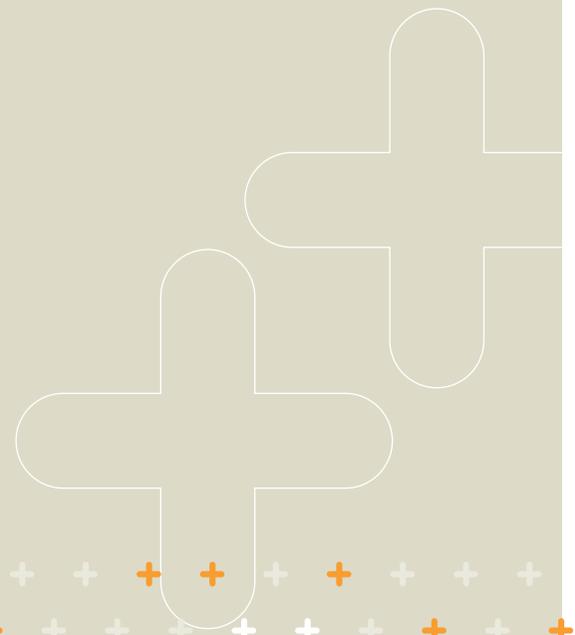




# Managing shift work to minimise workplace fatigue

➤ A GUIDE FOR EMPLOYERS





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## Overview of the guide

### Part 1: About workplace fatigue

Part 1 defines fatigue, examines the causes of workplace fatigue, and explains how recovery happens. Then it presents and explains 12 key facts about workplace fatigue (previewed below), and highlights the implications of these facts for employers.

#### The key facts

1. Adequate sleep is essential for maintaining and restoring full physical and mental functioning, and is the only way of providing recovery from fatigue (especially for the brain).
2. Stimulants, such as coffee, can provide only limited, short-term relief from the effects of fatigue.
3. Fatigue leads to physical and mental impairment.
4. Shift work (particularly night work) can be a significant contributor to fatigue.
5. Human alertness and capability vary with the time of day.
6. People are programmed to be awake during the day and asleep at night.
7. The ability to fall asleep easily varies with the time of day.
8. How much time people need to recover from fatigue depends on the time of day.
9. Sleep loss is cumulative.
10. Various strategies can minimise fatigue and promote better sleep.
11. Preventing workplace fatigue requires cooperation and compromise.
12. Various strategies are available for managing shift work to minimise fatigue.

### Part 2: Managing workplace fatigue

Part 2 presents a general framework for managing shift work to minimise workplace fatigue. It also offers some strategies for small employers who may not have the resources to fully develop the framework.

Putting a shift work management system in place may seem daunting at first. Managing shift work can be complex—production requirements and workers' needs must be weighed against each other. However, much of the framework presented here is common sense, which all employers can and should put in place.

Employers and employees need to work together to decide on the best strategies, policies, and procedures for their particular work setting. Some give and take will be required on both sides.

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may impair their strength, speed, reaction time, coordination, decision making, or balance.

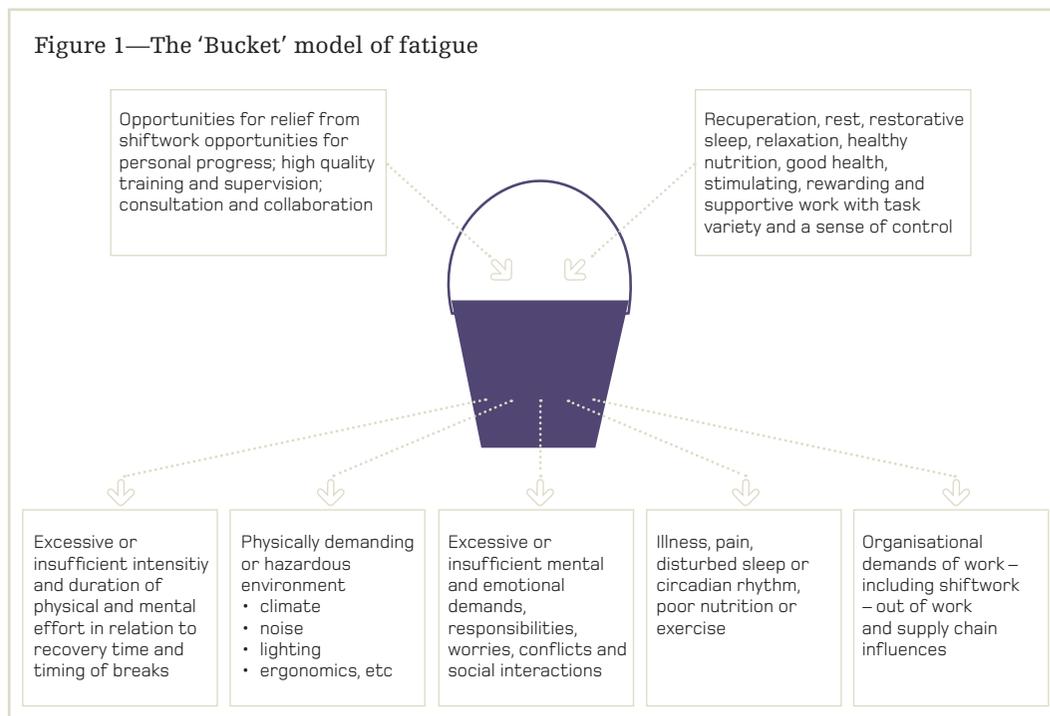
A level of fatigue is a natural response to the mental and physical effort of everything we do. Normally, good quality sleep reverses the imbalance, allowing the body and the brain to recover.

However, working long hours, working with intense mental or physical effort, or working during some or all of the natural time for sleep can all cause excessive fatigue. All of these have obvious implications for workplace and public safety. Fatigue can also have longer-term effects on health.

