PORT HEALTH & SAFETY LEADERSHIP GROUP

Building a Fatigue Risk Management System

Good Practice Guidelines for the ports industry

NOVEMBER 2022

Disclaimer
This document includes general information about legal powers and duties that affect health and safety in the ports environment. However, it does not create legal duties and is not intended to operate as legal advice. While every effort is made to ensure that, the information in this document is current and accurate, all relevant parties should ensure that they have up-to-date information about their legal obligations and comply with these as required by law. These guidelines are designed to support your duties it is a guidance document and not a compliance tool.

Acknowledgements
The project group that developed these guidelines acknowledges and thanks the people and organisations that have contributed to them, especially the International Civil Aviation Organization, WorkSafe New Zealand, WorkSafe Victoria, and the Safer Nursing 24/7 Project on whose publications significant portions of these guidelines have been based.

Contents

Foreword

It is now widely accepted that fatigue is a significant risk in the ports environment. Unpredictable work allocation or working patterns dictated by ever-changing shipping schedules, casual workers who may have other jobs, broken shifts, long workdays or nights – all of these factors can result in fatigue at work.

To properly manage the risks from fatigue, all port companies should have a Fatigue Risk Management System (FRMS). Fatigue is a complex issue, and currently not all systems are as robust as they could be.

That is why we – a group of regulators, unions and employers – teamed up with fatigue expert Professor Leigh Signal from Massey University's Sleep/Wake Research Centre, to create these comprehensive FRMS guidelines. We have identified the unique challenges the ports industry faces and tailored our advice and tools to address them. These guidelines step you through all the elements involved in managing the risks of fatigue. They also include practical examples and templates that you can incorporate into an FRMS.

The guidelines presented here are good practice guidelines. Good practice guidelines offer advice but are not legally binding. You have to think about how you can apply these guidelines to your particular circumstances.

These guidelines are a live document that is based on science. As new information and science come to hand, we will review this document.

Fatigue is complex

We understand that fatigue is a complex area, especially in the ports environment. There will never be a 'one size fits all' approach to fatigue management. The point of these guidelines is to provide information and examples so that organisations understand the issues and can tailor the material here to their specific needs. These guidelines are designed to only provide a starting point in the process of designing an FRMS and do not show what an FRMS looks like. An FRMS also takes time to develop and is constantly improved as understanding of fatigue changes.

Understand the science behind fatigue

Fatigue can be difficult to detect. It often plays a hidden role in incidents at work, only to be revealed as a contributing factor through subsequent investigations. It is also regularly misunderstood. People may use different terms to refer to fatigue, like sleepiness, decreased alertness or tiredness. However, what really matters is that fatigue reduces a worker's ability to perform at their best and may reduce health and safety at work.

People also differ in their experience of fatigue. These guidelines look at the science behind fatigue and how to recognise the symptoms, and explore the barriers to adequate sleep for different types of work patterns. Note that fatigue is not necessarily just a result of lack of sleep or poor quality sleep.

Make fatigue management a shared responsibility

Fatigue is not just about what happens on the job. A worker can also become fatigued because of what they do outside of work. This means fatigue is a 'whole of life' issue, and the responsibility of managing it should be shared between the person conducting a business or undertaking (PCBU) and workers. However, the PCBU has the overall responsibility for the primary duty of care under the Health and Safety at Work Act 2015. These guidelines explain the importance of workforce buy-in and include an example of an FRMS policy.

Create a ‘just culture’ at work

Do workers fully understand what fatigue is and if they do, how ‘safe’, do they feel when it comes to reporting fatigue? The more comfortable they feel about coming forward and being open and honest about their concerns, the better position you as a PCBU will be in to manage the risks of fatigue. These guidelines explain the importance of having a ‘just culture’, as well as the valuable role Health and Safety Representatives can play, and how you can create a just culture.

With a just culture framework, an organisation can learn from an incident by asking, “What caused the incident?” rather than “Who caused the incident?” It identifies the root causes of an incident, including possible impairment caused by fatigue. It then uses the information to manage the risks and help prevent incidents from happening again. A just culture framework can improve workers’ confidence to report incidents because they trust they will be treated fairly.

Use science to create an FRMS

We have done the research, filled in the gaps and consolidated the information to provide a solid foundation for developing an FRMS. So please use these guidelines to see what improvements you can make so your FRMS is as solid as it can be or to create an FRMS if your organisation does not already have one.

Audience and scope

These guidelines are primarily for PCBUs-who develop, implement, oversee and maintain a Fatigue Risk Management System at a port. Port workers, unions and Health and Safety Representatives (HSR) may also find these guidelines useful.

In these guidelines ‘you’ means the PCBU. Work allocation in this document is the work schedule or roster that your organisation uses. Under the Health and Safety at Work Act 2015 (HSWA), you must ensure that so far as is reasonably practicable, the health and safety of your workers, and other persons are not put at risk by your work.

Workers also have their own health and safety duties. In terms of risk management this means that you are expected to engage with your workers, so far as is reasonably practicable, and work together to deal with the work related risks of shift work, including mental and physical fatigue.

It is important to remember that the material in these guidelines only provides examples and a starting point for developing or improving your FRMS. You will need to build on it and engage with workers and their representatives to tailor it to your specific operation.

Background

These guidelines are a product of the Port Fatigue Risk Management Project, one of the first projects to emerge out of the Port Industry Health and Safety Plan (Plan). The Plan was established to improve health and safety for workers in and around the ports environment. This includes wharf-side activities, ship movements and activities on board moored ships.

A number of Maritime New Zealand-led stakeholder engagements had identified fatigue management as an important focus for future improvement for the sector. A collaborative, consensus-driven project group composed of industry, workers, unions and government representatives then drove the development of the guidelines. Specifically the project group was made up of representatives from Maritime New Zealand, WorkSafe New Zealand, the Maritime Union of New Zealand, the Rail and Maritime Transport Union of New Zealand, the Ports Industry Association and the Merchant Service Guild. A fatigue expert from Massey University's Sleep/Wake Research Centre advised the project group.

How these guidelines will help you

These guidelines tell you how together, you and your workers can manage the risks from fatigue by developing a Fatigue Risk Management System (FRMS).

These guidelines look at the science behind fatigue, how to recognise the signs of fatigue and the barriers to adequate sleep. They are tailored to respond to the challenges ports face and include advice about how to:

- have a common framework and language for understanding the risks from fatigue
- assess the risks from fatigue in the ports environment
- develop and put in place appropriate control measures for fatigue, which may include safer work allocation and adequate staffing to cover the work schedule and rest/recovery time
- engage workers in managing the risks from fatigue
- identify workers at risk of injury and ill-health due to fatigue
- identify and monitor current and emerging fatigue hazards in the ports environment, which may include how work is arranged and the hours of work
- determine if the processes in place for managing fatigue are effective
- plan, trial and launch an FRMS if you do not have one
- review and possibly refine any current FRMS that you have.

In doing the above, these guidelines provide general information about fatigue, as well as information about duties and general risk management under HSWA.

Definitions or explanations

These guidelines use these terms with the following meanings:

Circadian body clock: internal 'clock' in the brain that controls daily cycles of different processes in the body, including temperature, hormones, falling and staying asleep, moods and ability to work.

Circadian rhythms: daily cycles of different processes in the body that are controlled by the circadian body clock.

Fatigue: a physiological state where someone is unable to function at their best and that can reduce health and safety at work. The four main causes are: missing out on sleep; being awake for too long; working and sleeping in the wrong parts of the circadian body clock cycle; and physical or mental workload.

Fatigue metrics: data the Fatigue Safety Action Group routinely collects and looks at as part of the day-to-day operation of the FRMS.

Fatigue Risk Management System (FRMS): a data-driven means of continuously monitoring and managing fatigue-related health and safety risks. An FRMS is based on scientific principles and knowledge as well as operational experience and aims to ensure relevant personnel are performing at adequate levels of alertness.

Fatigue Safety Action Group (FSAG): a group of individuals, including worker representatives, within an organisation with responsibility for coordinating and overseeing FRMS activities. Sometimes called a Fatigue Working Group or similar.

Hazard: anything that can cause harm. Under HSWA, a hazard "includes a person's behaviour where that behaviour has the potential to cause death, injury, or illness to a person (whether or not that behaviour results from physical or mental fatigue, drugs, alcohol, traumatic shock, or another temporary condition that affects a person's behaviour)".

Health and Safety at Work Act (HSWA): HSWA is the key work health and safety law in New Zealand. All work and workplaces are covered by HSWA unless specifically excluded.

Risk: in the context of health and safety, risk results from people being exposed to hazards (a source of harm). Risk has two components: the likelihood that it will occur; and the consequences (degree of harm) if it happens. Under HSWA, risks to health and safety must be eliminated so far as is reasonably practicable. If a risk cannot be eliminated, it must be minimised so far as is reasonably practicable.

Safety Management System (SMS): established processes to maintain a high standard of health and safety at work.

Safety performance indicators (SPIs): data that provides a broad view of the operation of the FRMS. Fatigue metrics can be used to generate fatigue SPIs.

Shift work: work that requires a worker to be awake when they would normally be asleep. Shift work might be any of the following:

- permanent, rotating, changeable, non-standard, irregular, unpredictable work hours
- early starts
- late finishes
- night work.

Part 1: Introduction

This part will be useful for a general audience.

1.1 The benefits of managing fatigue at work

Managing risks from fatigue may have the following benefits.

It can improve worker health and safety.

- Data collected from over 15,000 New Zealand workers shows that rotating shifts increases the likelihood of a worker experiencing an injury at work.[1]
- Workers with sleep problems, such as sleep disorders and problems getting to sleep or staying asleep, are 62% more likely to have an accident at work. Estimates suggest that 13% of all injuries at work are linked with sleep problems.[2]
- Fatigue has been implicated in a number of catastrophic events in places of work, such as the grounding of the Exxon Valdez[3] and the Three Mile nuclear power plant accident.[4]
- Fatigue increases the risk of falling asleep when driving home from work.
- Studies show that shift work can be associated with several diseases.
- Poorly managed shift work can contribute to poorer mental wellbeing.

It can reduce absenteeism and staff turnover.

- A study of police officers found that they were more likely to take a sick day when their fatigue at work increased and the amount of sleep they had got before that day decreased.[5]
- The more fatigued a worker is, the more likely they are to look for a new job.[6]

It can improve performance and productivity.

- Research in the construction industry found that as fatigue among workers rose, productivity fell by an average cost of $50,000 per year for a work crew of 10.[7]

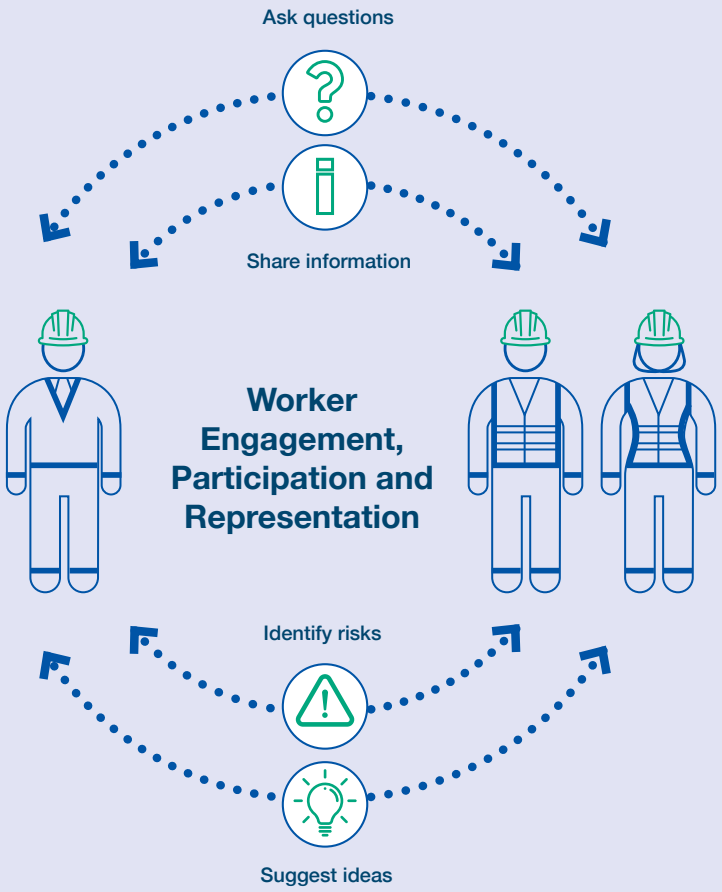


Figure 1: The flow of questions and ideas between you and your workers

1.2 Involving your workers in health and safety

You have a primary duty of care to ensure, so far as is reasonably practicable, the health and safety of your workers and other people is not put at risk by your work. Fulfilling this duty of care includes managing worker fatigue. It also means you must either eliminate health and safety risks at work, so far as is reasonably practicable, or minimise the risks, so far as is reasonably practicable, by putting in place control measures.

Managing fatigue at work is the responsibility of you – the business or undertaking and your workers.

This means that you must:

- engage with workers (including temporary workers, agency workers, contractors and subcontractors) on health and safety matters (for example, fatigue) that affect or are likely to affect workers, so far as is reasonably practicable, and
- have practices that give workers reasonable opportunities to participate effectively in the ongoing improvement of health and safety at work (see figure 1).

You can engage with workers by:

- sharing information about health and safety matters so that workers are well informed, know what is going on and can contribute to decision-making
- giving workers reasonable opportunities to have a say on health and safety matters
- listening to and considering what workers have to say at each step of the risk management process
- considering workers' views when you are making health and safety decisions
- updating workers about what decisions you have made.

You must engage with workers during specified times, including when identifying hazards and assessing risks (such as risks that may be affected by worker fatigue).

You must have clear, effective and ongoing ways for workers to suggest improvements or raise concerns.

As part of this engagement, involve your workers in the development of an FRMS and in its day-to-day operation. You can do this either directly with your workers or through their representatives.

Worker representation

Workers can be represented by a:

- Health and Safety Representative (HSR)
- union representing workers, or
- person that workers authorise to represent them – for example, a community or church leader, or another trusted member of the community.

HSRs and Health and Safety Committees are two well-established methods of participation and representation. If an HSR is representing workers, worker engagement must involve that representative.

When you must engage with workers

Under HSWA, you must engage with workers when you are:

- identifying hazards and assessing risks to health and safety, for example, fatigue. This could include identifying how a change in the way they work could impact on worker fatigue
- making decisions about:
  - ways to eliminate or minimise risks
  - the adequacy of facilities for the welfare of workers
  - possible changes that may affect the health and safety of workers
- making decisions about procedures for:
  - engaging with workers
  - monitoring the health of workers
  - monitoring the conditions at any workplace under the management or control of the PCBU
  - providing information and training for workers
- making decisions about the procedures (if any) for resolving work health or safety issues at the workplace
- developing worker participation practices, including when deciding on work groups
- carrying out any other activity that health and safety regulations prescribe.

Reporting health and safety issues

HSWA prohibits adverse, coercive or misleading conduct against a worker in relation to certain rights and duties under the Act. This means workers must be able to raise health and safety issues (such as risks from fatigue) without fear that they will be penalised for raising the issue. A work culture that promotes reporting of health and safety risks is of benefit to everyone.

Ceasing work if it is unhealthy or unsafe

Under HSWA, workers have the right to stop work and attempt to resolve the issue with the PCBU if they believe it is unhealthy or unsafe. For example, if they identify risks from fatigue that would have an impact on the health and safety of themselves or other persons. This is one reason why it is important that you proactively manage fatigue with an FRMS.

Overlapping duties

You must, so far as is reasonably practicable, consult, cooperate and coordinate your activities with other PCBUs. This applies particularly when you have overlapping duties in relation to workplace health and safety, such as managing worker fatigue.

Workers

Under HSWA, workers must:

- take reasonable care of their own health and safety
- take reasonable care that their actions do not adversely affect the health and safety of other persons
- cooperate with reasonable instructions, policies or procedures that you have in place, and have informed workers about, on how to work in a safe and healthy way (for example, an FRMS).

A worker must take reasonable care to ensure they are fit for duty. However, you should have in place systems to take account potential worker fatigue and manage this risk. For workers to fulfil their obligations, both you and your workers need to understand the sources of fatigue and the potential consequences for health and safety.

Health and Safety Representatives (HSRs)

HSRs have functions set out both in Schedule 2 of HSWA and in the Health and Safety at Work (Worker Engagement, Participation and Representation) Regulations 2016.

HSRs can help to reduce the risks associated with fatigue at work by:

- helping to identify the causes of fatigue (see part 2 of these guidelines)
- participating in fatigue risk assessments
- requesting information relating to fatigue management such as incident investigation reports or hours of work data
- raising fatigue as an issue at Health and Safety Committee meetings
- making recommendations on how to manage fatigue
- investigating complaints about hours of work and work allocation that are causing fatigue
- monitoring fatigue reporting and fatigue control measures
- facilitating cooperation between you and the workers in when you are developing an FRMS for the first time
- helping to develop rules, procedures and policies relating to fatigue
- if trained to do so,* directing workers to cease work because of an immediate or imminent exposure to risk to their own or others' health and safety, including risk that is caused by fatigue
- if trained to do so* and after consulting with you and attempting to resolve the issue, issuing a Provisional Improvement Notice to you if you are breaching HSWA or to prevent the breach from happening.

(*For these functions, the HSR needs to have been trained in New Zealand Qualifications Authority unit standard 29315: Describe the role and functions of the Health and Safety Representative in a New Zealand workplace.)

1.3 About Fatigue Risk Management Systems

These guidelines use the International Civil Aviation Organization's definition of an FRMS as:

"A data-driven means of continuously monitoring and managing fatigue-related safety risks, based upon scientific principles and knowledge as well as operational experience that aims to ensure relevant personnel are performing at adequate levels of alertness."[8]

This definition highlights that:

- data is central to an effective FRMS
- people with different areas of expertise work together to manage the risk of fatigue
- an FRMS is a dynamic system that involves a combination of processes.

Components of an FRMS

An FRMS has four components that are interlinked. Components two and three have an operational focus. Components one and four have an organisational focus.

Component one: FRMS policy and documentation

The policy outlines the structure and scope of the FRMS. Supporting documentation details the processes and procedures associated with the other FRMS components.

Component two: Fatigue risk assessment
Fatigue risk assessment describes the process of:

- identifying fatigue as a hazard
- assessing the risks from fatigue
- deciding how to eliminate the risks or, if elimination is not possible, deciding on control measures to minimise the risks
- monitoring and reviewing the control measures to make sure they are effective.

Component three: FRMS assurance
The FRMS is monitored to assess if it is delivering the expected levels of performance.

Component four: FRMS promotion
Provide information and training for workers to encourage them to behave in ways that support the FRMS.

Part 3 explains the minimum requirements for each of these FRMS components.

1.4 The need for worker buy-in

To be effective, an FRMS needs relevant fatigue data and information to be available. Individuals provide much of this data and information voluntarily. However, to obtain the information you need for an FRMS, you need strong and transparent systems to protect data, information and their sources that workers have confidence in. In addition, you need a willing and engaged workforce to deliver the full benefits of an FRMS.

