

Summary literature review of health issues related to NSW
mining

Report for the Mines Safety Performance Branch
NSW Department of Primary Industries

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BACKGROUND OF THE PROJECT OFFICER

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GLOSSARY

ASCC	Australian Safety and Compensation Council
IARC	International Agency for Research on Cancer
NDS	National Data Set of Compensation-based Statistics
NOHSC	National Occupational Health and safety Commission
NOSI	NOHSC On-line Statistics Interactive
OHS	Occupational health and safety
RFP	Request for proposal
TOOCS	Type of Occurrence Classification System

EXECUTIVE SUMMARY

BACKGROUND

The Wran Mines Safety Review identified, among other things, the relative lack of information on, and prevention activity in relation to, work-related disease affecting NSW miners. This project is intended as an initial step towards addressing this lack by providing literature-based information on disease problems known to be, or likely to be, affecting NSW miners and advice re priorities for further work in this area.

The overall aim of this project was to provide to the NSW Mining Industry Health Working Party a literature-based summary of the health issues relating to all sectors of the NSW mining industry that includes a recommendation on priority issues and a definition of occupational health or boundaries for the Mining Industry Health Working Party's consideration.

The specific aims were to:

- Identify occupational health hazards and issues relevant to all sectors (coal, metalliferous and extractive) of the NSW mining industry.
- Provide advice to Mining Industry Health Working Party members on the priority of each occupational health issue.
- Propose a definition of what constitutes an occupational health issue or boundaries within which the Mining Industry Health Working Party may focus.
- Recommend which of the high priority issues the Mining Industry Health Working Party should consider focussing its resources.

METHODS

This project was primarily based on a review of published information on health issues in the mining industry. A formal review of published New South Wales and Australian-focused literature was undertaken. Where the New South Wales and Australian-based literature was lacking (which was commonly the case), this was supplemented by relevant published literature from other countries, based on the assumption that many of the main health issues will be similar in the mining industries in developed countries. Workers' compensation information was used to provide information on the current burden from various conditions or exposures.

The scope of the report was essentially non-injury health issues in the NSW mining industry – that is, work-related diseases and the exposures that cause them. The approach taken in the report is based primarily on the hazards and secondarily on the conditions they cause.

FINDINGS

It is proposed that the definition of a non-injury health issue for use in the New South Wales mining industry should be essentially that used in TOOCS. That is:

“A work-related non-injury disorder is a condition that usually results from repeated or long term exposure to an agent or event; from a single exposure to an infectious agent; or from multiple or uncertain causes.”

In addition, it is proposed that all disorders arising from body stressing be included under the definition of a non-injury health issue unless the resulting disorder involves a sudden, immediate and easily identifiable acute pathology, such as a ligament tear or rupture, tendon tear or rupture, muscle tear or rupture, or dislocation or fracture. This approach would mean that most cases of back pain and nerve root irritation would be considered to be non-injury health issues.

Finally, the issue of alcohol and drug use should also be considered to fall under the definition of a non-injury health issue.

The intention of this project was for recommendations to be made that proposed a priority order for the non-injury health issues identified. This prioritization was to take into account a number of factors related to the condition and to mining. Unfortunately, most of the available information is not explicitly stratified by most of these factors. For some exposures or conditions, a logical separation can be made on the basis of some of these factors, but there necessarily remains some subjectivity and guesswork in the assessment. Fortunately, for many of the exposures or conditions, the importance of the issue is likely to be similar between sectors. On the basis of the information obtained, the conditions considered in the report were assessed on the basis of their frequency, latency and severity, taking into account some other factors where appropriate. On the basis of this, the issue was rated as High, Medium or Low, and the applicable sector (if a specific one is appropriate) was noted.

High priority exposures and related disorders are proposed to be:

- Noise causing noise-induced hearing loss;
- Vibration causing musculoskeletal disorders;
- Diesel exhaust fumes leading to respiratory disease;
- Hazardous substance exposure causing dermatitis;
- Ergonomic stressors causing musculoskeletal conditions;
- Ergonomic stressors causing back disorders;
- Ergonomic stressors causing fatigue and related disorders
- Psychosocial hazards causing mental disorders; and
- Ultraviolet radiation and skin disease.

The traditional mining-related exposures of concern – silica, coal and, to a lesser extent, asbestos – are now generally well controlled, and the resulting traditional respiratory diseases most associated with mining are almost certainly becoming far less common. Therefore, these exposure probably need to be less of a focus for current and future activity than the exposures and disorders rated more highly. Nevertheless, the disorders can cause severe disability and death, which means that exposure to traditional airborne contaminants will still need to be tightly monitored and controlled. The rating of these exposures and their associated diseases as medium priority does not reflect a lack of importance of the disorders, but the fact that control measures appear to be working well.

1 INTRODUCTION

1.1 BACKGROUND

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1.2 PROJECT AIMS

The overall aim of this project was to provide to the NSW Mining Industry Health Working Party a literature-based summary of the health issues relating to all sectors of the NSW mining industry that includes a recommendation on priority issues and a definition of occupational health or boundaries for the Mining Industry Health Working Party's consideration.

The specific aims were to:

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1.3 COVERAGE AND STRUCTURE OF THE REPORT

This report has 12 chapters. The Introduction provides information on the background to the project and the agreed scope of the study. Chapter 2 describes the methods used to obtain information and Chapter 3 provides an overview of information from various data sources. Chapters 4 to 8 consider the main hazards and resulting conditions, Chapter 9 proposes the scope and boundary of health issues and Chapter 10 presents a prioritisation of these issues. A brief conclusion is presented in Chapter 11 and the references are provided in Chapter 12.

2 METHODS

2.1 INTRODUCTION

This project was primarily based on a review of published information on health issues in the mining industry. A formal review of published New South Wales and Australian-focused literature was undertaken. Where the New South Wales and Australian-based literature was lacking (which was commonly the case), this was supplemented by relevant published literature from other countries, based on the assumption that many of the main health issues will be similar in the mining industries in developed countries. Due to the hundreds of potentially relevant publications in the international literature, preference was given to review articles and articles that were more recently published.

A similar approach was taken using information on the web. A targeted search of information from web sites of relevant government agencies and industry bodies was undertaken, but there was also a more general search of the web.

Workers' compensation information was obtained from a formal report published by Workcover New South Wales¹ and separate workers' compensation information provided in the RFP. Some further NSW information was also obtained from the workers' compensation data provided on-line by the Office of the Australian Safety and Compensation Council (ASCC)².

2.2 SCOPE

The scope of the report was essentially non-injury health issues in the NSW mining industry – that is, work-related diseases and the exposures that cause them. This included musculoskeletal conditions as long as they did not result from a single event. In addition, drug and alcohol use and conditions associated with this were covered.