## Part 1: About workplace fatigue

### What is fatigue?

Fatigue is a physical and/or mental state caused by overexertion. It reduces a person's capabilities to an extent that



## The causes of workplace fatigue

### Shift work

In terms of work hours, shift work is defined as work that starts before 8.00am and finishes after 6.00pm. A biological definition of shift work would be any work pattern that causes a change in normal sleep patterns.

Shift work (in particular night work) can be a powerful cause of fatigue when it:

- limits a person's opportunities to get adequate sleep
- requires them to work in the early hours of the morning, when people are normally at their sleepest and least functional.

The evidence available on the effects of shift work is sketchy. Interpreting it in the practical situation is difficult because the risks are different for different jobs and groups of people.

### Extended work hours

Shifts that last longer than 8 hours are classed as long or extended. People may work long hours on a short-term basis to deal with a major emergency or an unexpected situation, or they may work long hours regularly for financial or other reasons. Appendix A makes some recommendations about managing long work hours in emergencies.

The effects of working long hours depend on how long the work periods are, how often they occur, and at what time of day.

Sleep restriction (having several hours less sleep than needed) has clear, negative effects on human performance. It suppresses the immune system, increases appetite, and makes the body increasingly resistant to insulin. Several nights of restricted sleep can create a 'sleep debt', which has clear effects on performance.

### Effects accumulate

The combined effects of sleep restriction and extended hours of work have a short-term impact on performance, and in the long term may affect cardiovascular health, mental health, safety, and productivity.

How long people can go on working extended hours before they suffer adverse health effects is not known. We do know that:

- working more than about 55–60 hours a week (during the day) for an extended period is likely to have significant health effects
- extending a working week from 65 to 70 hours will have more impact than extending it from 40 to 45 hours, even though the amount of extra time is the same
- a period of extended work will have more impact if it follows other periods of extended work than if it is a one-off
- the effects of long periods of extended work hours (several months to years) will be greater than the effects of short periods (2–4 weeks).



### Night work

All the statements above refer to day work. Working at night has a greater impact than working the same number of hours in the daytime, and the impact is even greater when the work hours are extended.

On average, shift workers lose 1–1.5 hours of sleep for each 24-hour period. This builds up a sleep debt of 6 hours after 4 nights. Working more than three or four night shifts in a row is likely to cause a significant sleep debt, with serious consequences for safety.

Night-work hours should be limited. For example, an employment contract for employees doing work where risks of errors are high could state:

The total number of hours an employee may work between midnight and 6.00am is limited to 18 over three days, after which they must have two full nights off for sleep.

### The consequences of workplace fatigue

#### Fatigue leads to human errors

Errors made by shift workers in the early hours of the morning were critical factors in the disasters at Three Mile Island, Chernobyl, and Bhopal, as well as in the Exxon Valdez oil spillage. Fatigue-induced human errors can have major consequences for public safety, as well as for the workers involved, in one-off events like these.

A recent study showed that fatigue is common among New Zealand truck drivers and can build up over time. In this study:

- one out of four drivers reported being tired, even at the beginning of their shift
- 24 per cent of the drivers failed a standard computer test of their ability to steer, keep to speed, cope with wind gusts, and notice and respond to signals.

In a medical setting, a study of New Zealand anaesthetists found that 32 per cent recalled making a fatigue-related error in the previous 6 months. Further, 71 per cent of trainees and 58 per cent of specialists had exceeded their own safety limits for length of time at work.

Many other findings point to a clear link between fatigue and human error. For example:

- A recent study of medical interns found that every extended shift (of more than 24 hours) they worked in a month significantly increased their risk of a crash while commuting to or from work.
- In the United States, it has been estimated that fatigue contributes to between 20 and 40 per cent of all commercial vehicle crashes. These incidents are estimated to cost more than 15,000 lives in the USA and \$12 billion a year in lost productivity and property damage.

- Studies of error rates and productivity in round-the-clock industries, where work requirements and the work environment are comparable on all shifts, consistently show poorest performance on the night shift. Similarly, standard performance tests given to shift workers either at work, or at home between shifts, show poorest performance when they are working nights.

Extreme fatigue may cause a person to 'disengage' briefly in a so-called 'micro-sleep'. If this happens at a critical time, an accident may result. Micro-sleeps have been observed in train drivers and airline pilots during periods of critical operations, with the drivers and pilots often being unaware it was happening .

### Fatigue affects health

A recent summary from the National Institute for Occupational Safety and Health in the USA (NIOSH) analysed 52 recently published reports that examined long working hours in relation to illnesses, injuries, behaviour, and performance. The analysis indicated that long hours of work were associated with:

- people feeling less well, less alert, and more tired
- lower cognitive function, poorer performances on psychomotor tests, and declines in vigilance
- increased injury rates, more illness, and increased mortality.

When 12-hour shifts were combined with more than 40 hours' work per week, additional effects showed up. These workers had more health complaints, poorer performance, and a slower pace of work.

### Long term sleep problems

One way to measure the impact of night work is how much it restricts sleep . A 5-year study of over 18,000 French workers found that those who had worked at least 50 night shifts during 1990 were significantly more likely to have developed a sleep problem by 1995.

The study found that the more of the following conditions applied to a person's work, the more severe their problem was likely to be:

- not getting to bed until after midnight
- having to get up before 5am
- having to sleep in the daytime rather than at night.

### Recovery from fatigue

#### Sufficient sleep

In the long term, the average amount of sleep needed for health and alertness is between 7 and 9 hours a night. Most people need at least 6 hours of unbroken sleep in any 24-hour period to remain alert, assuming a zero sleep debt.

However, people vary in many ways—including their sleep needs and working time preferences (being an 'owl'



or a 'lark'). Little is known about the extent of this variation.