If you are to achieve such 'buy-in', workers need to have enough confidence that you will:

- meet your FRMS responsibilities with the necessary level of commitment, skills and resources
- use an individual's fatigue data and information only for the specific purpose of managing fatigue risks
- keep personal information confidential
- involve operational workers in identifying appropriate fatigue control measures.

In turn, you need to have enough confidence that workers will:

- meet their individual responsibilities for managing their fatigue level before and during work periods
- notify their manager if they recognise that they are fatigued so it can be managed
- provide unbiased feedback on the effectiveness of the control of fatigue risks
- be open to accepting that the intent of the FRMS is to improve health and safety and efficiency, rather than aiming for personal, financial or industrial gain.

This buy-in helps to create a 'just culture'. This 'just culture' is needed for the FRMS to work effectively.

Part 2: The science

This part provides important technical information that will be useful for people who contribute to designing and developing an FRMS for an organisation. These people include PCBUs, Health and Safety Representatives and union representatives. This part also provides background for people responsible for overseeing the implementation and operation of an FRMS in an organisation, such as health and safety managers and worker representatives.

2.1 About fatigue

Fatigue is a physiological state where someone is unable to function at their best. It can result in reduced health and safety at work and lead to poorer outcomes for health, including mental health. These guidelines focus on four causes of fatigue:

- missing out on sleep
- being awake for too long
- working and sleeping in the wrong parts of the circadian body clock cycle
- physical or mental workload.

Fatigue can also be caused by poor wellbeing, or the work environment. Examples include; extreme temperature, vibration, noise and stress or emotional events.

Work requirements can result in fatigue because a person misses out on sleep, is awake for a long period, works and sleeps in the wrong parts of the circadian body clock cycle, or experiences demanding physical or mental work. This is particularly likely with shift work, which is common in the ports environment, including on call work where a worker can be called into work at short notice. However, events that occur outside of work (for example, caring for a young child or attending social events) can also lead a person to miss out on sleep or be awake for a long period of time so that they become fatigued. This means that fatigue is a 'whole of life' issue, and to manage it, PCBUs (who influence the work environment) and workers (who influence how they use their time away from work) must share the responsibility for it, so far as is reasonably practicable.

2.2 What is shift work?

Shift work is any type of work that requires a worker to be awake when they would normally be asleep.

Shift work might involve:

- permanent, rotating, changeable, non-standard, irregular, on call or unpredictable work hours
- early starts
- late finishes
- night work
- split shifts.

Long hours that span the traditional workday can also be shift work if they include early starts and/or late finishes that require a worker to be awake when they would normally be asleep.

2.3 The importance of sleep

Sleep is essential for recovery from all waking activities, not just work. It is a complex series of processes during which many essential functions occur. These include storing memories, learning, repair of body tissues, growth and development, supporting the immune system, and regulation of mood and metabolism.

Getting the right amount of good-quality sleep is critical for workers to be able to function at their best and stay well. The long-term health effects of regularly missing out on good-quality sleep can include depression, obesity, type 2 diabetes, high blood pressure and cardiovascular disease.[9,10]

The recommended amount of sleep for people aged 18–64 years is 7–9 hours per night, although some workers may need less and others may need more.[11] Depending on their work pattern, workers may not get all their sleep in one block. They can increase their total amount of sleep in a 24-hour period by taking naps. However, people get their best-quality sleep at night.

2.4 Causes of fatigue

2.4.1 Missing out on sleep

When a worker misses out on the recommended number of hours of good-quality sleep, the negative effects build up across several days, leading to a sleep debt. The greater the sleep debt, the more likely the worker is to experience negative effects.

For the first few days, the worker is likely to feel sleepier and more fatigued as they miss out on more and more sleep.

The worker may also

- feel irritable
- experience mood swings
- be less alert
- have slower reaction times
- have poor coordination
- communicate less effectively
- think more slowly
- have less situational awareness
- be a less creative problem-solver.

Fatigue can affect a worker's ability to judge their own level of impairment. Over the first two to three nights of missing out on good-quality sleep, workers feel increasingly sleepy. Beyond that, with additional nights of short sleep, they may report feeling no sleepier even though their functioning is getting worse. This level of fatigue is especially dangerous, as it means a person is less able to identify how their own functioning has changed due to missing out on sleep.

Eventually, the brain's need for sleep reaches a point where a worker may loose control over when they fall asleep. Uncontrollable micro-sleeps have been connected with car accidents where a driver has fallen asleep at the wheel.

Recovering from a sleep debt

After building a sleep debt, a worker needs at least two consecutive nights of unrestricted, good-quality sleep for their sleep structure to return to normal.

A worker usually achieves unrestricted night-time sleep when they go to bed at the time they like and rise at the time they choose. In addition, unrestricted sleep occurs at night and the amount needed will vary from one person to the next. However, after building a sleep debt, it may take a worker more than two nights of unrestricted sleep before they can function at their best.

Reducing the amount of recovery time for workers will make fatigue more likely to occur in the workplace. In the ports environment, a worker may get less recovery time when they work overtime or are called back into work, which may happen because of resourcing issues or the way work is organised.

Some workers may find it easy to fall asleep and stay asleep at times when their body is programmed to be awake, whereas others may find this more difficult.

Some personal factors may make it more difficult for someone to cope with the disruption to their normal pattern of sleep and recover from a sleep debt. These include:

- being an older adult (over 65 years old)
- already having poor sleep habits
- having poor general health and wellbeing, including stress, some medical conditions and sleep disorders (such as insomnia and sleep apnoea)
- using some medications and drugs.

2.4.2 Being awake for too long

Depending on the pattern of work and sleep, there may be occasions when a worker spends a long period of time awake. For example, a worker on a series of night shifts who does not nap during the day before their first night shift or during any of their breaks may have been awake for nearly 24 hours by the time they finish their first night shift.

A worker that is able to get eight hours of sleep at night should be able to function normally for approximately 16 hours during the day. After about 16 hours of being awake, people's ability to function in a safe and healthy way starts to decrease.

Studies that compare fatigue with blood alcohol levels show that being awake for approximately 17 hours impairs performance to the same level as being at or above the legal blood alcohol limit for driving in New Zealand. See figure 2.[12]

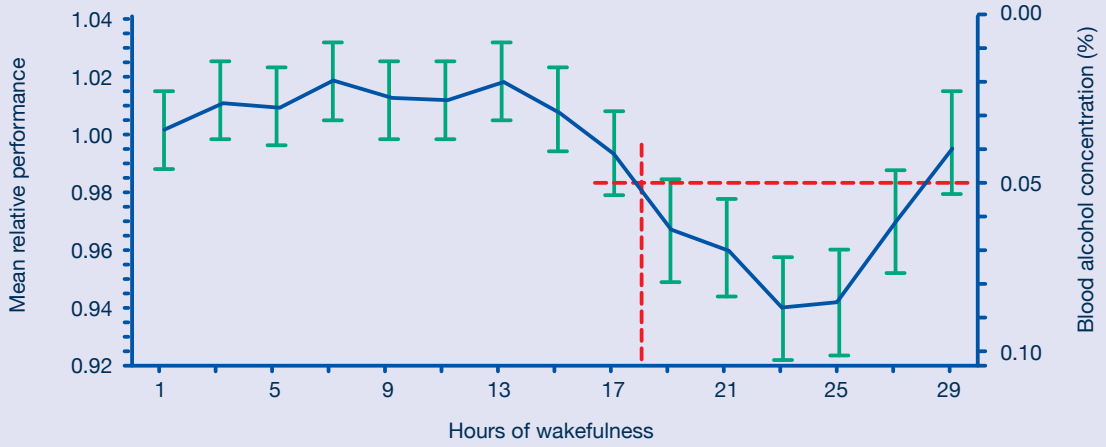


Figure 2: Hours of wakefulness

Naps can be used to decrease the continuous amount of time a worker is awake. If a worker needs to be functional immediately after a nap, it is recommended they limit the length of the nap to about 45 minutes or less. In other situations, for example when sleeping at home, a worker can have a longer nap: two hours is about right. However, they should not take a long nap close to their next planned sleep period or they may then have trouble falling asleep the second time. If a worker only has enough time for a brief nap of say 5 or 10 minutes, getting some sleep is better than no sleep.

2.4.3 Working and sleeping in the wrong parts of the circadian body clock cycle

People are programmed to be active and alert during daytime hours, and to sleep at night. We follow this pattern because of an internal 'clock' in the brain, called the circadian body clock. The circadian body clock keeps its own time but stays in step with the 24-hour day/night cycle mainly through exposure to daylight. It controls daily cycles of different processes in the body, including body temperature, hormones, falling and staying asleep, mood and ability to work. These daily cycles are called circadian rhythms, affecting our behavior and biological processes.

Meal times, interactions with other people, physical activity and work hours also play a role in keeping the circadian body clock in step with the day/night cycle. If one or more of these factors disrupts the natural timing of the circadian body clock, workers can experience shorter and poorer-quality sleep, sleepiness, poor functioning and poor health.[13]

As figure 3 shows, the circadian body clock naturally makes people feel:

- sleepiest in the earliest hours of the morning, when they are also most error-prone and least functional. A second peak in sleepiness occurs in the late afternoon
- most alert in the few hours before normal bedtime. This makes it difficult to fall asleep early ahead of an early morning shift. Another increase in alertness occurs across the morning, making it difficult to sleep beyond about lunch time, after a night shift.

This means that for shift workers, sleep during the day is often cut short and can be of poor quality.

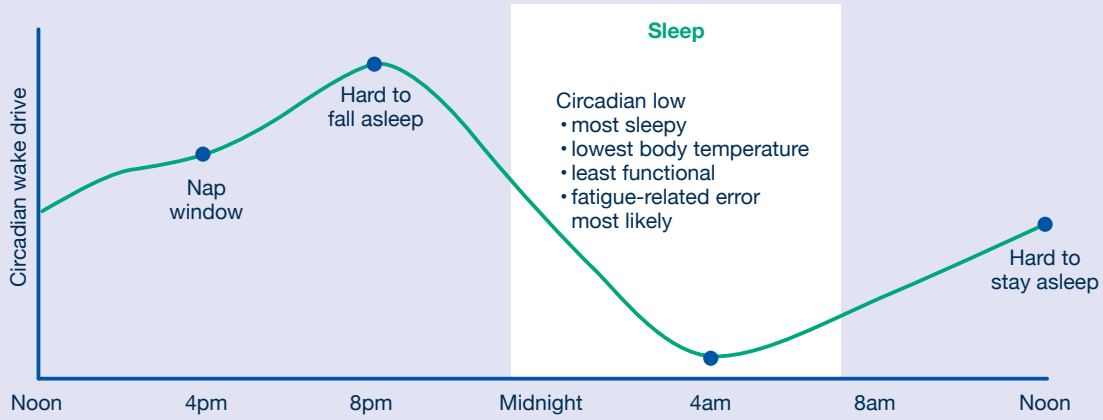


Figure 3: Circadian rhythm in alertness and sleepiness

Table 1 shows the barriers to sleep that may arise for different types of work patterns. Even in long-term shift workers, the circadian body clock does not fully adapt to the changes that shift work brings. As a result, circadian rhythms become out of step with the world around us and with each other. This disruption can result in poor sleep, poor health and lower functioning.[14]

Working at night	Sleep during the day is usually lighter and shorter than sleep at night. The amount of sleep a night worker will get depends on when they can get into bed after a night shift. The circadian body clock will make a person feel more alert around lunchtime or early afternoon and likely result in them waking from sleep.
Early starters	Sleep is cut short because early morning starts cut into the preferred sleep time. The circadian body clock makes people feel more alert in the few hours before their normal bedtime. This makes it difficult to fall asleep earlier than usual.
Late finishers	Sleep may be cut short because late finishes mean that workers get into bed later than usual. However, they may still have to wake early for household, family or other commitments in the morning.

Table 1: Barriers to sleep for different types of work patterns

2.4.4 Workload

Workload is made up of a combination of:

- how long the work takes (task duration)
- how difficult or easy the work is (task complexity)
- how much physical and mental effort the work demands (task intensity)
- how well a worker can meet the above demands.

When a worker is fatigued, sleepiness can become more obvious while their physical or mental workload is low because of the lack of stimulation. A high physical or mental workload may lead to fatigue because of the effort needed to carry out the work. It can also delay and/or disturb later sleep, adding to the fatigue the worker had

already. It is important for workers to take regular rest breaks from tasks that have a high workload as this can help prevent them from becoming impaired during a single work period.

Time-on-task fatigue

A worker develops time-on-task fatigue when they perform mental or physical tasks, particularly difficult or high-concentration tasks, for an extended period without stopping. This type of fatigue is made worse by sleep loss and by doing this work during the night. As with a high workload, taking regular rest breaks and keeping the work period shorter can limit the extent of time-on-task fatigue.

2.5 How to recognise fatigue

Workers experience fatigue differently and can have a range of symptoms. When a worker is experiencing fatigue, it might not be obvious from the outside or to the worker themselves. Do not leave it to the worker to self-monitor their fatigue. Instead monitoring needs to be a joint responsibility, involving managers, team members/colleagues and the individuals themselves.

A fatigued worker may show some or all of the following signs and symptoms, among others:

- excessive yawning or falling asleep at work
- short-term memory problems
- an inability to filter out distractions and to concentrate
- finding it harder to interact with other people
- finding it harder to communicate and becoming withdrawn
- poorer decision-making and judgement
- reduced hand–eye coordination or slow reflexes
- risk-taking behaviour
- other changes in behaviour, for example, repeatedly arriving late for work
- taking more days off work, including more sick leave
- feeling unusually wired or hyped after a long period of work
- lack of emotional control, for example, behaving aggressively, or becoming easily upset.

A fatigued worker may also experience symptoms that others cannot see, including:

- feeling drowsy
- micro-sleeps
- headaches
- dizziness
- blurred vision or impaired visual perception
- a need for extended sleep during days off work
- feeling disengaged (sometimes described as feeling like being on autopilot).

Part 3: Implementing an FRMS

This part describes the four components of an FRMS. It provides guidelines to assist those people who contribute to designing, developing or revising an FRMS for an organisation. These people could be PCBUs, Health and Safety Representatives, other workers and union representatives.

3.1 Policy and documentation (Component one)

The purpose of the FRMS policy and documentation is to set out in detail your organisation's commitment to and processes for safely managing fatigue.

3.1.1 About the FRMS policy

An FRMS policy is only one small part of the FRMS. The policy needs to explain how you will use an FRMS to manage the risks of fatigue at work.

The policy should:

- clearly state the health and safety objectives of the FRMS
- describe how the responsibility for managing risks arising from fatigue-related hazards will be shared between you, workers and others engaged in the FRMS
- record the organisation's commitment to providing adequate resourcing to manage fatigue
- explain which parts of your operation the FRMS covers (for example, piloting, stevedoring and office workers)
- explain how you will engage with workers and their representatives to manage the risks arising from fatigue
- declare management commitment to:
  - effective health and safety reporting
  - providing adequate resources for the FRMS
  - maintaining and continuously improving the FRMS
- provide clear lines of accountability for management and workers
- be signed by your accountable executive.

Once you have developed the policy, you should

- communicate it to all the relevant areas and levels of your organisation
- periodically review it so that it remains relevant and appropriate.

FRMS policy example

See **appendix 1** for an example of an FRMS policy. You may use the wording from the example but you should also work through the points listed above to make the policy specific to your organisation.

The FRMS policy is unique to the PCBU that develops it in that it reflects the PCBU, its organisational context and operational needs.

The policy is typically a short document. Supporting documentation gives more details about how the FRMS will operate, see **section 3.1.2**.

3.1.2 Supporting FRMS documentation

Documentation that supports the policy describes all the elements of the FRMS and provides a record of the activities, along with any changes to the FRMS. This documentation is an essential reference for internal and external audits of the FRMS. The required information can take two forms: either centralised in an FRMS manual, or integrated into other health and safety documentation. In either case, it should be accessible to all personnel who need to consult it.

What is in FRMS documentation

The documentation should describe all steps and processes in the FRMS. These need to include but are not limited to:

- FRMS policy and objectives
- fatigue metrics used in the day-to-day operation of the FRMS and fatigue safety performance indicators (SPIs). These metrics measure how well the FRMS is meeting its health and safety objectives
- FRMS processes and procedures – including details of fatigue risk assessment (FRA) and FRMS assurance methods
- accountabilities, responsibilities and authorities for these processes and procedures
- mechanisms for ongoing involvement of PCBU and workers
- FRMS training programme, training requirements and attendance records.

3.1.3 About Fatigue Safety Action Groups and Fatigue Working Groups

A Fatigue Safety Action Group (FSAG), Fatigue Working Group or equivalent is a group of individuals within a business that has responsibility for coordinating and overseeing FRMS activities. It is a critical part of having a functioning FRMS. It is not necessary to call such a group an FSAG or even to create a separate FRMS group. In smaller organisations, group members could be part of the Health and Safety Committee. The point is to identify who is responsible for the FRMS in the organisation.

Whether it is an FSAG or a Health and Safety Committee, the group needs to take a joint approach to problem solving. In line with HSWA requirements, the FSAG must include representatives of all stakeholder groups (management, scheduling staff, workers, HSRs, union representatives and/or other representatives). The FSAG or equivalent may also require input from others who can provide the scientific, statistical and medical expertise it needs. Including all stakeholders is an important strategy for promoting engagement in the FRMS (see **section 1.2** for more information on engagement, participation and representation).

The size and composition of the FSAG or the equivalent group will vary for different organisations. Make sure it is appropriate to the size and complexity of the operations the FRMS covers, and to the level of fatigue risk in those operations. In small organisations, a single individual may represent more than one stakeholder group. Larger companies will have specialised departments that interact with the FSAG – for example, cargo scheduling, berthing scheduling and work allocation scheduling.

The principal functions of the FSAG are to:

- oversee the development of the FRMS
- help to implement the FRMS
- oversee the ongoing operation of the fatigue risk assessment processes
- contribute as appropriate to the FRMS assurance processes
- maintain the FRMS documentation
- be responsible for ongoing FRMS training and promotion
- provide necessary input on fatigue risk to the organisation's Safety Management System (SMS).

Figure 4 shows that you can embed an FRMS within or connect it to other health and safety or Safety Management Systems (SMS) that your organisation uses.