Although the stated focus for this project was "health issues", the RFP specifically mentioned certain exposures as well as specific conditions. The approach taken in the report is based primarily on the hazards and secondarily on the conditions they cause. In general, this is the most logical approach to take when considering priorities for interventions, because the interventions will focus on controlling the hazards. It is difficult to be entirely consistent in the approach, but the hazard-centred focus has been used as much as possible.

The scope of the project did not include health monitoring, health surveillance, biological monitoring or environmental monitoring, so these activities are not considered in this report.

3 OVERVIEW

3.1 INTRODUCTION

This chapter considers what is known from workers' compensation and other data sources about the main non-injury health problems in NSW mining industry workers. There is also an overview of the information presented in the few publications that provide broad information on non-injury hazards in the mining industry in general.

3.2 WORKERS' COMPENSATION INFORMATION

The main sources of information on work-related disorders in the NSW mining industry are Workcover New South Wales' reports and the National Data Set of Compensation-based Statistics (NDS), which provide information on accepted claims for work-related disorders experienced by mining industry employees. NSW Workcover workers' compensation data were provided in the RFP developed by the Mine Safety Performance Branch. NSW workers' compensation information for the whole mining industry for 2004-2005 is available from a separate NSW Workcover publication, part of which was provided with the RFP. The whole publication was obtained separately from the NSW Workcover website for use in this report. National information from the NDS was obtained from through on-line searches of the NOHSC On-line Statistics Interactive (NOSI). For a number of reasons, workers' compensation information underestimates the true number of cases of work-related disorders. These reasons include that the systems only cover employees and claims that resulted in a certain minimum time off work (five or more days off work for both NSW and the NDS), that the connection between work and a health disorder is often not recognised by the worker and/or their treating doctor, and that a claim for a recognised disorder might not be made. The relative frequency of disorders should provide a reasonable indication of the more common disorders and associated exposures, but conditions such as dermatitis and asthma are probably not well covered because the connection to work is commonly not recognized.

Based on this information, the mining industry had the highest incidence rate of claims for "occupational diseases", with a rate of 9.7 claims per 100,000 persons per year, based on 157 accepted claims. Eighty per cent of these claims were for deafness. Using national compensation data for all miners in Australia, for the eight years from July 1997, there was an average of 2,544 accepted claims each year by mining industry workers. Eighty-three per cent of these claims were for injury. Of the remaining claims, 10% were for diseases of the nervous system and sense organs (primarily noise-induced

hearing loss), 2% were for diseases of the musculoskeletal system and connective tissue, and 2% were for diseases of the digestive system (nearly all hernias)². The interpretation of the data is complicated because the NDS does not cover all mining industry workers and, particularly for musculoskeletal conditions, because there can be variation as to whether a particular disorder is classified as an injury or a disease (this is discussed in a later chapter). This means that musculoskeletal disorders are certainly much more common in the mining industry than these data suggest. These results are similar whether coal-mining or non-coal mining is being considered.

Coal mining industry

Separate information is available for NSW coal mining workers through the Coal Mines Insurance Scheme. For all accepted claims, a subset of this information is provided to New South Wales Workcover. The Coal Mines Insurance Scheme has essentially the same coverage as the workers' compensation information obtained from Workcover NSW, but coverage is provided through a separate system.

Information on coal workers' compensation claims was provided with the RFP. This information covered from 1 July 2000 to 30 June 2006. However, the information from the first two years was very incomplete, so the data presented in this report come from the four-year period 1 July 2002 to 30 June 2006.

Noise-induced hearing loss was by far the most common basis for a successful workers' compensation claim by miners in the coal industry. The extent of musculoskeletal problems is hard to gauge because such disorders are sometimes classified as "injuries" and sometimes as "diseases". On the basis of the Nature coding, there were 56 successful claims for musculoskeletal disorders (and another 24 for back-related musculoskeletal problems), but the Mechanism coding suggested that there about 830 such cases, as there were 471 claims related to vibration, 300 related to overexertion, 51 related to vehicle jarring and seven related to repetitive movement, all of which usually result in a musculoskeletal disorder classified as a disease (Tables 1 and 2).

Table 1 Nature of disease in coal industry workers – accepted compensation claims, 1 July 2002 to 30 June 2006.

Nature of injury or disease	Number	%
Deafness	524	71.6
Musculoskeletal disorders ¹	58	7.9
Contact dermatitis	34	4.6
Anxiety/stress	28	3.8
Back pain and conditions ²	28	3.8
Respiratory condition /disease ³	25	3.4
Conjunctivitis	19	2.6
Other skin disease	9	1.2
Other and unspecified disease	7	1.0
Total	732	100.0

1: Includes epicondylitis (19), tenosynovitis (10), bursitis (9), tendonitis (7), fibrositis (6), arthritis / arthropathies (5) and "RSI" (2)

2: Includes "pinched nerve" (20), slipped disc (4), sciatica (2) and spondylitis (2)

3: Includes "respiratory condition" (19), "respiratory disease" (3), emphysema (2) and asthma (1)

Table 2 Mechanism of disease in coal industry workers – accepted compensation claims, 1 July 2002 to 30 June 2006.

Mechanism of disease	Number	%
Exposure to long-term sounds	525	34.6
Vehicle vibration	471	31.0
Overexertion	300	19.8
Single contact with chemical	112	7.4
Vehicle jarring	51	3.4
Long-term contact with chemical	23	1.5
Work pressure / mental stress	19	1.3
Harassment or bullying	8	0.5
Repetitive movement	7	0.5
Other	2	0.1
Total	1,518	100.0

Non-coal mining industry

NSW Workcover data on non-coal mining industry workers' compensation claims was provided with the RFP. This information covered the three-year period 1 July 2002 to 30 June 2005.

As with the coal-mining industry, noise-induced hearing loss was by far the most common basis for a successful workers' compensation claim by miners in the non-coal industry. Also as with coal miners, the extent of musculoskeletal problems is hard to gauge because such disorders are sometimes classified as "injuries" and sometimes as "diseases". On the basis of the Nature coding, there were 33 successful claims for musculoskeletal disorders (and another seven for back-related musculoskeletal problems), but the Mechanism coding suggested that there 137 such cases, as this was the number of claims arising from repetitive movement and low muscle loading (121) and vibration (16), which almost always results in a musculoskeletal disorder classified as a disease (Tables 3 and 4).

Table 3 Nature of disease in non-coal mining industry workers – accepted compensation claims, 1 July 2002 to 30 June 2005.

Nature of disease	Number	%
Deafness	150	56.0
Musculoskeletal disorders	33	12.3
Anxiety/stress ("mental disorders")	27	10.1
Respiratory condition /disease ¹	20	7.5
Dermatitis ²	12	4.5
"Pinched nerve" / sciatica / spondylitis	7	2.6
Other diseases ³	19	7.1
Total	268	100.0

- 1: Includes asbestosis (9), "other respiratory conditions due to substances (7) and silicosis (4)
- 2: Includes contact dermatitis (7) and other dermatitis or eczema (5)
- 3: Includes "other disorders of the eye (6), disorders of nerve roots, plexus and single nerves (5), other diseases of the skin (4) and other diseases (4)

Table 4 Mechanism of disease/injury in non-coal mining industry workers – probable disease cases only - accepted compensation claims, 1 July 2002 to 30 June 2005.

