



FATIGUE MANAGEMENT FOR THE WESTERN AUSTRALIAN MINING INDUSTRY

GUIDELINE

FOREWORD

Comments on, and suggestions for, improvements to the Guideline are encouraged. This Guideline will be revised as appropriate.

Comments should be sent to:

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1.0 INTRODUCTION

Fatigue is a physical condition that can result when an individual's physical or mental limits are reached. This can happen following:

- Physical exertion;
- Mental exertion; or
- Inadequate or disturbed sleep.

Managing fatigue is one of the components of an overall approach to fitness for work, the others include the management of alcohol and other drugs and management of medical conditions. This guideline addresses issues associated with Fatigue Management.

The *Mines Safety and Inspection Act 1994* requires employers and employees to consult and co-operate in the workplace to identify hazards, carry out risk assessments and take steps to eliminate or control the risks to within that which is reasonably practicable.

Fatigue is a recognised potential safety and health risk factor and needs to be managed and controlled as part of the duty of care responsibilities of the employer and the employees.

For Employers this may mean:

- Ensuring employees are informed of the risks associated with fatigue and how to participate in controlling these risks;
- That working hours, shift rosters and shift cycles are structured and managed to avoid or minimise fatigue;
- Increasing surveillance to ensure that exposure to workplace contaminants, such as noise and hazardous substances, are controlled to within acceptable limits; and
- Providing conditions that are conducive to sleep and where site accommodation is provided employees are provided with a balanced diet.

For Employees this may mean:

- Ensuring that their activities outside working hours have not inhibited their ability to carry out their duties without risk to their own or to other employees' safety and health; and
- Ensuring they get adequate sleep and are not in a fatigued state before commencing a shift.

1.1 Implementing the Guideline

The Guideline for *Fatigue Management for the Western Australian Mining Industry* (hereafter referred to as the Guideline) has been developed by the Mines Occupational Safety and Health Advisory Board (MOSHAB) to provide practical guidance to employers and employees on how to control the occupational risks associated with fatigue.

This Guideline outlines how employers may:

- Conduct a risk assessment that takes into account the risk factors associated with fatigue;
- Apply control measures, as appropriate, to adequately control the risks; and
- Document details of the assessment in the mine's safety and health management plan.

The legislative framework which supports this Guideline is outlined in **Appendix A** and the process for implementing this Guideline is outlined in the flow diagram in **Appendix B**.

1.2 Definitions

For the purposes of this Guideline the following definitions apply:

Rostered Hours

The hours for which an employee is rostered to work.

Extended Working Hours

Any working hours in excess of established rostered hours, and includes overtime.

Work Cycles / Rosters

The working period scheduled between any significant break away from work. Examples include:

- Two weeks on, one week off;
- Two days, two nights on followed by four days off;
- Four weeks on, one week off, etc.

Work Schedules

The hours to be worked for each day, shift, week, month or year, as scheduled by the employer.

Work Shifts

The hours worked between the start and finish of a shift, excluding any overtime or shift change-over period worked.

2.0 PHYSICAL AND SOCIAL EFFECTS OF FATIGUE

Fatigue is tiredness that results from physical or mental exertion or insufficient sleep. Physically and mentally demanding tasks combined with extended hours of work can cause fatigue.

When individuals get less sleep than they need, they can build up what is called a “sleep debt”. Each additional day without enough sleep increases the debt, and when it becomes large enough individuals can lose concentration and become fatigued. They then need to recover the debt to overcome these effects.

In general, sleep debt is recovered about one hour every night of adequate sleep thereafter. Therefore, sleep debt is rarely recovered in one night’s sleep, and it may take several days before a person recovers from an accumulated sleep debt.

Disruptions to normal sleep routines are common with night shift employees, where the major difficulty is getting adequate undisturbed sleep during the day. The cumulative result of these disruptions is a lack of sufficient sleep, which may lead to sleep debt.