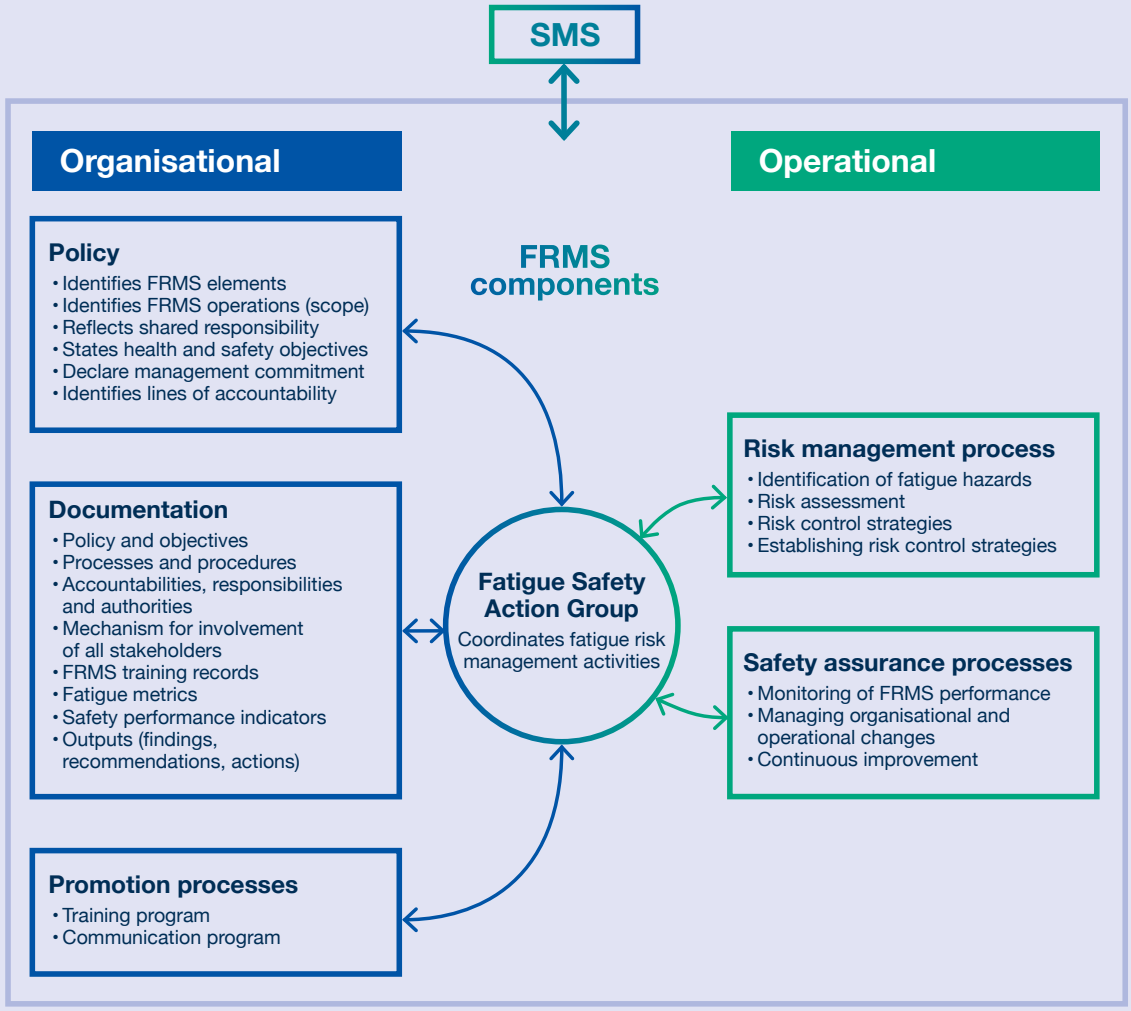


Figure 4: Interactions between the components of a fully functioning FRMS

The FSAG is responsible for the day-to-day running of an FRMS. A third-party provider or an area of your organisation that is independent of the FSAG should routinely audit your FRMS to ensure you are following your own FRMS policy and procedures.

How to establish an FSAG

To establish an FSAG, you first need to determine who the representatives will be, how frequently the group will meet and who will chair it. After that, you need to write the terms of reference for the FSAG.

The terms of reference for an FSAG consist of a document that specifies its activities, interactions with other parts of the organisation and the lines of accountability between the FSAG and the organisation's SMS. Appendix 2 gives an example of terms of reference for an FSAG.

3.2 Fatigue risk assessment (Component two)

The fatigue risk assessment (FRA) processes are the day-to-day operation of the FRMS. These processes enable you to achieve the objectives defined in your FRMS policy. This FRA process involves:

1. monitoring data to identify situations or conditions where fatigue may be a hazard
2. assessing the level of fatigue risk
3. where the risk cannot be eliminated, putting in place control measures to minimise the risk, so far as is reasonably practicable
4. establishing fatigue metrics and monitoring data to measure the effectiveness of the control measures and the wider FRMS
5. reviewing control measures for continuous improvement.

Figure 5 summarises these steps, which the following sections describes in more detail.

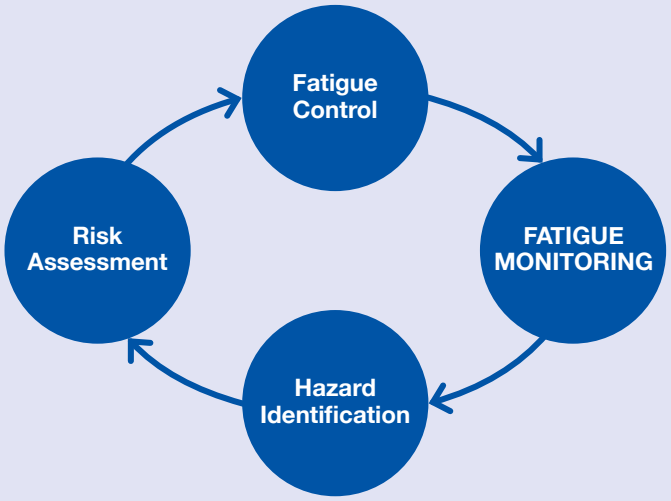


Figure 5: The fatigue risk assessment process[15]

3.2.1 Monitoring data to identify when workers may be at risk of fatigue

The FRA processes need to be data driven and continuous. Various types of data can be used to monitor for risk assessment. The key is to choose the right combination of risk assessment types, both for routine monitoring and if additional information is required about a potential hazard that has been identified.

An FRMS involves three types of hazard identification:

1. predicting fatigue hazards, which involves using information that is already available to identify fatigue hazards, such as by examining planned work allocation while taking into account factors known to affect sleep and fatigue.
2. proactively looking for fatigue hazards, which involves measuring fatigue levels in current operations
3. reactively finding fatigue hazards, which includes identifying hazards by assessing the contribution of fatigue to safety reports and incidents that have occurred.

You will need to use all three of these methods to identify the fatigue hazards at your work because you should make decisions based on multiple sources of data.

Predicting fatigue hazards

Predicting fatigue involves identifying fatigue hazards before they occur. These are sometimes referred to as lead indicators. Three possible methods of predicting fatigue levels associated with planned work allocation (schedules) involve using:

- previous experience of people in the business, others in the industry, HSR or union delegates
- fatigue science
- bio-mathematical models.

Previous experience

The experience of managers, schedulers, unions, HSRs and/or individual workers in your business is an important source of information for identifying where fatigue might occur in a work allocation. These individuals may know about:

- a set of tasks associated with a particular shift that is fatiguing or
- high levels of fatigue that occur on a certain shift because of regular delays or
- a certain pattern of shifts that lead to excessive fatigue.

You can enhance the value of this previous experience by educating staff about the science of fatigue – for example, on sleep loss and recovery and the circadian body clock. Understanding basic fatigue science

can help individuals identify why particular aspects of a work allocation – such as early starts, long working days, short recovery periods and limited daytime sleep opportunities – may result in fatigue.

When work allocations are complex or have been changed from a well-used pattern, using previous experience alone may not provide the best solution to a work allocation. When work allocations have been changed, it may be important to collect information on the actual levels of workers' fatigue. In this way, you can check whether the lessons learnt from previous experience are still valid.

Another way to identify fatigue hazards in a work allocation is to look for information on similar work schedules. This could include scientific research and information from other companies or industries that use similar patterns of work. The usefulness of this type of information depends on how similar the other operations are to your operation.

Using fatigue science

You can use fatigue science to predict where fatigue hazards might occur in a work allocation. For more on the principles of fatigue science, see **part 2** and for more information on how to apply them to designing a work allocation, see **section 3.2.3**. You may also identify fatigue hazards by gathering information on cases where the hours of work approach or exceed the safe limits defined by science. Such cases might occur with operational disruptions or when workers are sick or swap shifts.

Bio-mathematical models

Bio-mathematical modelling tools are normally available as computer software. They can be useful for predicting levels of fatigue in a work schedule. This is because it is hard to visualise the consequences of sleep loss and recovery and the influence of the circadian body clock across many days and many individuals. When using any model, it is important to understand what they can and cannot predict.

Models predict fatigue levels for an average individual. However, limitations are that they:

- do not predict the safety risk that an individual presents in a specific work context
- do not take into account workload or work-related stressors
- do not take into account the impact of any personal or operational fatigue control measure.

A bio-mathematical modelling tool can be useful as an additional tool along with other fatigue risk management processes and operational experience. Do not use bio-mathematical modelling tools as a stand-alone tool.

Appendix 3 discusses the benefits and limitations of bio-mathematical models in more detail.

Proactively looking for fatigue hazards

Proactively looking for risks associated with fatigue involves measuring fatigue levels in current operations. If proactive processes and the FRMS are to be successful, workers need to be engaged in them.

Examples of ways of proactively looking for fatigue hazards include:

- workers reporting fatigue hazards
- analysing planned versus actual time worked
- collecting additional information from scientific research, or by using surveys or monitoring sleep and performance.

For additional examples of data sources, see **appendix 4**.

Reporting fatigue hazards or risks

Encourage and support workers to report fatigue hazards if they cause an actual or potential risk to health and safety. They should provide this information before a health and safety event occurs. They also need to report near misses.

These reports of fatigue-associated hazards or risks could include identifying:

- experiences of fatigue before a shift starts
- experiences of fatigue when working
- other relevant hazards (for example, an unsuitable nap facility).

These reports can come from anyone in your organisation. They may be reporting on their own experience or on concerns, they have for people that they work with.

The process of reporting these hazards or risks will vary based on the size of the organisation and the internal reporting structure. Some organisations may use technology such as apps. An organisation can use an existing form (for example, an incident/event report form), possibly adapting it for this reporting purpose, or may need to develop a separate form for individuals to report fatigue. Individuals need to be aware of the procedure for reporting fatigue.

Information to collect through these forms includes:

- self-assessment of the severity of fatigue
- recent sleep history – as a minimum, this history needs to cover the timing and duration of sleep over the last three days
- if the report involves a safety event, the duration of time awake before the event occurred and the time of day that it occurred
- what individuals think caused their fatigue
- what the consequences of fatigue were
- any other contextual information.

See **appendix 5** for an example of a fatigue reporting form.

Once a worker has submitted a fatigue report, they need to receive a notification that it has been logged. Who looks at the fatigue reports and provides the feedback depends on the organisation and its size. If no action is needed in response to a report, the worker needs to be informed of this and told why no action or change will occur.

The role of the FSAG or equivalent group in this process also includes monitoring along with actively addressing the fatigue reports. The group looks at the fatigue reports to identify patterns. In some cases, it may decide it needs further information, such as when a series of fatigue reports come from one part of a place of work or relate to a particular pattern of work. See 'Proactively collecting additional information' below.

The FSAG or equivalent group should also identify possible barriers to fatigue reporting and consider ways of removing these barriers. It is important to encourage and support all workers to report, no matter what their role and employment status. For example, casual workers or those in less secure positions may feel that reporting could jeopardise their chances of future work. In addition, workers may feel it is easier to take sick leave than report being too fatigued. As a result, some experiences of fatigue in an organisation may be hidden. **Appendix 6** shows an example of a process to help manage a worker when they report fatigue.

It is important to remember fatigue reporting is limited in a number of ways. For example:

- it is difficult for an individual to determine whether they are fatigued
- it is often difficult to categorically prove fatigue was a cause of an incident or accident
- because it is well known that the effects of fatigue can lead to errors or long-term health issues, in some cases fatigue may be assigned as the cause without proper analysis
- unless workers are trained to understand the complexities of fatigue, their reports are likely to be limited in the information they can provide
- it is necessary to engage investigators trained in high-cycle fatigue or fatigue.

To offset these limitations, you need to look at them along with other information. Here we identify some other types of information that can be useful.

Analysis of planned versus actual time worked

Due to the complexity of the ports environment, it is common for workers' schedules to change. This can occur because of changes in shipping, unexpected weather conditions, the need to repair equipment and other workers being sick or away. Using the data about how long workers actually worked, you can identify times when the fatigue experienced might have been greater than planned.

Part of the monitoring role of the FSAG or equivalent group is to look at the data on both the planned and the actual work allocations. To do this, it should engage with workers and their representatives, including the HSR and the unions. Examples of the data needed include how often each month hours of work are longer than a certain value and how often off-duty periods are shorter than a certain value. This data involves creating fatigue metrics, which you can use to measure the effectiveness of fatigue control measures (see **section 3.2.4** for more detail).

Proactively collecting additional information

Data collected from other sources may show that fatigue is an issue in a particular part of your organisation or under certain conditions (for example, after a certain combination of shifts). In some cases, you may not have enough information to determine the exact cause of fatigue or the extent of the problem. In these cases, it may be necessary to find additional information such as reports or research studies on similar work allocation patterns or work environments. Occasionally you may need to collect new data.

Among the many methods of collecting new data from workers are:

- surveys asking workers questions such as if they have made a mistake due to fatigue in the last few months or how often they work extra hours
- workers providing information in real time such as by completing scales on how fatigued they feel at the beginning and end of a shift
- using research equipment to collect detailed information on sleep patterns – for example, Actigraphs record a person's wrist movements continuously over several days and this movement is analysed using specialised software to determine when a person is asleep and awake. They work in a similar way to an activity/fitness tracker
- using various tests to measure the performance of individual workers.

In deciding what measures to use to collect data, you need to engage with workers and their representatives. It may also be helpful to seek advice from a sleep researcher. Each measure has its strengths and weaknesses; there is no single 'gold standard' measure of fatigue. The choice of which measures to use depends on the level of fatigue that workers are likely to experience. More detailed data collection may be appropriate when the initial data indicates that workers' level of fatigue is high.

When making decisions on collecting new data, consider:

- whether the information gathered can answer the question you are asking
- what burden the data collection process places on workers who might need to provide data both at work and outside of work
- ethical considerations – for example making involvement in data collection voluntary and keeping the data confidential. The workers need to agree to the data collection and you need to understand how to manage any legal or privacy issues associated with the collection process.
- whether an independent ethical and privacy review and approval is appropriate. It may also be necessary to get legal advice and involve unions before starting the data collection process.

Reactively finding fatigue hazards

Reactively finding fatigue hazards involves identifying whether and how a worker's fatigue contributed to safety events that have occurred. This kind of information is sometimes referred to as lag indicators. When looking at past events or incidents, the aim is to identify how the effects of fatigue could have been controlled and how to reduce the likelihood of similar occurrences in the future.

Information that can be used for reactively finding fatigue hazards includes fatigue reports, confidential safety reports, accident or incident reports, and audit reports. Depending on how serious an event is, an investigation can be undertaken into the role fatigue may have had. The FSAG, your safety department, an external fatigue expert, or the regulator could undertake an investigation. Record the findings of any fatigue investigation in your FRMS documentation.

There is no simple test, such as a blood test, to show that a worker is fatigued. To establish that fatigue was a contributing factor in an event, the investigation has to show that the:

- worker(s) or other people involved were probably fatigued
- worker(s) or other people involved took particular actions or decisions that caused what went wrong
- actions or decisions of the worker(s) or other people involved are consistent with the type of behaviour expected of someone who is fatigued.

Appendix 7 provides more information on conducting a fatigue investigation.

A summary of ways to identify fatigue hazards

Table 2 summarises the different ways of identifying fatigue hazards.

In assessing which approach to identifying hazards is appropriate for a given situation, consider the following.

- No single measurement gives a total picture of an individual's current fatigue level. This is because fatigue-related impairment affects many skills and has multiple causes.
- The expected level of fatigue risk should guide the choice of measurements. All measures require financial and personnel resources for data collection and analysis. You need to use your resources effectively to identify fatigue hazards and to help the FSAG prioritise where controls are most needed.
- Choose a core set of measures for routine monitoring. For example, you could use fatigue reports and regular analyses of planned versus actual time worked for ongoing monitoring of fatigue-related hazards.
- Use additional measures if a potential risk is identified and the FSAG decides that more information is needed.
- Keep the balance between gathering enough data for the FSAG to be confident about its decisions and actions, and limiting the additional demands that data collection can place on individuals. These additional demands are sometimes described in science as 'participant fatigue'.
- Appendix 8 provides a list of possible fatigue-related hazards and risks. In deciding on which ones apply in your organisation, you need to consider: the type of work being undertaken; the timing of work; workforce education and skills; and environmental, organisational and individual factors.

Way of identifying fatigue-related hazard	What to consider
Predicting fatigue hazards	› Ensure that your workers and relevant personnel – for example, people involved in creating work allocations, HSRs, delegates and managers involved in contributing to this process – have an appropriate understanding of fatigue science. They can then use this knowledge along with their previous experience to help identify fatigue-related risks. › Engage your workers and their representatives when creating or changing work allocations so they can provide input on possible risks. › Use fatigue science when creating or changing work allocation. Record any work allocation rules and the fatigue science that supports those rules in the FRMS documentation. › If your place of work is considering using a bio-mathematical model, make sure you understand the strengths and limitations of these models. See 'Bio-mathematical models' under section 3.2.1 and appendix 3.
Proactively identifying fatigue-related hazards	› Have a suitable system in place for reporting fatigue hazards or risks. The FSAG or another part of the organisation that is reviewing the reports needs to have a process for assessing the reports in a timely manner and responding with its recommendations. › Regularly provide the FSAG with data on planned and actual time worked. Decide what metrics to apply when assessing these work allocations. › Consider the different types of data listed in appendix 4. This allows you to decide whether other sources of information would help the workplace proactively identify fatigue-related hazards.
Reactively finding fatigue-related hazards	› Ensure that your place of work is collecting appropriate information in fatigue reports and when investigating accidents or incidents. In this way, you can identify whether and how fatigue has contributed to safety events that have occurred. › If an accident or incident occurs, use the information in appendix 7 to help guide the investigation.

Table 2: Summary of ways to identify hazards that result from fatigue

3.2.2 Assessing fatigue risk

Assessing risks related to fatigue is extremely complex as there are many unknowns. Ports need to critically evaluate the risks of fatigue. They can do so in a number of different ways – there is no 'one size fits all' approach. Each port and organisation needs to adapt risk evaluation processes to suit its purposes and to match the definitions it uses. It must do this, so far as is reasonably practicable, in consultation with workers and their representatives.

After identifying a fatigue hazard, you need to evaluate the level of risk that the hazard presents. You then decide whether you need to change existing control measures or put in place additional control measures.

Determining the risks associated with the hazard of 'fatigue' is challenging because:

- fatigue can reduce a worker's ability to perform almost any task at work
- many factors can contribute to a worker's level of fatigue, such as sleep loss and time of day. It is difficult to weight these different causes of fatigue accurately.

How well the risk assessment process works will depend directly on the knowledge and experience of the person (or people) carrying out the risk assessment. People conducting a risk assessment need to have an appropriate understanding of fatigue science, the place of work and general risk assessment processes. They must conduct the risk assessment, so far as is reasonably practicable, with the input of workers and their representatives.

A number of different models or tools for risk evaluation are available. The organisation can choose how to define the terms used in these models or tools, with the engagement of their workers and their representatives. In some cases, technological solutions may be available but you should only use these in combination with other methods. You need to understand the strengths and limitations of each different risk assessment approach before making your decision on which one to use.

See **appendix 9** for another example of a risk evaluation tool.