Mechanism of disease	Number	%
Exposure to long-term sounds	149	40.5
Repetitive movement, low muscle loading	121	32.9
Single contact with chemical	31	8.4
Work pressure / mental stress	19	5.2
Long-term contact with chemical	18	4.9
Vehicle vibration	16	4.3
Exposure to environmental heat	9	2.4
Other	5	1.4
Total	368	100.0

3.3 OTHER POTENTIALLY USEFUL DATA SOURCES

Other potentially useful information sources of information on work-related diseases in the NSW mining industry provide patchy information because the coverage of the workforce they are supposed to cover is incomplete and/or because the reporting to the system is incomplete.

The New South Wales Dust Diseases Board provides information on all forms of respiratory disease related to occupational exposure to various forms of dust (primarily asbestos and silica). However, the publicly available information is of limited use to this report because industry specific information is not currently provided³. Some occupation and industry-specific information is available on request, but there are not many relevant cases*.

The Surveillance of Australian Workplace Based Respiratory Events (SABRE) program is a surveillance scheme designed to provide an overview of work-related respiratory diseases and the causative exposures. The scheme operates in Victoria, Tasmania and New South Wales. The SABRE results provide a useful guide to the main exposures associated with recognized occupational respiratory diseases but, like the Dust Diseases Board information, industry-specific information is not currently available⁴.

3.4 OVERVIEW OF OHS ISSUES IN MINING

There are a wide range of non-injury hazardous exposures and associated disorders in the mining industry. Some are specific to a particular sector of the industry, and many are common to most or all sectors. Physical hazards commonly identified are excessive noise, vibration, heat, ultraviolet radiation from sunlight and, in mineral sands mining, ionizing radiation. Chemical hazards include mine dusts (such as silica, coal, asbestos and dusts from various metal ores), diesel exhaust fumes and welding fumes. Biological hazards are less widespread and usually a result of problems with sanitation, but can also be associated with inadequately cleaned cooling towers. Ergonomic hazards are widespread, including prolonged poor postures, manual handling of heavy equipment or other loads, shift work and fatigue. Psychosocial stressors such as remote work for prolonged periods, long shifts and exposure to serious injury incidents have been associated with drug and alcohol abuse and stress-related conditions⁵⁻⁷.

* G Berry. Submission to the mining industry working party, July 2007.

4 PHYSICAL HAZARDS

4.1 INTRODUCTION

This chapter considers diseases that arise from exposure to physical hazards.

4.2 NOISE

Loud noise is an inherent aspect of all sectors of the mining industry. This noise arises from various sources, including large machinery, power tools, high-energy impacts and the movement of large amounts of earth. The main adverse health outcome related to noise is noise-induced hearing loss, although hypertension has also been associated with exposure to excessive noise. Prolonged exposure at levels above 85db(A) is expected to result in significant hearing loss. This hearing loss typically does not become evident for many years after first exposure⁸. Noise-induced hearing loss is sometimes classed as an injury and sometimes as a disease, but is considered as a disease for the purposes of the current report.

In 2004/05, there were 125 accepted compensation claims in the mining industry for deafness. Virtually all of these would have been cases of noise-induced hearing loss. Noise resulted in just over 524 claims for deafness, which represented between 35% and 72% of all such disease claims (depending on whether the total number of disease claims is based on the Nature category or the Mechanism category) in the coal mining industry from 1 July 2002 to 30 June 2006. For the period 1 July 2002 to 30 June 2005, there were 150 claims for deafness in non-coal mining workers, which represented between 41% and 56% of all diseases claims on non-coal miners.

4.3 ULTRAVIOLET RADIATION

Ultraviolet radiation from the sun is known to increase the risk of developing skin cancer, and is potentially an important skin cancer risk factor for above ground industry workers, particularly for melanoma⁹. Ultraviolet radiation can also result in eye disease such as cataracts.

There is no information on the extent of skin disease arising from exposure of mining industry workers to ultraviolet radiation from the sun.

4.4 IONIZING RADIATION

Exposure to ionizing radiation increases the risk of developing certain types of cancer. Such exposure in mining is possible if miners are working with, or near, radioactive ores or other material. In New South Wales, the only likely such exposure is from mineral sands, which contain small amounts of radioactive uranium and thorium. The primary source of such ionising radiation is thorium, contained in monazite, which occurs as a low proportion of most mineral sand deposits. However, the minerals sand deposits in New South Wales have low proportions of monazite and so radiation levels are always likely to be well below the required standards. Other exposure can occur through uranium and thorium in zircon, but this radiation is also usually at very low levels¹⁰. There is no evidence of significant ill health arising in New South Wales miners due to exposure to ionising radiation, and such exposure is expected to be very low. However, if a case did occur, it is likely any connection to work would not be readily identified.

4.5 THERMAL STRESS

Ill health arising from exposure to thermal stress at work can be due to physically demanding work in hot underground conditions and from work on the surface in hot ambient temperatures. A range of conditions can arise, ranging from heat cramps to potentially fatal heat stroke. Australian studies have documented heat-related illness in underground¹¹ and above ground¹² metalliferous mines, and during periods of high metabolic demand in underground coal mines¹³. A heat-related skin condition, miliaria rubra, has also been found to be common in Australian miners working in hot conditions¹⁴. These studies were conducted in the tropical, northern areas of Australia, but the results are probably applicable to some areas of New South Wales in the summer. There is little useful information on work-related ill-health related to thermal stress in NSW miners. There was only one recorded compensation case in coal miners in the four years to June 30 2006, and nine cases in non-coal mining in the three years to June 30 2005, but no detail was available as to the precise health disorder that resulted.

4.6 VIBRATION

Vibration is a very common exposure for miners. Exposure occurs via vehicles and power tools. The repetitive vibration and associated recurrent small movements are a known risk factor for various musculoskeletal conditions, with vehicle vibration particularly associated with injuries of the lower back and neck, and power tools

associated with disorders of the upper limb. Vibration, primarily from vehicles, appears to be a significant cause of ill-health in New South Wales coal miners. From 1 July 2002 to 30 June 2006, there were 471 accepted claims by coal miners for disorders arising from vehicle vibration. In a similar, three-year period, there were only 16 accepted claims in non-coal miners, but it is likely that this discrepancy is at least partly due to significant under-counting, since non-coal miners can be expected to be exposed to considerable sources of vehicle vibration. Vibration-related disorders accounted for 31% (and vehicle jarring for another 3%) of claims in coal miners, and 4% of claims in non-coal miners.

