Government of **Western Australia**
Department of **Mines and Petroleum**
Resources Safety

INFORMATION SHEET

Frequently asked questions on preventing and managing fatigue on Western Australian mining operations

1. What is fatigue?

Fatigue is more than feeling tired and drowsy. In a work context, fatigue is a state of mental or physical exhaustion (or both) that reduces a person's ability to perform work safely and effectively. It may result from prolonged or intense mental or physical activity, sleep loss or extended wakefulness, or disruption of a person's circadian rhythms.

Note: Circadian rhythms (the "body clock") repeat every 24 hours or so and reflect many human functions, including body temperature variations, hormone production levels, and natural periods of sleep and wakefulness.

2. Why is fatigue a problem in the workplace?

Fatigue can lead to:

- slower reactions
- reduced ability to process information
- memory lapses
- absent-mindedness
- decreased awareness
- lack of attention
- reduced ability to identify and calculate risk
- reduced coordination.

In the workplace this can result in:

- errors and accidents
- ill-health and injury
- reduced productivity
- low team morale.

3. What does the legislation say about fatigue?

Section 9 of 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 effectively control the risks to within that which is reasonably practicable. Fatigue needs to be managed and controlled, like other hazards, as part of the duty of care responsibilities of the employer and workforce.

Note: See section 4 of the Act for the definition of "reasonably practicable".

4. Who is responsible for managing fatigue?

The duty is on employers to manage risks from fatigue. Workers also have a duty to ensure that they are fit for work (e.g. adequate sleep, well rested). While employers cannot control what workers do in their time off, fitness-for-work is an employer's legal responsibility.

A planned and systematic approach to assessing and managing the risks associated with fatigue can improve the health and safety of workers. Employers should conduct a risk assessment that takes into account the fatigue risk factors relevant to their operation and develop a fatigue management plan.

5. What does a fatigue management plan involve?

The fatigue management plan should aim to maintain alertness and guard against fatigue. It should be based on a risk assessment for the operation and consider all employees, including contractors.

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

Aspects to consider when developing the plan and its supporting policies and procedures include:

- consultation with the workforce (e.g. safety and health representatives, supervisors)
- structure of the work schedules and rosters (e.g. fly-in and fly-out days)
- type of work (e.g. machine-paced, complex, monotonous)
- irregular and unplanned work schedules
- potential for call-out of shift workers for breakdown or absences, which may 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 workers and potential for commuting accidents
- environmental factors (e.g. heat, humidity, noise levels, vibration)
- access to a balanced diet and adequate rest
- new technologies and innovations that help prevent and manage fatigue
- break and rest strategies.

The risk management guidelines that accompany Resources Safety's code of practice on working hours may be useful when assessing the hazard factors and risks to be addressed in the fatigue management plan.

6. How is fatigue measured?

Fatigue is not easily measured as it depends on a person's physiology. Rather, there are different methods for estimating the level of fatigue. In an operational context, there are practical constraints on the number of measures that can be applied, each with its own advantages, disadvantages and limitations.

Subjective measures, such as visual analogue scales, Karolinska sleepiness scale and sleep diaries, are typically easy to administer, but can be manipulated or not reflect the person's actual performance.

Objective measures include techniques for recording microsleeps, eye movement, and sleep periods and quality, or assessing the performance of simple tasks. Most are easy to administer and sensitive to changes in fatigue levels, but they can require specialist knowledge and time, which may affect operational activities.

The data acquired may also be useful when reviewing the fatigue management plan to:

- identify times of higher fatigue risk
- monitor the effectiveness of controls.

