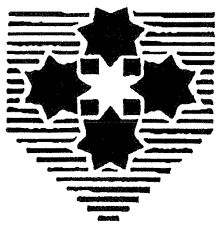


BALLARAT
UNIVERSITY
COLLEGE



VICTORIAN
INSTITUTE OF
OCCUPATIONAL
SAFETY &
HEALTH

Victorian Institute of Occupational Safety and Health

OCCUPATIONAL HEALTH AND SAFETY IN COAL MINES SEMINAR

YEPPOON, QUEENSLAND

SEPTEMBER, 1993

Australian Coal Association Commissioned Study, Part One:

A Review of National and International Research
Relating to Occupational Health and Safety
in Black Coal Mining

Author: Thomas Mitchell,
Lecturer and ACA Project Coordinator,
Victorian Institute of Occupational Safety and Health,
Ballarat University College,
P.O. Box 663,
BALLARAT, 3353,
Victoria, AUSTRALIA.

Telephone +61+53+339150
Telefax +61+53+339151

ACA Commissioned Study Part One: A Review of National and International Research Relating to Occupational Health and Safety In Black Coal Mining

T. MITCHELL¹

**VICTORIAN INSTITUTE OF OCCUPATIONAL SAFETY AND HEALTH,
BALLARAT UNIVERSITY COLLEGE, AUSTRALIA.**

ABSTRACT

The Australian Coal Association, BHP Australia Coal (Central Queensland Coal Associates) Special Research Program and other Australian sponsors of research aim to develop a unified strategy for research aimed at solving OHS problems in the coal industry. To achieve this goal they have sponsored the Victorian Institute of Occupational Safety and Health (VIOSH) to undertake a commissioned study of the present state of occupational health and safety in the Australian black coal industry. The study consists of two parts (i) an analysis of the Australian and international research literature to establish trends in OHS research relating to the coal industry; and (ii) an analysis of the accident and compensation data to determine priority OHS problems for future research. This paper presents the interim findings of the first part of the study.

Keywords: OHS Research Review; Australian Coal Industry; Research Analysis; Accident Analysis; Workers' Compensation Analysis.

¹ THOMAS MITCHELL is a Lecturer/Senior Research Officer at Ballarat University College coordinating the ACA Commissioned Study.

INTRODUCTION

Changing international economic conditions have caused Australian Industry, Trade Unions and Government to jointly focus their attention on enhancing the competitiveness of the nation's exports. In response, many Australian mining companies are enthusiastically adopting a management philosophy centred on developing and implementing systems to improve productivity, product quality and occupational health and safety (OHS) performance. Research relating to these three key areas: productivity; quality; and, occupational health and safety is essential to ensure that the mineral, financial and human resources at the disposal of the Australian coal mining industry are managed effectively. The importance of research can not be understated, however the assumption should not be made that all research centred on these three topics will result in increased productivity, enhanced quality or improved OHS performance. In an attempt to investigate the effectiveness of research, this paper specifically reviews some key issues relating to OHS research in the coal industry.

Recently, several Australian organisations have made considerable funds available for occupational health and safety research activities relating to the black coal industry. To date these organisations are credited with having encouraged and sponsored several high quality research projects. Unfortunately the approach taken to identify priority research topics and to select and manage OHS research projects has, in the past, been fragmented and somewhat uncoordinated.

To address this problem, the Australian Coal Association, in collaboration with the BHP Australia Coal (Central Queensland Coal Associates) Special Research Program have sponsored the Victorian Institute of Occupational Safety and Health, Ballarat University College to undertake a commissioned study into Occupational Health and Safety in the Australian Black Coal Industry.

An Overview of The Commissioned Study

It is the intention of the Australian Coal Association, BHP Australia Coal (Central Queensland Coal Associates) Special Research Program and other Australian sponsors of research to develop a unified strategy for research aimed at solving OHS problems in the coal industry.

To achieve this goal, the commissioned study will identify priority OHS research topics for the Australian Black Coal Industry that will contribute to the development and implementation of a co-ordinated and effective OHS research strategy for the industry.

The study has the following stated objectives:

To review the international research literature from the past ten (10) years relating to occupational health and safety in three key distinct areas of the industry:

- (a) Opencut Excavations;
- (b) Underground Activities; and
- (c) Surface Processing and Support Operations.

To identify current OHS research being undertaken relating to the Australian Black Coal Industry.

To analyse the available injury, and workers' compensation claims information of the Australian Black Coal Industry over a five (5) year period to identify major OHS concerns.