5 HAZARDOUS SUBSTANCES

5.1 INTRODUCTION

This chapter considers diseases that arise from exposure to hazardous substances.

5.2 SILICA-RELATED RESPIRATORY DISEASE

Silicosis and lung cancer are the main silica-related diseases in mining workers. Silicosis is a fibrotic condition of the lung due to exposure to high levels of silica. "Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources" is classified by the International Agency for Research on Cancer (IARC) as being a definite human carcinogen on the basis of causing lung cancer¹⁵. However, there is still debate as to whether lung cancer resulting from silica exposure can occur in the absence of silicosis¹⁶.

Both coal and non-coal miners, whether working above or below ground, are potentially exposed to silica during mining work, especially in places where quartz is common. Workers in underground gold mines are particularly at risk, since the rock is usually high in quartz. Silicosis was a significant problem for miners in past decades, but as exposure levels have dropped due to improved control measures, the incidence of silicosis has also dropped. The current exposure standard for silica exposure has been in the process of revision for a number of years, and the most appropriate level for the standard is debated, but few new cases of silicosis are likely to arise from current exposures. However, silicosis can take many years (typically 10 to 20 years) to develop, so newly diagnosed cases, due to past exposures, still occur. As with asbestos-related respiratory disease, an accurate assessment of the proportion of cases due to mining exposures is not known.

Silicosis is a chronic disease that can cause considerable disability. This means that there are many (mainly retired) mining workers who currently have ill health resulting from silicosis. The number of new cases of silicosis and silica-related lung cancer is difficult to determine, as the available data sets have issues with coverage and the level of detail of information provided. For example, in the three years to 30 June 2005, there were four compensated cases of silicosis in non-coal workers; silicosis was not separately identified in the available coal mining data; and an ad-hoc analysis of New South Wales Dust Diseases Board data showed no confirmed cases of silicosis in NSW miners since

1998[†]. This issue has been considered in some detail in a recent overview of work-related respiratory disease in Australia¹⁷.

5.3 COAL DUST-RELATED RESPIRATORY DISEASE

Coal workers' pneumoconiosis and bronchitis / emphysema have traditionally been the main respiratory disease related to work in coal miners¹⁸⁻²¹. These conditions clearly do not occur in miners not exposed to coal. Coal workers' pneumoconiosis has similarities to silicosis, but is characterised by nodules in the lung that do not have the extensive fibrosis seen in silicosis.

Coal workers' pneumoconiosis and bronchitis / emphysema related to coal are not separately identified in the New South Wales workers' compensation claim information available on coal miners. However, it is clear that as dust control mechanisms have improved over many decades, the incidence and prevalence of these conditions have dropped dramatically^{22, 23}. A 2002 study of longwall coal mining in New South Wales measured dust exposures and predicted (based on United States' risk data) the prevalence of coal workers' pneumoconioses of differing severity. The predicted prevalence was much higher than the observed prevalence of 0.5% for disease ranked as ILO 1 or greater (ILO 1+), but the study suggested that cases of progressive massive fibrosis, a severe form of coal workers' pneumoconiosis, would still occur in miners who worked at the measured exposure levels for 40 years²⁴. However, with continuing improvements in dust control measures, and the effective use of respirators, it is likely the current exposure standard for coal dust exposure should prevent nearly all new significant cases developing. Therefore, despite the conditions having a long latency, it is likely that few new cases will occur in New South Wales coal miners.

5.4 ASBESTOS-RELATED RESPIRATORY DISEASE

Asbestosis, lung cancer and mesothelioma are the main asbestos-related diseases likely to arise from exposure to asbestos in miners. Asbestosis is a fibrotic condition of the lung due to exposure to high levels of asbestos. Mesothelioma is a cancer of the inside lining of the chest wall (and of some other body cavities). Miners would have been exposed to asbestos in the recent past due to its widespread use in pipe insulation and in various building materials. Asbestos is no longer used for mining-related purposes (and has not been mined in Australia for several decades) and exposure in the mining industry can be expected to now be minimal, unless old mines are being demolished or

[†] G Berry. Submission to the mining industry working party, July 2007.

refurbished. Exposure to chrysotile might still be possible if asbestos-containing brakes are fitted to a mining vehicle, although this should be very uncommon. If demolition or related work with asbestos-containing materials does occur, it can be expected to be undertaken with stringent control measures in place, so any exposure should now be very uncommon and only at extremely low levels. It is very unlikely that any accidental exposures would be at a level high enough to result in asbestosis, but such exposures could be high enough to significantly increase the risk of developing lung cancer or mesothelioma.

Despite the low chances of there being significant exposures to asbestos in the mining industry, cases of lung disease related to asbestos can still occur because of the long latency between first exposure and the onset of the asbestos-related disease, especially in the case of malignant mesothelioma. The number of cases of asbestos-related disease each year is not known with any accuracy for the mining industry. There are a number of reasons for this, but it stems primarily from the fact that, as for silicosis, the available data sets have issues with coverage and the level of detail of information provided. This issue has been considered in some detail in the recent overview of work-related respiratory disease in Australia¹⁷. From the available workers' compensation data considered above, there were nine accepted claims for non-coal miners from 1 July 2002 to 30 June 2005, and one case of mesothelioma in a coal miner in the period 1 July 2002 to 30 June 2006. An ad-hoc analysis of New South Wales Dust Diseases Board data showed seven cases of asbestos-related lung disease (all but one in non-coal mining) - asbestosis (3 cases), lung cancer (1 case), benign pleural disease (1 case), and pleural mesothelioma (2 cases) - in NSW miners since 2000[‡].

5.5 SYNTHETIC MINERAL FIBRES-RELATED RESPIRATORY DISEASE

Ceramic fibres, rock wool, slag wool and glass wool are covered by the general term synthetic mineral fibres (SMF). These materials are typically used for insulation and so miners are potentially exposed to them. Exposure can occur during construction, demolition or when making modifications or repairs to structures or piping already constructed²⁵.

Synthetic mineral fibres are classified by IARC as possibly being carcinogenic to humans²⁶. Lung cancer and mesothelioma are both suspected of being related to exposure to synthetic mineral fibres, but there is no strong evidence of this.

[‡] G Berry. Submission to the mining industry working party, July 2007.

There is no information on the extent of respiratory disease in mining workers related to exposure to synthetic mineral fibres, but the level of disease is likely to be very low.