### Breaks between shifts

The Department of Labour recommends at least two consecutive full nights' sleep (with a normal day between) in each week. Available research indicates that, other things being equal, this is enough to allow performance to return to normal, at least in the short term.

The length of break a person needs to ensure they get enough sleep depends when the break begins. A 10-hour break starting at 10.00pm will allow much more sleep than a 10-hour break starting at 10.00am. We have a strong preference for sleep at night. This is not just a social convention, but a physiological need.

The length of break a person needs to get enough sleep will also depend on how much time they need for getting to and from work, eating, washing, dressing, and socialising.

### Breaks during shifts

Breaks within the working period provide for refreshment and restore physical capabilities and alertness.

Workers are often given breaks at set times determined by custom or convenience. However, shift workers need to protect themselves from fatigue. Ideally, they should take regular breaks from sustained activity, rather than waiting until their performance starts

to suffer after fatigue has set in (or until a scheduled break time). Rest taken after performance begins to decline tends to be less effective and provide only temporary relief.

There is evidence to suggest that rest breaks in addition to the traditional breaks (two 15-minute breaks, and one 30-minute meal break) can improve overall productivity. This is probably due to the relief from fatigue that these extra breaks provide.

Breaks can be used to

- attend to physical needs (eating, drinking, going to the toilet)
- recover from physical effort
- relieve the effects of static postures
- relieve the effects of repetitive physical actions (such as prolonged keyboard use)
- relieve the effects of concentrated mental work (including prolonged visual work)
- recover from unusually hot or cold conditions
- take a nap.

Education and training, such as useful exercises to do, will help workers to make the most of their breaks.

### Whole-of-work factors

Consider all aspects of employees' jobs when looking for ways to make their

work safer, more enjoyable, and more productive.

People cope better with day-to-day workplace stressors (including fatigue) when they:

- have a balance of effort and rest
- are properly trained and supervised
- get objective, prompt feedback
- feel their efforts are acknowledged and rewarded with appropriate pay and status.

Features of work that operate over a longer time span and may make it more satisfying are:

- training and other opportunities for skill development and advancement
- opportunities for relief from shift work
- opportunities for project work (work that has a clear end) as a change from repetitive work.

A fuller account of the effect of whole-of-work factors appears in the Department of Labour Publication *Healthy Work: Managing Stress and Fatigue in the Workplace*, available from [www.dol.govt.nz](http://www.dol.govt.nz).

### **Key facts about fatigue, and their implications for employers**

The following list of 12 key facts was developed from both practical experience and research results. It was presented

at a series of workshops on workplace fatigue held by the Department of Labour in June 2003.

#### **1. Adequate sleep is essential for maintaining and restoring full human functioning**

Most humans need an average of around 7.5–9 hours of good quality sleep a night for consistent physical and mental recovery from daily activities. Getting adequate sleep is the only way to recover from fatigue, especially for the brain. Just as muscle fatigue can only be reversed through rest, mental fatigue can only be reversed through sleep.

Sleepiness, like hunger and thirst, is a signal from the body of a basic need. In extreme sleepiness, a person may begin to 'nod off' without being aware of doing so, or even fall asleep.

Work-related sleep loss is a significant public health issue. In a recent survey, 37 per cent of New Zealanders aged 30 to 60 years said that they 'never' or 'rarely' got enough sleep at night, and 46 per cent said they 'never' or 'rarely' woke up feeling refreshed.

In the short term, people who do not sleep well tend to eat more, and are more likely to pick up infections. Long-term health effects related to sleep problems include digestive system upset, cardiovascular disease, and other complaints.



### Implications for employers

When employees' sleep is affected by shift work (particularly night work) they will not function as effectively as employees who work normal day shifts.

Aim to manage shift work and overtime so that employees have regular opportunities for adequate recovery through high quality sleep.

### 2. Stimulants provide only limited, short-term relief

The use of stimulants such as nicotine, caffeine, and some other drugs can help maintain alertness in the short term. However, this gain comes at a cost—the 'crash' when the effects of the stimulants wear off. Poor quality sleep may result from carry-over effects of the stimulants.

Sleeping tablets can reduce fatigue effectively if used appropriately and for limited periods. However, they just mask the problem if the causes of sleep problems remain unchanged. Only good quality, natural sleep will provide full recovery.

### Implications for employers

Providing coffee is not a solution to workplace fatigue. You need to manage shift work in ways that reduce employees' need for stimulants.

### 3. Fatigue leads to physical and mental impairment

Laboratory studies indicate that fatigue impairment can be equal to or greater than alcohol impairment.

In the workplace, fatigue may cause workers to:

- feel sleepy
- find it hard to pay attention
- have slower reaction times and poorer coordination
- have slower, muddled thinking.

### Implications for employers

Evaluate the risks posed by tasks performed when levels of fatigue can be expected to be high, and have systems in place to detect fatigue impairment. Design work to prevent fatigue accumulating, and support recovery by providing adequate opportunities for high quality sleep.

### 4. Shift work (particularly night work) can be a significant cause of fatigue

While shift work in itself inevitably produces fatigue, it is not the only direct cause. Shift work acts as a cause of fatigue along with other work and non-work factors.

Other causes of shift worker fatigue may include:

- physical and mental task demands—high workload, lack of breaks, work duration, type of work, work scheduling, unpredictability of hours of work
- environmental factors such as noise, artificial light, heat, humidity, and vibration

- biological factors—lack of sleep, less functional times in the body's daily cycle, poor health
- activities away from work—family responsibilities, social commitments, commuting.

Shift workers have more accidents commuting to and from work than non-shift workers, which are likely to be caused by fatigue.

#### Implications for employers

You need to be especially alert to the possibility of fatigue-induced impairment in shift workers by:

- identifying the times when workers are more likely to be affected by fatigue
- timing the starting and ending points of shift rosters to minimise fatigue
- applying and following the types of strategies described in Part 2.