3.2.3 Putting control measures in place

If the evaluation of a fatigue risk indicates actual or potential harm from the hazard, then the next step is to control the risk. Section 30(1) of HSWA requires risks to health and safety at work to be eliminated, so far as is reasonably practicable. If the risks cannot be eliminated, they must be minimised so far as is reasonably practicable. Section 3 of HSWA requires that regard must be had to the principle that workers and other persons should be given the highest level of protection against harm to their health, safety, and welfare from hazards and risks arising from work or from specified types of plant as is reasonably practicable. Organisations must make their choice of control measures with the engagement of their workers and their representatives, so far as is reasonably practicable.

When choosing control measures, consider:

- how likely it is that the hazard or risk will occur (likelihood)
- the level of harm that could result (consequence)
- what measures exist to control the risk
- whether ways to eliminate or minimise the risks are available or suitable.

After considering these steps, you should assess whether the cost of controlling the risk is grossly disproportionate to the risk.

You should base your choice of control measures on data, rather than on an urge to 'do something'.

Because fatigue can result from a range of factors, we suggest using a combination of planned control measures and on-the-day control measures (see table 4 for some examples). The planned control measures focus on reducing the possibility of a worker being fatigued at work. In contrast, on-the-day control measures focus on reducing the likelihood and/or the severity of fatigue-related risks when a person is fatigued at work. Remember, fatigue can occur in any place of work when the hours of work have the effect of shortening, shifting or disrupting workers' sleep.

Planned control measures reduce the likelihood of workers being fatigued at work	Potential on-the-day control measures minimise the consequences when a worker is fatigued at work
Provide fatigue and shift work education/training. See **section 3.4** and **appendix 10** for more detail on training and the topics to cover.	Have a policy in place for napping at work. See **appendix 11** for an example of a napping protocol.
Improve work allocation design. See **appendix 12** for principles of work allocation design.	Share or reduce workload of workers. Ensure that this change does not increase the workload for others.
Reduce workload, for example by: › improving the skill level of workers › increasing the number of staff.	Allow workers to finish a shift early. Providing that this does not result in other safety issues. Consider the consequences for others, such as increasing their workload or call-backs.
Put policies in place for: › calling in too fatigued to start or continue a shift. See **appendix 6** for an example process › napping at work. See **appendix 11** for an example napping protocol › managing staff with chronic sleep problems. See **appendix 13** for information on monitoring the health of workers › the maximum number of times somebody can be called back during their off cycles.	Have a process in place for self-assessing fatigue. See **appendix 14** for an example of a self-monitoring tool. Have processes for call-backs including: › splitting shifts across multiple workers › adapting shift lengths.
Provide access to: › a rest area at work › healthy food at all times › Employee Assistance Programme services › appropriate lighting in the place of work. (Light may improve approve alertness but it can also shift the timing of the circadian body clock).[16]	Have a process in place for getting fatigued workers home safely.
Ensure workers are healthy. See **appendix 13** for information on monitoring the health of workers.	Provide access to caffeinated drinks. Providing education on the use of caffeine is also necessary.

Table 4: Examples of planned and on-the-day control measures[17]

Having data on control measures can help when deciding on which planned and on-the day-control measures to use. Examples of useful data include:

- information from scientific studies
- prior experience of workers, HSRs and others in your organisation
- the practices of similar companies and organisations
- Health and Safety at Work (General Risk and Workplace Management) Regulations 2016.

The structure of the FRMS and the organisation will determine who makes the decision about resourcing and implementing a control measure. However, the FSAG will need to be involved in identifying appropriate control measures and consulted when decisions are made.

The following example shows how work allocation can be used as a planned control measure. For more examples of control measures and how to put them into practice, see the case studies in **appendix 15**.

One example of a planned control measure: work allocation/roster

Work allocation is a common planned control measure for managing fatigue risk. The best form of work allocation is permanent day work with unrestricted sleep at night. This means that any other arrangement of work will always be a compromise and rosters will differ in their strengths and weaknesses. Work allocation is important in managing the risks associated with fatigue and shift work. You must engage with your workers when setting up the design of the work allocation and any changes. This includes having worker representatives on the FSAG. In addition, you must engage with the HSRs if they are separate to the FSAG. You should only change a work allocation if evidence shows that aspects of the work allocation are causing high fatigue levels and a risk assessment indicates that further control measures are needed. You need to consider any changes to a work allocation carefully so that the changes do actually reduce fatigue levels. It is important to remember that changing work allocation can involve considerable disruption at work and for workers' lives outside of work.

As with any control measure, once you have implemented changes to a work allocation, you need to review its effectiveness as part of your ongoing work practice (see **section 3.2.4**). This involves the ongoing monitoring of fatigue data and whether the new work allocation is being as effective as it should, as well as looking for any remaining fatigue-related risks. If you have changed a work allocation and fatigue levels continue to be high or hard to estimate, then a period of more intensive monitoring may be needed. We recommend setting an agreed timeframe for the monitoring, after which you will make a final decision about whether to continue the new work allocation.

It is common for ports to operate an on call register and to frequently call back workers as needed. Risks resulting from this situation must be eliminated or minimised so far as is reasonably practicable. You also need to be aware that it is common for workers to have more than one job.

Work allocation design

When designing a work allocation, consider the general scientific principles in **part 2** along with the following.[18]

What is the impact of the work allocation on sleep? Early starts, late finishes and night work will all result in shortened or disturbed sleep. Consider:

- how fast a sleep debt will build up
- the minimum non-work periods workers needed
- the length of time between consecutive shifts to allow for sufficient sleep. Allow time for commuting and other necessary activities outside of work
- what is the amount of sleep workers need before their duty periods
- how to handle the roster where shift times change from one day to the next – each subsequent shift should start later than the previous shift and, if possible, rotate the shifts in a forward direction
- how often will a worker will get two consecutive nights of unrestricted sleep.

How long are continuous periods of work? Long periods of work can lead to time-on-task fatigue and fatigue from being awake for an extended period. Consider:

- how long shifts are
- when the shifts start
- frequency and length of breaks during shifts
- the type of work that workers do
- whether a single operational person or team undertakes the work
- the impact of undertaking duties within a window of circadian low
- if naps at work are possible
- consecutive and total work periods over defined periods of time in order to prevent cumulative fatigue.

Are the timing and duration of work predictable? Knowing work patterns ahead of time helps workers to arrive well rested and fit for work. Consider:

- how on call work and unplanned call-backs are managed
- how to assign unscheduled duties (for example, stand-by) so that no worker has extended periods of being awake
- how to fairly distribute weekends off, so that workers have the appropriate balance between work and non-work life.

More information

For more general information on managing fatigue risks in places of work see the WorkSafe New Zealand guidance *How to manage work risks* at **worksafe.govt.nz/managing-health-and-safety/managing-risks/how-to-manage-work-risks/**

3.2.4 How fatigue metrics can be used to measure effectiveness

Fatigue metrics are data that the people who are responsible for managing fatigue within the organisation routinely collect and measure. These people will include for example the FSAG members, operations manager and terminal manager. Your organisation may not call them 'fatigue metrics' as such if it uses this data for other purposes as well, such as for assessing fatigue risk.

These metrics provide a way of measuring the effectiveness of fatigue control measures. If this data indicates that control measures are not working as intended, you will need to put in place different control measures. Repeat the steps in figure 5 to adapt existing control measures or create new ones.

How to establish fatigue metrics

To establish fatigue metrics, you can use data sources that are monitored as part of the day-to-day functioning of the FRMS. For fatigue metrics to be useful, you need to set values and targets that are appropriate to the level of risk in a given operation, and in the 'tolerable/moderate' or 'acceptable/low' regions of risk assessments. Together, the fatigue metric and the acceptable value/target can also be used as a fatigue safety performance indicator (for more information see **section 3.3.1**). Having a range of different fatigue metrics is likely to give a more reliable picture of fatigue levels and of the performance of the FRMS. It is also important to note that different fatigue metrics may be appropriate in different types of operations.

Table 5 presents just some examples of fatigue metrics; others are possible too. Note that you may also use data similar to fatigue metrics for assessing the risk of fatigue. Fatigue metrics are also a critical source of information for FRMS assurance (see **section 3.3**).

Fatigue metric	Target (do not try to do all of these in one shift)
Less than 10 hours between consecutive shifts	No occasions in any month
More than one shift in a 24-hour period	No occasions in any month
More than 5 consecutive shifts	No more than 10% of occasions in any month
Work hours in 7 days do not exceed 50 hours	No more than 10% of occasions in any month
Fewer than 2 consecutive, unrestricted night-time sleep opportunities every 14 days	No occasions in any month
Shifts longer than 12 hours	No more than 10% of occasions in any month
Shifts extended by more than 30 minutes	No more than 20% of occasions in any month
More than 2 consecutive night shifts. Can be defined as work that is scheduled during some or all of the period from 23:00–06:00	No more than 10% of occasions in any month
More than 4 consecutive early starting shifts Can be defined as work that is scheduled to start before 07:00	No more than 10% of occasions in any month
Timing of shifts is changed	No more than 20% of occasions in any month
Fatigue-related incidents or accidents	No occasions in any month

Table 5: Examples of fatigue metrics

3.3 FRMS assurance (Component three)

Beyond the day-to-day functioning of the FRA process loop, there is another set of processes known as the safety assurance loop or FRMS assurance. Figure 6 presents these processes and how they link to the FRA processes.

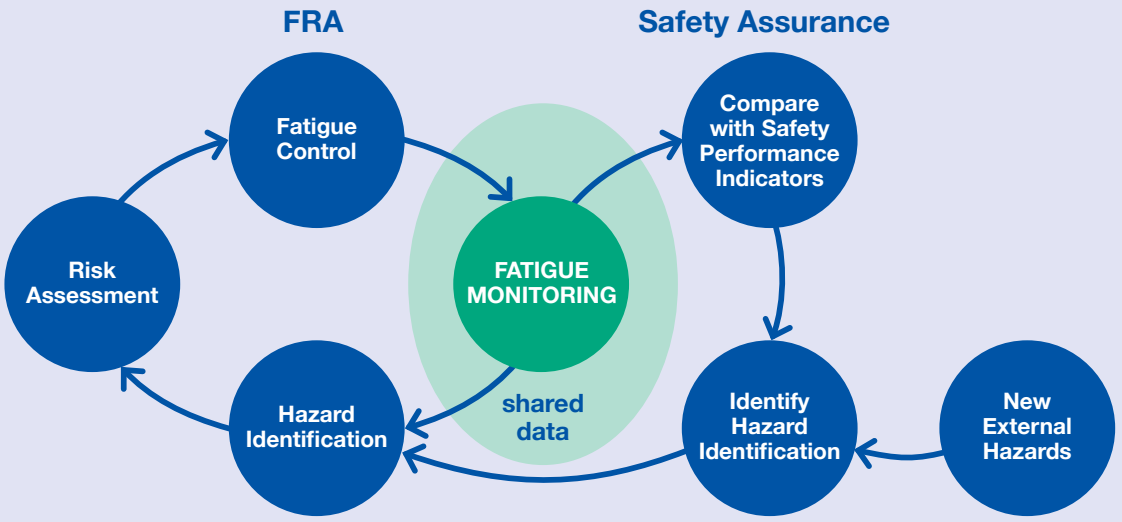


Figure 6: Linkages between FRA processes and Safety Assurance processes[19]

FRMS assurance has three main functions. These are to:

- monitor the performance of the FRMS to make sure that it is effectively managing the risks of health and safety objectives in the FRMS policy
- monitor changes in the work environment and the organisation that could affect fatigue risk, and to identify ways of maintaining or improving FRMS performance before such changes occur
- provide ongoing feedback that maintains and, where necessary, improves the FRMS.

The following subsections describe the functions of FRMS assurance further.

3.3.1 Monitoring FRMS performance

You can use fatigue metrics to generate fatigue safety performance indicators (SPIs). Fatigue metrics are designed for use in the day-to-day functioning of the FRMS and the fatigue SPIs can provide a broader view of the functioning of the FRMS. Fatigue SPIs may change as experience with the FRMS builds and as operational circumstances alter. Appendix 16 provides examples of fatigue SPIs.

In addition to fatigue SPIs, you can monitor the performance of the FRMS by looking at data from fatigue reports or fatigue-related incidents and fatigue reporting rates. Other possible measures are audit findings and surveys, which may involve checks to determine whether your organisation is following FSAG recommendations or delivering fatigue-related training as expected.

Trends in fatigue metrics and SPIs

You need to set acceptable values or targets for fatigue metrics and fatigue SPIs. For example, you could set a fatigue metric of no more than 10 shift length exceedances per month. You can then use trends in your place of work's ability to maintain acceptable values or achieve targets over time as a fatigue SPI to assess FRMS performance. This analysis could occur at a detailed level to identify trends in individual shifts. Examples include trends in night shifts; patterns of shifts; trends in particular periods of time such as seasons, yearly trends; and trends in specific locations, types of operations or groups of workers.

As the FRMS matures, and due to the continuous review requirements, you may need to identify more sophisticated fatigue SPIs and targets that allow you to monitor the performance of the FRMS more effectively.

Fatigue reports and fatigue-related incidents

You can monitor trends in voluntary fatigue reporting rates to assess the effectiveness of control measures and as indicators of the effectiveness of the FRMS. The FSAG needs to look carefully at the information that individuals have given in their fatigue reports and the findings of fatigue-related investigations. It does so to determine why a report was made or an incident occurred and whether it could have been prevented.

The FSAG should record fatigue hazards it has identified from voluntary fatigue reports and fatigue-related incidents in the FRMS documentation, together with any actions taken to control those hazards. As part of the FRMS safety assurance processes, you need to regularly evaluate the documentation of all fatigue hazards to ensure that it remains current. You need to check that the fatigue hazards and appropriate control measures are also recorded.

Audits and surveys

Audits and surveys can provide measures of the effectiveness of the FRMS and do not rely on fatigue levels being high enough to trigger voluntary fatigue reports or fatigue-related incidents.

The FSAG can use audits to periodically assess the effectiveness of the FRMS. It should address questions such as the following.

- Are all relevant departments implementing the recommendations of the FSAG?
- Are workers using control strategies as recommended by the FSAG?
- Is the FRMS training programme effective?

In addition, a unit in your organisation external to the FSAG needs to conduct other routine quality audits of the FRMS. It addresses questions such as the following.

- Is the FSAG maintaining the required documentation of its activities?
- Is the FSAG actively monitoring and managing all fatigue metrics and fatigue SPIs in line with documented processes?

Another type of audit that can be used in this context is an independent scientific review that periodically looks at the activities of the FSAG and the scientific validity of its decisions.

Surveys can provide a ‘snapshot’ of the effectiveness of the FRMS. For example, they can document how schedules and work patterns are affecting individuals, either by asking about their recent experiences (retrospective) or tracking them across time (prospective). Surveys for this purpose need to include validated measures. Note that if its results are to be considered representative of the entire group, a survey needs a high response rate – ideally more than 70%. Response rates tend to decline when people are surveyed too frequently.

How to monitor FRMS performance

The FSAG should decide what information it will need to collect to monitor the FRMS performance. Depending on the size of the organisation, the FSAG may need to work with other departments or groups, such as the health and safety department to monitor the performance of the FRMS. Figure 7 sets out one possible approach to this monitoring and what the FSAG needs to consider.

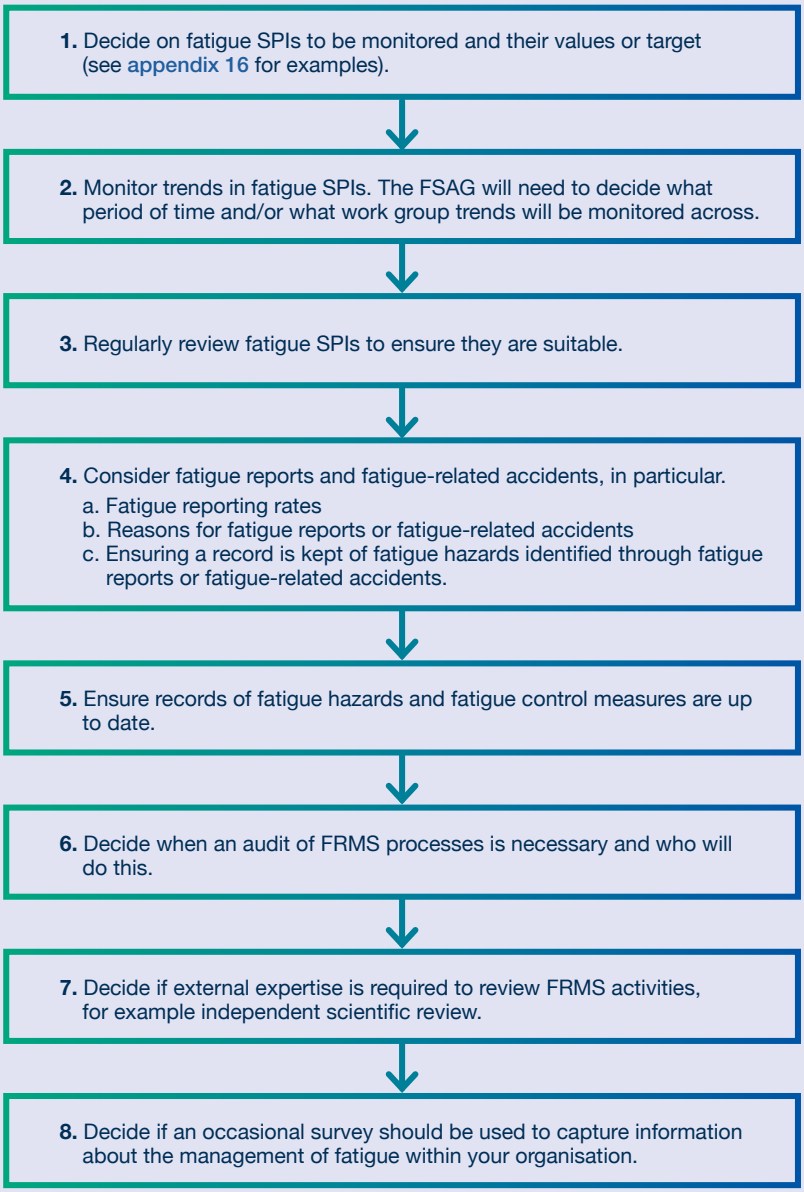


Figure 7: One approach to monitoring FRMS performance

FRMS peer reviews

To further refine an FRMS, it may be possible for ports and organisations to peer review each other's Fatigue Risk Management System. This could help each organisation to further improve their own FRMS and share any lessons learnt. The peer review either could be a formal process with a dedicated group that meets regularly or could occur informally, for example, through joint agreements.

3.3.2 Recognising emerging fatigue hazards

Analysis of trends in fatigue SPIs may indicate emerging fatigue hazards that have not previously been recognised. For example, changes in one part of your organisation may increase the workload and fatigue risk in another part. Refer any new and emerging fatigue hazards to the FSAG to evaluate.

How to manage emerging fatigue hazards

Any newly identified fatigue hazard should be referred back to the FSAG for evaluation and management. As part of this process, the FSAG evaluates the risk, considers new or changed controls and conducts ongoing monitoring.

3.3.3 Managing change

Your FRMS needs to include a process for managing change that can:

1. identify changes in the work processes or the organisation that may introduce fatigue risks
2. consider available tools that could be used to maintain or improve FRMS performance before changes are introduced. Examples of changes include: introducing new equipment; bringing new parts of your organisation into the FRMS; altering the workforce profile; and changing the number of workers.

