

## **Fatigue**

### What law applies

Legal obligations, legislation, codes of practice

### About fatigue

Mental and physical exhaustion, causes of fatigue, circadian rhythms, fatigue and sleep, causes of sleep loss

### Effects of shift work and extended working hours on fatigue

Shift work, poor quality sleep, adverse effects

### Effects of fatigue

Work performance, micro-sleeps, health effects

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## What law applies

In order to understand the workplace health and safety requirements for fatigue, and your obligations under the law you must consider and understand relevant legislation and codes of practice.

### ***General health and safety obligations***

To understand your obligations and safety requirements you must be familiar with the:

*Workplace Health and Safety Act 1995* which imposes obligations on people at workplaces to ensure workplace health and safety. The *Workplace Health and Safety Act 1995* also helps you to meet your workplace health and safety obligations through:

- The *Workplace Health and Safety Regulation 2008* which describes what must be done to prevent or control certain hazards which cause injury, illness or death
- codes of practice, which are designed to give practical advice about ways to manage exposure to common risks. In particular, the *Risk Management Code of Practice 2007* should be read in conjunction with information on PPE.

Every Queensland employer must have **workers' compensation** insurance. Most employers insure with WorkCover Queensland, while a small number of large organisations have their own insurance. This insurance coverage ensures that employees injured at work receive financial support.

### ***What you must do***

It is a requirement of the *Workplace Health and Safety Act 1995* that risks must be assessed and control measures then implemented and reviewed to prevent or minimise exposure to the risks.

If the *Workplace Health and Safety Regulation 2008* describes how to prevent or minimise a risk at your workplace you **must** do what the regulation says. If there is a code of practice that describes how to prevent or minimise a risk at your workplace you **must** do what the code says or adopt and follow another way that gives the same level of protection against the risk.

If there is no regulation or code of practice about a risk at your workplace you **must** choose an appropriate way to manage exposure to the risk. People must, where there is no regulation or code of practice about a risk, take reasonable precautions and exercise proper diligence against the risk.

See the *Risk Management Code of Practice 2007* for further information.

## About fatigue

Fatigue is mental or physical exhaustion that stops a person from being able to function normally. However, fatigue is more than just feeling tired or drowsy – it is normal to become tired through physical or mental effort.

### *Causes of fatigue*

Fatigue is caused by prolonged periods of physical and/or mental exertion without enough time to rest and recover. The level of fatigue varies, and depends on the following:

- Workload;
- Length of the shift;
- Previous hours and days worked; and
- Time of day or night worked.

Fatigue is associated with the following:

- Spending **long** periods of time awake;
- Obtaining an inadequate **amount** of sleep over an extended period; and
- Obtaining an insufficient **quality** of sleep over an extended period.

Fatigue significantly affects a person's ability to function and the effects of fatigue include decreasing performance and productivity, and increasing the potential for incidents and injuries to occur.

### *Circadian rhythms*

**Circadian rhythms**, or the internal body clock, are the body's natural rhythms that are repeated approximately every 24 hours.

Due to circadian rhythms, the human body is more awake during the day. The human body experiences a reduction in activity in the midnight to dawn period. This is a fundamental human characteristic and can not be changed.

Work schedules that require people to be awake and active at night, or to work for extended periods of time, disrupt circadian rhythms. These disruptions:

- Affect the quality and quantity of sleep;
- Affect task performance; and
- May also contribute to a sense of personal dislocation and imbalance.

Accidents are more likely to occur at night, particularly during the period when the circadian cycle is at its lowest point (midnight to dawn) when a person would normally be sleeping.

## ***Fatigue and sleep***

Sleep is the only effective long-term counter-measure to fatigue. Maintaining sufficient levels of sleep will prevent fatigue.

The amount of sleep required by a person varies, with seven to eight hours of daily sleep considered the average for an adult. People who continually get less sleep than that necessary for them will accumulate a sleep debt.

For example, if a person who requires eight hours of sleep only has six hours of sleep, then this person is deprived of two hours of sleep. If this occurs over four consecutive nights, the person will have accumulated an eight hour sleep debt. Sleep debt leads to increased levels of fatigue.

### ***Causes of sleep loss***

A number of factors in the workplace and in a person's private life can cause sleep loss. Examples from the workplace include:

- Extended working hours;
- Irregular and unpredictable working hours;
- Time of day when work is performed and sleep obtained;
- Shift work;
- Having more than one job; and
- Stress.

Sleep loss may also be caused by health conditions such as **obstructive sleep apnoea** which is a condition which occurs while sleeping, where the muscles of the throat relax and block the airway above the voice box. This causes breathing to stop until the brain registers a lack of breathing and sends a small wake-up call, which briefly wakes the sleeper before they drift immediately back to sleep (usually the sleeper is not aware of having woken up). This process can repeat itself many times through the night, causing a person to feel fatigued during the day.