### 5. Alertness and capability vary with the time of day

People's ability to be alert or to focus attention is not constant throughout the course of a day. There are two low points during the 24-hour cycle, which occur for most people somewhere between 3.00 and 5.00am, and again between 3.00 and 5.00pm.

These low points are reflected in the times when most fatigue-related driving accidents happen.

### Implications for employers

This information has possible implications for:

- task scheduling
- performance expectations
- the number, length, and use of breaks.

Shift workers may be less able to assess their safety and modify their behaviour during the low-functionality times of day or night. You and your employees need to agree to take a conservative approach to safety at those times.

The particular measures you take to prevent fatigue-related errors will depend on the risk—how likely such errors are, and how serious their consequences would be.

### 6. People are programmed to be awake during the day and asleep at night

Humans have an inbuilt 'body clock' that controls daily rhythms of alertness and sleepiness.

When people do shift work they must try to override the body clock to remain active at night when the body wants to sleep, and to sleep when the body wants to be active. As a result, they may be working when they are at their least functional and most error-prone, and not getting enough sleep between shifts to recover fully.

The body clock seldom adapts fully to shift work. An exception is when workers are never exposed to daylight at all. Workers



on oil platforms in the North Sea, for example, almost completely reverse their body rhythms after 2 weeks of working in this way.

#### **Implications for employers**

Try to minimise disruption to natural rhythms when planning shift work. Provide a roster that allows employees to regularly reset their body clocks to the natural rhythms.

### **7. The ability to fall asleep easily varies with the time of day**

Generally speaking, most people fall asleep naturally somewhere between 10.00 and 11.00pm, (although people do vary, with some preferring to go to bed earlier, and others preferring to stay up later). There is a period of wakefulness before this, from around 6.00pm to 10.00pm, when it is difficult for most people to fall asleep.

It is also difficult to fall asleep when the internal drive to be awake reaches its daily peak. This happens about 6 hours after the early-morning peak in sleepiness; that is, late morning for most people. It may be slightly later after a series of night shifts.

#### **Implications for employers**

Where practicable, avoid or minimise consecutive shifts that mean employees will need to sleep at those times when falling asleep is most difficult.

### **8. How much time people need to recover from fatigue depends on the time of day**

This fact, together with the following one (sleep loss is cumulative), means that while it is reasonable to expect employees to get adequate sleep during a normal overnight break of 12 hours, it is not reasonable to expect that they will get adequate sleep in a 12-hour break that begins in the morning.

#### **Implications for employers**

If possible, allow employees longer periods off if they must sleep during the day.

### **9. Sleep loss is cumulative**

As a pattern of shift work continues, the effects of sleep loss and poor quality sleep accumulate, leading to increasing sleepiness and performance impairment.

Two full nights of unbroken sleep within the normal self-selected sleep time of 10.00pm to 8.00am, with a normal day in between, are a minimum requirement for adequate recovery after periods of overnight work.

#### **Implications for employers**

Provide breaks with at least 2 full nights off (and where normal day-oriented functioning is possible) as part of the normal shift roster.

Depending on when the time-off period begins, this may mean providing a period longer than 48 hours. For example, a 48-hour break beginning at midnight gives only one full night of uninterrupted sleep.

Shift workers who cross time zones (such as international pilots) will have additional problems that need special measures.

### 10. Various strategies can minimise fatigue and promote better sleep

Good education about fatigue leads to common understanding and appropriate workplace-specific solutions. Shift workers can be given strategies to improve their quality of life and sleep, such as improving their sleep facilities, and avoiding caffeine or alcohol within the hours before sleep.

Make sure you cover the following topics in your information and training sessions:

- adjusting the sleeping area to promote good sleep
- good nutrition while working shifts
- use and avoidance of stimulants
- recognising fatigue
- getting to and from work safely
- fitness and exercise
- effective napping
- maintaining home and family life
- childcare arrangements
- equal facilities for shift workers.

#### Implications for employers

Provide training in fatigue management strategies before an employee begins shift work.

Education and training are an important part of any shift work management system, but they are never a complete solution.

### 11. Preventing workplace fatigue requires cooperation and compromise

Shift-working arrangements are a compromise between the business's need for work to continue at a time when people are normally asleep, and employees' need to recover adequately through quality sleep.

Finding compromises that are acceptable to the greatest number of people will require employee involvement and participation. Some rosters are better than others, but everyone involved needs to accept that there is no 'perfect' night-shift roster.

Bear in mind that:

- there is a sense that the most successful roster is the one that staff prefer
- people adapt their lives to any arrangements over time, and changing arrangements can be seen as a threat to their adaptations
- if a roster never changes, it cannot be improved.

#### Implications for employers

The success of any shift-working arrangements will largely depend on the quality of the consultation process. People taking on shift work need reliable, basic information to make informed choices.

Changing shift-working arrangements is a major undertaking. Employees will need time to adjust.



## 12. Various strategies are available for managing shift work to minimise fatigue

Strategies available for assessing and managing shift work include standard audit frameworks, roster design principles, risk assessment tools, and fatigue modelling methods.

There are various tools to use in developing these systems:

- FAID fatigue safety system – see [www.faidsafe.com](http://www.faidsafe.com)
- Australia New Zealand Standard 4360:1999 – Risk Management.

### Implications for employers

No single method of shift work management will fit all circumstances. Whichever method you use, you will need to tailor it to the needs of the organisation.

Strong leadership will be required, with one person with adequate authority overseeing the project as a whole. Good faith will also be required, with the understanding that shift work inevitably requires a balancing of interests.

The search for the ‘perfect roster’ is a wild goose chase. A shift work management system is never final—reviewing and evaluating it at an agreed level of formality must be part of shift work policy.