To critically assess the relevance, reliability and accuracy of existing accident and injury data as a tool for identifying priority OHS problems within the industry.

To develop a costing model to accurately reflect the financial burden incurred by the Australian Black Coal Industry as a result of workplace injuries and ill health.

The initial beneficiary of the study will be the Australian Coal Association Research Program. In addition it is anticipated that findings of the study will also benefit other organisations such as

- * The BHP/CQCA Special Research Program;
- * NSW Joint Coal Board Research Program;
- * The National Occupational Health and Safety Commission; and,
- * Other organisations funding OHS research in the mining sector.

Involvement and consultation with coal mining companies, trade unions, the mining inspectorates and research funding organisations plays an essential part in this project. Project consultative groups have been established in New South Wales and Queensland, the two predominant centres of black coal mining activity in Australia. Contact is being maintained with representatives of the black coal industry in Tasmania and Western Australia.

The Study Methodology

Part One: Research Literature Review

An extensive international literature search has been undertaken. As a result, abstracts of all relevant literature relating to occupational health and safety issues inherent in surface operations, underground activities and coal processing facilities were downloaded for further analysis.

The databases and information resources accessed during the search included:

CD-ROM DATABASES - NIOSHTIC/CISILO/HSELINE/CCINFO
ACEL MICROFICHE OHS Collection
"HAYSTACK" Information Search
AUSTRALIS - International on-line searching

NUCOS/NUCOM MICROFICHE -
Australian Government Authorities Collections
Australian Tertiary Institution Collections
Australian Hospital Collections

CAT ELECTRONIC DATABASE -
Australian Tertiary Institution Collections

CAVAL ELECTRONIC CATALOGUE -
Victorian Tertiary Institution Collections

INFO-LINE OVERSEAS DOCUMENT DELIVERY -
Access to microfiche and hard copy international data

WORKSAFE AUSTRALIA MICROFICHE - OHS Information Collection

OH&S AUTHORITY - OHS Information Collection

AUSTRALIAN MINERALS FOUNDATION -
Research Catalog and Information Centre

Also the information collections of major mining companies; State mining inspectorates; and the Australian Council of Trade Unions.

Through consultation with coal industry research organisation, mining companies, trade unions, mining inspectorates and tertiary institutions, an annotated report is presently being compiled on the state of current Australian OHS research. Contact is also presently being made with research organisations associated with coal mining in other countries to establish emerging trends relating to OHS research in coal mining and coal preparation.

Part Two: Accident and Compensation Analysis

Traditionally raw accident and compensation claim frequency data has been used to identify priority OHS problems within the Australian Black Coal Industry. Such data has mostly described the trauma resulting from accidents together with background information able to clarify some of the underlying contributing factors associated with the event. Information such as the injury characteristics (e.g. type of injury, part of body etc.) and hazardous condition information (e.g. the agency of injury, the task, the equipment etc.) only provide a rudimentary expression of the OHS problems within the coal mining industry. This approach does not accurately identify the occurrence of long term losses attributed to occupational injuries and ill health.

To address this issue, the accident and workers' compensation information relating to injuries and disease in the Australian Black Coal Industry for the period 1989 to 1993 is currently being analysed. The data, comprising approximately 21,000 records have been obtained from existing data sets of the New South Wales Joint Coal Board, the Queensland Worker's Compensation Board and the mines inspectorates of Queensland, New South Wales, South Australia, Western Australia and Tasmania. Precautions have been taken to ensure that no individual claimant is identified during the analysis.

The analysis will define a risk ranking of injury and illness classifications common to the industry. The risk ranking will be expressed in terms of prevalence (relating to the frequency of occurrence of the problem); severity (relating to the cost and the potential for permanent incapacity of the injury disease); and the size of the exposed population (relating to general worker classifications).

It is anticipated that this method, based on the consequence data from workers' compensation information, will provide a more accurate indication of priority research topics than the traditional approach based on identifying key OHS problem areas using only accident frequency statistics.

The results of the analysis described above will be appraised with regard to the relevance and reliability of this method for identifying priority OHS issues for research in the Australian coal industry. Additionally an assessment will be made of the limitations of present methods employed to record, analyse and use the accident and workers' compensation data of the industry. It is expected that this process will result in recommendations being made to improve the accessibility and usefulness of the accident and injury claims information of the Australian black coal industry and the workers' compensation authorities.

