

Mastering Fatigue Management

For the NSW mining and extractives industry

Facilitator's Guide



Trade &
Investment
Mine Safety

Acknowledgements

This publication is an initiative of the Mine Safety Advisory Council. It was written by Stacie Kendall of the NSW Trade & Investment, Mine Safety - Industry Assistance Unit to support industry in implementing a fatigue management plan.

The technical information in this publication was reviewed by Sally Ferguson from the University of South Australia.

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Published: 12 December 2013

TRIM No: PUB13/118

ISBN: 978 1 74256 587 3

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The mastering fatigue management workshop aims to provide skills and knowledge to stakeholders of the NSW mining and extractives industries to implement fatigue management systems and to achieve their obligations in the management of fatigue. The workshop is a support resource to the *Fatigue Management Plan: A practical guide to developing and implementing a fatigue management plan for the NSW mining and extractives industry*.

The program is an initiative of the Mine Safety Advisory Council (MSAC). MSAC is the peak tripartite WHS body for the NSW mining and extractives industry that provides advice to the Minister for Resources and Energy. It has become an authoritative and credible body on WHS. This program is an MSAC initiative to resource the industry toward world leading WHS culture.

The Industry Assistance Unit is an industry resource that provides assistance to the NSW mining industry by developing and delivering education programs, site assistance, information and advice.

For assistance, email: minesafety.assistance@industry.nsw.gov.au

Program purpose statement

The purpose of this program is to provide work health and safety professionals, educators and managers the ability to assess the causing and/or contributing factors of fatigue and lead a process toward a participatory and systematic approach in the risk management of fatigue.

Program participation statement

It is expected that participants have basic professional knowledge of work health and safety and are able to influence or implement change. Participants must have some knowledge of the fatigue related issues demonstrated in the *Fatigue Management Plan: A practical guide to developing and implementing a fatigue management plan for the NSW mining and extractives industry*.

Program instructions

Program delivery instructions

This program takes a flexible approach to delivery and can be delivered as a whole package or can be broken down into modules and delivered on a module by module basis. Facilitators can select modules that are most relevant for their operation and select and combine modules according to the needs of different operational groups.

The workshop uses tools developed by the Industry Assistance Unit as exercises and these tools are available to participants to use in their operations or modify to suit. The decision to present all or some of these exercises is at the discretion of the facilitator.

It is recommended that a trained facilitator deliver this workshop, however, it is not essential. It may also be useful to utilise the skills and experience of a health or medical professional such as a hygienist, ergonomist, sleep expert or OHS nurse etc, to assist in the delivery of the program. Facilitators should be familiar with the *Fatigue Management Plan Guide* and the *Health Management Plan Toolkit*.

It is also recommended that workshop participants are not assessed, as the intention of this workshop is to raise awareness of the impact that fatigue may have on the NSW mining and extractives industry.

The program establishes a baseline from the completion of the fatigue self-assessment form that can be used by WHS committees to assess and rate their fatigue management system.

Program delivery terminology

Narration

This is the presentation of information, it can be done in the form of a verbal presentation or the information can be provided in a separate document and given to participants at the facilitator's discretion. If the facilitator is presenting the information verbally, the text does not necessarily need to be word for word. This is a starting point for facilitators and can be personalised or additional information added.

Discussion

These are set questions posed by the facilitator to the participants in order to draw out on participant's experiences and ideas.

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Exercise

This is a structured learning activity that involves participants and is guided by the facilitator to reach a desired outcome.

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Read

Have participants read through the information provided.

N

Display

Display the graphic provided to participants, through such mechanisms as a data projector or handout.

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Information

This is added information or content. The facilitator can use this extra information to either field more specific questions or to provide more depth to the topic area.

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Action

This is a prompt for facilitators to prepare a scheduled activity or exercise.

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Activity

This is a semi-directed learning action that involves the participants but is guided by the facilitator to reach an outcome, however, there is no right or wrong answer.

Introduction

The mastering fatigue management program is intensive and provides an in depth look at the physiological aspects of fatigue. The more we understand about why people fatigue and what happens when they are fatigued, the more opportunity there is to effectively manage fatigue.

Module 1 will consider:

- the driving forces of sleep and wake
- why we need to sleep.

Module 2 will address:

- the impacts of work scheduling on sleep opportunity
- the effects of monotonous tasks
- the impacts of working environments
- the risk management framework
- how to demonstrate positive duty
- how to evaluate the effectiveness of controls.

Module 3 will present an approach to implementing a fatigue management plan including:

- resources to assist with establishing shared responsibility
- implementing fatigue management through worker education and awareness campaigns
- setting up an auditable methodology for ensuring compliance and continuous improvement in fatigue management through leading indicators.

— What is fatigue?

The *Digging Deeper Report* defined fatigue as “an increasing difficulty in performing physical or mental activities” associated with inadequate sleep, extended time awake or time of day.

— Why is fatigue such an issue?

Fatigue has become an issue in the NSW mining and extractives industry with the introduction of 24 hour operations and the issue was further exacerbated with the introduction of the 12 hour shift. With increasing focus on the commuting accidents and fatalities, there is now an increase in concern about the impacts of fatigue in mining and on general road users.

— Digging Deeper Report

MSAC commissioned some research to investigate the number of hours worked and the shift arrangements in the NSW mining and extractives industry and their impacts on industry. The findings showed that NSW mining worked some of the longest hours in the world. The far west of NSW and in particular, contractors in this region, worked the longest hours in the industry. Managers, on average, worked longer than operators.

The *Digging Deeper Report* recommended that MSAC develop and deliver education and assistance programs for the industry.

— The Mine Safety Advisory Council

The *Fatigue Management Plan: A practical guide to developing and implementing a fatigue management plan for the NSW mining and extractives industry; Implement a Fatigue Management Plan; and Mastering Fatigue Management* education programs are initiatives of the Mine Safety Advisory Council to resource the industry in fulfilling their obligations under the Work Health and Safety Act and Regulations.

Facilitator can add further notes here

Fatigue management plan: A practical guide to developing and implementing a fatigue management plan

In consultation with industry representatives, MSAC developed a guide to set the industry standard for managing fatigue. This program is based on the fatigue management approach recommended in the guide.

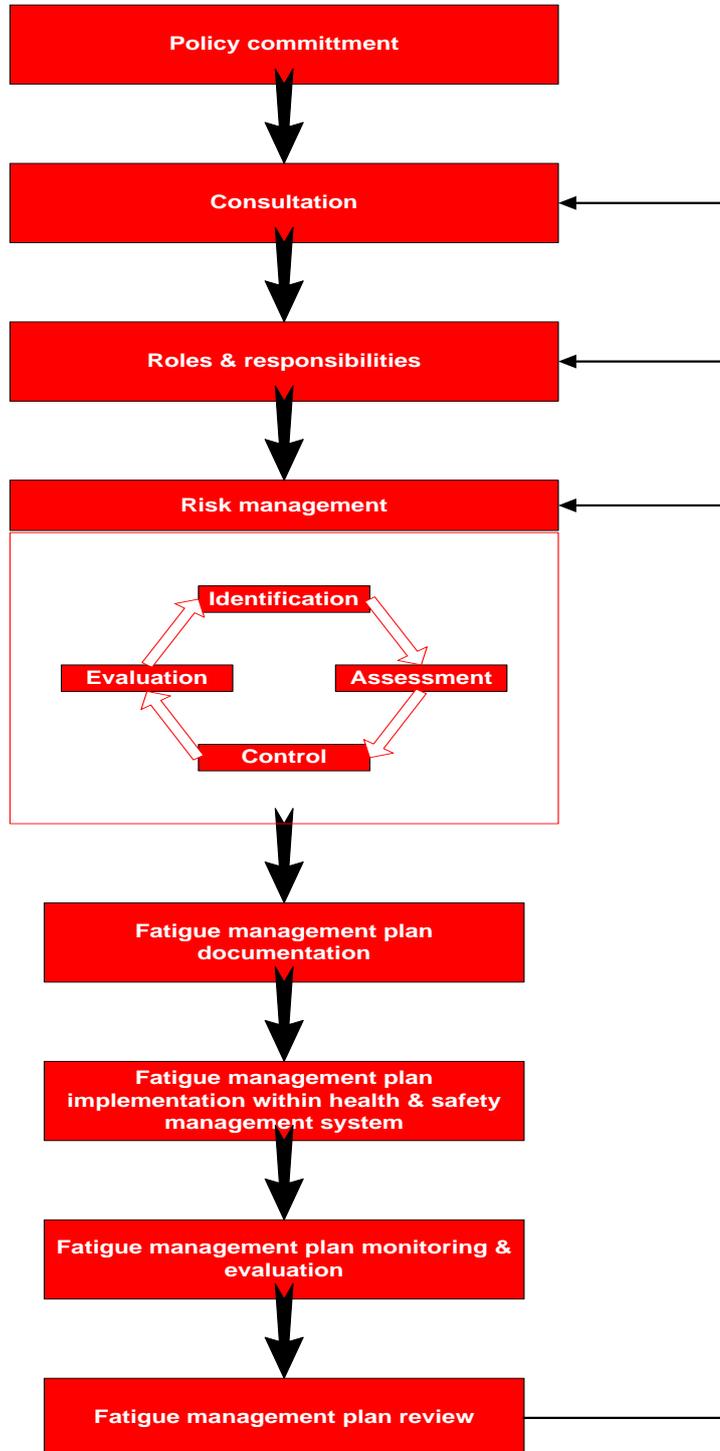


Fig 1: Fatigue management approach

Responsibilities toward managing fatigue

The health impacts of fatigue are well researched and clear links between fatigue and health related problems have been established. There are fewer good studies investigating incident risk in the workplace. But consistent trends have been identified for the hazard factors outlined in the guide (e.g. QinetiQ Centre for Human Sciences & Simon Folkard Associates Limited for the Health and Safety Executive 2006 United Kingdom).

PCBUs all have responsibilities under the *Work Health and Safety Act 2011*.

An organisation that has a system that allows a worker to undertake an activity whilst fatigued (an identified hazard no matter the origin) must manage the risk. This is the same as risks associated with any other hazard, under section 17 of the *Work Health and Safety Act 2011*.

The *Work Health and Safety Mining Regulation 2011*, identifies fatigue as a hazard and as such the regulation states that 'Mine operators must implement strategies to control any of the risks to health and safety associated with worker fatigue'.

The regulatory framework:

- imposes a shared responsibility for fatigue management (WHS general duty)
- applies a risk based approach (AS4360)
- within a safety management system (AS4801).

Facilitator can add further notes here

- 1.1 Demonstrate an understanding of the effects and consequences of fatigue.
- 1.2 Demonstrate an understanding of the nature of the causing and contributing factors of fatigue



Image: Underground workers in mine tunnel with artificial light

1.1 The effects and consequences of fatigue

- Copy the next four “Read” pages and hand this information out to participants to read through.



Option 1

Have participants read the literature review on the following pages. Divide participants into two groups.

Group A will need to read through the literature review and develop a presentation about the **Driving Forces Toward Sleep**. They will need to deliver this presentation to the rest of the group.

Group B will need to read through the literature review and develop a presentation about the **Driving Forces Toward Wakefulness**. They will need to deliver this presentation to the rest of the group.

Option 2

This information can be delivered as a narrative as part of your presentation.

Facilitator can add further notes here

3 Circadian influence

The suprachiasmatic nucleus is the site of the body's biological clock controlling our circadian (24 hour) rhythms. In the absence of time cues, the body clock continues to tick, such that the circadian rhythms of sleep, melatonin and temperature continue to cycle about every 24 hours. The light signal in the morning provides a signal to the biological clock to keep it synchronised with the external environment. Without the information from the light-dark cycle, we would drift later and later each day, a state that is called "free running".

The output from the clock drives the release of melatonin, the onset of sleep and the fluctuation in temperature and other physiological systems.

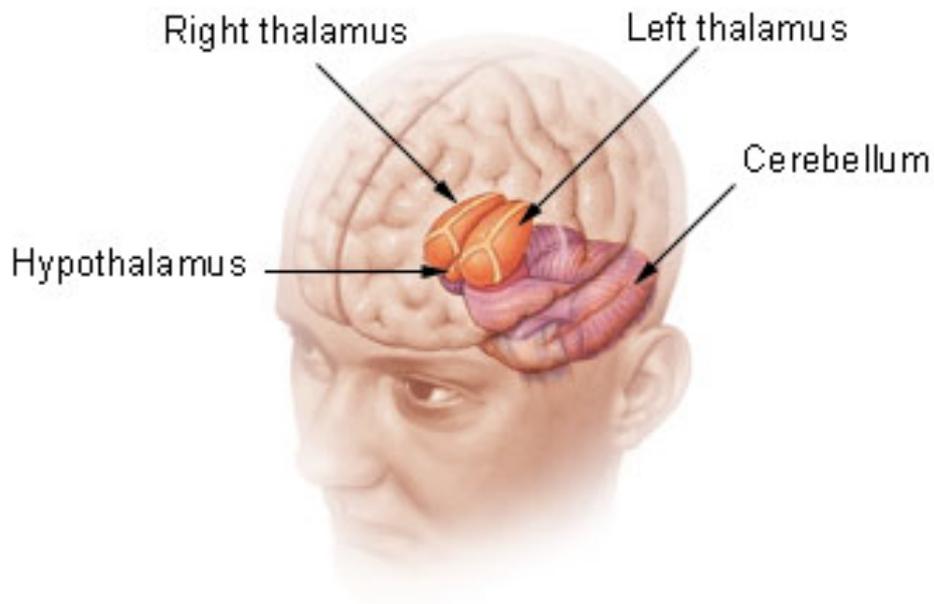


Fig 2: Location of the hypothalamus in the brain

3 Melatonin

The importance of melatonin in sleep is not only in its ability to induce sleep but to keep us asleep. The pineal gland secretes melatonin into our system. The amount of melatonin released affects the onset of sleep, the duration and the quality of sleep.

