

Technical Review Board

Our Ref: TRB.L23

25 May 2012

Mr J Mitas
General Manager
Minerals and Extractive Operations
Department of Primary Industries
Level 16, 1 Spring St
Melbourne Victoria 3000

Dear John

TRB Recommendations re PSM Yallourn Report

Please find attached the TRB's Recommendations to the Minister arising out of its review of the PSM Yallourn Report and other material it has reviewed in recent months.

Yours sincerely



JM Galvin
Chair, Technical Review Board

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TRB RECOMMENDATIONS

RE:

PSM YALLOURN REPORT

1. OVERVIEW

The Technical Review Board (TRB) has recently completed its review of the PSM Consult Pty Ltd report (the PSM Report) entitled *Yallourn Mine Stability and Risk Assessment*, PSM reference PSM1632-094R dated 7 March 2012. This review included access to an earlier draft report and a detailed presentation by the author of the PSM Report, Mr Tim Sullivan, on 16 February 2012. The TRB also sought information from TRUenergy on the design and construction of the second Morwell River Diversion (2nd MRD). The information was provided through a presentation given to the TRB by TRUenergy's consultant at a meeting on the 9th May 2012.

It is the view of the TRB that the PSM Report captures the essential elements pertaining to the stability of the mine. The TRB is in general agreement with the contents of the report. There are a number of minor aspects of the report with which the TRB does not fully agree, but these do not detract from the central tenets of the report.

2. TRB RECOMMENDATIONS TO THE MINISTER

2.1 STABILITY ASSESSMENT PROCESS

The PSM Report makes it clear that a number of events have occurred which were “*surprises in that they were either not predicted or not identified as issues before the event*”. The report goes on to state that:

“It should now be apparent that the Latrobe Valley materials should not be considered as relatively benign or materials which always show some movements and for which there are only minor concerns. Rather, it is considered there are significant risks and not all of these are yet fully understood. The geotechnical nature of the materials and these events highlight that risk to natural and public infrastructure around these mines is and remains an issue into the future.”

Arising from the recommendations of the PSM Report and a range of incidents at other sites relating to batter movement, the TRB recommends that there is a need to improve the standard of stability assessment of batters, not only at Yallourn Mine but at all declared brown coal mines and the Anglesea Mine. Accordingly, it is drafting a guideline to address this need.

In the interim, it is the TRB's advice that the geotechnical studies recommended in this report in respect of Yallourn Mine should include the following elements:

1. The development of a comprehensive geotechnical model that includes, but is not limited to:
 - i. the complete stratigraphic profile through the area, including the interseam sediments;
 - ii. the geotechnical engineering properties of each of the stratigraphic layers or units including the interseam sediments and their spatial variabilities;
 - iii. the locations and shear strengths of any sub-horizontal geological structures and clay-rich layers within the sequence and their spatial variabilities; and
 - iv. the distribution of groundwater pressures including artesian pressures in the area and their potential variabilities.
2. A review of current geotechnical and groundwater monitoring and the installation of any additional monitoring required to enable improved assessments of the geotechnical model and observed movement to be made, including the effects of hydrogeological and geotechnical coupling.
3. The development of a comprehensive stability model, preferably supported by probabilistic analysis, which explains the controls on stability and the observed movements and informs the monitoring program and the TARP.
4. The development of strategies and time-frames for stabilisation of the area in the event that the previous steps indicate that stabilisation is necessary. In this context, stabilisation refers to any measures that may be required to control movement, including the reduction of groundwater pressures.

The areal extent over which these detailed geotechnical engineering studies will be required can be expected to vary from location to location. However, in general, the area should include the floor in front of or below the batter or structure concerned and the surface to a distance behind the batter crest that is sufficient to enable impacts on man-made and natural features to be assessed.

2.2 YALLOURN SPECIFIC ISSUES

2.2.1 Latrobe River Batters

The Latrobe River Batters emerges as a particular concern in the PSM Report. The report comments as follows:



“.....there does not appear to have been a thorough geotechnical investigation comprising geotechnical core drilling, sampling and testing of the Latrobe River Batters after the Collapse.....”

and

Given the scale of the Collapse and the scale of the area moving prior to the Collapse, which was some five or six times larger, it is considered very unusual that investigations were not undertaken.

and

.....the movement patterns and the groundwater trends are a concern. It is considered unusual given the impacts of the collapse, that four years after the event, movements have not been stopped, that is, the area has been shown to be stabilised. Alternatively, if the area has not been stabilised, then a comprehensive geotechnical model is required that categorically explains the causes for the ongoing movements.”