When you identify a planned change, you should:

- use the FRA processes
- document the strategy for managing any fatigue risk associated with the changes
- engage with workers and their representatives if the change may affect the health and safety of workers.

When a change is underway, FRMS assurance monitoring provides feedback that the FRMS is functioning as intended in the new conditions. For example, include, when an organisation is:

- introducing new operations, the FRMS safety assurance process includes additional monitoring of worker fatigue, together with more frequent assessment of the fatigue SPIs
- extending shift hours within a particular operation, the FRMS safety assurance process includes additional monitoring of individuals' fatigue, together with more frequent assessment of fatigue SPIs.

3.3.4 Improving the FRMS

FRMS assurance processes provide for the continuous improvement of the FRMS by:

- removing or changing control measures that are not effective or are no longer needed
- regularly reviewing facilities, equipment, documentation and procedures
- identifying the need to introduce new processes and procedures to control emerging fatigue-related risks.

You should record any changes made to the FRMS so the information is readily available.

How to improve the FRMS

The FSAG needs to regularly review

1. control measures to determine if they are still working and needed
2. facilities, equipment, procedures and documentation.

The FSAG should also:

- be constantly looking for emerging fatigue hazards, as discussed above
- document changes to the FRMS so they are available for internal and external audit.

3.4 Promoting (Component four)

The FRMS promotion processes of training and communication support the operational activities of the FRMS. All stakeholders need to receive regular communication about the activities and performance of the FRMS. Ideally, the FSAG or the manager responsible for the FRMS will provide this communication. Workers and other stakeholders also need to be able to communicate their concerns about fatigue hazards to the FSAG or their manager.

Effective communication of the FRMS requires:

- fatigue-related training
- an effective FRMS communications plan.

3.4.1 FRMS training

You need to provide training for everyone who contributes to the FRMS and to everyone the FRMS applies to. This includes:

- workers
- people who create work allocation or have any input into the rostering of work
- people who influence what a worker might actually do
- all members of the FSAG
- union delegates
- Health and Safety Representatives
- personnel involved in overall operational risk assessment and resource allocation
- senior management – in particular, the senior manager accountable for the FRMS
- senior leadership in any part of your organisation that the FRMS covers.

Adapt the content of FRMS training programmes to make sure each part of your place of work has the knowledge and skills it needs to fulfil its role in the FRMS (see **appendix 10**).

Training should focus on the:

- dynamics of sleep loss and recovery
- effects of the daily cycle of the circadian body clock
- influence of workload
- ways in which all three of the above factors interact to produce fatigue.

It may also be useful to offer training on managing personal fatigue and sleep issues.

The key principles of fatigue science – managing sleep and understanding the effects of the circadian body clock – are relevant to individuals' lives outside of work as well as their roles at work. Examples of their broader relevance include safe motor vehicle driving and staying healthy.

FRMS training needs to cover issues that everyone can identify with. This can help promote the concept of shared responsibility in an FRMS.

How to carry out FRMS training

You need to consider:

- who will deliver the training (see **appendix 10**)
- how to deliver it – for example, face to face, online, by print or using a combination of these
- when to deliver it – for example, when workers start their employment with the organisation followed by refresher training each year
- what training should cover
- how to determine the effectiveness of the training – for example, by a short test or quiz after workers have completed the training.

See **appendix 10** for ideas on training topics. The FSAG is responsible for keeping records of FRMS training and monitoring its effectiveness.

3.4.2 Communications planning

Good communications are crucial in implementing an FRMS and in the successful day-to-day running of the FRMS. The communications and engagement plan needs to:

- explain FRMS policies, procedures and responsibilities to all workers and stakeholders
- describe communications and engagement channels used to gather and share FRMS-related information.

Once you have developed your plan, you should

- describe it in the FRMS documentation
- review it regularly.

Make sure the communications and engagement plan takes into account, is co-ordinated with and enhances the FRMS training. Where the interval between training is relatively long – for example, yearly – you can use the communications and engagement plan to maintain contact, keep fatigue 'on the radar' and encourage the continuing commitment of all stakeholders.

It is always important to first think about the perspective of those receiving the message. That is, rather than beginning with how we want to deliver a message, we focus on how the people or groups we are communicating and engaging with will receive it. Generally, before putting the detail of a communications plan together, it is useful to consider these questions.

- Where does your messaging about the FRMS fit in with people's everyday lives? People are bombarded with messaging all the time, so it is important to make your message relevant, clear and timely.
- What are the most effective forums for the messaging? People and organisations have well-established meetings, processes, habits and haunts. We need to look at how to fit our messaging into these forums, instead of trying to create something new.
- What does your audience care about? Why should they change what they do?
- Who are the best messengers with trust and creditability in your organisation?
- How will you measure the impact of your communications plan?

Your answers to these questions give you the framework within which you can decide on:

- key messages
- key audiences
- communications and engagement channels
- timelines and milestones.

Then consider how you will share this information. Potential channels include:

- electronic media – for example, websites, Facebook, Instagram, LinkedIn, on-line forums and discussion groups, email, texts
- newsletters, bulletins and poster campaigns in strategic locations
- regular meetings and forums, seminars, and discussion, focus and continuous improvement groups.

Consider using multiple channels, as delivering a message in a variety of ways is likely to be more effective. Communications from the FSAG or other designated management about the activities and safety performance of the FRMS need to be clear, timely and credible. They need to be consistent with the facts and with previous statements.

You also need to tailor the information to the needs and roles of different stakeholder groups so that it is relevant to each group.

Encouraging communication from operational workers and others who have relevant information is vital for fatigue risk management. Their communication is also a source of feedback on the effectiveness of control measures, and provides information for SPIs. Examples of ways to gather this information are through surveys and fatigue monitoring studies.

For communications to be open and honest, all FRMS stakeholders need to clearly understand the legislation governing data confidentiality for example the Privacy Act 2020 and the ethical use of information that comes from those who report. People need to be able to trust that information they give will be used for the stated purpose, and only for that purpose.

You need to describe the communications and engagement plan in the FRMS documentation and review it regularly as part of FRMS safety assurance processes. For an example of a communication and engagement plan, see **appendix 17**.

Appendices

Appendix 1: Examples of fatigue policies

The following are examples of fatigue policies. Make your policy specific to your place of work and work environment and link it to your SMS. You also have to ensure that your FRMS policy addresses your responsibilities under HSWA.

Example 1[20]

Purpose

[Port name] recognises the significance of fatigue as a hazard to the safety and wellbeing of our staff, compounded by the 24-hour nature of the place of work and industry. As work groups have different work arrangements depending on the nature of the tasks carried out, with some working non-standard hours and responsive to changes requested by the customer, [port name] acknowledges that managing the risk associated with fatigue will require a variety of controls and tools for use in varying ways throughout the work groups.

To keep staff as safe as possible, a Fatigue Risk Management System (FRMS) has been developed. It outlines [port name's] shared responsibility model, and provides education and tools, as well as guidance for the different levels of workers within the organisation including supervisors and managers. The aim is to eliminate workers exposure to fatigue where possible, and sufficiently minimise it in situations where it is not possible to eliminate as far as reasonably practicable. In situations where fatigue is not successfully minimised it exposes workers to risk.

Scope

The FRMS described throughout this document applies to all workers of [port name], including permanent staff, contractors and fixed-term or casual staff, as well as management. It applies to staff working at any of [port name's] work sites or when they are away from sites on business, including driving between sites to carry out work tasks.

This FRMS does not apply to people not employed by [port name], though they may carry out work for a tenant or port customer at the port's site. It likewise does not apply to any person entering or on site as a 'visitor'. While the FRMS does not apply, general duties for other persons under HSWA still apply.

Responsibilities

All of the roles below are responsible for ensuring that any fatigue-related incident or fatigue-related event are reported in the H&S reporting system, using the category 'Fatigue'. The fatigued staff member's name may be recorded but will never be used, because these reports are to be treated as learning opportunities within a just culture framework. Reporting is an opportunity to evaluate current controls and determine whether improvements are required or whether the control in question needs to be replaced with a more robust option.

Role	Responsibility
All workers	Workers, including individuals with management roles, are responsible for arriving at the start of their shift or work period in a state that is considered 'fit for duty'*. This helps ensure our people are able to carry out their work in a manner that is safe to themselves, co-workers and any other person on site, while also meeting customer or productivity requirements. Before starting work, if a worker has reason to believe they were not able to gain adequate sleep during their rest opportunity or they are too fatigued to work safely, they should tell the appropriate team leader or supervisor. Workers also have a responsibility to report fatigue-related concerns about themselves or others.
Team leaders, supervisors and managers	If a worker notifies them that they have had insufficient sleep or that they are too fatigued to work safely, team leaders or supervisors are responsible for following the guidelines and tools provided. Before confirming a call-back for a worker, they also need to ensure that: any additional risk introduced with the changed work pattern has been identified; and they are aware of any additional controls required by management.
Management	Management are responsible for ensuring that all workers are provided with an adequate rest opportunity to recover from their previous shift, commute, eat well, gain adequate sleep and participate in social or domestic activities. This allows workers to be 'fit for duty' for the next shift or work pattern required. They are also responsible for ensuring line management are equipped with clear guidelines and tools on what to do when a worker identifies themselves as or presents at work in a state that is not 'fit for duty'. Management are responsible for ensuring that the FRMS is robust and does not introduce unintended consequences when operational. It is their responsibility to ensure the FRMS and its related processes are suitably resourced. The FRMS needs to create an environment where staff feel confident about reporting fatigue. Management needs to ensure any audit/review findings are discussed within a just culture framework, and the legislative context for example HSWA and the Privacy Act 2020. The focus should be on working to identify improvements.
Health & Safety Representatives (HSRs)	HSRs are workers who are elected to represent workers in matters relating to their health and safety. They are able to inquire into anything that is a risk to the health and safety of workers. This includes being able to raise a fatigue issue on behalf of a staff member and supporting the staff member as required. They should also ensure that any audit/review findings are discussed within a just culture framework, and the legislative context for example HSWA and the Privacy Act 2020. The focus should be on working to identify improvements.

* Fitness for duty in regard to fatigue includes: being free from the negative impacts of fatigue on physical, cognitive or work performance; and having had at least five hours of sleep in the previous 24 hours and at least 12 hours of sleep in the previous 48 hours.

Example 2[21]

Fatigue Risk Management Policy

As part of its primary commitment to the continuous improvement of safety, [business name] has a Fatigue Risk Management System (FRMS) embedded within the Safety Management System (SMS) to manage fatigue-related risks. [Business name]'s FRMS policy represents the strongest commitment to safety at the place of work.

Scope

This FRMS applies to all workers, whether full time, part time or casual, including temporary workers and contractors.

FRMS objectives

- To proactively manage operational risks in order to achieve zero fatigue-related incidents every quarter.
- To enable workers to report fatigue hazards and incidents and the place of work to act on them to prevent recurrence.
- To conduct annual continuous improvement reviews with reference to feedback gained from appropriate sources – that is, reports, surveys, studies and audits.
- To provide initial and recurrent training for operational management and staff to build and maintain a high level of understanding of the scientific principles and processes that make up the FRMS.

FRMS principles

- At [business name], personnel operating under the FRMS will receive initial and recurrent fatigue management training.
- Staffing levels will be appropriate to support work allocations that minimise fatigue risks.

- Work practices will be tailored to operations and detail the duty limitations that workers are to follow.
- Minimum off-duty periods will be established for all operations.
- All personnel operating under the FRMS will be provided with an opportunity for an undisturbed eight-hour sleep. This opportunity occurs before staff begins any duty during which they will be required to conduct safety-critical tasks.
- Identified fatigue hazards and incidents will be acted on within timescales determined by their initial categorisation and appropriate control measures will be implemented in the FRMS manual.
- Safety Performance Indicators (SPIs) are monitored and reviewed quarterly during Fatigue Safety Action Group (FSAG) meetings to ensure the FRMS is functioning as intended.
- The FSAG shall use proactive data collection and report feedback to make informed decisions about work practice limitations and potential changes to work allocation patterns.
- [Business name] supports the FRMS as follows: "A developing culture in which risk management is integral to all activities, where there is trust and fairness, it is safe to report, learn from mistakes and system flaws, and the difference is clear between human error in unreliable systems and intentional unsafe acts, and safety remains the first priority."
- New fatigue science that is relevant to [business name]'s FRMS will be incorporated as it becomes available as part of a process of continuous improvement.

The FRMS manual describes the processes used for identifying fatigue hazards, assessing the associated risks, and developing, implementing, and monitoring control measures. The FRMS manual also describes the safety assurance processes used to ensure that the FRMS meets its safety objectives and how the FRMS is integrated with the [business name] SMS programme. Safety objectives are set using SMART principles.

While the primary responsibility for the FRMS lies with [business name] management, management and workers share responsibility for its effective implementation and ongoing development.

Management commitment

- Will identify and state clear lines of accountability for management and workers.
- Will allocate adequate resources to support, improve and maintain the FRMS.
- Will provide adequate staffing levels to support work allocation that minimises fatigue risk.
- Will accept a worker duty can be changed from rostered duty where the worker believes they are suffering from or likely to suffer from fatigue that may impair their performance to the detriment of safety.
- Will provide workers with adequate opportunity for recovery sleep between duties.
- Will create an environment that promotes open and honest reporting of fatigue-related hazards and incidents.
- Will provide fatigue risk management training to all workers required to operate under the FRMS.
- Will demonstrate active involvement in and understanding of the FRMS.
- Will ensure that the fatigue risks within their area(s) of responsibility are managed appropriately.
- Will regularly consult with workers about the effectiveness of the FRMS.
- Will demonstrate continuous improvement and provide annual review of the FRMS.

Worker commitment

- Will make appropriate use of their rest periods between shifts or periods of duty to obtain sleep.
- Will participate in fatigue risk management education and training.
- Will report fatigue-related hazards and incidents as described in the FRMS manual.
- Will comply with the Fatigue Risk Management Policy.
- Will inform their manager or supervisor immediately before or during work if they either:
  - know or suspect they are or another worker is suffering from unacceptable levels of fatigue or
  - have any doubt about their or another worker's capability to accomplish their duties.

The FRMS provides workers with skills, knowledge, processes and procedures to effectively monitor and manage their fatigue levels.

Appendix 2: Example of terms of reference for a Fatigue Safety Action Group[22]

The example below is not a template. Not all the items it includes will be needed by every organisation.

[Insert Business Name] Terms of Reference: Fatigue Safety Action Group

Purpose

The Fatigue Safety Action Group (FSAG) is responsible for coordinating all fatigue risk management activities at [insert business name]. This includes responsibility for gathering, analysing and reporting on data that measures fatigue among workers. The FSAG is also responsible for ensuring that the FRMS meets the safety objectives defined in the FRMS policy and fatigue safety performance indicators (SPIs). The FSAG exists to improve safety and does not get involved in industrial issues.

Terms of Reference

The FSAG is directly responsible to [named manager] and reports through [specified channels]. Its membership will include representatives of each of the following groups: management, work allocation, health and safety, workers, HSRs and unions with other specialists as required.

The tasks of the FSAG are to*:

- engage with and represent all sectors of the workforce covered by the FRMS, including workers and their representatives, for example, HSRs and union delegates
- develop, implement and monitor processes for identifying fatigue hazards. This may include monitoring and reviewing fatigue data – that is, fatigue reports, planned versus actual hours worked, and fatigue-related incident reports
- ensure that comprehensive risk assessment is undertaken for fatigue hazards
- develop, implement and monitor control measures as needed to manage identified fatigue hazards
- develop, implement and monitor effective FRMS performance metrics (fatigue SPIs)
- cooperate with the [appropriate parts of the organisation] to develop, implement and monitor FRMS safety assurance processes, based on agreed fatigue SPIs and targets to ensure the FRMS is functioning as intended and continuously improved
- be responsible for designing, analysing, and reporting studies that measure workers' fatigue, when such studies are needed to identify hazards or to monitor the effectiveness of control measures. Such studies may be contracted out but the FSAG is responsible for ensuring that they are conducted with the highest ethical standards, meet the requirements of the FRMS and are cost-effective
- be responsible for developing, updating and delivering FRMS education and training materials. These activities may be contracted out but the FSAG is responsible for ensuring that they meet the requirements of the FRMS and are cost-effective
- ensure that all relevant personnel receive appropriate FRMS education and training, and that training records are kept as part of the FRMS documentation
- develop and maintain strategies for effective communication with all stakeholders
- ensure that workers and others receive responses to their fatigue reports
- communicate fatigue risks and the performance of the FRMS to senior management
- develop and maintain the FRMS intranet site
- develop and maintain the FRMS documentation
- ensure that it has adequate access to scientific and medical expertise as needed, and that it documents recommendations of these specialist advisors and takes the corresponding actions

* This list should be edited for each business and FRMS.

- keep informed of scientific and practical advances in fatigue risk management principles and practice
- manage FRMS resources effectively and be accountable for them. FRMS resources.

[Example timeframes:] The FSAG will meet monthly. Minutes will be taken during meetings and distributed within 10 working days after each meeting. The FSAG will present an annual budget request in [designated part of the financial cycle] and an annual report of all expenditures.

Appendix 3: Bio-mathematical models[23]

Bio-mathematical fatigue models begin life as computer programs that scientists use to test their current understanding of how factors like sleep loss, recovery and circadian rhythms interact to affect human alertness and performance. The first part of the modelling process involves writing a mathematical equation – normally a software program known as a model – that explains how factors such as sleep loss and the circadian body clock interact to produce outcomes such as self-rated fatigue and performance measures in one situation. This first data set is a 'developmental data set'. If the equation can explain the outcomes in the developmental data set, then the model is used to predict outcomes in a different situation. Scientists then collect data in this new situation (a 'validation data set') and test model predictions against the new data.

Scientific modelling is a continuous improvement process. As scientific tools, bio-mathematical models are accepted as being incomplete and transient. In scientific best practice, scientists continue designing new experiments to try to find out where their models fail. In this way, they find out where their current understanding is incomplete or possibly wrong. This is a much more efficient way of increasing scientific knowledge than just doing random experiments.

Various bio-mathematical models have been commercialised and are marketed as tools for predicting fatigue hazards associated with work allocations. Several models are available in the public domain. Used properly, these models can be helpful tools in an FRMS, because it is hard to visualise the interactions of processes like sleep loss and recovery, or the circadian body clock. Using a model properly requires some understanding of what it can and cannot predict. An important question to consider about any model is whether it has been validated against fatigue data from operations similar to your own.

Currently available models:

- predict group average fatigue levels, not the fatigue levels of individual workers
- do not take into account the impact of workload or personal and work-related stressors that may affect fatigue levels
- do not take into account the effects of personal or operational control measures that individuals may or may not use – for example, caffeine consumption, exercise
- do not predict the safety risk that fatigued workers represent in a particular operation – that is, they are not a substitute for risk assessment, which is the next step in FRA processes.