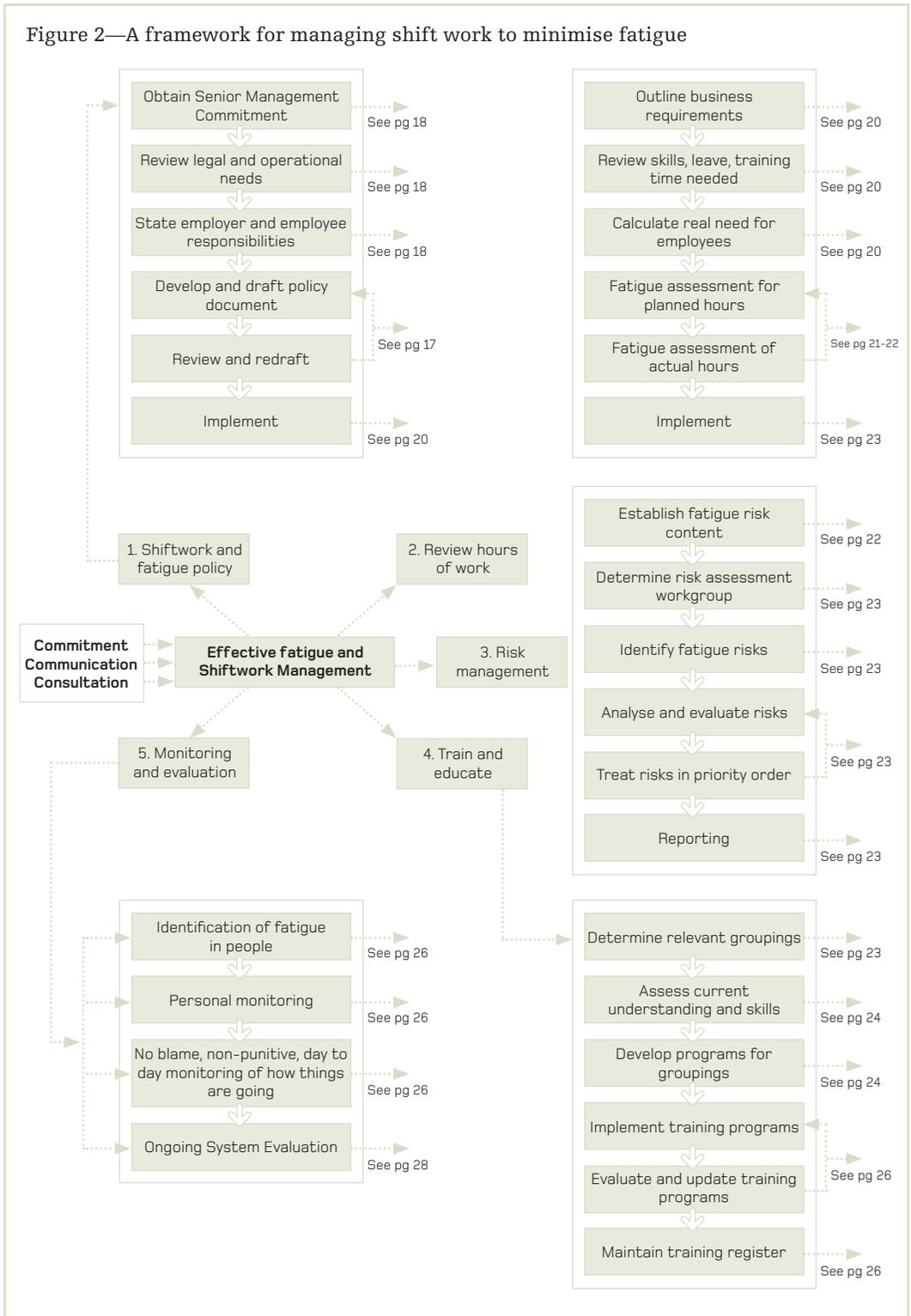
The framework below will apply more easily to larger employers. It is most important that it is applied in safety-critical work. A simpler set of strategies for small employers is provided at the end of Part 2.

## Part 2: Managing workplace fatigue

A framework for managing shift work to minimise fatigue

The framework presented here is not the only way to meet your obligations as an employer under the Health and Safety in Employment (HSE) Act. It is just one approach, based on the idea that the best focus is on opportunities for recovery, rather than on the number of hours worked.

Figure 2—A framework for managing shift work to minimise fatigue





## 1. Develop a shift work and fatigue policy

### Obtain senior management commitment

Managing shift work successfully needs high level commitment—and support with time and resources proportional to the importance of shift work in your business.

As an employer you need to:

- approve a responsible shift work policy
- support all activities needed to manage shift work
- insist on being up to date with any developments on shift work policy.

### Review operational and legal needs

Identify what your operation needs in terms of work that must be done by shift workers

Check what you and your employees have to do under the Health and Safety in Employment Act to manage fatigue.

As an employer your obligations include the following.

- Take all practicable steps to ensure the safety of employees at work. In relation to roster design, this could include:
  - reducing night work to the minimum possible
  - ensuring no worker spends more than 2–4 days on any one night shift
  - providing a minimum of 2 full nights' recovery after 2–4 night shifts

- rotating shifts forward (usually, although some rosters can work with backward rotation)
- avoiding rosters that require starting work before 6.00am
- implementing responsible alternatives where the measures above cannot be implemented.
- Systematically identify hazards and assess their significance in relation to shift work. This could include:
  - identifying risks in tasks to be performed
  - assessing the risk of performing tasks when workers are fatigued.
- Eliminate, isolate or minimize these hazards, in that order of priority.
- When employees face significant hazards, monitor their hours of work and their health.
- Provide information, training, and supervision for shift workers and health and safety representatives. Include families in training sessions if possible (though this is not an HSE Act requirement).
- Ensure that accident investigations consider whether fatigue was a contributing factor.