The TRB shares these concerns. It recommends that a geotechnical study of the Latrobe River Batters, consistent with the process and requirements already identified in Section 2.1, be undertaken as a matter of priority.

2.2.2 Second Morwell River Diversion

A range of issues identified in the PSM Report relate to the 2nd MRD. These include cracking near the embankment crest and in the low flow channel; seepages on both the eastern and western sides of this structure; local piping erosion; movement of the tunnel portal walls; ongoing settlement; and loss of design freeboard. The assessment of the significance of these issues and the reviews carried out to assess the integrity of the structure lead the author of the PSM Report to the conclusion that the river diversion should not be experiencing these issues so soon after completion, that the reasons for the issues are not clear, and that there are concerns about the performance of the structure in the long term, as opposed to its immediate stability. The condition of the river diversion in the long term, its performance under critical loading events, and the potential for piping are all highlighted. Piping failure is suggested as the probable critical failure mechanism.

In response to the comments, observations and recommendations contained in the PSM Report, a letter dated 8 May 2012 and addressed to Ron Mether, Manager of Mining at TRUenergy, was issued under SMEC letterhead providing the agreed comments of Max Irvin of Golder Associates Pty Ltd and Phil Cummins of SMEC. The letter addressed selected statements contained in the PSM Report, the first being:

“The seepages are ongoing and substantial and occur at elevations where they could be sourced from the river. Overall, it is considered more improbable to be able to generate these significant long term seepages from rainfall alone”.

The SMEC/Golders response agrees that the source of the seepage is the river. The response also states that all outflow points provide clear indication that seepage has been “*higher in the past*”



and “*has been generally decreasing with time*”, although the TRB is unaware of precisely how this important information about the seepage rates was arrived at. The response, which then goes on to discuss the reasons for this seepage, contains a number of scenarios that are “*likely*” or “*unlikely*”, “*possible*” or “*may*” have occurred. It argues that there is “*no immediate problem*”.

While this may be the situation currently, the fact remains that water is seeping out of a relatively large area on the western face of the embankment and the mechanisms involved with this are not known. The seepage is of particular concern if the sand drainage layers, which were specifically included in the embankment to intercept seepage and deliver it to the eastern face, are not performing as they should. From the information presented to the TRB, it appears that the seepage could be a result of using lower than design permeability sand in construction of the drainage layers and of significant variations in the horizontal permeability of the fill material used in construction. Both aspects could affect long term functioning of the structure.

Another PSM statement addressed in the SMEC/Golders letter is:

“The concerns are not immediate stability, but performance under critical loading events, the long term stability and the potential for piping failure, which is probably the critical failure mechanism”.

The SMEC/Golders response is similar to the response to the first statement in that it makes a number of broad comments about the immediate situation and what design assumptions were made. Notwithstanding this response, it appears to the TRB that there are clear indications that the embankment is not operating as designed. There is significant seepage and until it can be shown that this seepage is not critical and could not become critical under extreme loading events, the TRB considers that there must be cause for concern.

The SMEC/Golders letter also addresses the PSM statement that:

“The TRB considers that a structure like the second MRD should not be experiencing these issues so soon after completion”.

The SMEC/Golders response simply observes that “*around half of all incidents on earthfill dams occur in the first five years after construction*”, and “*it is most likely that these sorts of problems will become evident soon after completion*”. Given the extent of the observed behaviour of the embankment since construction and in view of the complex foundation conditions that had to be accommodated in the design and construction of the diversion, the TRB would have expected a more detailed response.

Another PSM statement addressed by SMEC/Golders is:

“TRB recommends that an independent third party review is required”.

The SMEC/Golders response makes it clear that its authors have no objection to a thorough third party review but indicates that, because of the complexities involved, such a review would involve considerable time and expense. It is also stated in the response that “*it is clear that the design is performing well*”. The TRB respectfully suggests that while the embankment appears to be performing adequately at present, it is not clear that the embankment as constructed will necessarily perform well in the future. It considers this issue to be critical in view of the



variations which may exist between the original design and 'as constructed'; the various events that have occurred since construction commenced; and the difficult foundation conditions.