7. What can management do to prevent or reduce fatigue in the workplace?

Management strategies to address fatigue include:

- managing alertness and fatigue in the workplace by implementing a fatigue management plan for the operation, and applying the fatigue policies and procedures
- structuring and managing working hours, shift rosters and shift cycles to minimise the potential for fatigue
- informing all personnel of the risks associated with fatigue, including practical guidance on its prevention
- providing targeted training to supervisors and workers on the application of the operation's fatigue policies and procedures
- encouraging a culture where fatigue is reported to the supervisor
- supporting supervisors' decisions that are in line with fatigue policies and procedures
- consulting the workforce on changes to working hours and shift patterns that may affect the fatigue risk assessment
- considering flexible work arrangements
- where accommodation is on-site, ensuring conditions are conducive to sleep and rest by implementing clear protocols to minimise disturbances (e.g. curfews, restricted cleaning times, window treatments to block external light, comfortable beds, "no noise" zones, designated zones for shift workers) and providing workers with a balanced diet and opportunities for exercise
- introducing journey management plans
- using the continuous improvement cycle of monitoring, reviewing and modifying to maintain the effectiveness of the fatigue policies and procedures
- keeping up-to-date with technologies and strategies that help prevent and manage fatigue
- seeking expert advice if necessary
- promoting use of the operation's employee assistance program (EAP) if people encounter difficulties that affect their levels of fatigue.

8. What can supervisors do to help prevent fatigue in the workplace?

Supervisors should support management's fatigue strategy by:

- understanding the operation's fatigue management plan and how it is implemented
- overseeing compliance with the fatigue policies and procedures by:
  - assessing workers' alertness through task observation or other regular contact throughout the shift
  - ensuring workers take breaks as scheduled
  - encouraging their team to speak openly about fatigue and if they are feeling tired
- applying the fatigue policies and procedures when there is a potential risk to safety and health
- discussing fatigue-related issues at toolbox meetings
- monitoring the effectiveness of the fatigue management plan and advising management if a review is necessary
- consulting with management on fatigue-related issues.

9. What can workers do to help prevent fatigue?

To reduce the likelihood of being involved in a fatigue-related incident at work, workers should:

- comply with the organisation's policies and procedures relating to fatigue
- understand their sleep, rest and recovery needs, and ensure they obtain appropriate rest and adequate sleep away from work
- be aware that fatigue may be exacerbated by pre-existing medical conditions (e.g. sleep apnoea, diabetes, asthma, some blood disorders, depression, anxiety), excessive work demands (e.g. stress), personal circumstances (e.g. external stressors)

- be aware that the ageing process alone can reduce the quality and quantity of sleep through a variety of mechanisms, including:
  - reduced production of melatonin, which promotes sleep
  - wakening during the night due to arthritis pain or, for women, post-menopausal hot flushes
  - effects of drugs used to treat ailments such as heart disease, chronic obstructive pulmonary disease and Parkinson's disease
- seek medical advice and assistance if they have or are concerned about a physical or mental health issue that affects their sleep or causes fatigue
- assess their own fitness-for-work before commencing a shift and inform the supervisor of their fatigue levels if necessary
- talk to their supervisor or manager if they think fatigue may be affecting their ability to carry out their duties without risk to their own or other workers' safety and health
- monitor their levels of alertness and concentration while at work
- look out for signs of fatigue in workmates
- in consultation with their supervisor, take steps to manage fatigue (e.g. take a break or short nap on night shift, maintain hydration by drinking water, do some stretching or physical exercise, modify the work environment by changing the lighting or temperature)
- assess their fatigue levels after work and take appropriate commuting and accommodation options (e.g. avoid driving if fatigued)
- maintain a healthy lifestyle in and out of work hours, including regular exercise, a healthy diet and limiting their intake of alcohol and other drugs that affect alertness and ability to sleep
- be involved in company initiatives for fatigue.

10. What roster is best for reducing the risks associated with fatigue?

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 potential for fatigue. However, the diversity of mining operations in Western Australia means that there is no single optimal shift roster that suits every workplace.

Some key risk factors in shift schedule design that should be considered when assessing and managing fatigue during shift work are the workload, the work activity, shift timing and duration, direction of rotation and the number and length of breaks during and between shifts. Other features of the workplace such as the physical environment, management issues and worker welfare can also contribute to the risks associated with shift work.