5.6 HAZARDOUS SUBSTANCE EXPOSURE AND ASTHMA

Occupational asthma is a disorder which is characterized by bronchial hyper-responsiveness or variable airflow limitation related to workplace exposures. There is some debate as to whether only immunologically-mediated asthma should be considered to be occupational asthma, or whether asthma arising as result of workplace exposure to irritants, or exacerbation of pre-existing asthma by workplace irritants, should also be considered in the definition. There are hundreds of causes of occupational asthma, and many of these are present in the mining industry. These include wood dust, formaldehyde, welding fumes, isocyanates and various biological antigens, and occupational asthma has been documented or suspected in many different of mining²⁷⁻³². Typically, occupational asthma can be caused by relatively low exposures and relatively brief exposure durations¹⁷. There is no relevant information on occupational asthma incidence in Australia. One study found that only about 2% of the estimated number of occupational asthma cases had been properly identified as occupational asthma³⁰.

The extent of occupational asthma in the Australian community is not known, but in industrialised countries it is probably the most common work-related respiratory disorder³¹. The most recent estimates from other developed countries were that between 11% and 21% of asthma in the United States³³, 18% of asthma in males and females in Finland³⁴, and 17% (for women) and 29% (for men) of asthma in Finland³⁰ was due to occupational exposures.

The number of occupational asthma cases in the New South Wales (or Australian) mining industry is not known. The available New South Wales Workcover information suggests there were very few instances, with only one case, in a coal miner, specifically coded to occupational asthma. However, this is very likely to be a significant underestimation due to the incomplete coverage of workers by the workers' compensation system and the difficulty in recognising occupational connections to asthma occurrence.

5.7 DIESEL EXHAUST FUMES AND RESPIRATORY DISEASE

Miners have potentially significant exposure to diesel exhaust fumes, primarily from vehicles. This is the case for both open cut and underground miners, particularly the latter³⁵, and for both coal miners and non-coal miners. Diesel exhaust consists of small particulate matter, carbon monoxide, carbon dioxide and oxides of nitrogen, plus other

substances. Organic compound molecules, including polyaromatic hydrocarbons, are adsorbed onto the particulate. Diesel engine exhaust is classified as being probably carcinogenic to humans (IARC Group 2A)³⁶. Lung cancer and bladder cancer are the two cancers most strongly associated with exposure to diesel engine exhaust³⁷. Diesel fumes are not classified in terms of carcinogenicity by the National Occupational Health and Safety Commission (NOHSC – now the Australian Safety and Compensation Commission (ASCC))³⁸.

The available workers' compensation information does not provide information on the extent of ill health related to exposure to diesel exhaust. This is because the information is not presented at a detailed enough level and because the relevant conditions may well not be recognised as resulting from occupational exposures. It seems likely that a considerable proportion of miners would be exposed to diesel exhaust fumes at a range of levels, some of which would be high enough and prolonged enough to cause ill health in the long term.

5.8 WELDING FUMES AND RESPIRATORY DISEASE

Welding fumes are classified as possibly being carcinogenic to humans (IARC Group 2B)³⁹. Lung cancer is the main cancer suspected of possibly being related to exposure to welding fumes. Welding fumes are not classified in terms of human carcinogenicity by NOHSC³⁸. Welding fumes probably also cause fibrotic lung disease.

Available workers' compensation does not provide any guidance as to the prevalence or level of exposure to welding fume in either coal or non-coal mining.

5.9 OTHER HAZARDOUS SUBSTANCE EXPOSURE AND OTHER RESPIRATORY DISEASE

In addition to the exposures documented and respiratory diseases considered above, there are a range of other exposures that can result in pneumoconioses or chronic cough in miners^{21, 40-42}. The causative exposure is not always known, and the exact diagnosis not always clear or well documented, but ex-miners are often found to have a higher prevalence of cough and worse respiratory function compared to non-miners⁴³.

5.10 HAZARDOUS SUBSTANCE EXPOSURE AND DERMATITIS

Occupational contact dermatitis is a disorder of the skin resulting from exposure to substances that come into contact with the skin. It may be primarily irritant or inflammatory in nature. The hands are the most commonly affected area of the body, but the condition can occur on the skin of any part of the body that comes into contact with the causative substance⁴⁴. It can be particularly a problem on the feet of miners because they spend so long wearing boots, often in moist conditions⁴⁵. Occupational dermatitis is often persistent and difficult to treat.

Mining work potentially involves exposure to wide range of substances and conditions that cause or predispose to the development of dermatitis⁴⁶. A recent United States review found that 85% of all cases identified cases were due to one of six sources – plants, trees and vegetation (24%); acids and alkalis (16%); caustic chemicals and other chemicals (13%); miscellaneous exposures (12%); coal and petroleum products (12%); and mine dust (7%)⁴⁶. That review suggested dermatitis is a problem in all mining sectors, but that the rate is highest in non-metal mining and lowest in coal mining⁴⁶.

The number of occupational dermatitis cases in the New South Wales mining industry is not high, with 34 cases in coal miners in the four years to 30 June 2006, and 12 cases in non-coal miners in the three years to 30 June 2005. However, these numbers are very likely to be a significant underestimation due to the incomplete coverage of workers by workers' compensation systems and the difficulty in recognising occupational connections to dermatitis occurrence⁴⁷. Data from the NDS covering mining across Australia suggest that about half the cases of skin disease in Australian miners are due to contact dermatitis².

5.11 HAZARDOUS SUBSTANCE EXPOSURE AND OTHER DISORDERS

There are a range of other hazardous substances to which miners are potentially exposed. These include solvents, acids and fuels (all types of mining) and cyanide (gold mining). However, there is no information on the extent of problems specifically associated with these exposures.

There have been several reports of cancer clusters amongst New South Wales miners, but investigations in those cases proved inconclusive in terms of any relationship to work^{9, 48, 49}, and other studies have suggested a lower rate of cancer in coal miners in New South Wales⁵⁰s. One recent report suggested about 21,000 miners nationally are exposed to carcinogens, primarily in metal ore mining. However, this number is only a general estimate. No New South Wales-specific data were available⁵¹.

6 BIOLOGICAL HAZARDS

There are no important infectious disease hazards in mining in New South Wales. In the whole of Australia in the eight years from 1 July 1998, there were never more than 10, and often less than five, accepted claims per year for infectious disease in workers in the mining industry². However disease outbreaks can occur if adequate standards of hygiene are not maintained⁵².

7 ERGONOMIC HAZARDS

7.1 INTRODUCTION

This chapter considers disorders associated with ergonomic hazards in mining.

7.2 ERGONOMIC STRESSORS AND MUSCULOSKELETAL CONDITIONS

Mining workers are commonly exposed to a wide range of body stressors in much of their work. Underground miners in particular are often called upon to work in awkward positions and to work with their hands above their heads, postures known to be associated with increased risk of developing musculoskeletal disorders⁵³. Much of this exposure is unavoidable without appropriate mechanisation, emphasising the need for proper control measures to be in place in order to minimise the likelihood and extent of any musculoskeletal disorders that might result. Vibration and jarring can also result in musculoskeletal disorders, as mentioned in the physical hazards chapter. Recurrent kneeling and squatting, possibly associated with lifting, in miners has also been associated with osteoarthritis of the knee⁵⁴.