On 9th May 2012, Peter Darling of SMEC and Sri Srithar of Golder Associates Pty Ltd gave a detailed presentation to the TRB on the 2nd MRD, including the background of the project; the conditions that existed; the development of the design; various aspects of the construction; and the performance of the structure with specific details of some of the events that have occurred. The presentation provided the current TRB with a much improved appreciation of the overall project. However, while this account gave considerable comfort with respect to the significance of some of these events, the TRB's concern about the seepage occurring on the western face of the structure still remains.

It is clear that there are a number of aspects of the construction that did not fully conform with the original design of the 2nd MRD and that a number of unexpected events have taken place. While it is evident from the presentation on 9th May 2012 that there have been considerable efforts made to assess these variations and events, and their causes and consequences, the TRB is not aware of these having been formally consolidated in one document. The 2nd MRD is a major structure that has to endure for a considerable length of time with no significant risk to stakeholders. It is the TRB's view, therefore, that TRUenergy should have this information collected, documented and consolidated in a single document and undertake a detailed assessment of what might happen based on the likely variations between the design and "as constructed" structure. It supports the PSM proposal for all issues to be compiled on a single site plan as a working record of the evolving operation of the MRD. The end product of this work should then be reviewed by an independent third party. The TRB further recommends that the reviewer is not simply a geotechnical engineer, but has a strong background in earth dam design and monitoring and can evaluate not only the movements of the structure but, equally, the probable water movements within the structure and the piping risks.

2.2.3 Maryvale Field Mine Development

The PSM Report makes a number of recommendations regarding data collection and analysis to support the extension of the Yallourn Mine into the Maryvale Field. Some of these have been captured previously by the DPI in approval conditions for the Maryvale Field Work Plan Variation (Maryvale WPV) which underpins this mine extension. The PSM Report also highlights a number of areas that warrant particular attention, including the 2nd MRD through the mine extension and stability controls on the Maryvale Field Batters.

The TRB provided comments to the DPI on documents submitted from TRUenergy on the 17th February 2012 purporting to fulfil approval conditions for the Maryvale WPV. Effectively, the TRB was of the view that the field investigations, the reporting of the field actions, and the Trigger Action Response Plan that support the Maryvale WPV approval conditions needed to be improved.



The PSM Report advice to DPI and the TRB's review of the TRUenergy work plan variation documentation submitted to DPI provide a good illustration of the need for and value of the approach recommended in Section 2.1 of this report. The TRUenergy workplan variation documentation, through pointers to several past documents, alludes to a significant body of work that has been used to develop the basis for the analysis of the impact of the new field on the 2nd MRD and the areas adjacent. This work and its conclusions are not visible in the report and, therefore, it is not possible to assess the quality of the total body of data, interpretation and analysis. The TRB recommends that, consistent with PSM's advice, all information used to predict stability and ground response should be consolidated in a single document and presented in a manner consistent with the approach advocated in Section 2.1.

Weaknesses in data collection, analysis and presentation identified in the PSM recommendations and in the TRB's review of the supporting documentation submitted by TRUenergy can then be tested and, if warranted, updated by ongoing data collection and analysis. If this approach is adopted, it will resolve the technical issues surrounding the current design assumptions for the dewatering of the batters and the 2nd MRD as well as the impact on the mine of the depressurisation of the underlying aquifers addressed in the PSM Report. It will also provide a means for the DPI to assess the performance of the mining operations and the Ground Control Management Plan adopted for the Maryvale extension.

3. FUTURE ISSUES

3.1 REHABILITATION

The PSM Report discusses rehabilitation of the mine briefly. It focuses on the practicality of the proposed rehabilitation strategy of flooding the mine in terms of water availability and short term stability of the mine slopes while flooding takes place. These issues along with environmental issues of mine lake water quality, groundwater and surface water impacts, risks to downstream water users and future mining, all pose significant questions that should be examined as part of future assessments of any mine rehabilitation plan. The TRB is concerned that these issues should be dealt with carefully, with appropriate expertise and in a timely manner. At this stage, it is sufficient to flag these concerns.