Obviously, rosters and work patterns must be considered carefully and there will be many competing interests in their selection.

11. What should be considered for 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 hand-over at both ends of an operating shift. Provision should be made to cover emergency or breakdown call-outs, and absences of rostered personnel, without introducing additional risks.

In situations requiring additional hours to be worked, consider the likelihood of fatigue and ensure the person is given a sufficient break to recover from the effects of fatigue before re-commencing work.

12. What about night shift? Are there any special considerations?

Disruptions to normal sleep routines are common with night shift workers, 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 — although 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 sleep during the day time may be of lower quality and quantity than that obtained at night. It is important for night shift workers to have a favourable sleeping environment during the day to help lessen the effect of a disturbed circadian rhythm.

13. What types of work contribute to fatigue?

Some tasks contribute to fatigue over the working period purely from the nature of the work. Physically demanding tasks, such as airleg mining, and mentally demanding tasks, such as shut-downs for maintenance, can lead to fatigue, and will require careful attention to ensure this hazard is adequately controlled.

Monotonous work, such as truck driving, and mentally demanding work, such as problem solving, can lead to mental fatigue and result in the individual falling asleep on the job.

Job rotation should be considered for work that involves heavy physical demand or repetitive or monotonous work.

The time of the day when the activities are carried out can 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. In turn, breaks should be scheduled appropriately for the type of work and the environmental conditions.

14. How does commuting affect fatigue?

Excessive commuting time combined with extended working hours can reduce the time available for adequate sleep and consequently 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, consider:

- suitable travel arrangements
- adjustment of the shift length
- varying the work undertaken in the first and last shifts.

Daily commuting

Significant travel to and from work on a daily basis can substantially erode the off-work time available to the worker. Where this is the case, the worker risks regular sleep disturbance as the time available during the work roster to meet personal, family and community responsibilities is reduced. Adequate sleep could be compromised to meet these demands. The risks are greatest where workers reside in townships at some distance from the mine, but are not long-distance commuters. Strategies to help manage the risk of daily commuting when fatigued include carpooling and shuttle buses.

Long distance commuting

At long distance commute operations, workers 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.

However, work schedules and rosters at long distance commute operations can 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. Where workers are required to commence work on the day of arrival after an extended journey, consider the potential for fatigue and assess shift commencement times and shift durations. The same consideration should be applied to travel at the end of a work roster cycle, particularly any travel in addition to the employer's commute arrangements.

Driving can be a mentally and physically fatiguing activity for many individuals. When combined with work-related fatigue, this can pose an increased risk for some workers. This situation is exacerbated for some workers who commute by aircraft, when the journey to the flight departure point from their place of residence is also significant. Workers should participate in developing a risk control strategy if their lifestyle choices (e.g. living far from the commute departure centre) could contribute to the overall risk.

When assessing the risks, employers need to take into account commuting hours both prior to commencing a shift and at the end of the roster period.

15. Can working in a hot or cold environment contribute to fatigue?

Yes, fatigue can be exacerbated when working in a very hot or cold environment. Western Australia is subject to extreme environmental conditions, with temperatures ranging in places from below zero in winter to over 50°C in summer. Exposure to cold (e.g. winter in southern regions) can lead to hypothermia, but hyperthermia is considered the more significant risk (e.g. summer in central and northern regions).

When carrying out the risk assessment for the fatigue management plan, factors that can affect the potential for fatigue include:

- air temperature
- level of humidity
- air movement
- radiant heat
- duration of exposure
- level of acclimatisation
- amount and type of clothing worn
- level of hydration
- health conditions and medications.

The environmental conditions and physical wellbeing of workers should be monitored when work involves prolonged or repeated exposure to heat or cold. Employers should train workers:

- on safe work procedures for these conditions
- how to recognise the early symptoms of heat strain or hypothermia
- to report problems immediately.