Summary of Interim Findings Part One: Research Literature Review

To date approximately 3000 international research abstracts have been captured relating to occupational health and safety in coal mining. At the time of publication of this paper a large proportion of the abstracts have been analysed in relation to the volume of research on the subject; the country of origin; the topic of research; and, the nature and focus of research. A summary and discussion of the interim findings follow.

Volume of Research

Analysis of all abstracts captured suggests an increasing amount of OHS research being documented in electronic bibliographical database format.

< 1960	2%
1960 - 1969	2%
1970 - 1979	33%
1980 - 1989	49%
> 1990	15%

Table 1. Research analysis by time intervals pre-1960; 1960-1969; 1970-1979; 1980-1989; and post 1990 (n=1755).

However the results in Table 1. may be influenced by the proliferation of electronic bibliographical databases during the 1980's.

Country of Origin

The United States (USA) feature in Table 2. as the predominant publisher of OHS research relating to coal mining. This is due to either the USA undertaking most research relating to the field or more likely, USA researchers are having their works published in refereed journals and publications that have a high level of exposure and therefore are more likely to be included in the electronic bibliographical databases.

USA	67%
Europe	11%
UK	11%
CIS/Russia	4%
Canada	3%
Asia	2%
Australia	1%

Table 2. Research analysis by country or continent of origin (n=1755).

The analysis shows that Australia is poorly represented in the international literature. This is more likely due to misdirected publication of research finding in journals that are not being captured by the electronic bibliographical database systems than there being a low volume of OHS research relating to the Australian coal industry.

Topic of Research

The literature has been grouped by topic. In most situations the literature has been grouped under general categories e.g. dust and respiratory disease. Where an emerging issue is, or would be expected to be prevalent in the literature, it has been set up as a separate category e.g., diesel fume. Table 3. presents the results of the analysis by topic.

Dust and Respiratory Disease	23%
Accident Analysis	16%
Ground Support	9%
Miscellaneous Hazards	7%
Machinery Safety and Ergonomics	6%
Explosion Prevention and Control	5%
Diesel Exhaust Fume	5%
Management Systems	4%
Fire Control and Prevention	4%
Ventilation and Air Quality	4%
All Other Research Topics	16%

Table 3. Research analysis by specific topic or by general category (n=1755).

Dust and respiratory disease encompasses all coal dust, silica, other airborne particles and lung disorder literature. The accident analysis topic heading mainly represents periodic (e.g. quarterly and annual) industry accident analysis report produced by mining industry bodies and mining inspectorates, but also includes specific research projects analysing compensation claims experience and accident trends. Ground support includes any literature on roof and pillar stability in underground mining operations or high/low wall design in opencut operations. The miscellaneous hazards category represents literature relating to non-specific hazard investigation undertaken at coal mines. Machinery safety and ergonomics; explosion control and prevention; and, diesel exhaust fume categories are self explanatory. The management systems category incorporates descriptions of administrative controls such as policies and procedures; studies relating to improving safety through behavioural modification of workers; and education and training programs. Fire prevention and control and air quality and ventilation are also self explanatory. The "all other research" category combines the research categories that individually constitute less than three percent of all research reviewed. These included: electrical safety, manual handling, mine rescue, noise, lighting, personal protective equipment, chemical storage and handling, heat stress, radiation, vibration, access and egress to equipment, occupational cancers, shiftwork and stress.

The significant finding of this analysis is the predominance of dust and respiratory disease (23.2%) compared with many of the other common hazards associated with coal mining such as manual handling (2.8%); noise (1.4%); heat (0.8%); vibration (0.4%).

Nature and Focus of Research

The nature of the research literature captured has been categorised as being:

- i. **Worker health and safety related** (i.e., the attention of the literature could relate to improving the working conditions for an individual miner); or,
- ii. **Disaster related** (i.e., the attention of the literature is more related to disaster prevention or control for miners in general); or,
- iii. **General information related** (i.e., the attention of the literature relates to the general mining industry).

Worker Health and Safety Related	66%
Disaster Related	18%
General Information Related	16%

Table 4. Research analysis by nature of research (n=1755).

The results appearing in Table 4. show a large proportion of research relating specifically to health and safety issues of individual mine workers. It is suggested that the proportion appears consistent with the notion that the risk exposure due to occupational health and safety problems in mining may be greater than the risk associated with disasters. If this notion is validated, the emphasis on worker health and safety research should be maintained.