The most reliable use of current commercial bio-mathematical models is for predicting relative fatigue levels – is the fatigue hazard likely to be greater on this work allocation or that work allocation? However, model predictions should not be used without taking into account operational experience when making decisions about work allocation design. On the other hand, data collected through FRA processes could be a rich resource for improving the performance of bio-mathematical models, if model designers follow a continuous improvement philosophy.[24]

Appendix 4: Data sources that can be used for hazard identification, monitoring and review at work[25]

The following table provides examples of sources of data that you may use to support your task of identifying and assessing of fatigue hazards. Any use of worker data needs to comply with the relevant laws that apply to the employer, such as HSWA and the Privacy Act 2020.

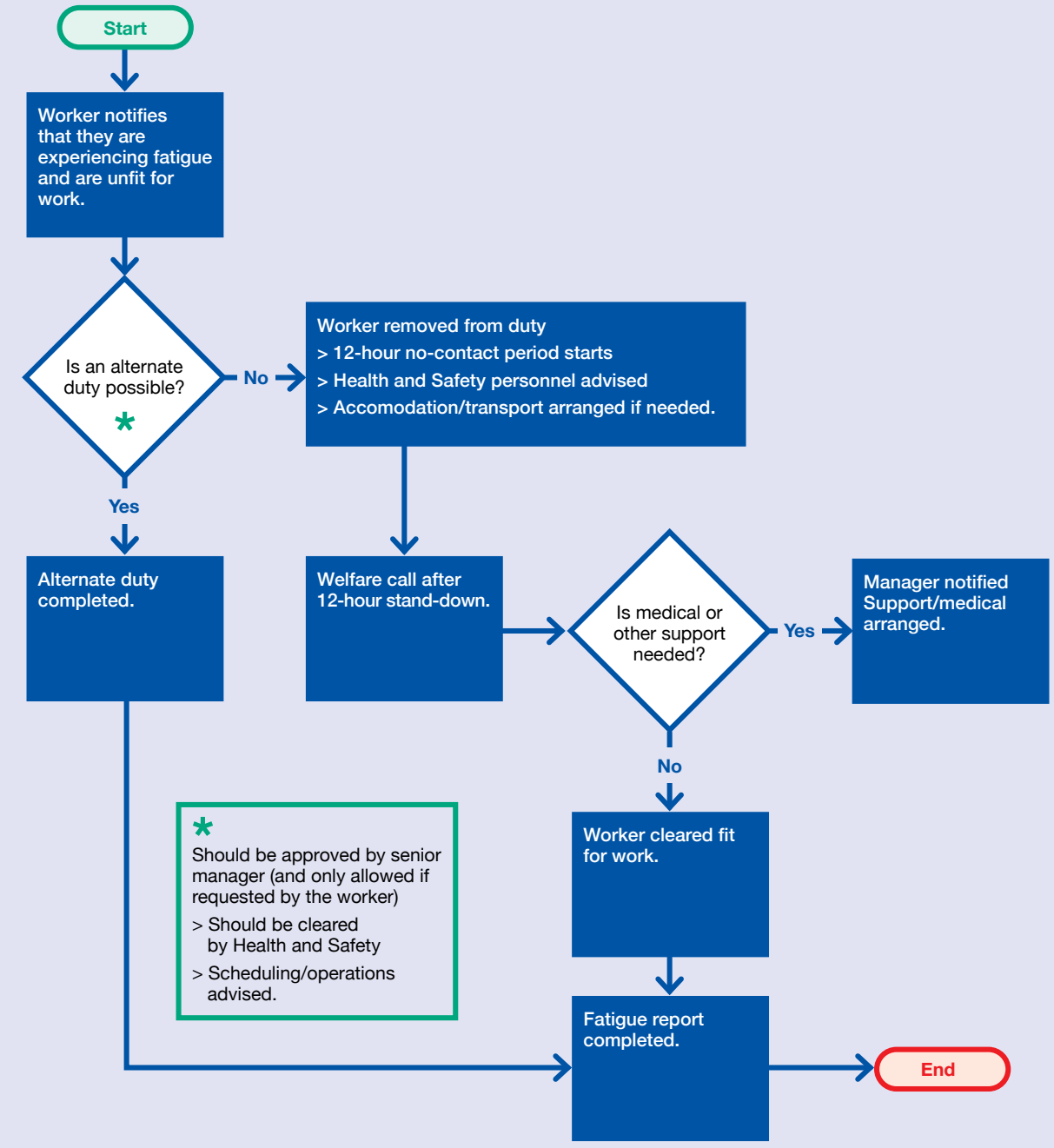
Workplace records	Examples of data to consider
Hours of work records	Number of hours worked on a weekly, fortnightly, monthly basis
	Number of hours of overtime worked
	Bio-mathematical modelling outputs, which might be via a programme or tool that estimates the level of fatigue by analysing work allocation or planned and actual hours worked
	Distribution of hours worked, including overtime, among workers
	Percentage of shifts where hours worked exceed the planned work allocation hours.
	Percentage of shifts where shift swaps occurred
	Number of workers rostered off or replaced to prevent shifts exceeding a business's limits
	Percentage of safety-critical tasks scheduled between midnight and 6 am
	Frequency of not taking scheduled breaks
Hazard reporting database	Number and nature of hazards related to fatigue
	Outcomes of fatigue-related hazard reports
	Number of workers reporting fatigue at work
	Frequency of workers reporting fatigue, not being fit for duty, or being tired before a shift or during a shift
Incident and investigation data	Number and nature of reports where fatigue was present at the time or found to be a causal or contributing factor
	Percentage of incidents that occur during periods of the work allocation where the risk of fatigue is elevated – that is, from midnight to 6 am or at the end of a shift
	Percentage of incidents that occur by consecutive shift worked – for example the third night shift or sixth consecutive shift
	Number of accidents that occur on way home including the type of transport (including walking)

Workplace records	Examples of data to consider
Records of current and recurring industrial issues in the place of work	The nature of industrial activity and recurring themes, particularly in regard to work allocation and hours of work, physical or cognitive workload or pay disputes
Data on use of leave, including sick, fatigue, annual and long-service leave	Fatigue leave taken
	Increasing leave use during certain periods of the work allocation
	Accrual of leave over a long period
	Leave taken in frequent short bursts during certain periods of the work allocation
	Frequency of unscheduled leave
	Accrual of time in lieu
	Leave taken more frequently in certain job roles or work groups
Minutes of safety meetings and staff meetings at the place of work	Whether any agenda items relate to fatigue
	Evidence of issues raised across a period of time with no apparent resolution
Health and safety issues register for the place of work	Recurring issues related to fatigue, hours of work, work allocation design, workload, work demands, work design or work layout that may have an impact on fatigue levels
	Whether issues raised have an action plan in place
Employee assistance data	Patterns associated with poor sleep, stress or other factors that may contribute to an elevated fatigue risk
Workers compensation claims data	Causal or contributing factors related to fatigue, hours of work or work demands
	Period of absence associated with claims of a fatigue nature
Inspections records and action plans for the place of work	Conditions in the place of work like inadequate lighting, excessive vibration and exposure to noise, and their impact on workers' fatigue levels
	Percentage of shifts that have facilities in place for managing working conditions that may impact on fatigue levels
	Percentage of sleeping facilities that are adequate in the place of work
	Number of reports that sleeping facilities in the place of work are inadequate – for example, due to noise, light, vibration, climate control, bedding
Fatigue-related survey data	Workers' self-reported sleep quality and quantity
	Self-reported fatigue levels
	Self-reported sleep habits of workers
	Reporting culture
	Percentage of workers that have reported swapping shifts to self-manage fatigue
	Percentage of workers who report taking a rest break, changing tasks or adopting fatigue-proofing strategies if they start to feel the onset of fatigue
	Percentage of workers who report making a fatigue-related error at work
	Percentage of workers who report having fallen asleep while driving to or from work
Medical and health assessment records	Sleep disorders self-reported and identified through assessment
	Number of reported medical conditions that may impact on sleep
	Employee Assistance Programme (EAP) data associated with poor sleep, stress or other factors that may contribute to an elevated fatigue risk
	Percentage of random drug and alcohol tests that indicate alcohol consumption or use of drugs known to impact on sleep/fatigue or promote alertness
Sleep data	Data recorded from the use of digital activity monitors (Actigraphs) or sleep diaries
Performance data	Data recorded from the use of vigilance and reaction time tests
	Data recorded on other relevant key performance indicators – for example, efficiency, error rates

Appendix 5: Example of a fatigue reporting form[26]

Confidential fatigue report form				
Name:				
When did it happen?	Date:		Time:	
Describe the roster on which the event happened.				
Describe the shift on which the event happened (rostered or actual).				
What happened?				
Describe how you felt (or what you observed).				
Circle how you felt				
2 Very lively, somewhat responsive, but not at peak			**6** Extremely tired, very difficult to concentrate	
3 OK, somewhat fresh			**7** Completely exhausted	
4 A little tired, less than fresh				
Why did it happen?				
Fatigue prior to duty	Yes		No	
Home	Yes		No	
Shift itself	Yes		No	
Personal	Yes		No	
How long had you been awake when the event happened?		hrs		mins
How much sleep did you have in the 24 hours before the event?		hrs		mins
How much sleep did you have in the 72 hours before the event?		hrs		mins
Other comments:				
What did you do? Actions taken to manage or reduce fatigue:				
What could be done? Suggested corrective actions:				
Who was this form sent to and on what date?				

Appendix 6: Example of a process for managing workers who call in fatigued



Example of a process for managing workers who call in fatigued

Explanation

A fatigue event can occur before, during or after a duty. When a fatigue event occurs, the process follows these steps.

1. The worker should notify the appropriate person (for example, the manager) that they are unable to start or continue a shift due to fatigue, or that they experienced fatigue during a recent shift.
2. The worker's manager may offer an alternative shift or alternative tasks. It is at the absolute discretion of the worker to accept or deny the alternative work offered. Any alternative tasks or shift needs approval from a senior manager. The health and safety team/manager also needs to approve the change and rostering/scheduling should be advised.
3. If the worker accepts the alternative duty or tasks, they still need to complete a fatigue report. This is important as it captures data to identify trends and to understand control effectiveness.
4. If a worker chooses not to accept an alternative duty, they need to complete a fatigue report within 48 hours. If they need more than 48 hours to recover from fatigue, they must have a medical certificate to confirm this.
5. The manager can provide transport home or accommodation for the worker as needed.
6. Once the worker is fit to work again, they should contact rostering/scheduling staff.
7. After a worker who has called in fatigued, returns to work, the manager will discuss the fatigue report with them. This discussion may uncover further information to help identify fatigue hazards and risks. The manager could also enquire about any ongoing fatigue issues, if applicable, to explore whether medical assistance is appropriate.
8. If the manager considers that the worker may be suffering from chronic repetitive fatigue, they will ask the worker to consult with a health professional, such as seeing a doctor, sleep specialist or psychologist with sleep expertise.
9. The FSAG needs to review the fatigue report at its next meeting.

Appendix 7: Analysing the role of fatigue in safety events[27]

The primary aim of investigating the role of fatigue in safety events is to identify how it might have been possible to prevent it or mitigate its effects. The reason for doing so is to reduce the likelihood of similar events occurring in the future. There is no simple formula for evaluating the contribution of fatigue to a safety event. To establish that fatigue was a contributing factor, it has to be shown that:

- the person was in a fatigued state
- the person took particular actions or decisions that were a contributing cause in what went wrong
- those actions or decisions are consistent with the type of behaviour expected of a fatigued person.

Basic information can be collected for all fatigue reports and safety events. More in-depth analyses can be reserved for events where it is more likely that fatigue was an important factor and/or where the outcomes were more severe.

Basic information

To establish whether a person was likely to have been fatigued at the time of an event, four pieces of information are needed.

1. What time of day did the event take place? If it was in the window of circadian low of 2–6 am, then fatigue may have been a factor.
2. Was the person's normal circadian rhythm disrupted? For example, in the last 72 hours did they work at night?
3. How many hours had the person been awake at the time of the event? A more reliable way to establish this information may be to ask, "What time did you wake up from your last sleep period before the event?" If the answer is more than 16 hours earlier, then sleepiness may have been a factor.
4. Does the 72-hour sleep history suggest a sleep debt? As a rough guide, the average adult requires 7–9 hours of sleep every 24 hours. If a person has had less than 21 hours of sleep in the last 72 hours, they will probably be experiencing the effects of a sleep debt. If information on sleep history is not available, duty history can provide information on sleep opportunities.

Investigating fatigue in depth

If answers to the four questions above suggest that the person was fatigued at the time of the event, then more in-depth investigation is required. This investigation looks at whether the person took particular actions or decisions that were a contributing cause in what went wrong, and whether those actions or decisions are consistent with the type of behaviour expected of a fatigued person. The following two checklists provide one example of how this can be done.

Checklist 1 is designed to establish whether the person was in a fatigued state, based on a series of questions or probes that address key aspects of fatigue. The answer to each question is compared with the best-case response in order to build an overall picture of the fatigue hazard. Any departure from the best-case response indicates increased risk of fatigue.

Checklist 2 is designed to establish whether the unsafe action(s) or decision(s) were consistent with the type of behaviour expected of a fatigued person.

Checklist 1: Establishing the fatigued state		
Question	**Best case response**	**Investigator's notes**
Quality of sleep Establish whether or not there was a sleep debt		
How long was the last consolidated sleep period?	7.5 to 8.5 hours	
Start time?	Normal circadian rhythm, late evening	
Awake time?	Normal circadian rhythm, early morning	
Was your sleep interrupted? If yes, for how long?	No	
Any naps since your last consolidated sleep?	Yes	
Duration of naps?	Had opportunity for restorative (1.5–2 hours) or strategic (20-minute) nap before start of the late shift	
Describe your sleep patterns in the last 72 hours. Apply sleep credit system.	Two credits for each hour of sleep; loss of one credit for each hour awake – should be a positive value	
Quality of sleep Establish whether or not sleep was restorative		
How did the sleep period relate to the individual normal sleep cycle – that is, start/finish time?	Normal circadian rhythm, late evening/ early morning	
Sleep disruptions?	No awakenings	
Sleep environment?	Proper environmental conditions – for example, quiet, comfortable temperature, fresh air, own bed, dark room	
Sleep pathologies (disorders)	None	
Work history Establish whether hours worked and type of activities involved had an impact on sleep quantity and quality		
Hours on shift and/or on call before the occurrence?	Situation dependent – hours on shift and/ or on call and type of work that ensure appropriate level of alertness for the task	
Work history in preceding week?	Number of hours on shift and/or on call and type of work that do not lead to a cumulative fatigue	
Irregular schedules Establish whether the scheduling was problematic in regard to its impact on quantity and quality of sleep		
Was the person a shift worker working through usual sleep times?	No. The circadian body clocks and sleep of shift workers do not adapt fully	
If yes, was it a permanent shift?	Yes – daytime	
If no, was it rotating or irregular shift work?	Yes – rotating clockwise, rotation slow about one day for each hour delayed, night shift shorter, and at the end of the cycle	
How are overtime or double shifts scheduled?	Scheduled when people are in the most alert parts of the circadian body clock cycle, which is late morning, mid-evening	
Scheduling of critical safety tasks?	Scheduled when people are in the most alert parts of the circadian body clock cycle, which is late morning, mid-evening	
Has the person had training on personal fatigue control measures?	Yes	

Checklist 2: Establishing the link between fatigue and the unsafe act (s)/decision(s)	
Performance indicator	**Investigator's notes**
Attention	
Overlooked sequential task element?	
Incorrectly ordered sequential task element?	
Preoccupied with single tasks or elements?	
Exhibited lack of awareness of poor performance?	
Reverted to old habits?	
Focused on a minor problem despite risk of a major one?	
Did not appreciate gravity of situation?	
Did not appreciate danger?	
Displayed decreased vigilance?	
Did not observe warning signs?	
Memory	
Forgot a task or elements of task?	
Forgot the sequence of a task or of task elements?	
Inaccurately recalled operational events?	
Alertness	
Succumbed to uncontrollable sleep in form of micro-sleep, nap or long sleep episode?	
Displayed automatic behaviour syndrome?	
Reaction time	
Responded slowly to normal, abnormal or emergency stimuli?	
Failed to respond altogether to normal, abnormal or emergency stimuli?	
Problem-solving ability?	
Displayed flawed logic?	
Displayed problems with arithmetic, geometric or other cognitive processing tasks?	
Applied inappropriate corrective action?	
Did not accurately interpret situation?	
Displayed poor judgement of distance, speed and/or time?	

Appendix 8: Example of a risk assessment chart[28]

Risk assessment chart			
Step 1: Hazard identification	**Step 2: Risk assessment**		**Step 3: Risk control**
Hazards	**Lower risk**	**Higher risk**	**Control measures**
Work demands			
Repetitive work	Tasks vary	Little or no variation Lengthy idle periods	Consider the information in **appendix 12** under 'The work activity'.
Work requiring concentration	Job demands are satisfactory, not too high or low	Requires intense focus for long periods; or alternatively too little concentration required	Consider the information in **appendix 12** under 'The physical and mental demands of the role' and in **section 2.4.4**.
Physical demands			
Repetitive work	Tasks vary	Little or no variation	Consider the information in **appendix 12** under 'The 'physical and mental demands of the role'.
Strenuous activities	Requires little physical exertion	Very physically demanding	
Work scheduling and planning			
Total work shift/day	Less than 8 hours	12 hours or more	Consider the information in **appendix 12** under 'The shift duration' and in **section 3.2.3** under 'work allocation design'.
Daily work hours and travel time combined	9 hours or less	13 hours	Consider the information in **appendix 12** under 'The shift duration' and in **section 3.2.3** under 'Work allocation design'.
Weekly hours	Less than 40 hours per week	56-hour week	Consider the information in **appendix 12** under 'The shift duration' and 'Rest breaks/ days'.
Changeable work schedules	Regular, predictable hours	Irregular, unpredictable, schedule changes at short notice	Consider the information in **appendix 12** 'The shift timing' and 'The shift duration' and in **section 3.2.3** under 'Work allocation design'.
Speed and direction of shift	Forward rotation; day > afternoon/evening > night	Backward shift rotation and/ or slower rotation	Consider the information in **appendix 12** under 'The shift pattern' and in **section 3.2.2** under 'Work allocation design'.
Breaks between work periods/recovery time split shift/variable shift	12 or more hours between shifts. Adequate time for sleep, travel, meals and socialisation	Less than 10 hours between shifts. Not enough time for sleep, travel, meals and socialisation	Consider the information in **appendix 12** under 'Rest breaks/days' and in **section 3.2.3** under 'Work allocation design'.