2.1 The Body Clock

Circadian rhythms, or the body clock, which repeat approximately every 25 hours, reflect many human functions including body temperature variations, hormone production levels, and natural periods of sleep and wakefulness.

Disruption of circadian rhythms through work schedules means not only that people are expected to be awake and active at an inappropriate time in the cycle, but also that environmental factors (like light and dark) that keep an individual’s cycle on track are out of kilter.

When examining these issues it is important to recognise that individuals vary in their response to disruptions of circadian rhythms, normal work and sleep routines, and disturbance of social and family life may be significant for some individuals.

2.2 Effects on Work Performance

Fluctuations in the body’s circadian rhythms may contribute to fatigue which increases the risk of human error.

Shiftwork and work schedules mean employees may be working when they normally would be sleeping, and sleeping when they would normally be working.

These disruptions impact on the quantity and quality of sleep and task performance, and may also create a sense of personal dislocation and imbalance.

Work performance may vary between day and night shifts and employees working in a fatigued or sleep deprived state may be less effective, and may place their own and others safety and health at risk, particularly:

- When operating machinery;
- When performing critical tasks that require a high level of concentration; or
- Where the consequence of error is serious.

2.3 Longer Term Effects on Health

Continued exposure to the disruptions and dislocations that result from some work schedules may have an adverse effect on the health of individuals. These effects can include:

- Gastrointestinal disorders; and
- Cardiovascular disease.

2.4 Social and Family Life

Work scheduling may influence the time available for employees to participate in social and family activities. Shiftwork employees may find it difficult to maintain a social and family life and some may neglect rest and sleep in order to be with friends or family.

The dislocation of family and social life may result in pressures on relationships, excessive domestic workloads and inability to participate in community activities. As with sleep and fatigue, this has implications for task performance and safety and health.

Equally, social lifestyle choices can result in insufficient sleep and can impact on an individual's work performance the next day.

3.0 RISK ASSESSMENT FOR FATIGUE MANAGEMENT

The degree to which fatigue impacts on safety and health depends, to a large extent, on the structure of the shift length and the shift roster, the nature of the work, commuting, sleeping arrangements in the home or at site accommodation and the lifestyle of the individual.

Under Section 10 of the *Mines Safety and Inspection Act 1994* a risk assessment must be carried out for all minesites in Western Australia and should take into account the risk factors outlined in **Section 3.1 Risk Factors**, as well as any other factors identified on the workplace.

3.1 Risk Factors

The risk assessment should take into account the following risk factors:

- Work shifts and schedules;
- Night shifts;
- Type of work;
- Commuting; and
- Potential Increased Exposure to Other Hazards.

The risks that may arise from each of these factors are outlined below.

3.1.1 Work Shifts and Schedules

The combined effects of sleep deprivation and disruption to the body's circadian rhythms may come together after some work shifts and schedules and increase the risk of fatigue.

The length of the shift and the roster design need to be determined taking into consideration all other risk factors to ensure the risk of fatigue is controlled.

Extended Work Schedules

Rostered working hours may need to be extended through additional work requirements and on-call arrangements to deal with emergency situations.

There can also be further demands on shift supervisors who are required to be present for shift handover at both ends of an operating shift.

Working long hours in any one period may have a number of effects where rostered hours include rotating shifts. Further disruption of circadian rhythms may result in:

- Lack of sleep; and
- Reduced work performance.

In situations that demand additional hours worked, consideration should be given to the risk of fatigue and to ensuring the employee is given a sufficient break to recover from fatigue effects before re-commencing work.

3.1.2 Night Shift

Disruptions to normal sleep routines are common with night shift employees, where the major difficulty is getting adequate undisturbed sleep during the day. Extended hours combined with night work may increase the problem.

Circadian rhythms can cause performance levels to vary and many aspects of human performance are at their lowest level at night. (However, the performance at any time of day can be made worse if sleep deprivation occurs.)