Night shift workers, work during the trough of the circadian phase. Sleeping during the day and being awake during the night will not reverse the circadian cycle. However night shift workers can improve the quality of sleep during the day if they darken their sleeping environment.

Sleep deprivation can also reduce the amount of melatonin being released. When our bodies are deprived of melatonin we fatigue more rapidly, we feel sleepy, experience reduced alertness and more sleep disruption and disturbances resulting in poor quality sleep.

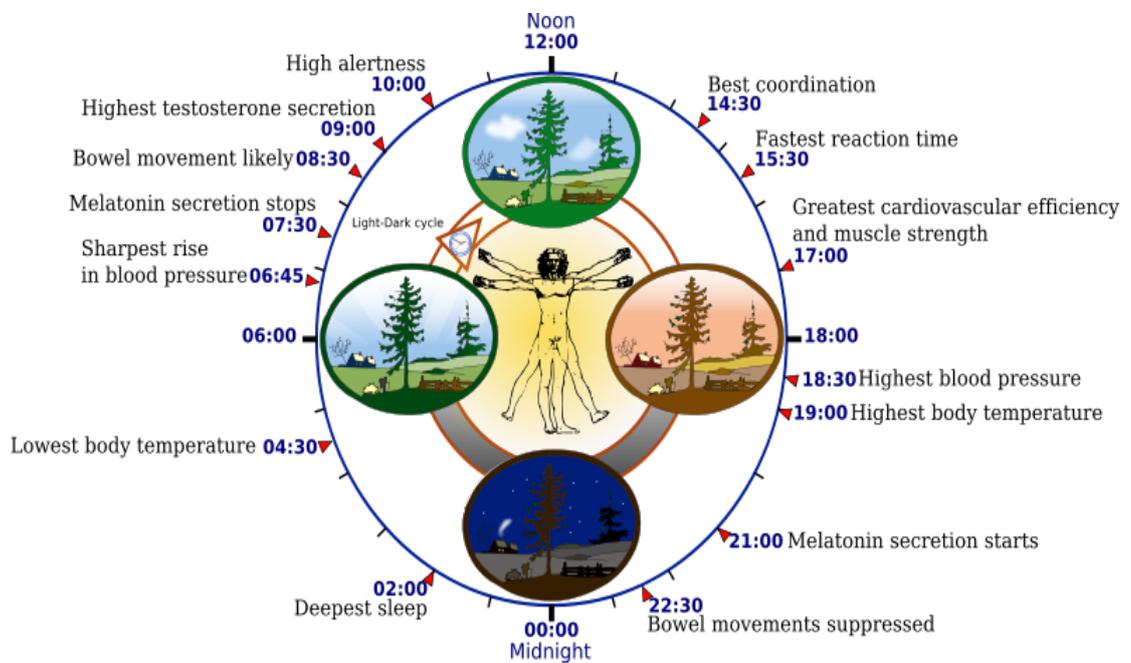


Fig 3: Circadian phases

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3 The drive for sleep and adenosine

During physical and mental activity our body metabolises Adenosine Triphosphate (ATP) for energy. This happens in muscles during physical activity as well as in the brain during mental activity. Adenosine is created as a by-product of metabolising ATP during both physical and mental activities.

We know that after heavy physical activity we need to rest to allow the muscles to replenish their energy stores. Sleep is the only way to restore the energy supply in the brain.

Mental activity

The more time we spend awake the stronger the drive for sleep and it is now understood that adenosine plays an important role in the drive for sleep. It does this by *inhibiting* the drive for wakefulness.

Studies demonstrate that an extracellular accumulation of adenosine results from local energy depletion in the area of the brain known as the basal forebrain. This is the specific area of the brain that is responsible for the detection and correction of sleep debt. One hypothesis is that the basal forebrain induces sleep in order to protect the brain from lesions due to lack of cellular energy.

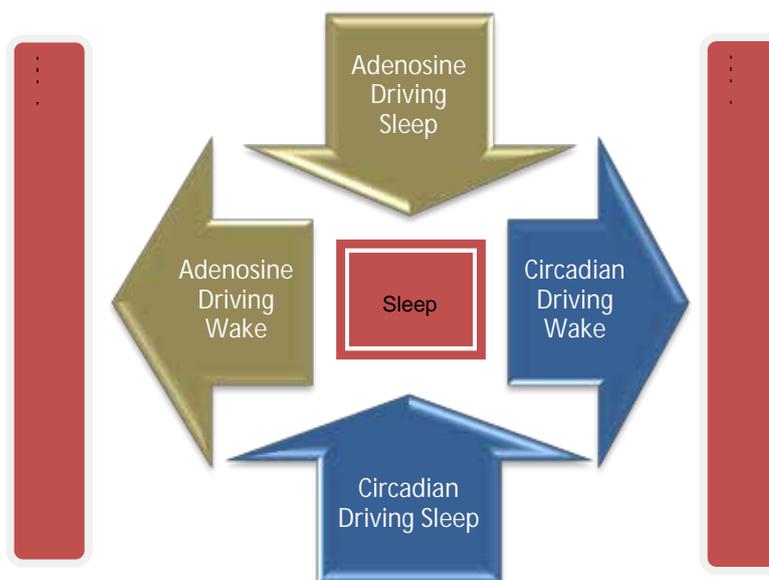


Fig 4: The drive for sleep and wakefulness

3 Homeostatic influence

Adenosine is an enzyme and acts on the A1 receptors in the basal forebrain and inhibits the release of acetylcholine which is known to promote wakefulness. This inhibition of acetylcholine release causes slow wave sleep. Stimulating the basal forebrain gives rise to acetylcholine release and induces wakefulness and REM sleep.

It is thought that the accumulation of adenosine results in an increase (or up regulation) of the A1 receptors. Sleeping processes the adenosine and reduces the build up. This results in a decrease (or down regulation) of the A1 receptors.

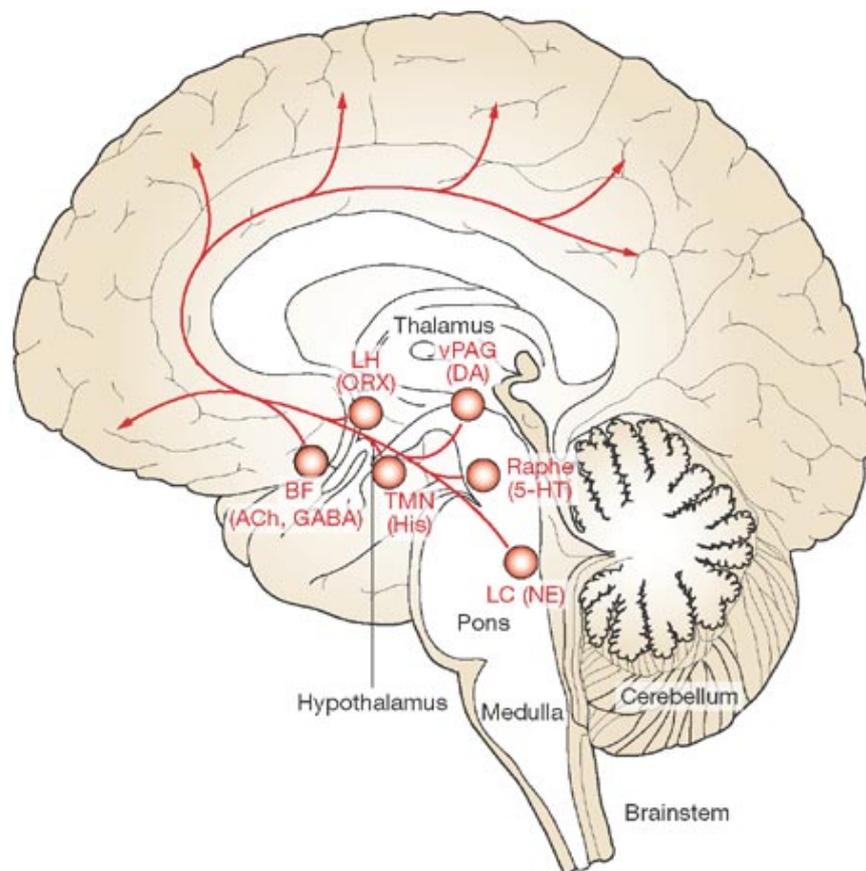


Fig 5: Key components of the ascending arousal systems in the human brain

© De Cock et al. VC (2008) Sleep disturbances in patients with parkinsonism.

Nat Clin Pract Neurol doi:10.1038/ncpneuro0775

Determining and measuring sleep

Different brain waves indicate different levels of alertness. An electroencephalograph (EEG) is a device that uses electrodes attached to a person's scalp to detect brain waves. The EEG measures the frequency of brainwaves to indicate what stage of sleep we are in. When we are awake with eyes open the EEG will detect alpha rhythms, which are at a frequency between 8 – 13 Hz. As we become drowsy EEG will detect theta rhythms where the frequency reduces to less than 8Hz but is greater than 4 Hz. Delta rhythms are less than 4Hz and are associated with Slow Wave Sleep (SWS) indicating deep sleep.

Electrooculogram (EOG) measures electrical activity associated with eye movements and is recorded by placing electrodes on the skin near the eyes. It is useful for monitoring eyeball movement in REM and non-REM sleep.

Electromyogram (EMG) measures electrical activity of muscles and is recorded with electrodes applied on the shin (this aids in diagnosing the sleeping disorder of restless leg syndrome) and/or on the chin. It is useful for assessing nerve and muscle function, and determining REM versus non-REM sleep.

There are approximately five cycles through all the stages of sleep in an eight hour sleep phase where there is no presence of sleeping disorders or sleep anomalies. Adults experience five different stages of sleep and these can be determined using the combination of EEG, EOG and EMG – Sometimes referred to as polysomnography or PSG.

Sleep states

Sleep occurs in two different states: Non-Rapid Eye Movement, involves high voltage, slow brain waves, low muscle tone and minimal psychological activity whereas in Rapid Eye Movement, the EEG is desynchronised, muscles are atonic and dreaming is typical.

Sleep onset

It is not always possible to clearly define the onset of sleep. An EEG pattern is not always associated with an individual's perception of sleep. Even when individuals may report that they are awake, clear behavioural and EEG changes can indicate the presence of sleep. Upon the transition of sleep there also appears to be short memory impairment.

Facilitator can add further notes here

Stage one

Arousal out of sleep is easiest during stage one. We may still respond to our name being said or changes in light contrast, but we are more likely to respond to smells in particular unpleasant smells and in some cases we may experience “*Hypnic Myoclonia*” or that sudden jerk or muscle twitch that arouses us out of sleep.

These pie graphs represents an eight hour sleep at an appropriate circadian phase (dark hours). Stage one of sleep is indicated in black while REM is represented in the first graph in red. Stage one tends to last between 1-7 mins throughout each cycle and as demonstrated in the pie, it does not dominate the sleeping phase.

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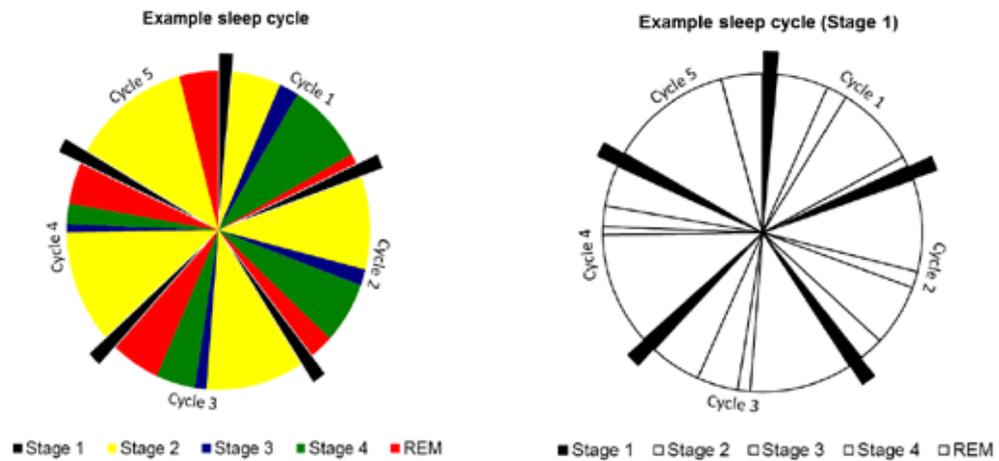


Fig 6: Stage 1 sleep cycle

Facilitator can add further notes here

Stage two

Stage two is represented here in yellow while REM is represented in the first graph in red. K-complexes and sleep spindles are indicators of stage two sleep. K-complexes are spikes of arousal during sleep and can either be triggered by some kind of external stimulus such as noise or they can be spontaneous. The “spontaneous” K-complexes tend to occur at regular intervals of between 1-1.7 mins and last less than 0.5 of a second. The K-complex is responsible for sleep arousal while at the same time it protects the individual from disturbance of sleep. In stage two sleep K-complexes are usually followed by “sleep spindles” which are short bursts of alpha waves that can last between 0.5-1.2 seconds.

So during stage two of sleep every 1-1.7 minutes we are rousing from sleep and we have some awareness to our external surroundings and we are taking in information because the sleep spindles are alpha waves, which is indicative of awareness and we have this awareness at regular intervals lasting between 0.5-1.2 seconds.

A more significant stimulus is required to wake an individual from stage two than stage one, however less stimulus is required to wake an individual in stage two than in stages three and four.