### Define employer and employee responsibilities

Review internal company policies and traditional operating methods alongside your legal and operational needs, to define who will have responsibility for doing what.

State these responsibilities as specifically and concretely as possible, as in the following examples.

Employees have a responsibility to:

- cooperate with the employer in matters of health and safety
- alert the employer if following normal procedures no longer seems advisable
- report hazards
- report when they feel they are not safe because of fatigue
- attend training, and be 'fatigue aware'
- use recovery and rest times appropriately, as much as they can.

Line managers have a responsibility to:

- contain working hours within specified fatigue limits
- monitor employee health, if required under the HSE Act
- keep training up to date and inform employees of hazards, including new hazards as they arise.

Senior managers have a responsibility to:

- take part in policy development
- provide facilities for night workers (training, access to HR, appropriate food) equivalent to those provided for day workers
- ensure regular reporting against standards
- evaluate from time to time how the shift management programme is going

- review counter-fatigue measures against specific standards
- provide adequate resources.

#### **Develop and draft a policy document**

A shift-work management policy should be constructed on two levels:

- the corporate level – establishing commitment from senior management
- the operational level – describing how the system will operate.

This policy (which could use the headings from this framework) can set a standard against which to evaluate the actual management of the shift work.

Remember that plans work best when they are SMART—that is: Specific, Measurable, Achievable, Realistic, and Time-framed.

For example:

*In 3 months all employees in the 'Product A' Division will be asked:*

- *what they know about the hazards of shift work*
- *what countermeasures they use to minimise the effects of fatigue*
- *what their last month's roster arrangements were*
- *what their opinions of their current roster arrangements are*
- *how they assess the hazards on their jobs.*



### Review and redraft

The policy will need to be reviewed and revised from time to time. Input from the people involved may identify areas that have been left out or need revising, and more formal evaluations may indicate where changes are needed.

### Implement

Once the policy is agreed on, move on to the next step.

## 2. Review the hours of work

Hours worked are one of the key factors affecting worker fatigue. Aspects of hours worked include:

- the number of hours
- the time of day
- the day of the week
- overtime or extended hours
- what breaks are provided within the work period.

The patterns of work to be done by each employee or group of employees need to be planned in advance and assessed.

### Outline business requirements

Identify your business requirements in terms of the outputs and inputs needed at different times of the day.

Some examples of outputs might be:

- wiring a home building extension
- driving from point A to point B and delivering so many packages

- ensuring the target amount of product is produced to the required standard.

Some examples of inputs are:

- adequate supplies
- trucks in roadworthy condition
- raw materials on hand.

Patterns of work hours for employees in a small business may have a less regular pattern than those of larger businesses.

### Review skills, leave, and training time needed

The outline of business requirements will indicate the roles required to do the work, the abilities and skills of workers in each role, and the training required for each role.

Shift workers need the same facilities as non-shift workers, such as access to first aid, training, human resources facilities, and refreshment. These needs should be planned for.

### Calculate the real need for workers

Using the information gathered under the previous headings, you can work out the number of workers needed at different times of the day, and so plan and assess a roster.

Making clear the extent to which the hours of work may vary will allow for appropriate planning by everyone. Unpredictability is a key element in employee dissatisfaction with shift work—for example, being called back to work unexpectedly while on leave, or at short notice.

### Fatigue assessment of planned hours

Table 1 outlines some of the factors that you will need to consider when developing a roster.

**Table 1. Suggestions for roster arrangements**

<b>Factor</b>	<b>Conventional recommendation</b>
1. Night work	Reduce to the minimum possible.
2. Length of work	<p>Extended working hours (shifts longer than 8 hours) may need to be examined.</p> <ul style="list-style-type: none"> <li>• Are the nature of the work and the workload suitable for extended hours?</li> <li>• Is the system designed to prevent fatigue accumulating?</li> <li>• Are arrangements to cover for absentees adequate?</li> <li>• Will overtime and/or double shifts be avoided or minimised?</li> <li>• Are toxic exposures limited?</li> <li>• Is adequate recovery after work possible before the start of the next shift?</li> <li>• Is there a high acceptance of the working time?</li> </ul>
3. Rate of rotation	Rotate shifts quickly—no more than 2–4 days on any one shift.
4. Direction of rotation	Rotate shifts forwards (ie, morning, afternoon, night). Some shift arrangements operate well when they rotate backwards, but such arrangements seem to need more commitment from employees.
5. Shift start and end times	Avoid rosters that require starting work before 6.00am. If possible, give longer breaks between shifts when breaks start in the early morning.
6. Lengths of periods off	Allow at least 2 full nights recovery time with normal daily activity after working nights—this is the minimum needed for recovery. Provide for some complete weekends off.



These recommendations reflect the requirements of human physiology. They are not all hard and fast rules, and it may be possible to devise successful shift-working arrangements that do not stick to them, if there are other ways of preventing fatigue accumulating.

Once you have designed a roster, you can assess how fatigue is likely to accumulate. There are various software programmes available for this purpose. However, fatigue modelling software may not take into account the effects of workload, environment, breaks within shifts, out-of-work activities, or the possible consequences of errors.

#### **Fatigue assessment of the actual hours worked**

The actual hours people work can differ from what is planned because of factors such as delays, call-backs, altered deadlines or delivery schedules, breakdowns, and shift-swapping.

Monitor the actual hours worked. If they differ significantly from the planned hours of work (and particularly if the actual hours worked cause a high level of fatigue) then you will need to revise the work schedule.

### **3. Manage risk**

#### **Establish fatigue risk context**

What are the risks (product liability, personal and public safety consequences of errors) if things go wrong? The answer

to these questions will determine how important it is to make sure that shift work is managed properly.