Many workers rely on caffeinated drinks, such as coffee to assist them to manage fatigue. However these will contribute to sleep loss if used within six hours before sleep. This effect may be increased if combined with medications containing ingredients such as pseudoephedrine hydrochloride.

## **Effects of shift work and extended hours**

Shift work and extended working hours can both impact on fatigue. Long hours and shift work patterns that disrupt the body's circadian rhythms often result in workers becoming fatigued.

### ***Shift work***

Shift workers as a group tend to get significantly less sleep than those who work equivalent hours that do not intrude on the typical sleep period (11pm – 7am). Sleep during the day is usually of poor quality due to circadian disruptions and environmental factors such as daylight, traffic and household noise.

### ***Extended working hours***

Extended working hours, particularly for shift workers, adversely affect the amount of time available for sleep and social activities. As work hours increase, the individual compensates by reducing the amount of time available for sleep and other activities. When a person works more than 48 hours within a week, the increased competition between sleep and other activities results in sleep of a limited quality and length. The individual begins to accumulate a sleep debt, which causes fatigue levels to rise, and affects health and safety.

## Effects of fatigue

Fatigue can affect and cause:

### Work performance

Reduced performance and output, increased risk of accidents

### Micro sleeps

Four to five second naps

### Health effects

Such as heart disease, high blood pressure, stomach disorders, mental illness and lower fertility

## ***Work performance***

High levels of fatigue cause reduced performance and productivity, and increases the risk of accidents and injuries. Fatigue affects the ability to think clearly. As a result people who are fatigued are unable to gauge their own level of impairment, and are unaware that they are not functioning as well or as safely as they would be if they were not fatigued.

Performance levels drop as work periods become longer and sleep loss increases. Staying awake for 17 hours has the same effect on performance as having a blood alcohol content of 0.05%. Staying awake for 21 hours is equivalent to a blood alcohol content of 0.1%.

The most common effects associated with fatigue are:

- Desire to sleep;
- Lack of concentration;
- Impaired recollection of timing and events;
- Irritability;
- Poor judgement;
- Reduced capacity for communicating with others;
- Reduced hand-eye coordination;
- Reduced visual perception;
- Reduced vigilance;
- Reduced capacity to judge risk; and
- Slower reaction times.

Not only do these effects decrease performance and productivity within the workplace, but they simultaneously increase the potential for incidents and injuries to occur. People working in a fatigued state may place themselves and others at risk, most particularly:

- When operating machinery (including driving vehicles);

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

### ***Micro sleeps***

A **micro sleep** is a brief nap that lasts for approximately four to five seconds. People who suffer from micro sleeps are not always aware when a micro-sleep occurs, which can have a significant affect on safety.

### ***Health effects of fatigue***

The effects of fatigue increase with age. People over 50 years of age tend to have lighter, fragmented sleep; which can prevent them from receiving the recuperative effects from a full night of sleep, and can make them more likely to become fatigued.

Lack of sleep has been indirectly linked with the following health effects:

- Heart disease and high blood pressure;
- Stomach disorders;
- Mental illnesses; and
- Lower fertility.

When the circadian rhythm is disrupted, the treatment of some medical conditions can be affected. Examples of medical conditions which may be affected include:

- Asthma;
- Depression; and
- Diabetes.

### **Heart disease and high blood pressure**

Circadian disruptions affect eating and sleeping habits and have been linked to the following types of cardiovascular disease:

- Coronary heart disease (blocked arteries in the heart);
- Ischaemic heart disease (blocked arteries leading to lack of oxygen to the heart muscle);
- High blood pressure; and
- Myocardial infarction (heart attack).

### **Stomach disorders**

The body rhythm for digestion is designed for food to be eaten during the day irrespective of whether an individual is working or resting. The most common complaints include:

- Bowel habit changes;

- Digestive complaints; and
- Increased risk of peptic (stomach) ulcers.

### **Mental health**

Anxiety and depression can be triggered or made worse by fatigue and irregular sleep patterns.

### **Lower fertility**

Fatigue and irregular sleep patterns have been associated with a number of negative effects for pregnant women and fertility rates, including:

- Increased risk of miscarriage;
- Low birth weight; and
- Higher occurrence of premature births.

# Managing fatigue

## Responsibility for managing fatigue

Who's responsible?

## Risk management

How to manage the risks associated with fatigue

## Factors

Considerations when managing fatigue

## ***Responsibility for managing fatigue***

Fatigue management is a shared responsibility between management and workers as it involves factors both inside and outside of work. Employers and persons conducting a business or undertaking are responsible for using a risk management approach to manage fatigue.