These pie graphs demonstrate the length of each period of stage two within different cycles throughout the sleeping phase. As the pie demonstrates, stage two is a dominant portion of the sleep phase. Stage two will occur for between 10-20 minutes in the first sleep cycle but as the sleep period continues stage two will occupy more time in the later cycles.

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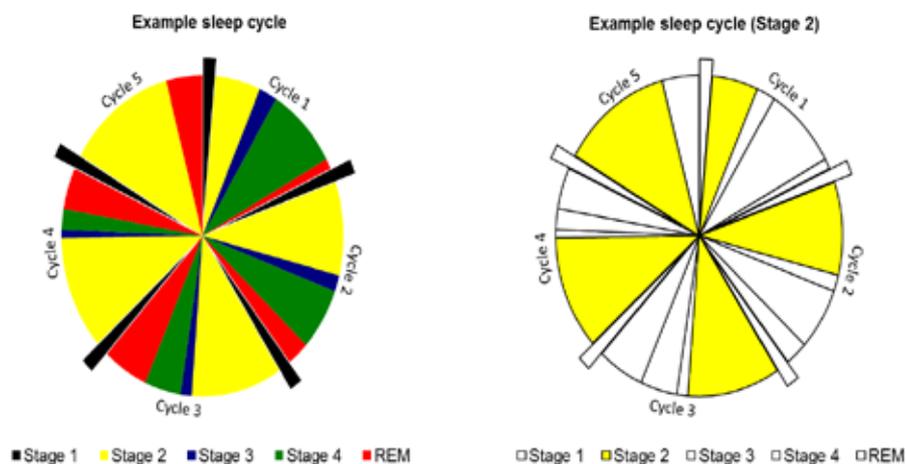


Fig 7: Stage 2 sleep cycle

Facilitator can add further notes here

Stage three

Stage three is represented here in blue while REM is represented in the first graph in red. Stage three is the transition into stage four, high voltage accounts for less than 50% but more than 20% of the EEG and brain waves decrease in frequency as stage three progresses to stage four and we begin our descent into deep sleep.

As demonstrated in the pie graphs, stage three does not make up for a large portion of the sleep phase and the time spent in stage three decreases with each cycle and in some cases may not be present in the last cycles.

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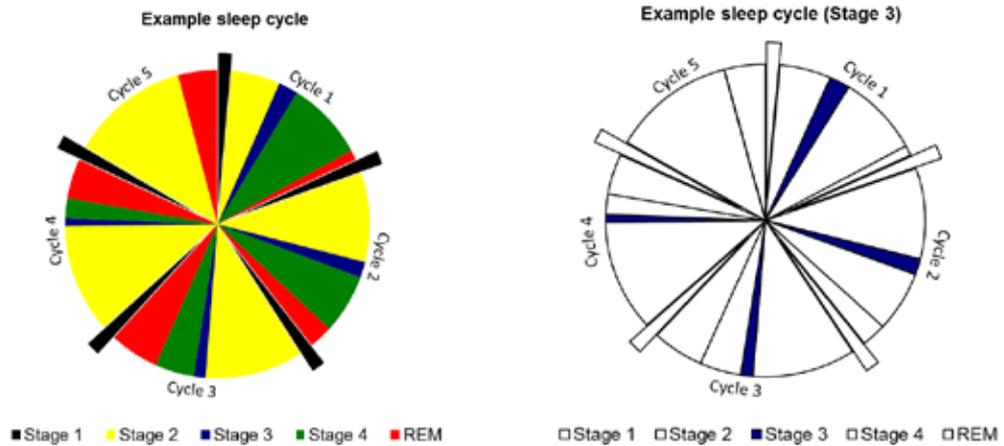


Fig 8: Stage 3 sleep cycle

Stage four

Stage four is represented here in green while REM is represented in the first graph in red. When high voltage slow wave activity makes up more than 50% of the EEG we have made the transition into stage four sleep. Stage four sleep is deep sleep. A significant stimulus is required to awaken an individual from stage four sleep. The amount of stage four sleep we get decreases with each cycle and like stage three, can phase out altogether in the later cycles.

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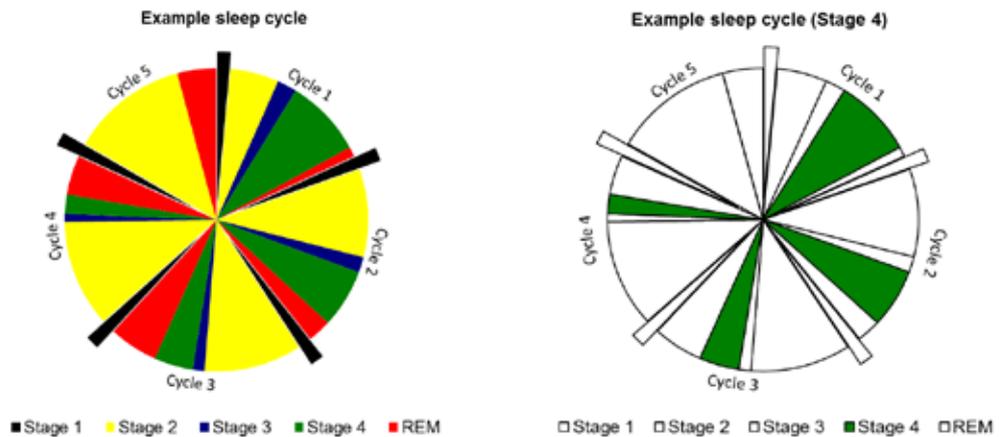


Fig 9: Stage 4 sleep cycle

REM

Rapid Eye Movement (REM), which is detected with EOG and EMG, is the other state of sleep and is when dreams typically occur. During REM we can be roused out of sleep with a stimulus or we can sometimes incorporate that stimulus into our dream. During non-REM our bodies will react to ambient temperature, if we are too cold we will shiver, if we are too hot we will sweat. However, during REM sleep we do not react to ambient temperature. Our muscles may twitch and this is where the EMG is most beneficial in determining when we have entered the REM stage. REM is represented in the graphs in red.

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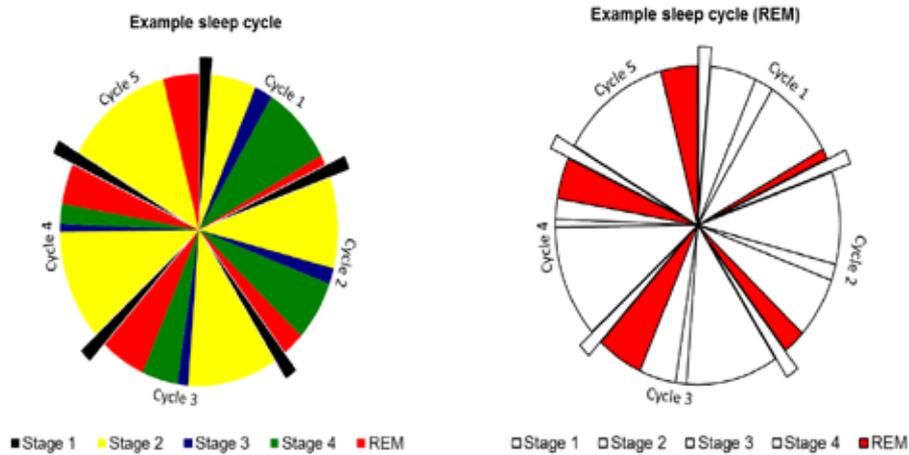


Fig 10: REM sleep cycle

How many of you have incorporated an external noise into your dream, such as an alarm?

How many people here sleep for 6 hours or less?

How do you feel when you wake up?

Do you still sleep 6 hours or less on your days off?

Facilitator can add further discussion questions here

— Sleep debt

Sleep debt is a state defined by inadequate sleep relative to what an individual needs. For example, if you have a sleep need of eight hours per night and for five nights in a row you only get six hours of sleep each night, you have an overall sleep debt of 10 hours.

A person who has a sleep debt will typically spend longer in stage four sleep which reduces the time we spend in REM and stage two. It may take more than one sleep period to fully recover from a sleep debt. If the sleep debt is not extinguished in one night, then the next night's sleep will also have a higher proportion of stages three and four. How much sleep debt an individual accumulates is difficult to track, however while there is a sleep debt we will fatigue quicker and it is possible we will wake up still fatigued.

— The purpose of sleep

Researchers can only hypothesise the purpose of sleep, through analysing what is happening in our body while we are awake after sufficient sleep and after inadequate sleep. There are probably both physiological and psychological reasons for sleep. As mentioned above sleep may protect the brain from the effects of lack of energy for essential cellular processes. We also know that sleep deprivation impairs normal mental function.

One hypothesis is that sleep may be a maintenance schedule for the information that is stored in our brain.

In simple terms, researchers suggest that during our waking periods we are taking in information and placing that information in a short term memory bank waiting for the sleep cycle where the information will be further analysed, encoded and stored with procedures established for easy retrieval where necessary.

Sleep may therefore allow the withdrawal, processing and storage of information in a very sophisticated biological filing system.

It is also thought that sleep conducts a scan of old information, decodes some of that information and compresses critical aspects of that information.

Who here has drug and/or alcohol testing on their site?

— What is the process if someone is found to have a positive reading?

Do we treat impairment from fatigue differently and if so why?

Can we measure impairment from fatigue?

Facilitator can add further discussion questions here

— Safety effects (short term consequences)

Lack of quality sleep impairs an individual's ability to adequately make judgements, recall information, and react to changes in situation in a timely manner and make well considered decisions.

Klein's theory of naturalistic decision making proposes that fatigue has five dimensions of effect on decision making;

1. **Situation awareness** – fatigue produces a tunnelling effect on attention and reduces our ability to sustain attention control, makes us more distractible i.e. our attention roams.
2. **Memory** – performance degrades because of a loss of transfer of situation awareness to short term memory. Attention lapses (even micro-sleeps) create gaps in information and therefore our situation awareness is not complete.
3. **Simulation ability** – this is the ability to imagine different future consequences based on the information we take in from the immediate situation and information we have stored in our memory which may be relevant. When we are fatigued, we explore a smaller number of possibilities and we have difficulty distinguishing between prominent as opposed to relevant information.
4. **Performance insight** – the ability to self-monitor performance is profoundly affected by fatigue. We lose the stop - check – do cycle.
5. **Emotional control** – tired people are grumpy and this has the potential to change the emotional characteristics of the environment - talk less, less likely to report bad news. Fatigue also steepens the authority gradient and supervisors may be less likely to explore alternative options and say 'just do it' and subordinates may be less likely to report.

Facilitator can add further notes here

Health effects (long term consequences)

Not having adequate quality and quantity of sleep has adverse effects on an individual. But what are the effects of fatigue, is it just sleepiness that we need to be concerned with?

Lack of quality sleep can impact an individual's health. Recent studies have shown that:

- blood glucose levels rise in individuals that are sleep deprived. Prolonged sleep loss could be a risk factor for type II diabetes and related health issues.
- individuals who are sleep deprived experience changes in snacking behaviour, snacking more frequently and opting for less desirable food options. This snacking behaviour can increase the likelihood of the sleep deprived individual developing obesity and increase the risk of health issues associated with obesity, including developing sleeping disorders such as Obstructive Sleep Apnoea.

There is also evidence that heart disease and rates of some cancers are increased in individuals who work shift work. It may not be the shift work itself which is responsible for increased risk to these diseases, but poor coping behaviours.

Does your approach to fatigue management take into account the long term health consequences?

Facilitator can further discussion questions here

1.2 Causing and contributing factors to fatigue

What causes fatigue

Fatigue is a multi-factorial hazard. It is difficult to isolate a single factor and in fact there may be several factors contributing to the onset of fatigue.

Fatigue arises from time awake (drive for sleep), time between shifts (recovery), time of day (circadian phase) and length of reset breaks (opportunity to pay back any fatigue debt).

Level of alertness at any given time is affected by the sleep/wakefulness drives which are physiologically regulated, and the time awake. Time awake is mediated through different mechanisms, but the homeostatic mechanism is one of the strongest drivers. We can only sustain vigilance for a given amount of time. That is, once the drive for sleep has built up sufficiently over a period of wake, we cannot resist sleep.

Facilitator can add further notes here

- 2.1 Systematic approach to fatigue risk management
- 2.2 Identifying and assessing fatigue risks
- 2.3 Managing fatigue risks
- 2.4 Investigating fatigue in incidents
- 2.5 Evaluating fatigue controls



Image: Heavy equipment in use at an above ground coal mine

2.1 Systematic approach to fatigue risk management

Managing fatigue risks systematically

Consultation forms the foundation of the systematic management of fatigue risks. Risk management encompasses the identification, assessment, control and evaluation of hazards that pose a meaningful risk to the health and safety of employees/workers (including contractors and visitors to the workplace).

Identifying fatigue hazards involves identifying the activities, environment or systems of work that may pose a risk.

Assessing fatigue risk is the process of determining the extent of the risk arising from exposure to the hazard.

Controlling fatigue risks is the process of addressing the risk by eliminating, preventing or minimising its effect.

Evaluating fatigue controls is the process of checking the extent to which the control measures have been successful.