The extent of musculoskeletal diseases in the mining industry is hard to determine because of the overlap between disorders that are usually seen as musculoskeletal injuries and conditions that are usually considered to be musculoskeletal diseases. This makes data coded to the Nature of injury difficult to interpret when considering musculoskeletal disorders. There are still some definitional issues in the Mechanism coding, but the Mechanism codes are probably more consistently applied. Within the Mechanism codes, "body stressing" is the category used to identify musculoskeletal disorders, so it can be used to provide a guide as to the extent of this problem in miners.

A recent review of musculoskeletal conditions in the Australian workforce provides useful information on the mining industry⁵⁵. This review found that mining workers had a moderately high incidence of approved compensation claims for work-related musculoskeletal disorders of some form (those arising from the mechanism "Body stressing"), but some of these might be better deemed "injuries" than "diseases". There were nearly 600 such claims in the 12 month period 1 July 2002 to 30 June 2003, an incidence rate of 7.2 per 1,000 employees (compared to a high of 12.6 in the Transport and Storage industry, and a low of 1.6 in the Finance and Insurance industry).

The New South Wales Workcover data available for this report identified for coal miners 58 cases of some form of musculoskeletal disorder, but this is clearly a major underestimate, as the same data, using the Mechanism coding, identified about 830 cases due to ergonomic factors likely to result in a musculoskeletal disorder (Tables 1 and 2). The situation is similar for non-coal mining, for which 33 musculoskeletal cases were identified using the Nature variable, whereas 137 cases likely to involve musculoskeletal conditions were identified using the Mechanism coding (Tables 3 and 4).

Some more detail is available using NDS data for the whole of Australia. This shows that for the eight years from July 1 1997, there was an average of 825 cases of body stressing each year in mining industry workers. About 87% of these were classified as injuries (nearly all coded to the Nature category "Sprains and strains of joints and adjacent muscles"), 5% (about 50 cases each year) as musculoskeletal and connective diseases ("Diseases of the musculoskeletal system and connective tissue") and 6% as hernias. This emphasises the fact that most musculoskeletal disorders in the workers' compensation system are coded as injuries rather than diseases, even though "body stressing" would be expected to result in conditions usually considered to be musculoskeletal diseases. These findings and proportions are similar for all sectors of the mining industry².

7.3 ERGONOMIC STRESSORS AND BACK DISORDERS

As mentioned, mining workers are commonly exposed to a wide range of body stressors in much of their work. Much of this work involves moving heavy loads and, particularly in underground miners, this can be done using awkward or postures. These circumstances predispose to the occurrence of back disorders such as lumbar disc protrusion, lumbar (and cervical) nerve root irritation, and non-specific back pain⁵⁶. Such conditions are sometimes included in the broader musculoskeletal category, but are also sometimes coded to the available separate Nature codes. Vibration and jarring can also result in back disorders⁵³.

The extent of disorders of the back in miners is hard to determine because of the coding issues with musculoskeletal disease and injury, and between various types of musculoskeletal disorders. The New South Wales Workcover data available for this report identified 28 cases of back disorders in coal miners and seven such cases in non-coal miners, but it is likely that these numbers are major underestimates.

7.4 ERGONOMIC STRESSORS AND FATIGUE

Fatigue is a disorder in itself and also predisposes to the occurrence of physical and mental disorders, as well as increasing the risk of injury related to work. The transition to long (10 to 12 hour) shifts and prolonged periods (14 to 21 days) of continuous work in some areas of the mining industry is likely to have increased the incidence of fatigue and associated physical and mental disorders in the mining industry in recent years⁵³ and this problem remains an area of concern in Australian mining^{57, 58}. This trend to extended work hours and an increased number of days without a break from work seems unlikely to change. However, there is no firm evidence on the incidence of fatigue and fatigue-related conditions in the mining industry.

8 PSYCHOSOCIAL HAZARDS

8.1 INTRODUCTION

This chapter considers disorders associated with psychosocial exposures.

8.2 MENTAL DISORDERS

Mental disorders can arise in the mining industry due to work organisation factors, exposure to the serious injury of the worker or a colleague, long working hours, shift work, and prolonged stretches working away from family and friends in remote places⁵³.

Mental disorders appear to be a problem that needs to be considered in the New South Wales mining industry. Based on the available workers' compensation information, mental disorders were the fourth highest disease category in coal miners and the third highest disease category in non-coal miners. In the four years from July 2002, there were 28 accepted cases of anxiety or stress in the coal mining industry, and 27 such cases in the non-coal mining industry. The cause of these specific cases is not known, although work pressure, mental stress, and harassment or bullying were all identified in the New South Wales Workcover workers' compensation information used in this study. As with many other diseases, this is likely to considerably underestimate the true extent of the problem.

One specific reflection of these psychosocial hazards is alcohol and drug-related conditions. The extent of alcohol and drug use in association with work is not well known, both in the workforce as a whole^{59, 60} and specifically in the mining industry. One study of Western Australian miners in a remote area suggested an association between binge drinking and certain shift cycles and a higher overall level of alcohol intake⁶¹. The general area of alcohol use in relation to work has been recently considered in detail elsewhere^{59, 60}. These authors argue for the importance of taking a broad approach to the study of alcohol use, including alcohol intake away from work as well as before and during work. This is because the pattern of alcohol use away from work can strongly influence the impact that alcohol use has on work in terms of still being under the influence of alcohol at work, decreased productivity and increased absence from work.

The effect of alcohol and drug use can be seen in terms of effects on the health of the involved workers (injury or disease) or in terms of decreased productivity⁶⁰. It is not clear if alcohol use within the mining industry is an important problem or not. However,

it is reasonable to assume that a considerable proportion of miners in remote places would be at risk of having an excessive alcohol intake.

The 2001 National Drug Strategy Household Survey

A recent analysis of the 2001 National Drug Strategy Household Survey (NDSHS), although not specifically focussing on the mining industry, provides some information on the extent of alcohol use⁵⁹. Of all persons surveyed who were employed, 89% drank some alcohol in the previous 12 months. These were defined as “recent drinkers”. The risk from this drinking was defined as:

- “short term risky” (seven to ten drinks on any one day for men; five to six drinks on any one day for women);
- “short term high risk” (11 or more drinks on any one day for men; seven or more drinks on any one day for women);
- “long term risky” (five to six drinks per day, 29 to 42 drinks per week, for men; three to four drinks per day, 15 to 28 drinks per week, for women); and
- “long term high risk” (seven or more drinks per day, 43 or more drinks per week, for men; five or more drinks per day, 35 or more drinks per week, for women).

Using these definitions, in the mining industry, 57% of recent drinkers drank at a short term risky or high-risk level at least once per year. Thirty-three per cent drank at this level at least once per month and 9% at least once per week. Comparable values for the whole workforce were 47%, 28% and 9%, respectively.