Risk assessment chart			
Step 1: Hazard identification	**Step 2: Risk assessment**		**Step 3: Risk control**
Hazards	**Lower risk** **Risk indicator** **Higher risk**		**Control measures**
Working time			
When a shift ends	Early evening	Early morning – for example between 1 am and 6 am	Consider the information in **appendix 12** under 'The shift timing' and in **section 2.4.3**.
Sequential night shifts	No night shifts	More than three consecutive night shifts	Consider the information in **appendix 12** under 'The shift pattern' and 'The shift timing' and in **section 2.4.3.**
Time of shift	Day shift	Night shift	Consider the information in **appendix 12** under 'The shift pattern' and 'The shift timing' and in **section 2.4.3**.
Time not working between a sequence of night shifts	A minimum of two full sleep periods at night-time after three night shifts worked	Less than 48 hours	Consider the information in **appendix 12** under 'Rest breaks/days' and in **Part 2**: The science, Recovering from a sleep debt.
Break frequency during work	Adequate and regular breaks	Infrequent, short or no breaks	Consider the information in **appendix 12**: under 'Rest breaks/days' in **section 2.4.4**.
Seasonal work hours worked	Regular hours over 12 months	Long hours during peak season	Consider the information in **appendix 12** under 'The shift timing', 'The shift duration' and 'Rest breaks/days'.
Environmental			
Exposure to hazardous substances or atmospheres	Exposure standards indicate a low risk	Exposure standards indicate a high risk	Refer to WorkSafe New Zealand's guidance on hazardous substances see (**hazardoussubstances.govt.nz/guide**) and confined entry (**worksafe.govt.nz/topic-and-industry/planning-entry-and-working-safely-in-a-confined-space/**).
Exposure to noise	Minimal exposure	Lengthy exposure or exposure to high decibels	Consider the information in **appendix 12** under 'The physical and mental demands of the role'.
Exposure to extreme temperatures	Minimal exposure	Lengthy exposure	Consider the information in **appendix 12** under 'The physical and mental demands of the role'.
Exposure to vibration	Minimal exposure	Lengthy exposure	Consider the information in **appendix 12** under 'The physical and mental demands of the role'.

Risk assessment chart			
Step 1: Hazard identification	**Step 2: Risk assessment**		**Step 3: Risk control**
Hazards	**Lower risk**	**Higher risk**	**Control measures**
Training and information			
Information on fatigue risk identification and management	Extensive	None provided	Consider the information in **section 3.4.1** and **appendix 10**.
Training on fatigue and sleep	Extensive; targeted at both managers and workers	None provided	Consider the information in **section 3.4.1** and **appendix 10**.
Job skills training	Extensive	None provided	Consider the information in **appendix 12** under 'The physical and mental demands of the role'.
Organisational governance			
Change involving downsizing or expansion	Effective change management	No change strategy	Consider the information in **section 3.3.3**.
Culture and leadership	Supportive leaders and positive, safety-focused culture	Unsupportive leaders and poor culture	Consider the information in the Foreword **section 1.4**, **section 3.1.1** and **appendix 1**.
System for identifying and reporting fatigue concerns	Workers proactively report concerns, leading to a risk assessment and implementation of higher-order controls if required	None provided	Consider the information in **section 3.2.1** under 'Reporting fatigue hazards or risks' and **appendix 5**.
Occupational health and safety policies	Effective policies for workers that are widely accepted and followed	No policies, or policies not followed	Consider the information in **section 3.1.1**.
Individual factors			
Amount and quantity of sleep	Sleeping at night 8 hours of sleep	Sleeping during the day. 6 hours of sleep or less	Consider the information in **part 2**.
Health	Good nutrition Moderate, regular exercise	Poor diet; lack of exercise; recent illness/injury; sleep disorder	Consider the information in **part 2** and **appendix 13**.
Fitness for work	Alert, adequate energy, generally well	Consumes drugs or alcohol	Consider the information in **part 2** and **appendix 13**.
Lifestyle	Sufficient sleep period Work–life balance	Activities or responsibilities that limit amount of sleep, like a second job or long-distance commute	Consider the information in **part 2.**

Appendix 9: Example of a risk evaluation tool

The example below outlines the steps for one particular model: the Drew Dawson risk evaluation tool, as used in a port environment.

Step 1: Estimate the likelihood of a worker being fatigued and a safety event occurring

You can do this in a number of ways, including by using knowledge of fatigue science, information from a bio-mathematical model or information from a matrix. You should consider this information in combination with knowledge of the operation, and it is recommended that you use more than one tool to estimate the likelihood of fatigue. Step 1 is across three different levels as follows.

Level 1: Sleep opportunity: use a tool to work out how much sleep a worker could actually have. You can do this one of two different ways.

1. Use a roster assessment matrix, like the one in table A. Note this roster assessment tool only considers five aspects of the work allocation; there may be other aspects that you use in your work allocation.

For example, you may have a work allocation that:

- has a seven-day period of work rostered to be 50 hours (four points)
- includes shifts of up to 12 hours (four points)
- has breaks between shifts of at least 12 hours (two points)
- includes three 12-hour nights – that is, 36 hours at night (eight points)
- includes two consecutive nights once every 14 days (one point).

In this case, it would score a total of 19 points.

It is important to remember that fatigue occurs because of what workers actually work, not what work is planned.

Roster dimension	Points				
	0	1	2	4	8
Max hours per 7 days	≤36h	36–43h	44–47h	48–54h	55+
Shift duration	≤8h	8–10h	10–12h	12–14h	≥14h
Short break duration	≥16h	16–13h	12–10h	10–8h	≤8h
Max hours of night work per 7 days	0h	1–8h	8–16h	16–24h	≥24h
Long break frequency	≥1/7 d	≤1/7d	≤ 1/14d	≤1/21d	≤1/28d

Notes: h=hours d=days

Table A: Roster dimension tool

You then map the score to a likelihood value for fatigue-related impairment. As table B shows, our example, above, with a score of 19, equates to a likelihood value of 3.

You need to decide whether the scores in table A and the cut-off scores in table B are appropriate for your organisation and for each work group that you are assessing.

2. Use a bio-mathematical model, such as FAID (see the **section 3.2.1** under 'Bio-mathematical models' and **appendix 1** for more information). You can map FAID scores to a likelihood value as well. Table B sets out one example of how you can do this. As with the roster assessment matrix, you need to decide whether the cut-offs from FAID are appropriate for your organisation and each work group that you are applying the model to. Some port companies use bio-mathematical models in real time. This requires workers on call, such as marine pilots, to enter their actual work patterns into the model, which can then determine if they are able to continue to work.

A FAID score of 60 for a work pattern would result in a likelihood value of 3 (medium likelihood of occurring).

You then assess Level 2 and Level 3 to get a score.

Level 2: How much sleep a worker has had in the previous 24 and 48 hours

Level 3: The worker's self-assessment

The individual self-reports their behavioural signs and symptoms of fatigue. This gives a number of between 1 and 9 on the Karolinska Sleepiness Scale (KSS).

You map each of these assessments to the ISO 31000 (see table B).

Fatigue likelihood score mapped to ISO31000				
Likelihood (ISO31000)	**Level 1 (Roster assessment)**	**Level 1 (FAID 95%)**	**Level 2 (PFLS)**	**Level 3 (KSS)**
1	0–5	<40	0	1–2
2	6–11	40–60	1–4	3–4
3	12–20	60–79	4–8	5–6
4	21–25	80–100	9–12	7–8
5	25+	100+	12+	9

Table B: Example of mapping likelihood values to roster assessment and FAID scores

Step 2: Identify the worst credible degree of harm to health and safety that is possible

When you are deciding if and how a workers fatigue is likely to affect health and safety, what is important to consider is the task the fatigued worker is undertaking. For example, if a worker falls asleep while filling out paperwork, there may be no immediate health and safety consequences. However, if the same worker falls asleep while operating a straddle crane or piloting a vessel, it is far more likely to lead to an event that could harm the worker or other people, or cause damage. To understand the severity of consequences, it is also necessary to consider how fatigued the worker may be, along with the resulting impact of that level of fatigue on the worker's performance and how that will affect their tasks at work.

See table C for one approach to severity classification. These categories consider the consequences for people, equipment, systems, the environment, the organisation's reputation and the financial cost of the event.

For example, an event that could result in moderate damage to equipment or in a financial cost of up to $1 million would be classified as a '3' in the consequence score column (the first column of table C).

	Consequence					
	People	**Assets/ infrastructure**	**Operational/ systems**	**Environment**	**Reputation**	**Financial**
1	Slight effect – discomfort or first aid injury/ illness	Slight damage	Disruption of non critical process <4 hours	Very minor spill/ no affect	Non-influential social media	Up to $50,000
2	Minor injury or health effect – medical treatment	Minor damage	Disruption of critical process <4 hours	Minor spill/ insignificant effect	Minor negative local coverage/ low level negative social media	Up to $500,000
3	Major injury or health effect – lost time injury/ illness	Moderate damage	Disruption of critical process 4–24 hours/total port shutdown 4–48 hours	Moderate spill/ minor short-term effect	Negative community and social media/ minor negative national coverage	Up to $1.0m
4	Notifiable or permanent disability or illness	Major damage	Disruption of critical process >4–24 hours/total port shutdown 4–48 hours	Spill requiring regional response/ moderate short-term or minor long-term effect	National coverage/major negative or viral social media	Up to $5.0m
5	Fatality	Extensive damage	Disruption of critical process >1 week/total port shutdown >48 hours	Spill requiring regional response/ significant short-term or moderate long-term effect	International/front page national/ blanket negative social media	Greater than $5.0m

Table C: Examples of health and safety consequences of fatigue at different levels of severity

Step 3: Calculate the risk by combining likelihood of fatigue and severity of the worst possible outcome

A likelihood and severity matrix is commonly used to assess all types of risk and help establish whether it is necessary to invest resources in control measures. You need to work out the level of the risk associated with a hazard and whether that risk level is 'tolerable'. To do so, you plot its position on the matrix using the likelihood score obtained from Step 1 and the consequence score from Step 2.

Following on from the example above, with a likelihood score of 3 (medium likelihood) for the level 1 roster dimension tool and the severity consequence score of 3 (moderate damage and financial cost of up to $1 million), you would calculate the risk to be 15 or high (table D). At this level of risk, senior management would have to give its approval for this activity to occur unless additional control measures were in place to reduce the risk.

One of the limitations of using risk matrices is that they do not take into account whether control measures are in place.

Likelihood of fatigue (ISO31000)	**Severity of consequence**				
	1	2	3	4	5
1	Low	Low	Moderate	Moderate	Moderate
2	Low	Moderate	Moderate	Moderate	High
3	Moderate	Moderate	Moderate	High	High
4	Moderate	Moderate	High	High	Extreme
5	Moderate	High	High	Extreme	Extreme

Table D: Risk matrix based on the likelihood of fatigue and severity of consequence

Example of a roster assessment matrix

Table E sets out part of a simple roster assessment matrix. Note that this not a complete example and does not illustrate what to do with the likelihood value.

This example has been developed using data from a large study of New Zealand nurses. It is designed to be applied to a seven-day period of work. It considers:

- total hours worked
- the frequency of shift extensions
- the frequency of very short breaks between shifts
- the number of night shifts worked where night shift is defined between the times of x and x, where x is what time your organisation defines a night shift starting and ending
- the number of breaks longer than 24 hours
- the frequency of changes to the roster
- the number of times a worker is able to sleep during the night.

In this case, you consider each aspect of the roster and give it a score, and then sum up all the scores to give a total score. You will have to consider how you can map this total score to the likelihood values. For example, if you end up with a total score of 7, how likely is the risk in your organisation?

A limitation of this model is that it has no validated cut-offs for total scores. Before deciding to use this matrix, you would have to consider whether it is suitable for your workforce and the work they do.

Risk factor	Lower fatigue, score 0	Significant fatigue, score 1	Higher fatigue, score 2
Total hours worked	≤40 hours	40 hours+ to 48 hours	>48 hours
Shift extensions ≥30 minutes	None	≤50% of days worked	>50% of days worked
Break <9 hours between shifts	0	1	>1
Number of nights	0	1-2	>2
Number of breaks ≥ 24 hours between shifts	≥2	1	0
Work allocation change	No	Work allocation change requested	Work allocation change not requested
Number of nights of sleep (defined as 2300–0700)	6–7 nights	4–5 nights	0–3 nights

Table E: A simple roster dimension tool similar to a tool New Zealand nurses use

Appendix 10: Recommended fatigue training topics[29]

Note the following three tables are designed for three different target groups.

Recommended fatigue training topics
Target group: Workers 'at the coalface'
The scientific principles that underpin fatigue and fatigue management, including: › defining fatigue and understanding the key causes › defining shift work › basic information on sleep and the factors that influence sleep duration and quality › basic information on the circadian body clock › consequences of sleep loss › recovery from sleep loss › the impact of shift work on sleep, recovery and wellbeing
How to use fatigue-reporting systems, including how to report that they are too fatigued to undertake safety-critical duties. Any other FRMS processes in which they play a vital role
An overview of the FRMS structure and how it works in the business, including the concepts of shared responsibility and encouraging effective reporting
The responsibilities of workers and of the business in the FRMS
Causes and consequences of fatigue in the operation(s) in which they work
Individual variability in fatigue symptoms and how to identify fatigue in themselves and others
Personal strategies that they can use to improve their sleep at home and to minimise their own fatigue risk, and that of others, while they are on duty
Sleep disorders and their treatment, where to seek help if needed, and any requirements relating to fitness for duty
The legal responsibilities under HSWA to manage the risk of harm from fatigue
Workers right and responsibility to refuse to work or stop work likely to cause serious harm arising from impairment caused by fatigue
The role of elected HSRs to represent workers' health and safety interests

Recommended fatigue training topics
Target group: Personnel involved in planning and day-to-day operations
The scientific principles that underpin fatigue and fatigue management, including: › defining fatigue and understanding the key causes › defining shift work › basic information on sleep and the factors that influence sleep duration and quality › basic information on the circadian body clock › consequences of sleep loss › recovery from sleep loss › the impact of shift work on sleep, recovery and wellbeing
An overview of the FRMS structure and how it works in the business's organisation, including the concepts of shared responsibility and encouraging effective reporting
How scheduling affects sleep opportunities and can disrupt the circadian body clock cycle, the fatigue risk that this creates and how it can be mitigated through scheduling
Use and limitations of any scheduling tools and bio-mathematical models or other algorithms that may be used to predict the levels of an individual's fatigue across work allocations/schedules
How fatigue reports are generated and analysed
Their role in the FRMS in relation to fatigue hazard identification and risk assessment
Processes and procedures for planned schedule changes, including: › assessing the potential fatigue impact of planned changes › early engagement of the FSAG in the planning of changes with significant potential to increase fatigue risk › implementing changes recommended by the FSAG
Individual variability in fatigue symptoms and how to identify fatigue in themselves and others
Personal strategies that they can use to improve their sleep at home and to minimise their own fatigue risk, and that of others, while they are at work
Basic information on sleep disorders and their treatment, and where to seek help if needed

Recommended fatigue training topics
Target group: Executive decision-makers and managers
The scientific principles that underpin fatigue and fatigue management, including: › defining fatigue and understanding the key causes › defining shift work › basic information on sleep and the factors that influence sleep duration and quality › basic information on the circadian body clock › consequences of sleep loss › recovery from sleep loss › the impact of shift work on sleep, recovery and wellbeing
An overview of the FRMS structure and how it works, including the concepts of shared responsibility and an effective reporting culture, and the role of the FSAG
The responsibilities and accountabilities of different stakeholders in the FRMS, including themselves
An overview of the types of fatigue control measures the organisation uses
Regulatory requirements for fatigue management
FRMS safety assurance metrics the organisation uses
Linkages between the FRMS and other parts of the PCBU's SMS
Linkages between the FRMS and other parts of the organisation, for example the scheduling department, operational sections, medical department, safety department
Regulatory and legal requirements for the FRMS
Individual variability in fatigue symptoms and how to identify fatigue in themselves and others
Personal strategies that they can use to improve their sleep at home and to minimise their own fatigue risk, and that of others, while they are at work
Basic information on sleep disorders, their treatment and where to seek help if needed, so they can make organisational decisions about how to manage affected individuals

Appendix 11: Example of a protocol for taking naps during work periods[30]

This is an example of a napping protocol that organisations could use as a starting point to develop their own planned napping protocol. Naps are an effective way of addressing fatigue as they have a positive impact that will not disturb later sleep.

[Business X] will use four general steps to ensure the effective use of planned naps.

1. Plan.
2. Inform.
3. Create an appropriate environment.
4. Return to work.

1. Plan

a. Identify who will take a planned nap. Managers may give a worker a planned nap if:
   - current and anticipated workload permits
   - the worker can be recalled if needed.

b. Identify the length of the planned nap.
   - A nap at work needs to be about 45 minutes or less. If you can have only a brief nap of 5 to 10 minutes, that is worthwhile because getting some sleep is better than no sleep.
   - For a longer planned nap at home, consider about two hours. However, do not to take a long nap too close to your next planned sleep period, or you may have trouble falling asleep then.

c. Identify specific start and end times for the planned nap.
   - Be clear about when you will begin and end your planned nap. Do not make it 'open-ended'.

d. Identify a specific method for waking up.
   - Do not leave waking up to chance. Before you go to sleep, put in place a reliable way of waking up. For example, you might set an alarm or ask someone to wake you up at the identified time.

2. Inform

Have a specific hand-over procedure. Before your nap, inform an appropriate person that you are going to take a planned nap and when it will start and end. If necessary, hand over work responsibilities to specific people and provide important information to your co-workers before taking a planned nap.

3. Create an appropriate environment

Establish a comfortable environment in which to take your planned nap, such as the rest room or TV room. As general ways to support your nap, make the environment as dark and quiet as possible; and consider using an eyeshade or ear plugs. Adjust these and other factors (for example, your sleeping position) to make yourself as comfortable as possible.

4. Return to work

a. Allow a wake-up period after a planned nap.

- The reason for limiting the length of a planned nap is to minimise the chance of waking up from deep sleep, which can leave you feeling groggy or sleepy, an effect called 'sleep inertia'. Because sleep inertia usually disappears in about 10–15 minutes, allow a 'wake-up' period of at least 10–15 minutes immediately following a planned nap. During this time, you might find it helpful to move around, stretch, generally be physically active or talk to help you wake up.
- People sometimes wake up from a nap without feeling any better. If this happens to you, be assured that the planned nap can still produce benefits such as improving your performance and making you more alert.

b. Get back in the loop.

- Get any information you need from your co-workers or manager that will help you safely resume your responsibilities.

Appendix 12: Work allocation principles

The physical and mental demands of the role

Key points	Potential actions for workers
Workers with a balanced workload will be more efficient, more effective and less fatigued than those who are overloaded or under loaded. Concentration and productivity may decline towards the end of a shift, after lunch, and overnight. Workers usually experience lowest level of functioning from 3–5 am. You must provide shift workers with appropriate amenities such as kitchen facilities, rest areas and first aid facilities. See WorkSafe New Zealand's guidance for more information on these requirements.[31] You must provide lighting levels that are appropriate for the type of work going on. Night workers should have enough light to work safely, as well as to arrive at and leave work safely.	Plan an appropriate workload with workers, taking into account the length and timing of the shift. Add more break times if you cannot modify long shifts. Schedule demanding work for times when workers are most alert and least likely to be fatigued. Avoid scheduling dangerous work during the night, in the early hours of the morning and towards the end of a shift, where reasonably practicable. Add more workers for demanding work or, if this is not reasonably practicable, schedule shorter shifts. Rotate workers through different workstations regularly if reasonably practicable. As well as reducing fatigue, it improves workers' skills and knowledge in different areas. Think about the physical nature of the work, repetitive activity, cognitive demands, isolated workers, environmental factors and training/competency. Monitor the temperature of the work area to keep it at an appropriate level for the type of work going on. Alternatively make sure workers can control the temperature of the work area themselves. For more information on thermal comfort at work, see WorkSafe New Zealand's guidance at **worksafe.govt.nz/topic-and-industry/temperature-at-work/managing-thermal-comfort-at-work/** Be aware of physical factors that can contribute to fatigue, such as noise and vibration. Provide workers with access to telephones or alarm systems, and consider installing security cameras or hiring security staff.