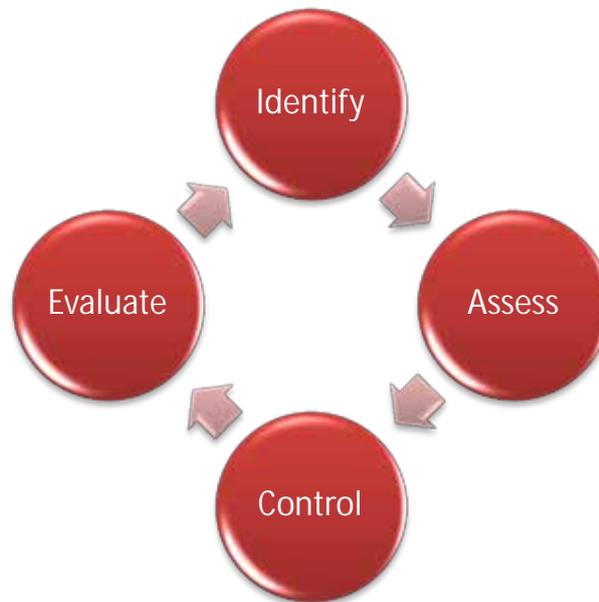


Fig 11: Systematic management of fatigue risks

Facilitators can add further notes here

2.2 Identifying and assessing fatigue factors

— Identification of fatigue risks

We have considered the contribution of sleep and wake to the development of fatigue. There are other work environment and job demand factors which may further contribute to fatigue or compound the effects of fatigue on mental and physical performance.

facilitator can add further notes here



The following activity can be useful in identifying fatigue issues. In the space below, provide details on how you use these activities to identify fatigue issues.

Consultation

How do you use consultation to identify fatigue?

- Committees
- Toolbox talks
- Reporting procedures

Observation

How do you use observation to identify fatigue?

- Change in mood
- Errors in tasks
- Forgetfulness

Evaluation

How do you use evaluation/s to identify fatigue?

- Behaviour checklist
- Testing games

The identified fatigue risk factors for NSW mining and extractives

The factors that can cause or contribute to fatigue in the NSW mining industry have been identified as:

- Work scheduling and planning
 - Night shift
 - Shift length
 - Working times
- Physical and mental demands of work
- Working conditions
- Commuting times
- Individual, non-work related factors.

There are two aspects to the risk relating to fatigue:

- the risk of developing fatigue
- the risk associated with being fatigued.

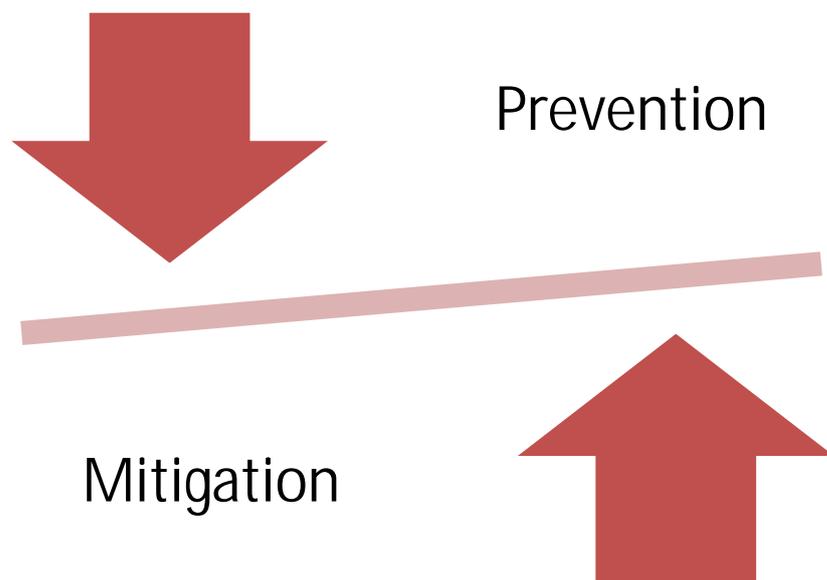


Fig 12: The prevention and mitigation of fatigue

Facilitators can add further notes here

Scheduling and planning

Work schedules can impact on an individual's opportunity to gain full restorative sleep. Understanding why and how an individual needs sleep is important when designing work schedules and planning work tasks to ensure they have the capacity to complete work schedules or planned tasks at work.

Understanding the impact of circadian rhythm and the drive for sleep can help plan the way work tasks and schedules are organised. Remember work demands (under and overload) can influence fatigue related errors.

Work scheduling impacts sleep debt recovery. The sleep debt must be repaid and work scheduling may not allow enough sleep opportunity to repay the sleep debt. If the sleep debt is not repaid the debt is recycled to the next sleep period where further sleep debt may be added.

Sleep debt

Sleep debt is the gap between the amount of sleep you need and the amount of sleep you obtain.

Sleep debt recovery

The only way to overcome a sleep debt is to have adequate sleep and to get this we need enough opportunity under the right conditions. This opportunity is referred to as sleep opportunity. Work scheduling can impact on an individual's ability to get enough sleep.

Sleep opportunity

Sleep opportunity is the time available for us to get sleep. The more opportunity we have to acquire sleep the more likely we are to acquire sleep, however increased sleep opportunity does not guarantee quality sleep.

Facilitators can add further notes here

— Fatigue and shift length

The more hours we spend at work, the less hours we have for sleep opportunity, also, as we spend more time at work, the need for sleep increases.

There is no work-to-sleep ratio that is practical for every individual, as each individual has different needs for sleep. Factors that may impact on an individual's sleep needs are age and type of occupation.

The more fatigued we become, the more we need to recover. Longer working hours require longer recovery periods, for example: a 12 hour shift will take longer to recover from than working than an eight hour shift because there are four extra hours that you have worked and need to recover from.

† Fatigue and shift length

The follow risk rating graph for risk assessing shift length was taken from the MSAC Risk Management Chart. Draw a line on the area that best represents your shift length. What rating is your shift length?

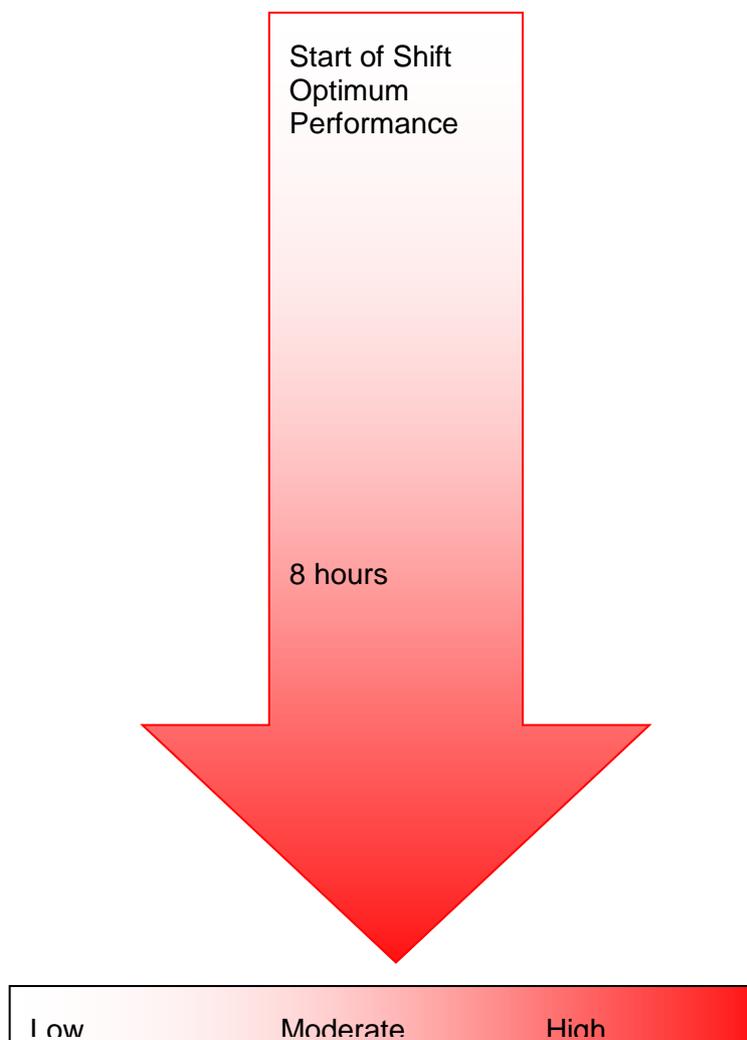


Fig 13: Fatigue and shift length



Complete the following worksheet by writing your planned working hours in the relevant fields.

Monthly Working Hours x 3 Months Working Hours								
Month 1	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total weekly working hours
Week 1								
Week 2								
Week 3								
Week 4								
Total working hours for month 1								
Month 2	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total weekly working hours
Week 1								
Week 2								
Week 3								
Week 4								
Total working hours for month 2								
Month 3	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total weekly working hours
Week 1								
Week 2								
Week 3								
Week 4								
Total working hours for month 3								
Total Working Hours for 3 month period								

† The following graphs for risk assessing time at work were taken from the MSAC Fatigue Risk Management Chart.

† Daily hours

Using the risk rating graph below, rate your risk of fatigue based on your planned daily hours of work. Indicate by drawing line from top to bottom in the arrow where your risk rating is.

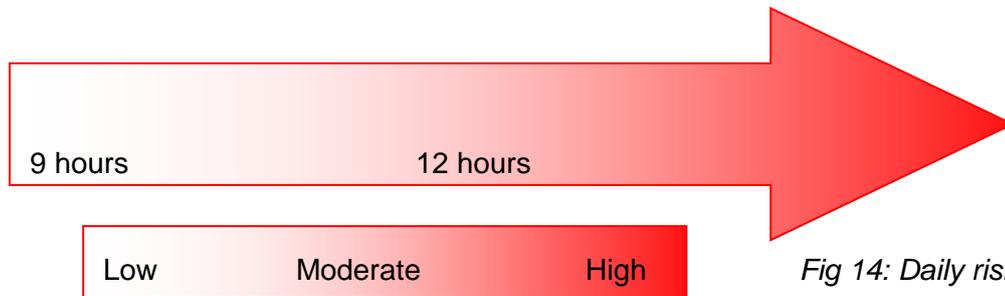


Fig 14: Daily risk graph

† Weekly hours

Using the graph below, rate your fatigue risk based on your planned weekly working hours of work. Indicate by drawing line from top to bottom in the arrow where your risk rating is.



Fig 15: Weekly risk graph

† Cumulative hours

Using the graph below, determine your risk rating for cumulative sleep debt over a three month period. Indicate by drawing line from top to bottom in the arrow where your risk rating is.

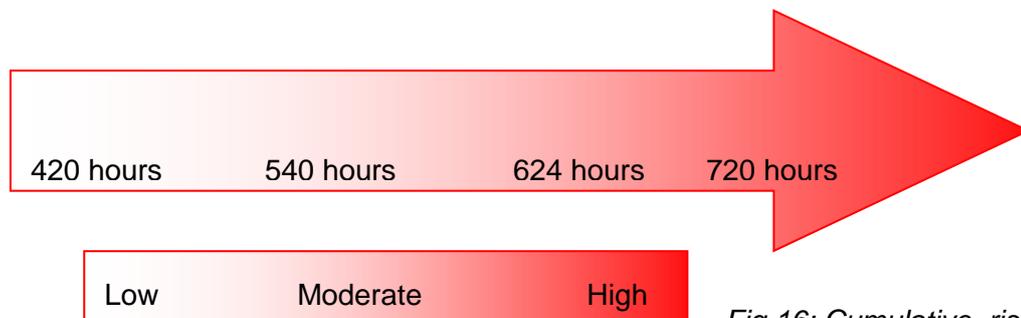


Fig 16: Cumulative risk graph



As best as you can remember complete your actual work hours for the past month.

Monthly Working Hours								
Month 1	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total Weekly working hours
Week 1								
Week 2								
Week 3								
Week 4								
Total working hours for the month								

Facilitator can add further notes here



Daily hours

Using the graph below, rate your risk of fatigue based on your unplanned daily hours of work. Indicate the least number of hours you worked in a day by drawing line from top to bottom in the arrow where your risk rating is.

Now draw another line indicating the most number of hours you work in a day on the arrow where your risk rating is.

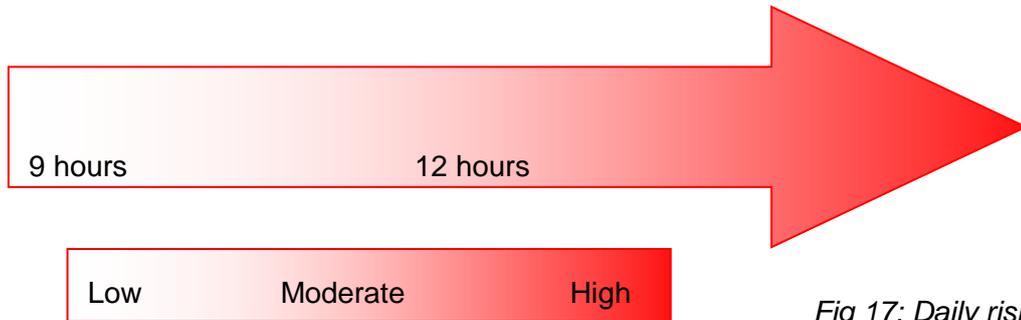


Fig 17: Daily risk graph



Weekly hours

Using the graph below, rate your fatigue risk based on your unplanned weekly working hours of work. Indicate the least number of hours you worked in a week by drawing line from top to bottom in the arrow where your risk rating is.

Now draw another line indicating the most number of hours you worked in a week on the arrow where your risk rating is.



Fig 18: Weekly risk graph

Did you have unplanned working hours?

How often would you do unplanned work?

How many days a week do you work?

Facilitator can add further notes here

Time of shift

As demonstrated previously in the circadian rhythms discussion, we are most physically and mentally efficient during the diurnal or day phase of the circadian cycle and at our least optimum physically and mentally during the nocturnal phase of the circadian rhythm.

Lower performance associated with low body temperature has also been reported in studies of shift work and continuous night operations. This is related to all the circadian rhythms. Core body temperature is lowest at night and driven by our chrono-biological clock.