Relevant obligation holders under the *Workplace Health and Safety Act* include:

- Employers and self-employed persons;
- Persons conducting a business or undertaking; and
- Workers.

The *Fatigue Management Guide* has been developed to help these obligation holders address the issue of fatigue within Queensland workplaces.

## ***Risk management***

There are five basic steps in the risk management process, as outlined in section 22 (2) of the *Workplace Health and Safety Act 1995*. They include:

1. Identifying hazards;
2. Assessing risks that may result because of these hazards;
3. Deciding on control measures to prevent or minimise the level of risks;
4. Implementing control measures; and
5. Monitoring and reviewing the effectiveness of control measures.

For more information on how to use the risk management approach to meet workplace health and safety obligations, please refer to the Workplace Health and Safety *Risk Management Advisory Standard 2000* (now known as a Code of Practice).

## **Step One: Identify factors that contribute to fatigue**

The first step when managing fatigue is to identify factors within the workplace that may contribute to fatigue.

There are many ways to identify workplace factors that contribute to fatigue including:

- Inspecting workplace rosters;
- Consulting with workers – Ask about any problems encountered, any near misses or unreported injuries.
- Consult with workplace health and safety representatives and committees;
- Conduct a safety audit;
- Analyse injury and incident reports, pay particular attention to injuries and incidents that occur in periods of high fatigue; and
- Undertake worker surveys.

## **Step Two: Assess risk**

Risk is the likelihood that death, injury and illness may result because of the factors that contribute to fatigue. To assess risk, it is necessary to consider both likelihood and consequences.

The following should be considered when assessing the factors that contribute to fatigue:

- Time of day – incidents are more likely to happen in circadian low points;
- Length of shifts worked – the effects of fatigue are cumulative;
- Lack of opportunity to recover from fatigue;
- How often the situation occurs – the more often a worker is fatigued, the greater the likelihood is that an incident will occur;
- How many people are fatigued – the greater the number of people who are fatigued, the more likely an incident is to occur;
- The skills and experience of persons fatigued – consider training in managing fatigue;
- Any special characteristics of the people involved – such as medical conditions that may be affected by circadian rhythms and night shift work;
- The duration of exposure to fatigue – the longer a person is fatigued, the more likely an incident will occur; and
- The level of risk inherent in the work – particularly in work that is generally hazardous, such as operating heavy machinery or plant.

## **Step Three: Decide on control measures**

The third step when managing fatigue involves deciding on control measures to manage exposure to fatigue. Control measures should be introduced

according to the hierarchy of control, as outlined within the *Risk Management Advisory Standard 2000* (now known as a Code of Practice).

The ideal solution when managing fatigue is to completely eliminate factors contributing to fatigue. Because fatigue is caused by a combination of factors, the most effective way to manage it is by using a combination of risk control measures. Examples include:

- Limiting shift work to core duties that must be completed at night;
- Redesigning work practices so that routine administrative tasks are minimised for night shift workers;
- Scheduling later start times so that maximum night sleep can be had before starting work (however this can affect those on night shift);
- Scheduling low risk work during periods of high fatigue; and
- Scheduling complex tasks to be performed only during the day.

Administrative controls should not be relied on as the primary means of risk control until the options higher in the list of control priorities have been exhausted and should only be used:

- When there are no other practical control measures available;
- As temporary measures until a permanent solution is found; or
- To supplement other controls.

Examples of administrative controls that may be used to manage fatigue include:

- Sufficient supervision, particularly during periods of high fatigue, and especially for hazardous work;
- Contingency plans removing fatigued workers from work activities where there is a considerable risk to health and/or safety;
- Effective emergency responses;
- Strict controls and procedures if performing hazardous work during high fatigue periods; and
- Job rotation for repetitive tasks, or work that involves heavy physical demands.

#### **Step Four: Implement control measures**

The fourth step when managing fatigue is putting the selected control measures in place. These activities include:

- Developing work procedures;
- Communicating control measures ;
- Providing training and instruction; and
- Supervision.

Effective fatigue control measures should define and communicate responsibilities, and provide a shift system that gives staff sufficient opportunity for rest and recovery.

When communicating control measures to workers, it is important to remember that under section 81 (1) (f) of the *Workplace Health and Safety Act 1995*, workers (through their workplace health and safety representatives and committees) are entitled to be consulted about any changes in the workplace that affect, or could affect their safety.

This consultation process should include:

- The possible health and safety impact of changes;
- The benefits and problems associated with the proposed changes;
- Measures needed to eliminate or control any adverse impact on health and safety;
- Processes for incorporating needs of workers with impairments;
- Procedures for workers to notify supervisors of any impairment or potential impairment that may pose a risk; and
- Definition and communication of responsibilities.

