropriate measures and processes for closure, considerable study, assessment, evaluation, implementation and ongoing monitoring with action plans are required"* and that *"this will take time to develop and will be a costly process."*

12. The TRB also recommended that *"steps be taken immediately to begin an assessment of the issues, the processes, the risk and their amelioration, the time lines and priorities and, most importantly, the cost liabilities required for closure of each existing mine."*

13. The TRB identified to the Government early on that, in its view, since the privatisation of the mines, there has been a critical loss of corporate

knowledge regarding mine stability and the risks associated with instability. In our 2011-2012 Annual Report, we noted that *"mine operators have become conditioned to risk and are normalising risk (that is, some risks are now viewed as 'normal, to be expected') and the risk acceptance criteria and risk appetite of the present owners are higher than that of the SECV."* In that Report, we also identified *"Planning for mine closure"* as one of eight technical areas that appeared not to have experienced continuity and ongoing development at each mine in recent years.

14. We advised the Government that changes needed to be made to stakeholder culture and technical expertise so that standards, practices and risk management became commensurate with international best practice. We recommended a range of initiatives including rehabilitation and future research. While there has been some pleasing improvements since our 2011-2012 annual report, particularly in a change of culture towards more engagement between stakeholders, the development of a geotechnical guideline and increased support for research, there is still some way to go.

15. The TRB remains of the opinion that the measures originally proposed and incorporated into Work Plans for the rehabilitation of the Latrobe Valley brown coal mines fall well short of what could reasonably be considered as adequate for achieving long term safe and stable batters from a ground control perspective. There appears to have been a general presumption and acceptance that the mines would simply become flooded to form inland lakes, with little consideration given to a range of complicating issues, such as local geology, material characteristics, batter stability, groundwater behaviour, and long term water quality.

Complexities Relevant to Rehabilitation of the Mines

16. The mines are large by world standards and are continuing to become larger and deeper. They contribute to widespread surface settlement caused by groundwater extraction. A key issue is that brown coal is not very heavy (it is not much denser than water) and so it is prone to move when acted against by

water pressure. As groundwater and coal are extracted, the unmined coal relaxes and moves, allowing natural joints, or cracks, to open up. If a crack then fills up with water, the water pressure in the crack can cause a whole block of coal to be pushed and slide outwards. This has occurred many times in the history of brown coal mining in the Latrobe Valley. It is what happened, for example, when the Yallourn Mine Northern batters moved in 2007 and resulted in the Latrobe River being breached, and when the Hazelwood Northern batters moved in 2011, causing the closure of the Princes Highway.

17. One way of managing this type of stability issue is to drill long near-horizontal holes into the batter faces at regular intervals along the faces in order to drain water out of cracks before it can lead to a build-up in water pressure. However, the success of this control in the future is dependent on the drains being regularly inspected, maintained and redrilled when they become blocked or are severed due to ground movement. This, in turn, requires funding and a management system that provides for oversight by appropriately qualified personnel.

18. Both batter stability and the capacity to cover the batters with appropriate soil materials depend on the steepness of the batters. Another complicating factor is that because the coal is so light and wants to slide when impacted by water pressure, batter stability decreases as a batter slope is made flatter. This is the opposite behaviour to that associated with most other mine slopes and surface excavations. Since steep batters are an impediment to covering the batters with soil materials, this conflict can present a serious impediment to undertaking rehabilitation that remains safe and stable in the long term.

19. There is also not enough known about covering coal batters so that they remain safe and stable. Some research and field trials have been undertaken, such as at Loy Yang Mine, but there is a need for much more. Some fundamental questions which still need to be answered include at what slope can soil materials be permanently retained on a batter; and can this final smooth profile be achieved by simply placing fill over the existing steps in the coal batters, or will the steps in the coal batters need to be cut away (at

least to some extent) to produce a smooth final profile. The answers can have huge implications for the cost of rehabilitation. In some situations, they may also have implications for the security of public infrastructure that is in close proximity to the crest of mine workings.

20. Another complexity is that it is extremely unlikely that there is one answer to the types of questions just raised. A long batter, for example, may have zones along it that need to be treated differently because of factors such as variation in joint direction, dip of the strata and groundwater. This is one reason for why the TRB considers the concept embedded in Work Plans of a final batter slope of "1 vertical to 3 horizontal" to be too simplistic.

21. Further, the concept in the Work Plans to allow the mines to flood does not deal with issues around long term water quality and how to deal with major batter instabilities that may occur under the water.

22. Mine stability is particularly important in the Latrobe Valley because of the closeness to mine crests of key infrastructure, such as highways, railway lines, power transmission lines, telecommunications systems, rivers, and drains. In many instances, these features are within zones of potential significant movement and some are in zones that already have a history of ground movement. It is for this reason that the TRB recommended in 2011 and subsequently that hazards maps be prepared showing all infrastructure within one kilometre of mine crests and the risk presented to this infrastructure by significant mining-induced ground movement (risk being defined as is a combined measure of the likelihood of a significant ground movement event and the consequences should such an event occur).

23. Basically, current rehabilitation plans only provide for those portions of batters above the post-mining water level to be covered with soil materials. The TRB is of the view that Work Plans to date have not had a sufficient focus on "progressive rehabilitation". This has resulted in the situation where progressive rehabilitation has been restricted mostly to overburden. There has been limited rehabilitation of coal batters, although benches (horizontal surfaces) have been covered soil materials as an interim measure in order to limited water ingress into cracks and to reduce exposure of coal benches to fire.

24. Legacy issues associated with the types of mining methods, mine layouts and the location of mine infrastructure in the Latrobe Valley brown coal mines are put forward as reasons why progressive rehabilitation of exposed coal faces is not practical or feasible. The TRB accepts that there is considerable merit in this reasoning. Nevertheless, it believes that there is scope to increase the rate of rehabilitation of exposed coal faces, albeit at an additional cost impost. The issues are complex but not insurmountable.

The Need for Further Research, Coordination, Leadership and Oversight

25. Since the 2011-2012 Annual Report of the TRB was provided to the Government, there have been some significant positive signs of changing culture in regard to managing mine stability in the Latrobe Valley. These include mines collaborating much more closely with each other on hydrogeological and geotechnical issues and demonstrating commitment to education and research. Some of this research has been directed towards rehabilitation issues (see Attached 2012-2013 and 2013-2014 TRB Annual Reports).

26. In addition, in August 2013, the Government approved funding for a batter stability study at the Yallourn Mine. One of the major goals for this project is to build a more complete understanding of geotechnical processes required for long-term management of mine stability, mine environmental impacts and mine rehabilitation. The TRB considers this project to be an important, albeit small, step forward in developing a proper understanding of mine stability and rehabilitation options. Unfortunately, the study has yet to commence.

27. Work Plans are, in the view of the TRB, simplistic and do not adequately address the risks associated with mine instability and rehabilitation. However, the TRB has also formed the view that the mines have been developing an increased awareness of these issues for themselves and have been demonstrating a willingness to go beyond the requirements of Work Plans in endeavours to achieve long term mine stability.

28. Notwithstanding these positive developments, a significant amount of further research directed towards achieving mine stability in the long term is

required. Addressing this legacy issue will require significant funding.

29. With few exceptions, major government responses to mine instability and rehabilitation issues since the inception of the TRB have been in reaction to incidents. The TRB is of the view that, in respect of rehabilitation, the government needs to be more proactive in adopting contemporary rehabilitation policies and practices, in promoting research and collaboration between all stakeholders, in conditioning Work Plan approvals, and in regulatory oversight of rehabilitation.

24 November 2015