General Circadian Cycle				
00:00				
01:00				
02:00				
03:00				
04:00				
05:00				
06:00				
07:00				
08:00				
09:00				
10:00				
11:00				
12:00				
13:00				
14:00				
15:00				
16:00				
17:00				
18:00				
19:00				
20:00				
21:00				
22:00				
23:00				
Sleepiness Scale				
Extreme	High	Moderate	Low	Optimum



Tasks on shift

Document the safety critical tasks that can occur on site, hour by hour in a day using the table below.



Fig 19: Shift cycle risks

General Circadian Cycle	Task 1	Task 2	Task 3
00:00			
01:00			
02:00			
03:00			
04:00			
05:00			
06:00			
07:00			
08:00			
09:00			
10:00			
11:00			
12:00			
13:00			
14:00			
15:00			
16:00			
17:00			
18:00			
19:00			
20:00			
21:00			
22:00			
23:00			
Sleepiness Scale			
Extreme	High	Moderate	Low
			Optimum



- 1) Write 'start' in the field that most closely represents the time that your site typically commences shifts in each shift column.

Note: If your site only has two shifts, just use the day shift column and the night shift column.
- 2) Write 'finish' at the field that represents when your site concludes their shift in the appropriate shift column
- 3) Determine the times where breaks have been scheduled and write the length of that break in minutes. (e.g. If I have a 30 Min break at 10am on day shift I would write 30 mins in the day shift column on the 10:00 row).

General Circadian Cycle	Day Shift	Afternoon Shift	Night Shift	
00:00				
01:00				
02:00				
03:00				
04:00				
05:00				
06:00				
07:00				
08:00				
09:00				
10:00				
11:00				
12:00				
13:00				
14:00				
15:00				
16:00				
17:00				
18:00				
19:00				
20:00				
21:00				
22:00				
23:00				
Sleepiness Scale				
Extreme	High	Moderate	Low	Optimum

What was the highest rating on the sleepiness scale for day shift?

What time of the day did this high rating occur?

What was the highest rating on the sleepiness scale for afternoon shift?

What time did this high rating occur?

What was the highest rating on the sleepiness scale for night shift?

What time did this high rating occur?

Do you take the circadian cycle into consideration when planning shift start and end times?

Do you take the circadian cycle into consideration when planning tasks and breaks during shifts?

Facilitator can add further notes here

Sequential night shifts

A sleep debt is typical for those working rotating night shift rosters, as workers tend to sleep for shorter periods. However, workers that are on a permanent night roster over a length of time begin to increase their sleeping periods in the right environment.

However chronic restriction of nocturnal sleep or frequent disturbances of nocturnal sleep can result in a peculiar distribution of sleep states characterised by premature REM sleep and can be associated with hypnogogic hallucinations, sleep paralysis and increased incidence of hypnic myoclonia. It takes longer break periods between night shift periods than the breaks needed for day shift to allow the person the opportunity to sustain nocturnal sleep.

N

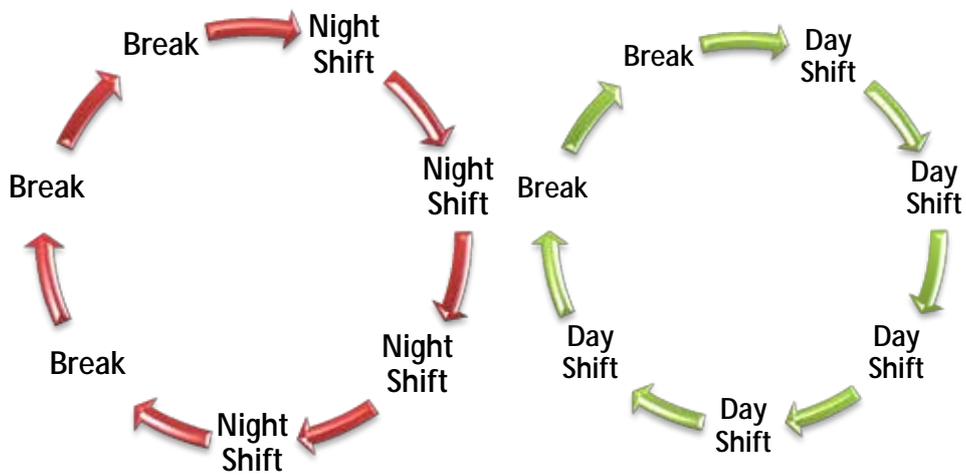


Fig 20: Break periods for night and day shifts to sustain nocturnal sleep

The chart above demonstrates an example of break periods between shifts for night shift and day shift.

Facilitator can add further notes here

- **Option one**

Copy the next five pages on circadian rhythm, body temperature, light, performance, noise and vibration. Hand this information out to participants to read through.

”

Mental, physical demands of work and working conditions

Split into three groups:

- **Group A** will need to read through the information and develop a presentation about the contribution of physical demands of work to fatigue. They will need to deliver this presentation to the rest of the group.
- **Group B** will need to read through the information and develop a presentation about the contribution of mental demands of work to fatigue. They will need to deliver this presentation to the rest of the group.
- **Group C** will need to read through the information and develop a presentation about the contribution of our work environment to fatigue. They will need to deliver this presentation to the rest of the group.

Option two

This information can be delivered as a narrative in your presentation

Facilitator can add further notes here

3 Circadian rhythm, core body temperature and performance

Core body temperature

As we progress through the circadian cycle, our core body temperature rises and falls. Core body temperature falls to the lowest around 4:30am and rises to its highest at 7:00pm.

Higher brain temperatures result in faster transmission of information and lower brain temperature result in slower transmission. So alertness levels, reaction times, co-ordination, cardiovascular efficiency, muscle strength and performance are at their optimum at the peak of the circadian cycle and worst at the trough of the circadian cycle.

Alertness however, depends not only on sleep/wake time of day, but on other factors such as the physical and mental demands at work, and the working environment. Understanding and controlling these influences will require a holistic approach to fatigue management within the workplace. A summary outlining the factors for consideration are listed below.

Physical demands

High demands

Sustained exertion or force, sustained awkward postures and long duration repetitive movements are all factors that may affect fatigue. Prolonged physical work with insufficient recovery breaks may result in physical fatigue.

The aches and pains that we feel in our arms and legs after strenuous physical work is a build-up of lactic acid and micro tears. Muscles need time to repair. If muscle tissue is not given the opportunity to recover and process the lactic acid build up in muscle tissue and replenish the oxygen and nutrient supply to the muscles before engaging in more physical work, an injury is more likely to occur.

Low demands

Static posture over a long period of time can also result in muscular fatigue.

Activity increases blood flow supplying our muscle tissues with oxygen and nutrients and removing lactic acid. If we remain in a static posture, the lactic acid is not easily flushed from the muscle tissue and as it accumulates we begin to feel stiff, sore and tired.

3 Mental demands

Understanding under-load

When we are exposed to stimuli we respond by taking in information, deciphering what it means and the context of the information then we store that information. When we are exposed to the same stimuli our reaction changes, we skip over information we already have and look for information we don't have. We process less and less information because we have already processed the information and we are therefore less likely to respond to that stimuli.

We are not only responding to stimuli psychologically but also physiologically. When we are stimulated our brains theta rhythm increases triggering alertness and wakefulness. When we are not stimulated our brains alpha rhythms increase, inducing drowsiness, which is why we feel, tired when we are bored or not doing much.

Understanding over-load

Overload occurs when we are engaged in activities that require high levels of concentration or we are deciphering large quantities of information. Over the long term this creates a stressful working environment that can impact on our health.

When dealing with large volumes of information or tasks that require significant levels of concentration, our minds tend to prioritise the information and this sometimes means that we may fail to pick up critical cues to a situation that is unfolding and react or make decisions that do not incorporate the full picture. Not understanding the full picture, makes us more prone to making errors.

3 Temperature light, noise and performance

Temperature, light and noise interact with the circadian rhythm in different ways, impacting the sleep quality and the ability to remain alert.

There is evidence that suggests that stimulating sound or a combination of sounds can counter sleepiness and fatigue

Light influences the circadian cycle by synchronising with the light and dark cycles of the day and can contribute to managing alertness in night shift workers.

Environmental temperature also impacts alertness levels and the rate of fatigue onset.

Hot working environments

Exposure to environmental temperatures of 28 degrees and above, have been shown to reduce alertness when performing tasks involving high cognitive demand and increased muscular fatigue when performing physical work.

When we do physical work in hot environments, ATP is processed more rapidly and this means that we develop fatigue more rapidly. In warm environments the rate at which ATP is metabolised during physical activity is increased. In comfortable environments although the rate at which ATP is metabolised is increased, it is not as high as in hot environments.

Adenosine builds up as a by-product of metabolising ATP. In hot environments we tire more quickly and more rest breaks are required to reduce the adenosine build up in the muscle tissue and the basal forebrain and allow recovery.

Alertness levels, reaction times, co-ordination, cardiovascular efficiency and muscle strength and performance are at their optimum at the warmest parts of the day.

Cold working environments

In cold environments we react and process information more slowly than we would in an environment where the temperature is comfortable.

A drop in core body temperature promotes the onset of sleep. Cold environments may contribute to lowering our core body temperature. Studies have shown that extremes in cold temperature also have the capacity to desynchronise the circadian cycle. De-synchronisation can be further exacerbated in dark environments.

This de-synchronisation may result in:

- the secretion of melatonin in periods of the circadian when melatonin would not ordinarily be secreted promoting sleepiness; or
- not enough melatonin being secreted during the period of the day where melatonin needs to be secreted, delaying the onset of sleep and quality of sleep.

3 De-synchronisation also affects core body temperature, metabolism, blood pressure and other rhythms associated within the circadian rhythm.

Keeping temperatures cool (but not too cold) and the humidity low, may assist in alertness and vigilance. Recommendations are that indoor work environments should be maintained at the lower end of the comfort range, as warm stuffy environments can cause drowsiness. For work involving intense physical activity, the metabolic rate of individuals can be estimated to determine an appropriate break schedules for recovery.

Light, circadian rhythm and alertness

For night shift workers, light should be managed to achieve a balance between optimising alertness, whilst causing as little disruption as possible to sleep and minimising adverse health effects. There are negative impacts to being exposed to bright light at night which include:

- a shift in the biological clock and disrupted sleep
- elevation of cortisol which can promote insulin resistance and contribute to obesity
- suppression of melatonin and probable carcinogenic risk.

Exposure to bright light during night shift has been shown to:

- increase alertness and reduce sleepiness
- increase vigilance
- improve cognitive performance.

Noise

Some sounds can be sedating (continuous droning/humming) or stimulating (music of various tempos and conversation).

Providing opportunity for social interaction and non-monotonous sound can help maintain alertness and reduce performance decline. The effect of noise is dependent on the nature of the noise, nature of the task, time of day and personal factors.

Noise can lessen the performance decline due to the circadian effect by increasing general brainwave activity associated with alertness, however not all noise is beneficial, particularly when the task is demanding and the noise levels are loud.

A loud noise can trigger the 'fight flight' response in the human body, a reflex to protect us from danger. This mechanism increases the production of adrenaline and cortisol which prepares the body for a rapid response to danger by increasing the heart rate, breathing and blood pressure.

Working in a noisy environment appears to increase our perception of fatigue. Some research has been carried out on fatigue and noise and one study showed that working in a noisy environment increased reports of fatigue similar in nature to fatigue associated with performing mental tasks after night shift. The study concluded that maintaining attention and concentration becomes difficult with the existence of noise.

3 Another study (of 254 workers) explored the interactions between noise, shift work, fatigue and age. Day workers and shift workers were surveyed for personal and environmental risk factors related to fatigue. Noise exposure at work was measured with personal noise dosimetry. The study found that noise exposure had a main effect on fatigue. The highest noise exposure resulted in an increased level of fatigue for older shift workers. The results suggested that noise is an important factor which seems to aggravate work-related fatigue associated with shift work and ageing.

Studies have also shown that exposure to loud noise causes a significant and persistent decrease in the growth of new nerve cells in the area of the brain which is involved with memory. This may contribute to functional deficits in memory and may also compound the effects of fatigue and high mental demands on situation awareness, short term memory and decision making.

Vibration

Vibration has been shown to affect psychomotor performance. Musculature, circulatory, respiratory and nervous systems all react to and are affected by vibration. Vibration appears to generate muscle reflexes and this activity of muscles may explain the observed increase in energy consumption, heart rate and respiratory rate. Whilst the effects of vibration on metabolism are small the reflex closure of sphincter muscles around blood vessels can severely reduce blood flow in the afflicted body part (e.g. white finger).

Strong vibration impairs performance in various psychomotor tests. In simple terms, vibration can impair visual perception, the mental processing of information and the performance of skilled motor tasks. The physiological effects of vibration, arising from the mechanical oscillations, have been demonstrated to reduce efficiency and in many situations may lead to the risk of errors and incidents.

Vibration is subjectively felt as a burden ranging from minor annoyance to an unbearable nuisance depending on the frequency, acceleration and duration of the oscillations.

Hazardous substances

Various substances may impair brain function and levels of alertness which may compound the effects of fatigue. Each site should keep a register of the substances that are kept on site, as well as a copy of the material safety data sheet detailing the side effects and safe handling procedure.

Excessive commuting

It is dangerous for anyone to drive on the road while fatigued. The Roads Authority acknowledges that fatigued drivers are a risk on public roads and have made regulations toward the fatigue management of long haul heavy rigid drivers.

They have also campaigned to the public with the 'stop, revive, survive' message.

The fatigue issues that impact on workers commuting to and from work in the NSW mining industry that employers have direct influence over are the:

- time of day in which a worker travels
- length of time a worker spends working on site.

Employers have indirect influence over the:

- length of time a worker spends travelling to and from site
- means of travel which a worker will use to travel.