In terms of long-term risky and high-risk drinking, 10% of mining industry workers who were recent drinkers drank at a level considered long-term risky (6%) or high-risk (4%). These percentages were lower than for the entire workforce, in which 13% of workers who were recent drinkers drank at a level considered long-term risky (9%) or high-risk (3%) (the individual percentages don't add to the total due to rounding).

For the whole workforce (not just the mining industry), riskier drinking was associated with a greater likelihood of taking days off work due to alcohol use; a greater likelihood of taking days off work due to injury or illness; a greater likelihood of going to work under the influence of alcohol; and a greater likelihood of drinking at work. The percentage of recent drinkers who had missed at least one day off work in the three months prior to the survey was not presented separately for the mining industry, but the range for all industries was between 8% (hospitality industry) and 2% (wholesale industry). On a more positive side, the mining industry had the lowest percentage (2%) of recent drinkers who had attended work under the influence of alcohol in the 12 months prior to the survey, with the highest percentage being in the hospitality industry (15%). Also, none of the mining employees included in the survey reported being afraid

at the workplace because of the behaviour of work colleague affected by alcohol or drugs, or being physically abused by such a person. The percentage of recent drinkers who reported “usually” consuming alcohol at the workplace was not presented separately for the mining industry, but the range for all industries was between 18% (hospitality industry) and 5% (services industry).

These results for the mining industry can probably be at least partly explained by the culture of mining and the work arrangements for miners in the more remote regions. Regular heavy drinking is not as common as in other industries because of the strict enforcement of rules requiring that workers not be affected by alcohol or drugs because of the potential effect this could have on safety. However, with long breaks (sometimes a week or more) between stints of work, the workers have ample opportunity to drink heavily away from work⁵⁹.

9 THE SCOPE AND BOUNDARY OF HEALTH ISSUES IN THE NSW MINING INDUSTRY

9.1 INTRODUCTION

This project was designed to examine “health issues” in the mining industry, but essentially the intention was to cover “diseases” rather than “injuries”. These terms are commonly used but rarely defined precisely. This section considers aspects of the definition of disease and proposes the scope that should be used when considering health issues in the mining industry.

9.2 FACTORS TO TAKE INTO ACCOUNT

Work-related disorders in Australia are usually coded using the Type of Occurrence Classification System (TOOCS)⁶². This is currently in its third edition. The classification system provides definitions for both injuries and diseases:

“...A work-related injury is the result of a single traumatic event where the harm or hurt is immediately apparent - for example, a cut resulting from an incident with a knife or burns resulting from an acid splash. A work-related disease, on the other hand, usually results from repeated or long term exposure to an agent or event - for example, loss of hearing as a result of long term exposure to noise; from a single exposure to an infectious agent; or from multiple or uncertain causes.”

These definitions can usefully form the basis of the definition of diseases, or health issues, when considering health disorders in the mining industry.

New South Wales Workcover uses a slightly different definition, which seems to have some minor internal inconsistencies, but the intent appears to be very similar to the TOOCS definition¹. The Workcover definition of a compensable case is:

“Diseases contracted or aggravated in the course of employment and to which the employment was a contributing factor. Occupational diseases are distinguishable from workplace and other work-related injuries by at least one of the following characteristics:

- *the slow and protracted nature of its cause;*
- *the result of a single traumatic event, for example the development of hepatitis following a single exposure to the infection or the development of conjunctivitis after;*
- *being exposed to a welding flash;*
- *repeated or continuous action of a mechanical, physical or chemical nature, not the effect of a single event but a cause acting imperceptibly and constantly the uncertain time of its beginning a possible predisposition to the development of the condition.”*

It is proposed that the definition of a non-injury health issue for use in the New South Wales mining industry should be essentially that used in TOOCS. That is:

“A work-related non-injury disorder is a condition that usually results from repeated or long term exposure to an agent or event; from a single exposure to an infectious agent; or from multiple or uncertain causes.”

In addition, it is proposed that all disorders arising from body stressing be included under the definition of a non-injury health issue unless the resulting disorder involves a sudden, immediate and easily identifiable acute pathology, such as a ligament tear or rupture, tendon tear or rupture, muscle tear or rupture, or dislocation or fracture. This approach would mean that most cases of back pain and nerve root irritation would be considered to be non-injury health issues.

Finally, the issue of alcohol and drug use should also be considered to fall under the definition of a non-injury health issue.

10 PROPOSED PRIORITY NON-INJURY HEALTH ISSUES

10.1 INTRODUCTION

The intention of this project was for recommendations to be made that proposed a priority order for the non-injury health issues identified. This prioritization was to take into account:

- frequency;
- latency;
- "demographic of the industry";
- severity, impact on health;
- sector (coal, metalliferous, extractive);
- large or small sector;
- above or below ground.

Unfortunately, most of the available information is not explicitly stratified by most of these factors. For some exposures or conditions, a logical separation can be made on the basis of some of these factors, but there necessarily remains some subjectivity and guesswork in the assessment. Fortunately, for many of the exposures or conditions, the importance of the issue is likely to be similar between sectors. In Table 5, the conditions considered in earlier chapters are listed, and an assessment made of their frequency, latency and severity, taking into account some other factors where appropriate. On the basis of this, the issue was rated as High, Medium or Low, and the applicable sector (if a specific one is appropriate) was noted.

10.2 HIGH PRIORITY EXPOSURES AND CONDITIONS

Noise, vibration, diesel exhaust fumes, hazardous substances related to dermatitis, ergonomic stressors related to musculoskeletal disorders (including back disorders), fatigue, psychosocial hazards and ultraviolet radiation are given the highest priority. All these exposures are common in all sectors, or are a particular problem in at least one sector.

Noise-induced hearing loss and musculoskeletal disorders arising from various exposures are ranked high because they appear to be common disorders in all forms of mining, can

result in considerable disability and have considerable scope for improvement through better control measures.

Whole body vibration is ranked highly because it is a widespread exposure in all forms of mining, there is scope for considerable improvement in the control of exposure in many mining tasks, it is known to be an important risk factor for musculoskeletal disorders of the lower back and neck, and there is still much to learn about the extent of risk and the optimal control measures. Localised vibration, such as from power tools, can also result in significant disability, primarily of the upper limbs.

Exposure to diesel exhaust fumes is ranked highly because this is a common exposure, especially in underground mines; the extent and risks of ill health arising from exposure to diesel exhaust fumes is still not well characterised; and diesel exhaust fumes are considered a probably human carcinogenic exposure.

Dermatitis is ranked highly because there are many exposure situations in mining that can cause dermatitis, the condition is probably much more common than the compensation statistics suggest, significant morbidity can result if the condition is not properly recognised and treated, and it is likely that many of the cases are preventable.