The focus of the research literature captured has been categorised as having:

- i. **An analytical focus** (i.e., where a known hazard is monitored, assessed, measured or analysed. In most cases only descriptive information is reported and little new knowledge results.); or,
- ii. **An informative focus** (i.e., where a historic information is collated and presented, again resulting in only descriptive information being reported.); or,
- iii. **An investigative focus** (i.e., where the potential risk associated with a work activity, product or the work environment is questioned and as a result, the potential hazard may be monitored, assessed, measured or analysed. In such cases, new knowledge usually results.); or,
- iv. **A preventive focus** (i.e., where a report is given of steps taken to develop, trial, demonstrate or implement control measures to reduced the risk associated with a known hazard. This type of focus adds new knowledge via an applied approach).

Analytical Focus	25%
Informative Focus	39%
Investigative Focus	15%
Preventive Focus	21%

Table 5. Research analysis by the general focus of research (n=1755).

Table 5. clearly demonstrates that historically the focus of published works relating to occupational health and safety in the coal industry have been mainly directed towards informative and analytical activities describing known problems. While these types of research do play an important role, by themselves informative and analytical research add little new knowledge and do not directly contribute to risk reduction. Therefore an opportunity exists to rectify the imbalance in OHS research in coal mining by placing greater emphasis on research initiatives with an investigative or preventive focus.

Analysis by Benchmark

At the time of preparing this paper only a limited amount of Australian research literature was captured from the international bibliographical database search. The results of an analysis by the focus of research are presented and a comparison is made with all international research literature captured (see Table 6.)

AUSTRALIAN		ALL INTERNATIONAL	
Analytical Focus	21%	Analytical Focus	25%
Informative Focus	58%	Informative Focus	39%
Investigative Focus	5%	Investigative Focus	15%
Preventive Focus	16%	Preventive Focus	21%

Table 6. Research analysis of Australian literature appearing in the international literature sets (n=19) by bench mark with all international literature (n=1755).

The Australian data represented in Table 6. is very limited, therefore no accurate conclusions are drawn. It should however be noted that a greater number of analytical and informative literature entries are represented in the limited number of Australian abstracts reviewed. Presently, several Australian databases are being reviewed therefore comment on the Australian research position compared with international research activities is reserved until the analysis is complete.

Summary and Conclusions

The Australian Coal Association and other organisations interested in OHS research in coal mining have recognised the need to select, fund and coordinate research activities to solve the industry's OHS problems. To achieve this goal, a study has been commissioned to develop a greater understanding of national and international research trend and to identify the priority OHS problems to which the workers of the Australian black coal industry are exposed.

The interim results from the collection, review and analysis of international literature and research suggests that OHS research in coal mining is increasing, however Australia is under represented in the international research databases.

Dust and respiratory research is the predominant research topic, constituting almost one quarter of all published abstracts relating to OHS in coal mining. This category of research literature is approximately eight times more common than manual handling or noise research abstracts appearing in the databases. It is anticipated that the analysis of the coal industry compensation data will verify whether the emphasis on dust and respiratory disease research is warranted.

In general terms the nature of international research has related to occupational health and safety issues and less emphasis has been placed on disaster related research and the provision of general informative reports. If these ratios can be maintained in Australia, research initiatives can benefit a larger proportion of mining industry workers.

The focus of research activities requires immediate attention to address the imbalance between the proportion of research producing descriptive outcomes and the proportion of research initiatives producing solutions to occupational health and safety problems at the coal face.

Part one of the Commissioned Study sponsored by the Australian Coal Association and BHP Australian Coal has set out to identify trends in occupational health and safety research in the coal industry. Currently most of the international literature has been analysed and interim results support a need to change the present focus of sponsored research relating to occupational health and safety in coal mining. In addition, immediate action should be taken to ensure that advice is given to the coordinators of research projects in progress to enable the findings of their projects to reach the international coal industry audience.

If the Australian coal industry intends to have an effective research program that will improve occupational health and safety in the industry it should give priority to research activities that:

- (i) Have an **inherent focus on implementing risk control measures** at the "coal face" that can be readily applied by the coal industry;
- (ii) Develop control measures **in collaboration with organisations supporting the coal industry (e.g. manufacturers of equipment)** thus providing a pathway for rapid deployment of the results of research; and,
- (iii) Investigate and validate **potential risk factors likely to have considerable impact** on the resources of the industry. Outcomes of such projects, where applicable, should link into ongoing research activities structured around (i) and (ii) above.

Finally, activities centred on monitoring OHS performance, (e.g. checking dust levels, reporting accident frequency trends, etc.) should be an integral part of the day to day operations of the coal industry. Therefore descriptive research projects should be stringently vetted to assess the proposed project's ability to introduce new knowledge and provide information for an intended application.