EXECUTIVE SUMMARY

This report presents the findings from the second phase of a research project aiming at understanding the nature of rockfall hazards and risks in Australian underground metal mines. A comprehensive database of almost 800 rockfalls and their related data, covering the decade from 1993 to 2003, has been assembled during the two phases of Australian Rockfall Research projects. It was found that the rockfall record keeping has significantly improved since 1997-98. However, when a rockfall occurs, some important information is still not systematically collected by many mines (e.g. size of fall, support status, distance from active face, etc.).

The rockfall risk has been reduced significantly (75 to 80% reduction in the number of annual rockfall injuries) around 1997-98, due to changes in development mining practices. However, the statistics show no further improvement since 1999.

In recent years, rockfalls that caused injuries generally originated from the unsupported rock surfaces near active development mining faces, namely the face itself, the lower 3 m of the walls or the last half metre of the backs immediately adjacent to the face. As a result, the tasks most at risk are the ones exposed to these surfaces, such as face mapping, marking up the face, cleaning blast holes and charging blastholes. Many other rockfall injuries also occurred during the installation of ground support.

Further away from active development mining faces, areas most at risk are near active stopes: at the brows and in stope accesses that are not surface supported. It is considered good practice to surface support accesses within 300 m of active stopes.

The project concluded that implementing flexible risk management and control measures at individual mines, targeting to address local rockfall hazards and personnel exposure has greater merit than a "one-fits-all solution". The project has used the new knowledge acquired from rockfall data analysis to develop new tools to assist mining operations in implementing efficient rockfall risk management systems.

A methodology combining development mining process mapping and rockfall hazard matrices has been proposed to assess rockfall risks. The method is particularly suited to focus management to systematically analyse each micro-task and ensure that the level of hazard associated with it is thoroughly understood. The assessment and implementation of controls can then be performed with an emphasis to mitigate or effectively control the hazard as the micro-tasks "at risk" are being performed.

There is no universally accepted definition of rockfall. The first definition proposed below was developed with representatives of the sponsors of Phase 1 of the Australian Rockfall Research. This definition was later modified through extensive consultations with mining industry professionals during the development of the Australian Rockfall Risk Management Guidelines, resulting in the second definition below. Both definitions are valid and applicable to this report.

ROCKFALL: "An uncontrolled fall of ground of significant size in an entry area or an uncontrolled fall of ground of any size that causes (or potentially causes) injury or damage."(Potvin et al., 2001)

ROCKFALL: "An uncontrolled fall (detachment or ejection) of ground of any size that causes (or potentially causes) injury or damage". (Minerals Council of Australia, 2003)

1. INTRODUCTION

This report presents the findings from the second phase of a research project aiming at understanding the nature of rockfall hazards and risks in Australian underground metal mines. The first phase of the "Australian Rockfall Research Project" was completed in December 2001. The initial research phase sought to assemble a comprehensive database of rockfall case histories and search for trends in terms of causes and conditions leading to rockfalls. Based on 494 case histories, it was found that to understand rockfall risk, it is useful to analyse the rockfall cases that have occurred near active mining faces (within 10 m) separately from the cases further away (>50 m) from mining faces. The risk of being injured by a rockfall near an active mining face was found to be significantly higher than in the rest of the mine. The detailed findings from Phase 1 of the project are documented in Potvin et al., 2001.

In this second phase of the project, the database was expanded to further explore how rockfall injuries occur near the face. In particular, the exposure of personnel to potential rockfall injuries while carrying out their daily tasks is investigated by "mapping" the processes involved in the different mining activities near an active development mining face. New data was also collected to better characterise the rockfall risk away from active faces, including intersections.

This report addresses the following topics:

- Expanded rockfall database.
- Analysis of rockfall case histories away from active mining faces.
- Analysis of rockfall case histories close to active mining faces.
- Understanding personnel exposure through process mapping.
- Rockfall risk management and control.
- Summary and conclusion.

Many performance indicators suggest that the risk of rockfalls in Australian underground metal mines has been managed more effectively in recent years. Phase 1 showed that around 1997-98, changes in practices and regulations did have a significant and positive impact on the occurrence of rockfall injuries. This latter sub-group of rockfall data is relevant to the rockfall risks associated with current mining practices. For this reason, the entire dataset is initially examined to define the trends from the last decade and then, as a sub-group from 1999 to present.

One of the underlying goals of this study is to stimulate industry to make another step change and contribute to further reducing the risk of rockfalls in Australian underground metal mines.