Fatigue is increasingly becoming recognised as a problem in many industries and to be associated with important physical and mental disorders. The widespread use of shift work in mining, and the increasing length of shifts, suggests fatigue will become an increasing problem in all sectors of the mining industry. Unfortunately, the presence of fatigue, and the associated health disorders, are hard to monitor, which means they will need to be made the focus of specific work if reliable information is to be made available for prevention purposes. Fatigue and the resulting health disorders are therefore given a high priority.

Mental disorders related to psychosocial hazards could arguably be considered to have medium priority, as the extent of exposure, and of resulting disorders, is uncertain. They are included as high priority exposures / issues because the relevant exposures are not well characterised; the associated disorders are not likely to be well-covered by the available statistics; the exposures can potentially result in significant morbidity; the exposures and associated disorders are developing an increasingly high profile in occupational health and safety in general; and these exposures and disorders are likely to increase in importance with current trends in work organisation.

Ultraviolet radiation is common exposure for above ground miners in most parts of Australia and is increasingly being recognised as an important problem in outdoor

workers in many industries. The resultant skin disease can be debilitating or, in the case of malignant melanoma or squamous cell carcinoma, potentially fatal. Skin exposure to ultraviolet radiation from the sun is potentially largely avoidable through use of appropriate personal protective equipment. These exposures are rated highly because they are very important in the above-ground sector. They are not likely to be a significant issue to below ground workers.

10.3 MEDIUM PRIORITY EXPOSURES AND CONDITIONS

It could be argued that the traditional mining-related exposures of concern – silica, coal and, to a lesser extent, asbestos – should remain high priority health issues. However, these exposures are now generally well controlled, and the resulting traditional respiratory diseases most associated with mining – silicosis, coal workers' pneumoconiosis and asbestosis, and other respiratory conditions which can result from exposure to one or more of these, or other, dusts (such as lung cancer, malignant mesothelioma, bronchitis and emphysema) - are therefore almost certainly becoming far less common⁶³. Control of these exposures must be maintained or improved, but this can be expected to occur. Therefore, these exposure probably need to be less of a focus for current and future activity than the exposures and disorders rated more highly. Nevertheless, the disorders can cause severe disability and death, and the need for a new silica standard, and the monitoring of the effectiveness of the current standard, or any new standard, will remain a priority. This means that exposure to traditional airborne contaminants will still need to be tightly monitored and controlled, but that these exposures and their associated diseases are rated as medium priority. As mentioned, this does not reflect a lack of importance of the disorders, but the fact that control measures appear to be working well.

The extent of problems arising from exposure to hazardous substances causing asthma, and to welding fumes, is not clear from any of the information available. However, occupational asthma is known to be a common work-related disorder, to occur in mining elsewhere, and to be commonly significantly under-recognised. If untreated, the condition can result in considerable long-term disability, but if identified early and managed appropriately, the prognosis for the affected worker is usually very good. Similarly, exposures associated with welding have been associated with lung cancer and chronic diseases of the lung, are probably under-recognised and should be able to be minimised with adequate control measures. These exposures are rated as medium priority rather than high priority because of the uncertainty about the prevalence of exposure. If information becomes available which suggests that a considerable

proportion of the workforce is exposed to asthmagens or welding, then it would be reasonable to give these exposures and the associated conditions a high priority.

10.4 LOW PRIORITY EXPOSURES AND CONDITIONS

Exposures and conditions rated as low priority appear not to be a significant issue because of one or more of low intensity, low frequency or low severity. However, it should be noted that there is a lack of information on exposures to many hazardous substances and of the disorders that might arise from such exposures.

Note that this rating is a relative rating, and so does not necessarily indicate that an issue rated as "Low" is unimportant. It just means that the issue is probably less important currently compared to the issues given a higher rating.

Table 5 Intensity, frequency, latency, severity, priority and key sector for main exposures and conditions.

Exposure	Condition	Intensity ¹	Frequency ²	Latency ³	Severity ⁴	Priority ⁵	Key sector ⁶
Noise	Noise-induced hearing loss	High	Common	Long	Medium	High	All
Vibration	Musculoskeletal disorders	High	Common	Medium	Medium	High	All
Diesel exhaust fumes	Bronchitis/emphysema, lung cancer	?Medium	Common	Medium	Medium	High	Underground
Hazardous substance exposure	Dermatitis	?High	Moderate	Short / Medium	Low	High	All
Ergonomic stressors	Musculoskeletal disorders (including back pain)	High	Common	Medium	Medium	High	All
Ergonomic stressors (shift work)	Fatigue and related disorders	?Medium	Common	Short and medium	Medium	High	All
Psychosocial hazards	Mental disorders, drug and alcohol use	Medium	Moderate	Short	Medium	High	All (particularly Remote)
Ultraviolet radiation	Skin cancer, cataracts	Medium	Common	Long	Medium	High	Above ground
Asbestos-related respiratory disease	Asbestosis, lung cancer, mesothelioma	Low	Common	Long	High	Medium	All
Silica-related respiratory disease	Silicosis, lung cancer, ?bronchitis / emphysema	Low	Common	Long	High	Medium	Gold
Coal dust-related respiratory disease	Coal workers' pneumoconiosis, bronchitis / emphysema	Low	Common	Long	High	Medium	Coal

Exposure	Condition	Intensity ¹	Frequency ²	Latency ³	Severity ⁴	Priority ⁵	Key sector ⁶
Hazardous substance exposure and asthma	Asthma	?Medium	?Moderate	Medium	Medium	Medium	All
Welding fumes and respiratory disease	Bronchitis / emphysema, fibrotic lung disease, ?lung cancer	?Low	Occasional	Medium	Medium	Medium	All
Thermal stress	Heat-related illness	Low	Uncommon	Short	Medium	Low	Remote western and underground
Synthetic mineral fibres-related respiratory disease	?Fibrotic lung disease	Low	Uncommon	Long	Medium	Low	All
Other hazardous substance exposure and other respiratory disease	Bronchitis / emphysema	?Low	Occasional	Long	Medium	Low	All
Hazardous substance exposure and other disorders	Various	?Low	Occasional	Various	Medium	Low	All
Biological hazards	Various infections	Low	Uncommon	Short	Low	Low	All
Ionising radiation	Malignancies	Very low	Occasional	Long	High	Low	Minerals sand mining

1: Intensity: the intensity of the exposure

2: Frequency: the frequency of exposure of miners

3: Latency: the period of time between first exposure and development of symptoms

4: Severity: the severity of the disease resulting from the exposure

5: Priority: the assigned priority of the exposure / issue

6: Key sector: the sector(s) for which the exposure / issue is particularly relevant and for which the priority is primarily proposed.

11 CONCLUSIONS

The aim of this report was to identify the main non-injury health issues in the New South Wales mining sector. This has been attempted by reviewing relevant literature and using available workers' compensation data. The identified issues have been ranked in terms of priority, taking into account how common the condition is, its severity and the latency between exposure and symptom development.

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