The fatigue issues that impact on workers commuting to and from work in the NSW Mining industry that workers have influence over are the:

- length of time spent travelling to and from work
- means of travel
- adequate use of recovery times.

What is your current fatigue risk management strategy for workers commuting long distances?

How do you know it is working?

Facilitator can add further notes here

Individual non work related factors

Not all factors causing or contributing to fatigue start in the workplace, however under section 17 of the *Work Health and Safety Act 2011* there must be a safe system of work in place. A safe system of work would not allow a fatigued worker to operate dangerous equipment or expose others to a fatigued worker making judgements and decisions that may affect them.

What this means is that no matter what the origin of fatigue, when a fatigued person enters your site, you need to manage the risk where reasonably practicable.

Factors that cause or contribute to fatigue that are not work related, need to be considered.

Do your current strategies consider the following individual factors:

- Health
- Sleep disorders
- Family
- Secondary employment
- Activities
- Other commitments

What are the difficulties associated with identifying this risk?

How does your strategy deal with these risks?

Facilitator can add further discussion points here

2.3 Managing fatigue risks

— Fatigue risk management

Fatigue risk management is essentially about managing the:

- opportunity for sleep
- time awake
- working conditions
- job demands
- likelihood and consequences of a fatigue related error
- medical conditions.

Researchers at the Centre for Sleep Research at the University of South Australia have developed a five level system toward fatigue risk management. This approach considers the:

1. sleep opportunity - safe system of work
2. sleep obtained - fitness for work
3. systems and tools to identify fatigue related behaviour
4. systems and tools to detect fatigue related error
5. procedures for identifying fatigue in incidents.

In the mining industry work environments are typically dusty, noisy and can potentially be hot or cold and job demands include both monotonous and mentally demanding tasks combined with high physical demand or awkward sustained postures. The impacts of these factors on the ability of individuals to sustain vigilance on task, which may also be impaired by fatigue, need to be considered in the risk management framework.

The likelihood and consequences of a fatigue related error needs to be assessed for all involved in work tasks, taking into consideration the job demands and work environment factors.

To address these issues another level of control should be added to the Sleep Research Centre approach, as this approach does not take into account the contributing impacts of the job demand and work environment.

The long term health consequences should also be considered and are most effectively managed at levels one and two. Health assessments, which address fatigue and other potentially related health consequences associated with fatigue eg. diabetes and obesity, could also be included in the risk management framework.

Documenting identified fatigue risks

It is essential to document all identified fatigue risks. A fatigue hazard risk register can make tracking fatigue risks simpler and is best used in consultation with the work force.

Questions to consider when developing your fatigue hazard risk register are:

- When is fatigue-related risk increased for us?
- When in the roster, or the day, or the week, or the year is the fatigue-related risk increased?
- When the fatigue-related risk is increased, who is it impacting?
- Is there a specific group of workers that are at increased risk due to the nature of the work arrangements and what is the impact?
- What tasks are susceptible to fatigue, and how does performance change?

Facilitator can add further notes here



For the fatigue hazards identified at your site draw up a fatigue risk register detailing the control measures in place, additional controls, review actions and who is responsible.

Risk Rating	Potential Impairment	Groups at Risk	Current Controls	Person Responsible for Implementing Controls	Date Controls were Implemented
Risk:					
Risk:					
Risk:					
Risk:					

Risk assessment

We have already conducted risk assessments on various factors of fatigue. To do this we considered the likelihood of becoming fatigued due to exposure to different shift and working arrangements, commuting, individual and non-work factors, job demands and working environment.

Fatigue is cumulative in nature so in undertaking an assessment we need to consider how all these factors interplay and contribute to sleep / wake and the maintenance of vigilance on task.

The first tool can be used to determine an individual's sleep opportunity and incorporates commuting times.

Level 1 controls: Rostered sleep opportunity

Rostering for sleep opportunity

As mentioned earlier work scheduling and planning can interfere with an individual's opportunity to gain restorative sleep. Level one controls are about assessing whether an individual has had adequate sleep opportunity and assessing planned and unplanned working schedules for sleep opportunity. There is a legislative requirement for safe systems of work and this includes work scheduling and planning.

Facilitator can add further notes here



There are five dimensions that indicate the level of fatigue associated with a roster. These are:

1. Hours per seven days
2. Shift length
3. Short break duration (break between shift)
4. Hours of night work per seven days
5. Long break duration (break between roster).

Rostered sleep opportunity

Determine how well your planned working hours allow for sleep opportunity. Using the table below, calculate the Fatigue Likelihood Score (FLS) for your mines roster. Indicate where your score sits on the risk continuum.

A score greater than five requires a risk management plan to be in place.

RISK MANAGEMENT TOOL 1						
Dimension	+0	+1	+2	+4	+8	Score
1. Max hours per 7 days	≤36	>36 - ≤44	>44 - ≤48	>48 - ≤54	>54	
2. Shift duration (hours)	≤8	>8 - ≤10	>10 - ≤12	>12 - ≤14	>14	
3. Short Break duration (hours)	≥16	<16 - ≥12	<12 - ≥10	<10 - ≥8	<8	
4. Max hours of night shift work per 7 days	0	1 - ≤8	>8 - ≤16	>16 - ≤24	>24	
5. Long Break frequency (days)	>1/7	≤1/7	≤1/14	≤1/21	≤1/28	
Total FLS						



Unlikely Likely Extremely

University of South Australia Sleep Research Centre



Individual sleep opportunity

Determining time awake

RISK MANAGEMENT TOOL 2		
How much time, are you awake for prior to leaving for work?		p
How much time does it take for you to get to and from work?		c
How much time do you spend at work?		w
How much time do you spend awake after you have finished work (not including commuting home from work) prior to going to bed?		a
Add $p+c+w+a$ to work out Time Awake	t	
$24 - t =$ Sleep Opportunity	o	
Use the risk rating graph below to risk assess your individual sleep opportunity		

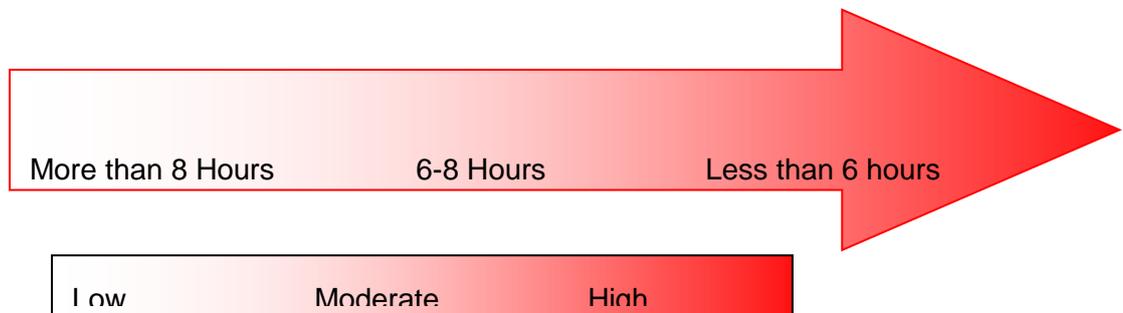


Fig 21: Individual risk rating graph

Facilitator can add further notes here



Level 2 controls: Prior sleep/wake

It is one thing to have sleep opportunity, but another to take advantage of the time rostered for recovery. To effectively determine whether fatigue has an influence on performance, determining how much sleep obtained and how long the individual has been awake is fundamental to the management of fatigue.

NOTE: The following assessment is a method in predicting the onset of fatigue and is not an assessment to determine fatigue.

Determining prior sleep

Using the table below determine:

- Step 1: How much sleep have you had in the past 24 hours? (Circle the hours & write the corresponding score in the appropriate score field below e.g. 6 hours = 0 points)
- Step 2: How much sleep have you had in total over the last 48 hours? (Circle the hours & write the corresponding score in the appropriate score field below e.g. 12 hours = 2 points).

Fatigue Assessment

RISK MANAGEMENT TOOL 3 (A)						
Step 1: Sleep in prior 24 hours						Score
Sleep:	≤2 Hours	3 Hours	4 Hours	≥5 Hours		
Points:	12	8	4	0		
Step 2: Sleep in prior 48 hours						Score
Sleep:	≤8 hours	9 Hours	10 Hours	11 Hours	≥12 Hours	
Points:	8	6	4	2	0	
Total Score						

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Compare your total score to the FLS rating table on page 58.



Level 2 controls: Current/scheduled wake hours

Fatigue assessment

RISK MANAGEMENT TOOL 3 (B)	
Step 3: Current wake hours	Score
Step 3: How many hours have you been awake since you woke today? Subtract these wake hours from the amount of hours slept in the last 48 hours. Write this figure in prior wake score field A. (e.g. 6 hours awake – 12 of sleep = minus 6 hours, translates to a score of -6).	
Step 4: Fatigue onset prediction score	Score
Step 4: Add up the prior sleep total score to the current wakes hours score to determine the fatigue onset prediction score (e.g. Step = 0, Step 2 = 2, Step 3 = -6. $0+2-6=-4$ This score indicates the time an individual may begin to feel the effects of fatigue. In the case of our example, in 4 more hours the individual may begin to feel the effects of fatigue.	
Total Score	

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Potential impairment

Using the table below, determine your fatigue likelihood rating from the previous exercise. What type of impairment has been predicted for your rating?

Fatigue Likelihood Score (FLS) Rating Table

RISK MANAGEMENT TOOL 3 (C)	
12	Struggling to stay focused on any task. Difficulty staying awake at times. Micro-sleeps likely.
10	Clear loss of motivation. Significant loss of situational awareness. Task performance impaired.
8	Clear evidence of behavioural impairment. Difficulty sustaining attention on simple tasks.
6	Difficulty concentrating. Occasional lapses of attention. Poor judgement on complex task.
4	Difficulty in maintaining extended concentration for complex tasks.
2	Slowed cognition. Occasional minor fatigue behaviours. Minor mood changes observable.
0	Not fully alert but able to perform tasks safely. Few external signs of fatigue.
<0	No signs of fatigue are likely to be demonstrated.

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Predicting fatigue

The level 2 control tool not only can be used for determining “actual” fatigue, but can be used to predict fatigue levels as the shift progresses. This can be useful in determining when to conduct monitoring, what behaviours to look for and determining an individual’s potential capacity when planning safety critical tasks. It also presents as a useful tool in determining an individuals’ capacity before they engage in the activity of commuting home.

To predict fatigue, count the total hours from when you woke up to the end of your shift and subtract from the amount of hours you have slept in the past 48 hours. eg. 14 hours awake – 12 hours sleep = 2.



Possible response to identified impairment

The table below provides guidance as to what action a supervisor or manager may take once fatigue has been identified. In the “Your Response” fields, develop a plan of action you might take for each rating score if an individual presents with symptoms of fatigue.

RISK MANAGEMENT TOOL 3 (D)			
Score	Tick box below if the task is Safety Critical	Your Response	
		Task <u>is</u> Safety Critical	Task is <u>not</u> Safety Critical
≤0		No action required.	No action required.
1-5		Document locally with supervisor and undertake approved individual countermeasures. Self monitoring for symptoms, napping. Team monitoring by colleagues, task rotation	Document locally with supervisor
6-12		Document externally by supervisor. Organise supervisor checks. Complete symptoms checklist, task reassignment.	Document locally with supervisor
>12		Document externally, do not engage in any safety critical tasks. Do not recommence safety critical tasks until fit for work.	Document locally with supervisor

Level 3 controls: Assessing the likelihood of fatigue onset

Behavioural indicators of fatigue

Even though an individual's roster and sleep history might be low risk, it is still possible that cumulative forms of fatigue can impair performance and give rise to elevated levels of fatigue related risk.

The level 3 controls enable individuals and teams to identify the symptoms of fatigue and put in place risk management controls when an individual might be exhibiting symptoms of fatigue.

The level 3 control tools for self-assessment can be as simple as a subjective fatigue scale and can trigger a range of controls from a short rest to being relieved of duty for a period of time to enable sleep.

Behavioural indicators of fatigue can be detected using various tools:

- Symptom checklists
- Self-report behavioural scales – e.g. Epworth, Stanford and Samn Perelli sleepiness scales
- Impairment assessments - visual response times, eye hand co-ordination (iPhone app – Alertometer)
- Physiological monitoring – operator monitoring technologies e.g. eye blink rates.

Critical questions:

“Am I safe to work – Am I feeling okay or am I tired”?

“Is my work mate showing signs of fatigue”?

Facilitator can add further notes here



Individual fatigue self assessment

The following table can be used by individuals to determine their level of fatigue and can be used:

- before the start of a shift as a routine assessment
- during a shift
- when fatigue has been reported
- when on call
- at the time of an incident.

The self-assessment can assist supervisors and managers in determining an individual's level of fatigue.

Determining individual fatigue

RISK MANAGEMENT TOOL 4 (A)	
1	Fully alert
2	Very lively
3	Okay
4	A little tired
5	Moderately tired
6	Extremely tired
7	Completely exhausted

Facilitator can add further notes here



Possible response to individual self-assessment

The following table demonstrates some suggested responses to the rating from the criteria on the previous page.

RISK MANAGEMENT TOOL 4 (B)		
Samn-Perelli Fatigue Checklist	Risk level	Controls
1 - 3	low	No specific controls necessary. Except in the presence of higher level indicators of fatigue (i.e. symptoms, errors or incidents).
4 - 5	moderate	<ul style="list-style-type: none">· Initiate moderate fatigue risk mitigation actions· Level 2 and 3 assessment· Individual controls.
6	high	<ul style="list-style-type: none">· Initiate high fatigue risk mitigation actions· Document with unit director and / or EDMS· Level 2 and 3 assessment· Individual controls· Team-based controls· Support napping and safe-home policies.
7	extreme	Intolerable risk. No individual rostered beyond this threshold. Any proposed exceptions to be escalated to the group management for approval.