#### **Form a risk assessment workgroup**

A risk assessment workgroup could be formed to carry out the activities described in this section of the management system. The group would need to represent all employees affected by shift work.

#### **Identify fatigue hazards**

Assess each job or task to see if there are hazards that could worsen the consequences of a fatigue-related error. For example:

- moving machinery poses an extra hazard if a worker 'nods off'
- carrying out a maintenance operation early in the morning could result in incorrect reassembly.

Identifying hazards and assessing their significance are requirements of section 7 of the HSE Act.

#### **Analyse and evaluate risks**

Once you have identified the hazards, assess the risk associated with each one. You can do this using a framework such as that in the Australia/New Zealand Standard for Risk Management (ANZS 4360).

Table 2. Risk assessment scoring

Likelihood	Consequences				
	Insignificant	Minor	Moderate	Major	Catastrophic
A. Almost certain	High	High	Extreme	Extreme	Extreme
B. Likely	Medium	High	High	Extreme	Extreme
C. Moderate	Low	Medium	High	Extreme	Extreme
D. Unlikely	Low	Low	Medium	Medium	Extreme
E. Rare	Low	Low	Medium	Medium	Medium

It is clear that this process is valid only when there is good information about both the likelihood and the consequences of an event. If good information is not available then estimates of risk should not be presented as anything other than 'guesstimates'.

#### Treat risks in priority order

Risk control measures are described at this step and their effectiveness can be assessed from time to time. As an employer you are required to:

- assess each hazard identified and decide whether it is significant or not
- take all practicable steps to eliminate, isolate, or minimise significant hazards, in that order of priority
- where significant hazards can only be minimised, monitor workers' exposure to each significant hazard and, with their informed consent, monitor their personal health in relation to it.

#### Report

Results from this section of the system feed into shift work policy.

#### 4. Train and educate

The HSE Act requires that employees be informed about the hazards that exist in the workplace and about the measures the company is using to control them.

Information, training, and supervision of employees should aim to create a set of values, beliefs, and expectations shared by management, employees, and other affected people.

Provide new staff with information about shift work at induction. Those doing night work should be trained during their normal work hours—they should not have to come back during the day for training. Families and partners can be included in the training programmes. Educating their families about the importance of sleep will help night shift workers.



### **Determine relevant groups**

You will need to decide how to group employees and management (and perhaps other stakeholders) for training and education. Groups could be based, for example, on the similarities of their work/sleep patterns.

### **Assess the groups**

To design appropriate training, you will need to assess the current knowledge, values, beliefs, and expectations of each group in relation to shift work.

Questions to assess an employee's knowledge of shift work and its hazards could include some of the following:

- What are some of the hazards of shift work and night work related to fatigue, safety issues, and long term health problems?
- What are some hazards faced by night workers that are not faced by day workers in the same organisation?

- What are some of the warning signs and effects of fatigue?
- What does being 'fatigue aware' mean?
- What are some ways to promote high quality sleep?
- What are good eating and drinking practices for shift workers?
- How can exercise affect sleep quality and workplace alertness?
- How can commuting be affected by working shifts?
- How can working shifts affect family relationships?
- What are some helpful strategies to promote shift workers' family life?

### **Develop training programmes**

Design a training programme for each group of trainees that covers all the topics listed in Table 3.

Table 3. General training topics

Topic	Topic has consequences for work arrangements and facilities	Topic has consequences for out of work activities and sleeping facilities
Fatigue-related hazards and measures to combat them.	✓	✓
Napping	✓	✓
Fatigue awareness	✓	✓
Getting to and from work	✓	✓
Stimulant use and avoidance	✓	✓
Promoting good sleep	✓	✓
Fitness	✓	✓
Childcare arrangements	*2	✓
Home and social life	*3	✓
Nutrition	✓	✓
Exercise	*4	✓
Self-management, lifestyle choices, responsibilities	✓	✓

Notes

1. Will be relevant in workplaces that promote napping.
2. Providing childcare facilities may be an option for some workplaces.
3. Certain elements in work life overlap home arrangements for night workers; eg, ability of family to contact night workers in a home emergency.
4. Exercise is an important factor in shift work. Providing exercise facilities in workplaces can help people manage sleepiness.



### **Implement training programmes**

Training programmes can now be conducted. However, to make the desired behaviours possible, the organisation will need to implement the policies, processes, and workplace changes needed.

### **Evaluate and update training programmes**

You will need to evaluate the training programmes continually to find out whether:

- it is possible to apply the strategies proposed in the training
- the strategies are being applied
- there are any gaps in training and opportunities
- employees retain the information.

Various methods are available for evaluation, including focus groups, semi-structured interviews with employees and supervisors, direct observation, and questionnaires.

### **Maintain a training register**

A training register can help you manage, track, schedule and document training activities, requirements, and staff who have completed training activities

## **5. Monitor and evaluate**

This section describes four further steps that will be important in your shift work management programme.

### **Identify shift workers who are not coping well**

Some people do not cope well with shift work, especially when concerns outside the workplace weigh more heavily than usual (for example, a sick relative, a difficult relationship, or a bereavement). Managers and supervisors should be aware of the warning signs that an individual is not coping or is fatigued.

Factors that can affect individuals' responses to shift work are:

- training and experience
- general health and fitness
- age
- sex
- eating habits
- general coping skills
- rigidity of sleeping habits
- adaptability to different daily rhythms
- whether they are a morning person or an evening person
- whether they are introverted or extroverted.

The Health and Safety in Employment Act requires employers to take all reasonably practicable steps to identify when a fatigued employee is impaired to the point where they are a danger to themselves, their colleagues, or the public.