Sleep deprivation is most likely to accumulate when working night shifts, as daytime sleep may be of lower quality and quantity than night sleep.

3.1.3 Type of Work

Fatigue can develop following certain types of work, such as:

- Physically demanding;
- Monotonous; or
- Mentally demanding tasks.

Strenuous and physically demanding tasks can lead to fatigue over the working period purely from the nature of the work.

The physically demanding nature of some tasks, such as airleg mining, can lead to fatigue, and requires careful attention to ensure the risk is adequately controlled. While tedious or monotonous work, such as truck driving, can lead to mental fatigue and may result in the individual falling asleep while on the job.

In addition, the time of the day when the activities are carried out may also impact on an individual's ability to remain alert. For example, monitoring tasks are generally performed better during the day than they are at night. The risks associated with such tasks can be minimised by rotating the activities.

3.1.4 Commuting

A lack of adequate sleep between shifts or periods of work presents a risk of fatigue and sleep deprivation. Excessive commuting time combined with extended working hours may reduce the time available for adequate sleep and subsequently may also increase the level of fatigue.

Where substantial distances are travelled in commute, either on a daily basis or at the start and finish of the shift roster, suitable travel arrangements, adjustment of the shift length or a variation on the work undertaken in the first and last shifts should be considered.

Daily Commuting

Significant travel to and from work on a daily basis can substantially erode the off-work time available to the employee. Where this is the case, the employee risks regular sleep disturbance as the time available during the work roster to meet personal, family and community responsibilities is reduced, and adequate sleep may be compromised in order to meet these demands.

These risks are greatest where employees reside in townships at some distance from the mine, but are not long distance commute.

Long Distance Commuting

At Long Distance Commute (LDC) operations, employees are normally accommodated on-site and have a greater opportunity for adequate sleep following their shift, as they are not subject to normal domestic disturbances and distractions.

LDC work schedules and rosters may result in both the requirement to work a full shift after travelling to the site, and to travel from the site after completing a full shift, which can contribute to fatigue.

Driving can be a mentally and physically fatiguing activity for many individuals. This, combined with work-related fatigue, may pose an increased risk for some employees.

This situation may be exacerbated for some employees who commute by aircraft, when the journey to the flight departure point from their place of residence is also significant.

Employers need to take into account commuting hours both prior to commencing a shift and for that at the end of the roster period when assessing this risks.

3.1.5 Potential Increased Exposure to Other Hazards

Information on the long-term health effects and the need for adjustment of exposure standards for hazardous substances is provided from other Guidelines^{1 2}.

3.2 Risk Assessment

Risk assessment involves considering the likelihood that injury or harm to a person's health can occur and the consequence of exposure to a hazard. Identified risks are then ranked in order of significance to allow control measures to be appropriately applied.

As an initial step, a review of the mine's operating requirements should be carried out to determine:

- Required staffing levels, work schedules and shift rosters to produce the required outputs with an adequate margin of safety, accounting for all identified risks; and
- A process for monitoring safe and efficient performance.

In terms of assessing the risks, risk factors may be considered in the context of the following:

¹ Chamber of Minerals and Energy (1997) "Shiftwork and Occupational Health and Safety in the Western Australian Mining Industry: Guidelines for Workers and Management", 2nd Edition.

² Dept of Minerals and Energy Guideline (1999) "Adjustment of Exposure Standards for Extended Workshifts"

- The structure of the work schedules and rosters;
- Irregular and unplanned work schedules;
- Potential for call-out of shiftwork employees for breakdown or absences to result in sleep deprivation and fatigue;
- Shift length in relation to the physical and mental demands of the work and commuting arrangements;
- Proximity of residence or accommodation;
- Method of travel to and from work available to employees and the risk of commuting accidents;
- Environmental factors - eg. heat, humidity, noise levels, vibration etc; and
- Ability to access a balanced diet and adequate rest.