Training and instruction for workers and supervisors on fatigue should include information about:

- Common causes of fatigue including shift work, extended working hours and roster patterns;
- Potential health and safety affects of fatigue; and
- How workers are responsible for making appropriate use of their rest days.

If workers must attend training outside the normal shift, they should be considered at work and rosters adjusted accordingly.

Adequate supervision should be provided to ensure that new control measures are being used correctly.

### **Step Five: Monitor and review**

The final step in the fatigue management process is to monitor and review the effectiveness of fatigue control measures to consider these points:

- Have the chosen control measures been implemented as planned?
- Are the chosen control measures working; and
- Are there any new problems?

When answering these questions:

- Consult with workers, supervisors, health and safety representatives, officers, and committees,

- Measure exposure to fatigue; and
- Monitor incident reports and assess the likelihood for fatigue contributing to incidents – pay particular attention to injuries and incidents that occur in periods of high fatigue.

To best manage fatigue, it is essential that there is a process, regularly reviewed, for ongoing monitoring and evaluation of workplace fatigue.

## **Factors to consider when managing fatigue**

The following factors should be considered when managing fatigue:

- Roster design;
- Commuting;
- Shift rotation;
- Sleep inertia;
- Breaks;
- Occupational exposure levels; and
- Manual tasks.

### ***Roster design***

When determining if roster design is contributing to fatigue, consider the following:

- Length of shifts – depends on physical and mental load of the work;
- Distribution of leisure time – allow for adequate rest and recovery;
- Regularity of shift system – allows workers to prepare for work,
- Length of shifts worked – this can contribute to fatigue;
- Previous hours and days worked – the effects of fatigue are cumulative, workers may have sleep debt due to the length of previous shifts;
- Type of work being performed – pay particular attention to the level of physical and/or mental effort required; and
- Time of the day when the work is being performed – remember that disrupting the body's circadian rhythms can cause fatigue and affect performance.

The key to managing fatigue successfully is ensuring that workers are given sufficient time between shifts. Adults require approximately seven to eight continuous hours of daily sleep. One way of doing this would be giving workers two successive full days off within a seven day period, so workers can catch up on their night sleep.

### ***Commuting***

Excessive hours spent travelling to and from work can extend the effective length of a shift, reduce the time available for sleep and recovery between shifts, and may have significant effects on fatigue levels. When combined with work-related fatigue, driving to and from work can be hazardous.

### ***Shift rotation***

If the starting times of shifts vary, the cycle should begin with an early start and move progressively later. Where a rotating three shift system is in

operation the preferred rotation is day, afternoon, and night. This will allow workers the maximum opportunity for rest between shifts.

### ***Sleep inertia***

**Sleep inertia** can occur if a person is woken after sleeping for more than 40 minutes. They may be slow to respond, may feel drowsy and disoriented. It may take up to 30 minutes before complex tasks can be performed efficiently.

Sleep inertia has implications for safety when workers are on-call for emergencies. Suggested measures to control sleep inertia and the subsequent impairment in work performance include:

- Minimising naps taken at work that exceed 40 minutes; and
- Planning for recovery times of up to 30 minutes for workers who may be subject to sleep inertia, before they are to perform hazardous tasks.

### ***Breaks***

Time spent away from the work environment allows workers to recover from fatigue and improve performance, vigilance, safety and efficiency. For this reason breaks should be taken during work shifts, and should not be traded for an early finish time.

Consider the following when deciding on the length and frequency of breaks within a shift:

- Type of work being performed – the greater the physical and/or mental effort required, the longer the total break time required per shift; and
- Length of shifts worked – the longer the shift the longer the total break time required per shift.

### ***Occupational exposure levels***

Extended working hours increase the risk of exposure to hazards such as noise, heat and chemicals and should be carefully monitored. National and international exposure standards are usually based on five 8 hour days per week. Workplaces where extended hours are worked will need to monitor exposure levels.

It is recommended that expert advice is sought in adjusting exposure levels, because the increased exposure of workers over a 10 hour shift may not be simply 1.25 times the exposure for eight hours. Models need to be used, to take into account the reduced recovery time after exposure to hazards when extended shifts are worked. Workplaces should always aim for best practice, to keep all exposures significantly below the specified standards which will ensure workers are not over-exposed to a hazard.

## ***Manual tasks***

The prolonged performance of repetitive tasks without the adequate chance of rest and recovery may result in an **occupational overuse injury**. The risk of a musculoskeletal injury occurring may also be increased within extended shifts due to the cumulative effects of muscle fatigue, strains and sprains. Workers involved in repetitive manual tasks should have regular breaks

The *Manual Tasks Advisory Standard 2000* (now known as a Code of Practice) provides guidance on eliminating and controlling risks associated with manual handling.