16. How can I improve my quality of sleep?

Some strategies for tackling sleep deprivation, and improving the quality and quantity of sleep are listed below.

- Darken the bedroom (e.g. ensure curtains are fully drawn, turn the clock radio away from your bed).
- Activate the "silent" setting on items such as telephones and doorbells.
- Let people know that there is a shift worker sleeping (e.g. sign on door, respect your mates on the cross shift).
- Maintain the room temperature between 18 and 24°C.
- Use ear plugs and eye masks.
- Sleep in a room remote from other activities (e.g. family, other workers).
- Use background noise (e.g. air conditioner, fan) to mask outside noise.
- Avoid caffeine, alcohol, smoking and going online (or other activity that over-stimulates the brain) before bedtime.
- Use a routine similar to that of your "normal hours" before retiring to sleep.
- If sleeping becomes too difficult, get up and walk around or read for 20 minutes then try again (don't log on to the computer or other hand-held electronic device as bright light will stimulate, and not aid, your sleep regime).
- Implement camp rules and arrangements that contribute to an environment conducive to adequate rest and sleep.
- Maintaining good health through a balanced diet, regular exercise and adequate rest will help manage the physical demands associated with work schedules.

17. How can I repay my sleep debt?

If you have accumulated a sleep debt of about 10 hours over the course of a week, experts advise adding three to four hours of extra sleep over the weekend followed by an extra one to two hours per night for the following week. Follow this routine until your sleep debt has been repaid in full.

If your sleep debt has accumulated for some months, it can take a few weeks to fully repay. This can be achieved through planning a holiday with a light schedule. You could also turn off alarms and to sleep through the night until you awake naturally the next morning. Over time, you will return to the amount of sleep your body requires to awake refreshed and relaxed.

Once you have repaid your sleep debt, it is important to factor the optimal amount of sleep into your day to avoid a recurrence. Maintain a routine as far as possible, going to sleep and waking at about the same times throughout the week, or at least on working days. Days off can be used to repay sleep debt as a fall back plan. Maintaining a high quality of sleep is also vital.

18. Where can I find out more about fatigue?

There is a lot of information available online and in publications. Some useful links include:

www.dmp.wa.gov.au/15548.aspx
The Department of Mines and Petroleum's working hours code of practice was issued jointly by WorkSafe and Resources Safety in 2006.

www.safeworkaustralia.gov.au/sites/SWA
Safe Work Australia has guidance for general industry on preventing and managing fatigue, as well as a code of practice on managing the work environment and facilities.

www.resources.nsw.gov.au/safety/world-leading-ohs/fatigue

The New South Wales Department of Primary Industries' Mine Safety program has a package of fatigue resources for the mining and extractive industry, including a guide to the development and implementation of a fatigue management plan and training material. The documents on this website include practical tools for measuring fatigue and a template for a fatigue management plan.

www.hse.gov.uk/humanfactors/topics
www.energypublishing.org/browse-by-topic/topic-9
The UK-based Health and Safety Executive (HSE) and Energy Institute have extensive collections of online guidance on human factors, including fatigue and shift work.

monographs.iarc.fr/ENG/Monographs/vol98/mono98-8.pdf
The International Agency for Research on Cancer (IARC) has published a paper on shift work, including some international research studies on the effects of shift work.

www.icao.int/safety/fatiguemanagement
The International Civil Aviation Organization (ICAO) has an online site dedicated to fatigue risk management. The tools and information available include a November 2012 presentation on measuring fatigue.

www.health.harvard.edu/newsweek/Repaying-your-sleep-debt.htm
Harvard Medical School has published some useful information about sleep in an article titled "Repaying your sleep debt".

www.sleephealthfoundation.org.au
The Sleep Health Foundation is a national organisation devoted to education, advocacy and supporting research into sleep and its disorders. It has a series of fact sheets on sleep-related topics.

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Comprehensive work safety and health information provided by the Department of Mines and Petroleum can be found at:

www.dmp.wa.gov.au/ResourcesSafety

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