### **Monitor hazard exposure and health**

As mentioned earlier, monitoring employees' exposure to significant hazards and, with their consent, their personal health in relation to such hazards, is a requirement of the HSE Act.

Examples of exposure to a significant fatigue-related hazard include:

- operating dangerous machinery in the early morning
- having responsibility for seriously ill patients
- being a security officer.

Fatigue estimation software can help you to predict when people might experience hazardous levels of fatigue, and to adjust rosters accordingly.

It may help to consider the issues below, which can affect individual responses to shift work.

- Is the shift worker single, or living with a partner?
- Is the partner also a shift worker?
- How many children are affected by the shift work, and what ages are they?
- What housing does the shift worker have?
- What job alternatives are there in the locality?
- Is there a local shift-working community, and if so, how big is it?
- What local shift-working traditions exist?

- What leisure activities are available to the shift worker?
- What social support does the shift worker have?
- How much time does the shift worker have to spend travelling?

### **Find out about 'near hits'**

To get valid feedback about how well a shift-work management system is working, you need to know about fatigue-related 'near hits'. These include such things as when:

- a driver 'nods off' and clips a safety barrier
- a maintenance engineer realises later that she omitted a step in a reassembly procedure.

An anonymous, no-blame reporting system will make employees more willing to provide information about these sorts of incidents. Analysing the information may alert both you and your employees to safety issues and increase fatigue awareness.

### **Design a questionnaire for shift workers**

Supervisors need to be alert for signs of fatigue. A questionnaire to monitor the individual effects of shift work can be circulated to all employees at regular intervals, or be available for individuals to complete at any time.

The questionnaire could include questions such as the following.



1. *Are you generally coping with shift work better or worse than you have done in the past?*

*If worse, why do you think this is?*

2. *Do you recover from periods of shift work more slowly now than you did in the past?*

*If yes, why do you think this is?*

3. *Has your health been affected by working shifts?*

*If yes, how has your health been affected?*

4. *Have you been involved in a 'near hit' where you felt that your safety, or the safety of your colleagues or the public, was at risk because of some aspect of shift work?*

*Please describe the incident (without giving names) and say why you think it happened.*

### **Continually evaluate and improve the system**

At agreed intervals, as specified in policy documents, carry out an evaluation of the system involving all the key stakeholders.

### **Strategies for small employers**

Small businesses may lack the time, skilled personnel, or resources to develop complex, systematic approaches to the fatigue aspect of safety management. However, a responsible employer with

good staff support would find the strategies below reasonable, and easily accommodated into daily work activities and normal contact with staff.

To manage shift work well:

- involve your employees
- agree on responsibilities in relation to preventing fatigue
- work safe numbers of hours and allow enough recovery time
- ensure that high-risk tasks are done at safe times, or under special precautions
- train and educate staff to develop a culture of fatigue awareness
- support staff as far as possible (and ask staff about the best way to do this)
- look out for staff who are not coping (in both the short and the long term)
- take steps to detect impairment from fatigue
- monitor staff health, where they face significant hazards
- be alert for the contribution of fatigue in accident investigations
- assume that your arrangements will never be perfected, so evaluate them from time to time.

## **Appendix A: Working long hours in emergencies and shutdowns**

Coping with a major natural or industrial emergency, or a planned shutdown for maintenance or repair, will usually mean that some people must work extended hours, often at night.

Employers are not expected to follow the suggestions below as a prescription, but rather to adapt them to their own needs.

### Working through an emergency

Pre-planning anticipates emergencies and prepares responses as far as possible. Assess fatigue risks as an integral part of planning for envisaged emergencies.

- Provide appropriate preparation and training of people who may be called on.
- Provide supervision and prompt feedback about how to deal with uncertainties on the job
- Make sure workers get at least 6 hours sleep in each 24 hours, as well as other appropriate breaks.
- Allow time for napping, and provide beds or comfortable loungers.
- Provide washing facilities, including portable hot showers.
- Provide appropriate food and drinks.
- Assess fatigue risks as work proceeds.

- Provide information, consultation and opportunities for feedback.
- Keep special checks on workers aged over 50, who may not tolerate shift work well.
- Enable workers and their families to contact each other.
- Limit continuous work periods to 3–4 days.
- Allow workers enough time for full recovery after their period of work.
- Assess and monitor each worker's recovery.

### Working through a shutdown

The following strategies could apply to a prolonged industrial emergency such as repairing a damaged item of plant, or to a planned shutdown required for maintenance.

- Provide appropriate preparation, training and supervision, and prompt feedback about how to deal with uncertainties.
- Provide time and a suitable place for napping, with beds or comfortable loungers.
- Provide appropriate meal and refreshment breaks.
- Monitor fatigue risks.
- Provide information, avenues for consultation, and opportunities for feedback.



- Limit individual work hours to a maximum of 80 a week for a maximum of 2 weeks
- For night workers, provide transport to and from home, and make sure they can get appropriate food during their meal breaks.

## 📖 Appendix B: Your legal obligations

The Health and Safety in Employment Act 1992 requires employers to take all practicable steps to prevent harm from workplace hazards, including fatigue and the behaviour of fatigued workers.

Your legal obligations include:

- identifying and assessing fatigue hazards (section 7)
- controlling fatigue hazards by eliminating or minimising them
- where a significant fatigue hazard can only be minimised (rather than eliminated), monitoring employees' workloads and work hours, and (with their consent) monitoring their health in relation to that hazard (section 10.2)
- providing information and training about fatigue management (sections 12 and 13)
- making employees aware of their responsibilities in minimising fatigue (section 19)

- ensuring employees participate in health and safety processes (section 19A)
- responding to reports of fatigue, and report serious harm (section 25)
- acknowledging employees' right to refuse work that is likely to cause fatigue leading to a risk of serious harm (section 28A)
- detecting fatigue-related impairment in employees (section 19).

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