A generic risk assessment may be completed for homogeneous work groups where the risk factors are the same. However employers should ensure the assessment is valid for all employees within each group.

For further advice on risk assessment refer to the DME Guideline *Safety and Health Risk Management in Mining*.³

³ Dept of Minerals and Energy (1999) "Guideline: Safety and Health Risk Management in Mining".

4.0 RISK CONTROL

The Guideline recommends that each workplace conducts a risk assessment for fatigue and identifies and implements control strategies to minimise the risks relating to fatigue.

Employer and employee individual responsibilities should be taken into account in assessing the following risk factors, and any other factors identified during the risk assessment process.

Shift length and roster design

- Shift length and roster design should not place employees, including contractors and subcontractors, at risk of fatigue or sleep deprivation.

Type of Work

- Job rotation should be considered for repetitive or monotonous work and for work that involves heavy physical demand.
- Breaks should be scheduled appropriately for the type of work and the environmental conditions.

Commuting Arrangements

- Where employees on LDC operations are required to commence work on the day of arrival after an extended journey, account should be taken of the potential for fatigue and consideration given to shift commencement time and shift duration.
- The same consideration should be applied to travel at the end of a work roster cycle, particularly any travel in addition to the employers commute arrangements.
- Employees should participate in determining a risk control strategy when their lifestyle choices contribute to the overall risk, ie living in an area outside a reasonable distance of the commute departure centre.

Work Environment, Facilities and Services

- Extreme environmental conditions should be considered in risk control strategies.
- Camp rules and arrangements in place that contribute to providing an environment conducive to getting adequate sleep. Educating employees on maintaining good health through a balanced diet, regular exercise and adequate rest and providing access to such facilities will help manage the physical demands associated with work schedules.

Overtime Provisions

- Provision should be made to cover emergency or breakdown call-outs, and absences of rostered personnel, without introducing an additional risk.

Social and Lifestyle Factors of Employees

- Employers should inform employees who are required to work compressed, extended schedules or shiftwork of the potential for increased levels of fatigue and educated on ways they can help to control these risks.
- Where possible employees need to manage their out-of-work activities to ensure they are available for work in a non-fatigued state.

5.0 MONITORING AND REVIEW

A program of fatigue management strategy monitoring and review should be established to ensure control strategies are applied and remain valid. Reviews or changes to the fatigue management strategy should be documented in the safety and health management plan.

6.0 REFERENCES

Baker A, Fletcher A, Dawson D (1999) *Policy Guidelines for a Risk management Approach for Shiftwork*, Centre for Sleep Research, University of South Australia, Adelaide.

Department of Industry and Resources (1999) *Guideline: Adjustment of Exposure Standards for Extended Workshifts*, Western Australia.

Department of Industry and Resources (1999) *Guideline: Safety and Health Risk Management in Mining*, Western Australia.

7.0 FURTHER READING

Chamber of Minerals and Energy of Western Australia Inc. (1997) *Shiftwork and Occupational Health and Safety in the Western Australian Mining Industry: Guidelines for Workers and Management 2nd Edition*, Western Australia.

Department of Industry and Resources (2000) *Guideline – Safety and Health Risk Management in Mining*, Western Australia.

Department of Industry and Resources (1999) *Guideline – Adjustment of Exposure Standards for Extended Work Shifts*, Western Australia.

Mines Occupational Safety and Health Advisory Board (2000) *Guideline – Duty of Care in Western Australian Mines*, Department of Industry and Resources, Western Australia.

Mining and Resource Contractor Safety Training Association (1997) *Fact Sheets for Shiftworkers*, Western Australia.

Appendix A Legislative Framework

The *Mines Safety and Inspection Act 1994* sets objectives to promote and improve occupational safety and health standards. The Act sets out broad duties and is supported by more detailed requirements in the Mines Safety and Inspection Regulations. A range of guidance material, including codes of practice and guidelines, further supports the legislation. The legislative framework is set out in Figure 1

Guidance material includes explanatory documents that provide more detailed information on the method of meeting the requirements of the legislation.