Facilitator can add further notes here



Identifying or monitoring fatigue

This table can be used to assist an individual to determine the effects of fatigue. Should three of these behaviours be present in a fifteen minute period, while on task, the individual should report to the supervisor or manager for further assessment such as the Samn Perreli Sleepiness Scale.

RISK MANAGEMENT TOOL 5			
	Physical	Mental	Emotional
Generic Behaviours	<ul style="list-style-type: none"> • Eye Rubbing • Yawning • Slumped Posture • Slow Blinks 	<ul style="list-style-type: none"> • Forgetfulness • Easily distracted 	<ul style="list-style-type: none"> • Irritability • Terse Communication • Hyper-reactivity
Task Specific Behaviours	<ul style="list-style-type: none"> • Speed variability • Delayed reactions • Poor Operation of Equipment 	<ul style="list-style-type: none"> • Poor anticipation • Concentration lapses • Spatial disorientation 	<ul style="list-style-type: none"> • Withdrawn • Un-talkative • Delayed responses

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Physiological monitoring

All these fatigue impairment, behaviour and physiological indicators need to be linked to a management system which determines an appropriate management response. This information can also be used to monitor and evaluate the effectiveness of fatigue management controls at the other two levels. Organisations also need to carry out their due diligence on any behavioural scales or physiological monitoring technologies to ensure that they are valid and reliable before they are implemented.

Facilitator can add further notes here

Level 4 control: Mitigating fatigue related error

This involves threat and error management. There is no easy tool or process to monitor errors.

1. Consult: An organisation needs to be open to talking about fatigue and fatigue related errors. One approach is to talk to workers about the dumb things they do when they are tired.
2. Identify: Document common errors and raise awareness through information and training.
3. Report: Implement a fatigue error reporting system.
4. Monitor and review: This information can be used for continuous improvement and as an indicator of which level controls are being used.

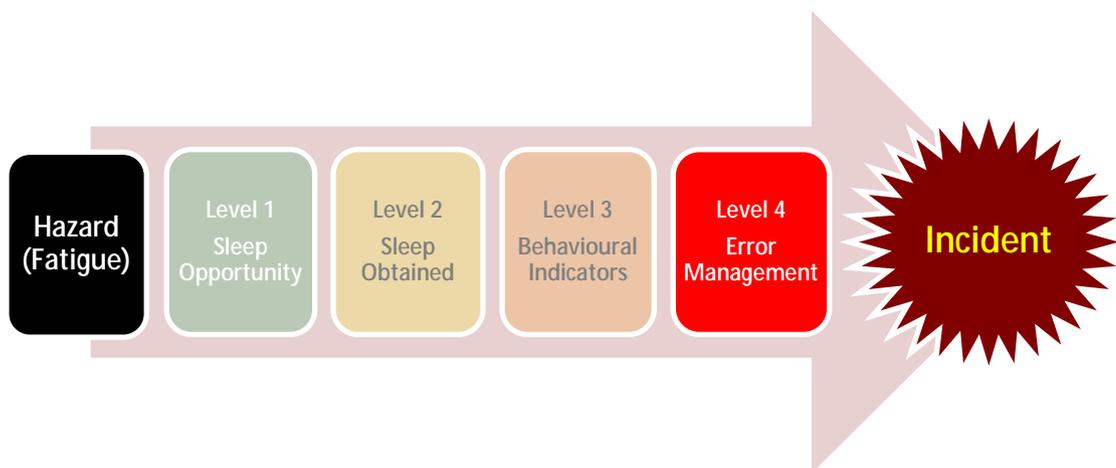


Fig 22: Mitigating fatigue related error

The *WHS Act 2011* refers to the elimination, prevention or protection of workers from exposure to risk arising from a hazard. How would you categorise the above controls within the context of the *WHS Act*?



Managing fatigue related error (FRE)

Select a safety critical task that is regularly conducted on your site. Identify the potential fatigue related errors associated with that task. What controls do you have in place to manage FRE.

RISK MANAGEMENT TOOL 6

Task:

Describe potential impaired performance

Describe associated fatigue related error

Consequence

e.g. poor spatial judgement operating mining equipment

e.g. collide with pillar, ribs/back, people or other equipment

e.g. compromise stability of strata causing collapse

Describe what measures will you take to reduce the likelihood of the error occurring in the field below?

2.4 Investigating fatigue in incidents

Level 5 control: Investigating fatigue in incidents toward continuous improvement

Investigating fatigue in incidents

For fatigue to be considered as a causal or contributing factor to an incident, two conditions must hold:

- evidence of a level 1, 2, or 3 indicator of fatigue
- nature of error is consistent with a fatigue related error

To determine how fatigue might be impacting your operations, it is important to include fatigue in our investigations. The information obtained in an investigation should be used to further identify fatigue causing and contributing factors, to assist our capability to put into place, robust controls and determine the effectiveness of current fatigue control measures.

Actions implemented as a response, where fatigue has been identified as a clear factor should be considered carefully, as appropriation of blame to an individual may have an impact on individuals reporting they are fatigued.

Investigating fatigue may also reveal high risk activities that may not have been considered high risk previously.

We investigate incidents, not only to find out the cause of the incident but to:

- learn how to prevent it from occurring again in the future
- fulfil our legal obligations
- determine the cost
- assist in the identification of fatigue hazards
- determine the effectiveness of controls
- determine compliance with applicable safety regulations.

How do you currently investigate if fatigue was a causing or contributing factor?

Facilitator can add further notes here

Investigating fatigue can be incorporated, into the same investigation principles currently being used in your organisation.

Level 1	Level 2	Level 3	Level 4
Quantative Fatigue Modelling Qualitive Rule Sets	Actual Sleep Time Awake	Individuals Identifying Fatigue Others Identifying Fatigue	Control to Manage Fatigue Related Errors Error Analysis

Facilitator can add further notes here

2.5 Evaluating fatigue risk controls

It is important to evaluate controls, to determine the effectiveness of the controls in practice. We are all familiar with the term, but what may sound great in theory may not be so great in practice.

Fatigue is a multi-factorial hazard and effective approaches to fatigue management look at the interconnected range of factors that contribute to fatigue risk. The multi-layered system of controls can tolerate imperfect defences yet remain effective.

In addition, information gathered from a lower level of control can provide feedback on the effectiveness of the level above.

One way to evaluate the effectiveness of controls is to determine fatigue management goals and identify performance indicators for each goal.

For example

Level 1 control: Establish a target sleep opportunity score for your planned roster and then assess the actual hours worked against this target.

Level 2 control: Establish a standard for the number of workers scoring above zero on the FLS and monitor the actual number of reports per month.

Facilitator can add further notes here



RISK MANAGEMENT TOOL 7

Analyse your current fatigue management strategies:

- What controls do you have in place that prevent fatigue?
- What controls do you have in place that protect exposure?
- What controls are individuals expected to be responsible for?

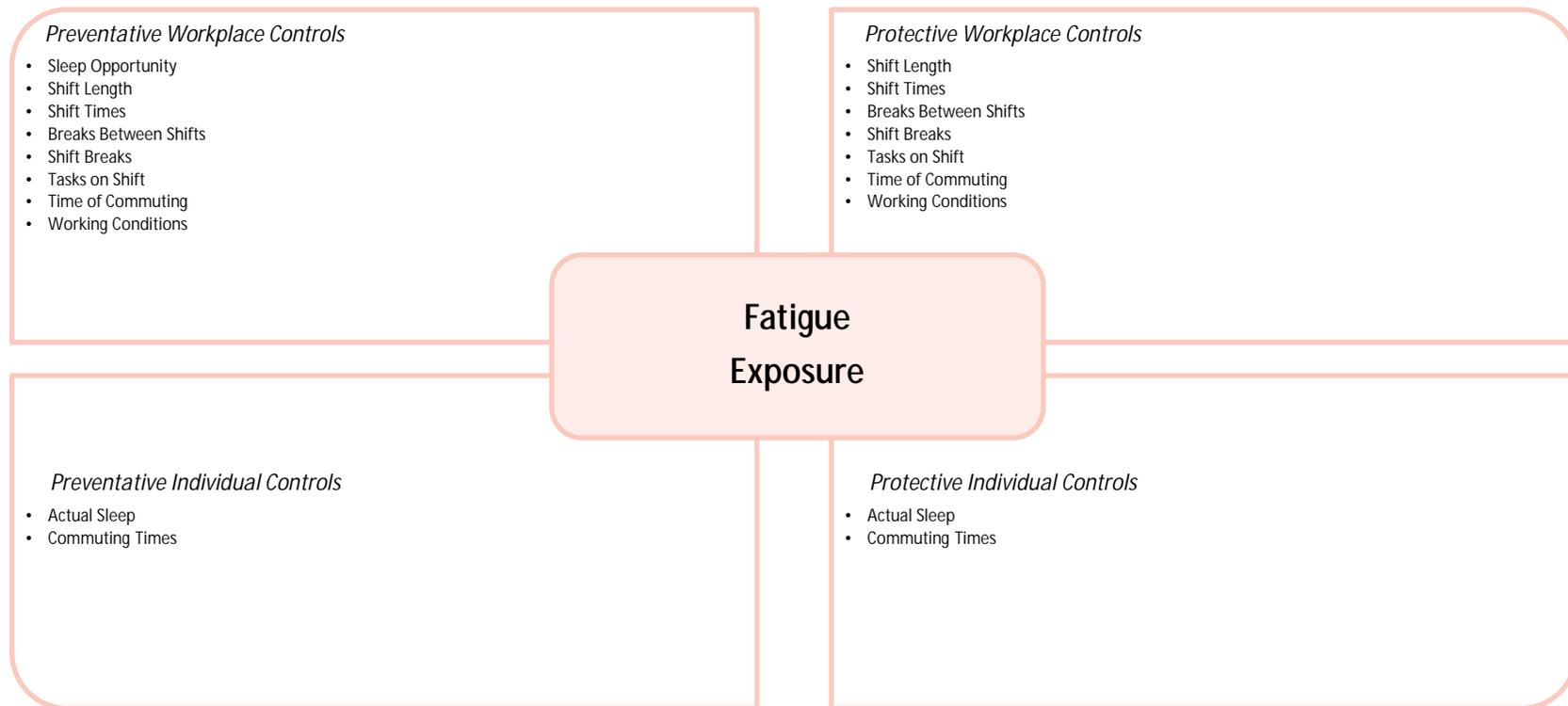


Fig 23: Fatigue exposure controls

- 3.1 **Fatigue management policy**
- 3.2 **Fatigue management consultation**
- 3.3 **Roles and responsibilities for fatigue management**
- 3.4 **Understanding the forces driving change**
- 3.5 **Implementation of a fatigue management plan**
- 3.6 **Monitoring the implementation of fatigue management**



Image: Trucks passing closely on a dirt roadway on a mine site.

3.1 Fatigue management policy

Fatigue management plan

Most of you should have a fatigue management plan in place, for those of you who do not have a plan to management fatigue, you need to have a plan in place if:

- the hours worked are outside the hours of 6:00am and 7:00pm
- more than 48 hours are worked in any consecutive 5 day period including unplanned work
- there are not a minimum of 2 consecutive days off in any 7 day period.

A fatigue management plan should include:

- a fatigue management policy
- training on how to identify and assess fatigue risks and how to manage risks according to the fatigue management plan
- a proven means of ensuring a safe level of alertness that is appropriate for tasks undertaken
- a fatigue management system that is measurable and captures sleep opportunity, fitness for work and the means to identify symptoms of fatigue.

A fatigue management plan is also required if a fatigue hazard has been identified during a risk assessment.

Facilitator can add further notes here

— Fatigue management policy

A fatigue management policy demonstrates the commitment towards managing fatigue. The policy should be clear to all stakeholders, including contractors, that the organisation is committed to managing fatigue risks.

Things to consider in your policy framework are:

- The responsibilities of the PCBU for preventing excessive duration of wakefulness at work and inadequate sleep opportunities between shifts
- The responsibilities of workers for using the time between work periods to obtain sufficient sleep
- The responsibilities of employees to engage in mitigation should this be necessary
- The responsibilities of the PCBU for providing clear guidelines on how to manage an insufficient sleep/excessive wakefulness incident.

Does your organisation have a written fatigue management policy?

— How is commitment to managing fatigue demonstrated?

Are roles and responsibilities for managing fatigue clearly communicated at all levels?

Facilitator can add further notes here

3.2 Fatigue management plan: consultation

Consulting about fatigue

Consultation should occur throughout the whole process of development and implementation of fatigue management. The process should include an education and communication strategy and be adequately resourced.

Employees and contractors should be involved in deciding how to control the risks associated with fatigue and there should be an agreed approach to monitoring and evaluating the effectiveness of the controls. Everyone should be adequately trained to undertake their role in fatigue risk assessment.

Through consultation, the mine should decide who will be responsible for different actions.

Facilitator can add further notes here

3.3 Roles and responsibilities of fatigue management

Who is responsible for implementing a fatigue management plan

The fatigue management plan should name the people who are responsible for different actions. It is the employer's job to make sure that the fatigue management plan is implemented, as well as providing adequate resources for the implementation of the plan.

What are some of the activities that you have been responsible for implementing in your workplace?

What have been some of the challenges you have faced in implementing these responsibilities?

Facilitator can add further notes here



Fatigue responsibilities worksheet

Identify responsibilities that are appropriate to your role. Identify other roles that you will need to participate in with implementing the fatigue management plan.