Codes of practice contain practical information on how to comply with legislative requirements. They describe safe work practices that can be used to reduce the risk of work-related injury and disease. Codes of practice may also contain explanatory information.

The standards included in a code of practice may not represent the only acceptable means of achieving the standard to which the code refers. There may be other ways of setting up a safe system of work and, providing the risk of injury or disease is reduced as far as practicable, the alternatives should be acceptable.

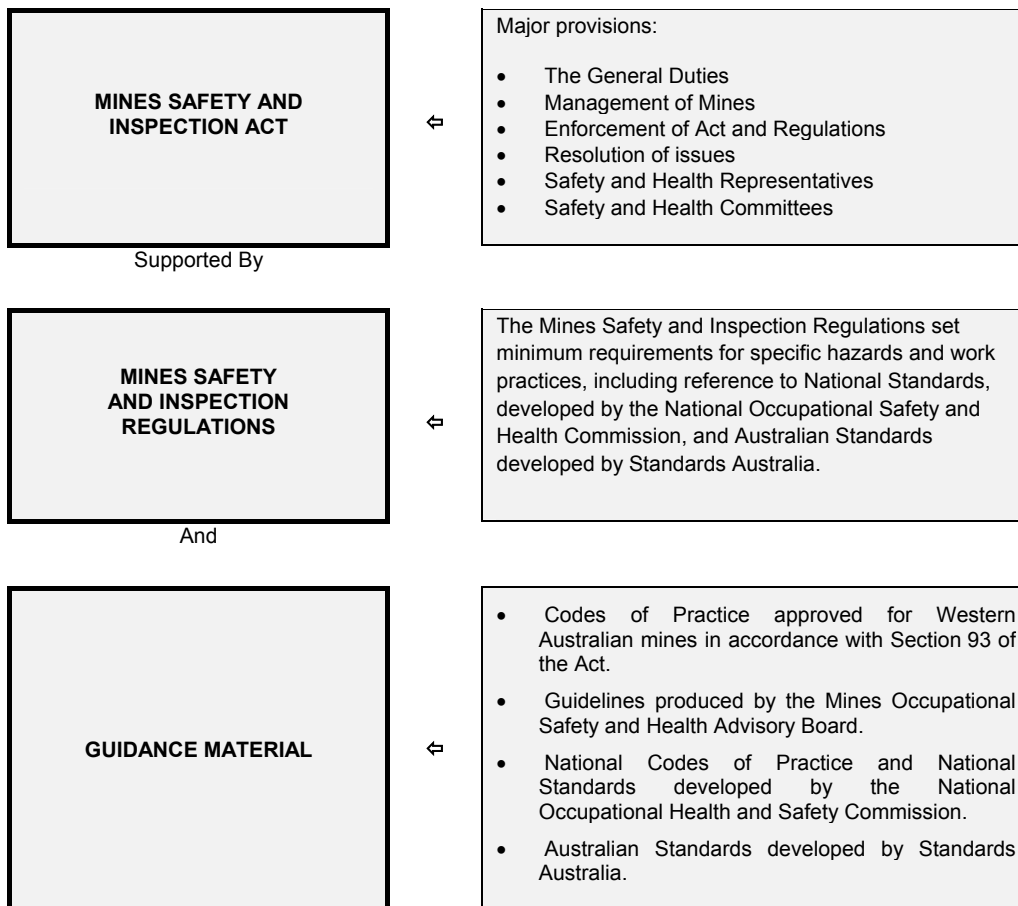


Figure 1 Legislative framework

Further information on the legislative framework can be found in the MOSHAB Guideline “*General Duty of Care in Western Australian Mines*”.

Appendix B Flow Diagram How to Implement the Guideline