Mine name	Section	Date
Lead by	Participants	
Fatigue health & safety activities	Responsible position	Who else will participate
Consulting with workers		
Developing a policy		
Assessing rosters to ensure sufficient sleep opportunity is provided		
Reviewing actual hours of work to ensure they meet rostering standard		
Monitoring worker sleep / wake and fitness for work reporting patterns		
Develop fatigue reporting system – fit for work assessment and reporting		
Organising and monitoring behaviour impairment due to fatigue		



Fatigue Health & Safety Activities	Responsible Position	Who Else will Participate
Following up fatigue error reports to ensure close out		
Review and analyse incident reports, claims etc.		
Maintain a fatigue hazard register		
Day to day monitoring of worker fitness for work		
Organise worker information and training on fatigue hazard, risk and how fatigue is managed / controlled		
Supervisor training in day to day monitoring of fitness for work		
Identify high risk and assess the likelihood and consequences of fatigue related error		
Ensure fatigue risk controls and safe work procedures are followed		
Review risk management procedures to ensure fatigue related error is included in risk analysis		
Maintain induction training content		

3.4 Understanding the forces driving change in fatigue management

— The challenges of fatigue management

Hours of work were traditionally managed under the industrial framework, some might even remember the no napping at work clause. The amount of hours we work and the time of hours we work are no longer only recognised in the industrial framework, but also in the health and safety framework. These competing priorities can challenge the implementation and management of fatigue.

There are some cultural issues that also need to be examined, Australians typically have a dedicated work ethic. While in most cases this is positive for many aspects of the industry, the association with long work hours equals good worker can actually be causing more harm than good.

Regulators are reticent in prescribing the hours of work as paradoxically prescription may not provide the best outcome for health and safety. Prescription does not drive toward best practice, only compliance.

What hours would you prescribe for the entire industry including Lightning Ridge, quarries and the larger operators? Be mindful to consider:

- local legislations that have the power to limit mining between certain times
- local environmental factors that may impact on mining times / seasons
- earning opportunities, commuting times, medical conditions, family, life work balance of the individuals your prescriptive times affect.

— Historical and political context

Reforms in the industrial environment following the accord and the deregulation of award negotiations to enable enterprise based agreements changed the landscape of negotiation around working conditions. Between 1985 and 2005 90% of EBA's involved change in hours of work.

OHS Reforms in the 1990's redefined fatigue as a workplace hazard and community concern around fatigue began to emerge. By 2000 most jurisdictions identified fatigue and shift work in the OHS regulations.

The parliamentary enquiry into a fatigue in the transportation industry accelerated the reform process. The enquiry clearly identified fatigue as a safety issue, articulated the shared duty for fatigue management and the need to apply risk management principles within a systematic management framework. Over the past 10 years the recommendations have shaped regulations, not only in the transport industry, but in other industries where shift work and long hours are typical.

— Changing litigation landscape

Courts are now taking fatigue more seriously, in many states there have been examples where drivers involved in fatal accidents that have been charged and found guilty of driving when fatigued have been sentenced to terms in prison based on their decision to operate a vehicle while impaired.

— Courts are recognising that fatigue may be a by-product of a system of work and to that extent the organisation has contributed to fatigue and can be held liable.

Why would the courts hold an organisation as liable to an incident in the workplace that involved fatigue worker?

— Criminal law

Fatigue was argued in the courts as a defence in that a defendant had diminished capacity. However, with further research and understanding of fatigue the courts have shifted from diminished capacity toward voluntary impairment.

The principle of 'reasonable foreseeability' has been applied to judgement of culpability. The prosecution calls on many pieces of evidence to construct the case for lack of sleep. Mobile phone records, internet usage, credit card usage may be collected to ascertain a period in which a person may have been awake.

Civil Law

Courts and juries increasingly view fatigue as a reasonable foreseeable voluntary risk similar to drug and alcohol use and therefore avoidable.

- Civil law has established liability under tort law
- Liability cannot be outsourced to sub-contractors
- The chain of responsibility can flow upward to the principal contractor

After how few hours of sleep would you decide that you wouldn't go to work?

Work Health and Safety Regulations

Supporting the *Work Health and Safety Act 2011* are the *WHS Regulations*. The regulations have a chapter dedicated to mining. These regulations state that:

Worker fatigue

“the mine operator must develop and implement strategies for the control of any fatigue risks to the health and safety associated with worker fatigue”.

Duty to carry out health monitoring

“(1) The Mine Operator of a mine must ensure that health monitoring is carried out in relation to a worker at a mine who is exposed to a risk associated with mining operations, that may reasonably be expected to have an adverse effect on the worker’s health”.

“(2) Health monitoring must:

- (a) commence before the worker starts work at the mine
- (b) be carried out immediately before the worker ceases carrying out the work that exposes the worker to risks associated with mining operations”.

Political, economic, social and technical (PEST) analysis

On a flip chart, title eight pages with the following:

- t Political Drivers
- t Economic Drivers
- t Social Drivers
- t Technical Drivers
- t Political Barriers
- t Economic Barriers
- t Social Barriers
- t Technical Barriers

Record participants responses to the following exercise on the appropriate chart.

// Ask participants to identify fatigue management drivers and to characterise them either as:

Political Economic Social Technical

Ask participants to identify fatigue management barriers and to characterise them either as:

Political Economic Social Technical

Facilitator can add further notes here

— Analysing forces

The fatigue management drivers we identified are factors in building recognition for the need to change, they become the reason why we need to change the way we do things. Implementing change is more palatable than being affected by change if there is an understanding as to why we need to make the change and why we need to do it now.

The fatigue management barriers identify the issues we will need to resolve in order to implement the fatigue management plan. Identifying these barriers means we are able to consult, educate, negotiate and inform those who are affected by the change to disperse any misinterpretation or misrepresentation in the need to change.

In knowing where we will receive resistance to the implementation of the fatigue management plan we will be able to develop strategies to overcome this resistance and achieve fatigue management.

Facilitator can add further notes here

3.5 Implementing a fatigue management plan

— Planning action

Once fatigue risks have been comprehensively identified and assessed, the risk management strategies need to be planned and the roles and responsibilities for actions need to be assigned.

Establishing shared responsibility

The responsibility for worker well-being needs to be formally defined and accountability for a safe system of work to be established. Actions that establish accountability and responsibility for managing fatigue-related risk could include:

- clear delineation of accountability and responsibility for fatigue risk management
- organisational requirement for managers to report formally on fatigue risk management in their work area
- management to resource fatigue risk management.

— Promoting the necessity for fatigue management

Promoting a workplace environment in which fatigue related risk is managed by all individuals is essential. The first step is to encourage a culture in which the shared responsibility for fatigue risk management is established through the change management process.

The political, economic, social and technical (PEST) analysis outcomes identify drivers for and the barriers resisting fatigue risk management.

Promoting drivers of fatigue risk management can be useful in overcoming resistance in implementing a fatigue risk management plan.

// In groups develop a strategy how you may use the identified drivers in the PEST analysis to promote the need for fatigue risk management in your workplace.

Identify how your strategy can overcome resistance to the implementation of a fatigue management plan?

— Education and awareness program and competency based training

As part of the implementation of an FMP all workers should be required to attend education sessions.

Three modules should be included in the education package:

Module 1: Fatigue-related risk and management at an individual level. This covers the scientific evidence about the role of inadequate sleep, long periods of wake and the circadian system in elevating fatigue related risk. It should also cover the specific aspects of performance that are affected by the mining setting.

Module 2: This module should provide information on the mine policy, fatigue risk management, the implementation of an FMP and the roles and responsibilities under the policy.

Module 3: This module should cover the requirements under the WHS legislation and how the implementation of a Fatigue Risk Management System (FRMS) can address responsibilities under the Act.

This module is aimed at the local fatigue working group and all staff in a supervisory or managerial role.

The local working group will determine the processes to ensure that all affected workers receive appropriate training.

// Develop a worker awareness or education campaign targeting fatigue. Choose from the following topics:

- The shared responsibility framework
- Work scheduling and sleep opportunity
- How workers can present fit for work - no blame reporting
- Mental and physical demands of work, the work environment and likelihood and consequences of fatigue related error
- Determining the likelihood of fatigue
- Commuting
- Individual and non-work related factors.

Things to consider:

- Who is your audience
- What is your message

Facilitator can add further notes here

Developing a fatigue management plan

Now that your workforce are on the same page, management have demonstrated a commitment to fatigue management (through the development of a policy outlining how they plan to resource implementation and have defined the responsibilities of certain roles in implementing the fatigue management plan) and a risk management system has been established, what do we want our plan to achieve? How do we ensure a process for continuous improvement?

Performance indicators can facilitate the establishment of a process to achieve an agreed goal and can also be used as a process toward continuous improvement.

On a flip chart or white board, create three columns and write the headings 'Goals' in the first column, 'Performance indicators' in the second and 'Actions' in the third.

Goals	Performance Indicators	Actions
Establish an agreed approach to fatigue management.	All PCBU's and workers participated in the consultation.	Managers agree on a broad framework. Information and awareness. Fatigue management survey. Drivers and barriers.

Establish some goals, performance indicators for an FMP and determine some actions to achieve the goal.

Ask participants to review each element of their fatigue management self assessment and identify an element of the fatigue management plan which requires further action.

Identify:

- Goals
- Performance indicators
- Actions.

If you refer back to modules 2.4 and 2.6 each of the levels of control presented could be expressed as a leading or lagging performance indicator.

Refer to the *Health Indices Fatigue Management* factsheet as a reference for understanding leading indicators and to identify possible actions.

3.6 Monitoring and evaluating: fatigue management plan

Meeting regularly with persons identified with responsibilities in implementing fatigue management is useful in monitoring the implementation and status of each of the implementation phases.

In particular the *Fatigue Management Plan Guide* requires that sleep opportunity and sleep obtained be monitored.

Further information about the effectiveness of the plan can be obtained through monitoring incidents to identify if fatigue may have been a contributing factor. If you have any systems or tools to detect fatigue related behaviour or for reporting incidents involving fatigue related error, these can be an indicator of how well your plan is managing fatigue.

Leading performance indicators

A good approach to monitoring a plan is to establish management goals and measurable 'performance indicators' for different elements of the plan. Actions can then be identified for each management goal and the plan can be monitored and evaluated against the pre-determined performance indicators.

The *Fatigue management self-assessment worksheet* can be used as a guide to identifying health management goals that will help progress a site along the maturity ladder. Goals can be identified for important elements of the plan such as consultation, information and training, and fatigue risk management and control.

If you refer back to modules 2.4 and 2.6, each of the levels of control presented could be expressed as a leading or lagging performance indicator.

Refer to the *Health Indices Fatigue Management* factsheet as a reference for understanding leading indicators and to identify possible actions.

Facilitator can add further notes here



Fatigue action and review plan record sheet

Mine name:		Section:		Date:		
Person responsible for maintaining plan:				Induction updated (date):		
Fatigue Source	Control Measures	Fatigue Management or Work Procedures for Review	Training requirements	Exposure Monitoring	Review Date	Person Responsible
Management sign off:					Date:	

- **Evaluating your fatigue management plan against your positive duty**

Write the following statements as titles on separate pieces of butcher's paper and stick on the wall.

- Ensuring they keep up-to-date knowledge on WHS matters
- Understand the nature of the duties of the PCBU and the risk associated with those duties
- That the PCBU is appropriately resourced and has processes of work that eliminate risk or control risk
- That the PCBU has processes to receive information for consideration, regarding incidents, hazards and risks in a timely manner
- That PCBU is resourced and informed to ensure that it is able to comply with their obligations
- Other

Give each participant some medium sized post-it notes

Consider the statements and write a fatigue management strategy on a post-it note that most closely represents the statement. Then place the post-it note on the page.

Facilitator can add further notes here

Positive duties

Reasonable practice must be taken to eliminate risk or control risk, and persons concerned with the risk must be provided with information regarding the risk under Section 18 of *WHS Act 2011*.

We have duties under the WHS Act. Duties of officers are prescribed under section 27 where it states that an officer must exercise due diligence by:

- Ensuring they keep up-to-date knowledge on WHS matters
- Understand the nature of the duties of the PCBU and the risk associated with those duties
- That the PCBU is appropriately resourced and has processes of work that eliminate risk or control risk
- That the PCBU has processes to receive information for consideration, regarding incidents, hazards and risks in time, so that the PCBU has the opportunity to consider the information
- That the PCBU is resourced and informed to ensure that the PCBU is able to comply with their obligations
- That the PCBU verifies that the resources and processes are working.

Workers must take reasonable care for their own health and safety and ensure that their acts or omissions do not adversely affect the health and safety of other persons.

This means that workers need to take reasonable steps not to present to work in a fatigued state that could hinder their capacity to undertake work tasks safely and they need to report when they are on a task and they do not have the capacity to conduct the task safely due impairment under Section 29 of the *WHS Act 2011*.

The six statements that have been placed around the room, can anyone tell me where these statements came from?

Section 27 of the *WHS Act 2011*, Duties of Officers.

Facilitator can add further notes here

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Glossary

Active Work	Total time spent at work including overtime. This does not include time travelling to or from the work site or rest breaks during shifts.
Employee / Worker	Any person who works on the site, regardless of their employer. This includes contractors.
Operator / Employer	Any person or organisation responsible for the employment of one or more employees / workers on site.
Extended Working Hours	Any hours in excess of established rostered hours, including overtime.
OHS	Occupational Health and Safety
Rostered Hours	The hours for which an employee / worker is rostered to work
Time Not Working	Time outside of working hours. Does not include time travelling to or from the work site.
Work Cycles / Rosters	The working period scheduled between any significant break away from work.
Work Schedule	The hours to be worked for each shift, week, month or year as scheduled by the employer.
Shift	The hours between the start and finish of establish rostered hours.