The work activity[32]

Key points	Potential actions for workers
Rotating sedentary mental tasks with physical tasks can help temporarily reduce the effects of fatigue during a shift.	Schedule a variety of tasks into the shift plan, where reasonably practicable. Give workers some choice over their work activities and the order in which they are carried out. Rotate a variety of work activities to reduce the likelihood of workers being continuously exposed to tasks with either a high or a low workload, which can lead to fatigue.

The shift pattern[33]

Type of shift	Key points	Potential actions for workers
Permanent shifts	People who permanently work shifts at night and in the early morning are more likely to experience fatigue and other negative outcomes. Some workers may prefer regular permanent shifts, while others may prefer rotating shifts. Fixed shifts limit contact between different shift teams.	Avoid scheduling permanent night shifts if reasonably practicable. Ensure workers are correctly trained to work permanent night shifts, or early shifts. Offer workers the choice between permanent and rotating shifts, if reasonably practicable. Provide enough supervision of shifts to facilitate clear and accurate communication between workers, particularly at shift handover time.
Rotating shifts	Rotating shifts reduces the number of consecutive night shifts. Rotating shifts may allow night work to be shared between all workers. Workers may find it harder to move from one shift schedule to the next when it is constantly changing. Workers may find it easier to shift from one schedule to the next when rotation of shifts is slow and forward. For example, it may be easier when work progresses from morning to afternoon to night in a clockwise direction, but the circadian body clock still has to re-adjust with every change of shift type, and on days off. Faster rotation of shifts every two to three days creates opportunities for night-time sleep to come around faster. How long workers need to recover from shift work depends on the sleep debt they build up during consecutive shifts.	Allocate shifts to be forward rotating where reasonably practicable. Allow enough rest time between shifts. This rest time needs to allow for enough sleep, as well as commuting and domestic activities. Appendix 7 of WorkSafe's New Zealand's guidance[34] has information about how much sleep is enough sleep. Include some weekends in the opportunities for recovery sleep.

The shift timing[35]

Type of shift	Key points	Potential actions for workers
Night	Night shifts are extremely disruptive. They cause sleep loss and lighter sleep during the day, and mean that people are working at less functional times in their circadian body clock cycle. They can increase the likelihood of error, accident, injury, and poor health and wellbeing. Night shifts can significantly disrupt workers' family and social lives. Time-on-task fatigue can build up faster during the night, so demanding tasks at night will increase the likelihood of fatigue. Night work can limit training opportunities for workers. Night work can reduce communication between night shift workers and other workers. You must provide training for and information about the risks of shift work to night workers. No matter what time of day workers are working, you must provide and maintain facilities for them.	Avoid scheduling permanent night shifts, where reasonably practicable. Consider the safety risks of working night shifts. Consider the likelihood that a worker will be fatigued, as well as the risks of fatigued workers doing different tasks throughout the night. If workers find it hard to cope with night work, try to find alternatives for them. If reasonably practicable, transport workers to and from work, or provide a place to sleep at work during breaks or before they drive home. Provide enough supervision for workers during particularly risky times, such as periods of low alertness. These periods can occur throughout the night-time hours and peak in the early hours of the morning. For more information on training and supervision, see **worksafe.govt.nz/managing-health-and-safety/businesses/general-requirements-for-workplaces/providing-information-training-instruction-or-supervision-for-workers/** Avoid scheduling overtime for night shift workers by providing relief staff to cover absentees and other reasons for absences like illness, increased workloads and emergencies. Monitor and record instances of shift swapping. If it is used, you should review workers' scheduled work and rest periods before agreeing to shift swaps, so that night shift workers do not work excessive hours.
Early morning starts	Early morning starts can cut night-time sleep short. This increases the likelihood of fatigue and other negative outcomes. Remember that workers may be commuting to work at times when their circadian body clock is less functional. Workers may find it difficult to go to sleep earlier than their usual bedtime in anticipation of an early-starting shift. The earlier bedtime is when the mind is naturally alert.	If not essential for business needs, try to avoid shift starts before 7 am. When deciding on start times for early shifts, consider commute times for workers. Workers with early starts need to be trained in the risks of their work patterns, including the risks of reduced sleep.
Afternoon starts	Afternoon starts may be a better alternative than working at night or in the early morning. Afternoon starts can reduce family and social contact. Afternoon starts with late finishes can also cut night-time sleep short, as a worker may not be able to sleep in the next morning.	Schedule afternoon starts rather than night or early morning starts. Provide predictable start and finish times for work.
Daytime shifts	Daytime shifts are the best type of work. They do not disrupt the circadian body clock or reduce contact with family and friends.	Schedule daytime shifts rather than night or early morning shifts, where reasonably practicable.

The shift duration[36]

Duration of shift	Key points	Potential actions for workers
8–11 hours	Shifts of up to 8 hours provide more time for rest, which includes time for sleep, commuting, and domestic and daily activities that are important for health and functioning. Fatigue becomes more likely if workers take on second jobs or overtime on their days off. Fatigue becomes more likely in any shift longer than 8 hours and when the total number of work hours in a week is high.	Schedule shifts no longer than 8 hours when the work is monotonous, mentally or physically demanding, or isolated.
12 hours	12-hour shifts can make fatigue more likely, depending on the type of work and how long any particular task continues. Fatigue when working 12-hour shifts is even more likely when those hours occur during, or overlap with, night-time hours. Working consecutive 12-hour shifts can build up a sleep debt and result in a high number of work hours. Vulnerable workers, such as older people or new parents, may have an increased likelihood of fatigue when working a shift of 12 hours of more. Fatigue on 12-hour shifts can be more likely if workers take on overtime or second jobs in their free time. As fewer shift teams are needed for 12-hour shifts than 8-hour shifts, it may be more difficult to arrange cover for illness, holidays and training.	These points apply to any shift longer than 8 hours. Avoid shifts longer than 8 hours when the work is monotonous, mentally or physically demanding, or isolated. Encourage workers to take frequent and regular breaks to minimise the likelihood of fatigue. Provide suitable and safe facilities where workers can take naps when they choose, particularly before travelling home after a long shift. For more information on safe workplace napping, see **appendix 11** and the section 'Napping at work' in WorkSafe New Zealand's guidelines on managing the risks of shift work.[37] Allow enough rest time between shifts, taking commute times and availability of public transport into account. Limit 12-hour night shifts to two to three consecutive nights. Arrange shorter shifts for vulnerable workers if necessary. Avoid overrun of shifts, and discourage overtime. Monitor weekly work hours to ensure they are not excessive. Monitor and control shift swapping. Make adequate arrangements to cover absentees.
Longer than 12 hours	The longer the shift, the more likely it is that fatigue will increase. Alertness and performance will deteriorate significantly over a shift longer than 12 hours.	Avoid scheduling shifts of more than 12 hours. Carefully monitor weekly work hours, overtime and unplanned shift extensions.
Flexibility in shift length	Flexible start and finish times are popular among workers with commitments outside of work. However, scheduling may be more complex, and will require careful planning and engagement with workers, in order to manage and monitor risks.	Consider if variable shift lengths, or flexible start and finish times, are practicable.
Split shifts	Split shifts can lengthen a working day, and can make fatigue more likely if the rest break between shifts is too short. Split shifts that include early starts and late finishes shorten the opportunity for night-time sleep, which makes fatigue more likely. Workers may not be able to sleep during the day in the rest break between shifts.	Avoid split shifts if reasonably practicable. If you have to schedule split shifts, make the break between periods of work long enough to allow for sleep. In addition, provide adequate facilities for sleeping. Provide the same or similar facilities and opportunities for all workers.

Rest breaks/days

Type of rest	Key points	Potential actions for workers
Rest breaks within shifts	Frequent short breaks can reduce fatigue and improve productivity, and may reduce the likelihood of errors and accidents. Workers get a better-quality rest when they take their breaks away from their workstations. The frequency and length of breaks a worker needs will depend on the type of work, and where their circadian body clock is at, when they are working. You must provide rest facilities for workers to take their breaks, including facilities where they can prepare food. See WorkSafe New Zealand's guidance for more information on what facilities you must provide: **worksafe.govt.nz/managing-health-and-safety/businesses/general-requirements-for-workplaces/workplace-and-facilities-requirements/** The law sets minimum break requirements that you must follow. For more information, see **employment.govt.nz/hours-and-wages/breaks/rest-and-meal-breaks/**	Encourage workers to take frequent and regular breaks to minimise the likelihood of fatigue. Allow workers to choose when they take their breaks if reasonably practicable. Monitor their fatigue levels. Encourage workers to take their breaks away from their work stations. Do not include the time it takes for a worker to reach the break area, toilets or facilities in the rest time – this should be added on.
Rest breaks between consecutive shifts	Fatigue is more likely when the breaks between shifts are too short, such as when you split rest breaks. If 10 hours of rest breaks are split into 6 hours and 4 hours with a shift in between, the worker will not recover as well as they would with an unbroken 10 hours between shifts. The timing of breaks between shifts is important. This determines how likely it is that a worker will get enough good-quality sleep during a break.	Give workers enough time in their rest breaks between shifts to recover from their shift, commute, eat well, sleep and participate in social/domestic activities. Do not split rest breaks if that increases the likelihood of fatigue. Note that the recommended amount of sleep for people aged 18–64 years is 7–9 hours per night.
Rest days	Rest days are opportunities for unrestricted sleep. A person usually achieves unrestricted night-time sleep when they go to bed and rise when they choose, and when the sleep period occurs at night. This is the key point to understand when considering the number of days needed for recovery between a series of consecutive shifts. Too many consecutive workdays or a high number of weekly work hours can increase the likelihood of fatigue, ill-health, errors and accidents. Sleep loss and fatigue can build up if a worker has too many consecutive night shifts, early morning starts or late finishes. Fatigue occurs when a sleep debt builds. The number of consecutive shifts that allows for the best-quality rest depends on several things, such as the shift pattern, the workload and the work environment. Having very long periods away from work can reduce communication between workers. Rest days are best when they allow the worker to recover from a work schedule, and to take part in social/domestic activities. Ideally, include some weekends in rest days. The number of rest days needed for recovery after a series of consecutive shifts depends mostly on the sleep debt that the worker has built up.	In general, set a limit of five to seven consecutive working days for standard shifts and consider an appropriate limit for weekly work hours. When planning work allocation, consider how many rest days and opportunities for unrestricted sleep workers will require after shifts to allow them to fully recover from fatigue. Consider regular refresher training if work is complex. This is so that if communication has lapsed between shifts, workers will have a chance to become familiar with tasks again. When switching from day to night shifts or vice versa, allow workers a minimum of two nights of full unrestricted sleep so they can recover from the effects of the previous work schedule. Build regular weekend breaks into the shift schedule where reasonably practicable. When night shifts or shifts with early morning starts are longer than 7–8 hours, think about how many shifts workers should work in a row before having rest days. The number of days required to fully recover greatly depends on the nature of the previous work pattern and most importantly, on the sleep debt that the worker has built up. Consider the sleep debt that will build up as a result of the work pattern.

Appendix 13: Monitoring the health of workers

As part 2 notes, missing out on sleep can result in short-term changes to a person's functioning. Over the longer term, working against the body clock and not getting enough sleep, which can occur with many different work patterns, has been associated with a greater risk of certain health conditions.

The following health problems have been associated with not getting enough sleep and working against the body clock:

- sleep problems, particularly insomnia and excessive daytime sleepiness
- stomach and digestive complaints, including peptic ulcers[38]
- cardiovascular disease, including coronary heart disease and stroke[39]
- metabolic disorders, including weight gain, obesity and type 2 diabetes
- mental health issues, including depression and alcohol and drug abuse
- breast, prostate and colorectal cancer.

Getting enough good-quality sleep and being able to 'tolerate' changes to the circadian body clock are much more difficult when someone is already in poor health. An individual who is struggling with a health condition may be more likely to experience work-related fatigue.

It is important to identify any health conditions that might interfere with an individual's ability to obtain enough good-quality sleep. In addition to those conditions listed above, relevant health conditions include:

- sleep disorders such as obstructive sleep apnoea
- pain issues.

There are also many different medications that can affect the structure of sleep or cause daytime sleepiness.

You can support a workforce to be healthy in multiple ways. For example, you can provide them with education on fatigue science and strategies for managing fatigue, so that they can use their time away from work to get the best sleep they possibly can. Providing rest areas at work, access to healthy food at all times of the day and the ability to use Employee Assistance Programme services are other aspects of this support.

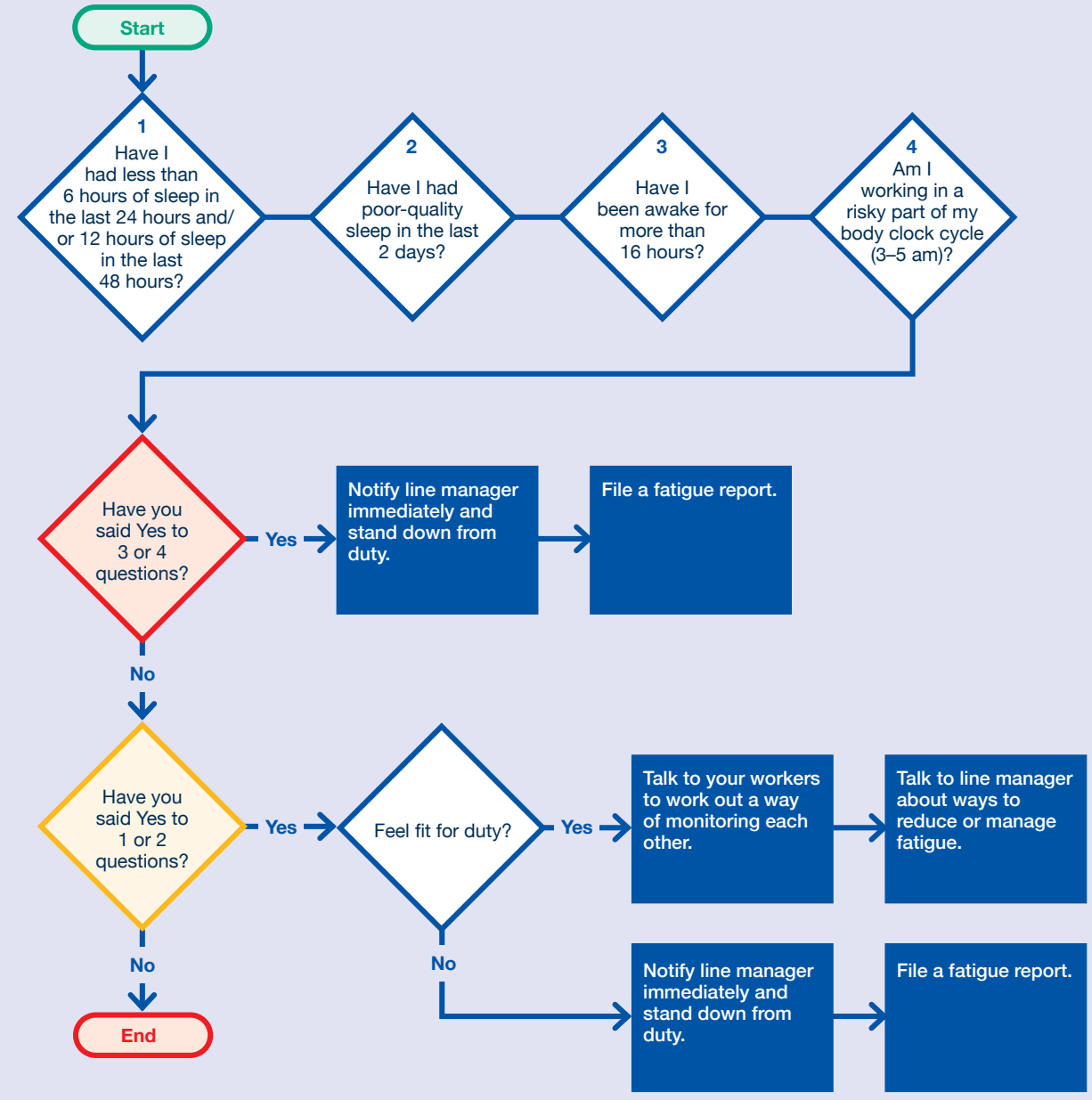
Regularly monitoring the health status of workers may also be useful to identify health issues early. An affected worker can then receive treatment and support, such as professional medical advice from an occupational physician.

You must also so far as is reasonably practicable put processes in place for managing any worker who has a health issue that may make it more likely that they will experience fatigue in the place of work.

For more information around exposure monitoring and health monitoring, see WorkSafe New Zealand's guidance at **worksafe.govt.nz/topic-and-industry/monitoring/guidance-for-businesses**

Appendix 14: Example of a self-monitoring tool[40]

As part 2 notes, people can find it hard to judge how impaired they might be by fatigue that has built up over several days. The flowchart below provides four key questions that a worker can use to help them decide whether fatigue is likely to be a problem for them and an example of the processes an organisation can put in place. If a worker answers yes to one or two of these questions, they need to consider if they feel fit and safe to work. If they decide they can work, then they need to discuss on-the-day fatigue management strategies with their colleagues and line manager. If they do not feel fit for duty, then they need to notify their manager, stand down from work and file a fatigue report. Answering yes to three or four questions requires a worker to stand down from work. This checklist is designed to help workers think about their level of fatigue and has not been validated for use in the place of work.



Self-monitoring for alertness

Some apps are available that perform a similar monitoring function. None of the apps have been scientifically tested to show that they accurately detect fatigued individuals in the place of work, although the questions and tests they contain are based on fatigue science. These apps differ in their level of complexity but all are designed to 'check' an individual's current level of fatigue. Some apps allow the organisation to collect data across individuals, store it confidentiality and use it as part of its FRMS.

Examples of monitoring apps are PeakAlert and FatigueSafe. See **integratedsafety.com.au/eclipse/smartphone-apps/ for more information.**

Appendix 15: Case studies

The following are case studies of different control measures in a variety of port operations. You may find that some of these examples are measures your organisation can use.

Case study 1: Control measures used in a port

Port B has implemented numerous control measures to control risks that arise from fatigue. These control measures include:

- improved rest and sleeping quarters
- improved work and shift patterns
- moving away from work schedules that require five continuous midnight shifts to fewer continuous midnight shifts
- using FAID to identify whether shift patterns are likely to cause fatigue
- setting up a Fatigue Working Group, which meets monthly
- reviewing work and shift patterns without having to wait until the collective employment agreement expires.

Case study 2: Suggested control measures for on call rosters involving tug crews

Different control measures will be appropriate for different organisations. For example, if a port with tidal windows misses a tidal window, it has the potential to delay a ship itinerary. Which control measures for tug crews are appropriate depends on the level of fatigue that a worker is experiencing and the risks that they face. The following are some potential control measures to choose from.

- If a worker feels unable to do their work safely, have a way for them to communicate it to the relevant person.
- Ensure teams discuss alertness strategies to use if they are feeling fatigued.
- Ensure workers communicate with each other in the team. For example, if a worker is feeling fatigued, they can talk to their crew mates to let them know that they have an increased risk, a little bit off game, get them to keep an eye out on one another.
- Encourage workers to increase interaction with each other during jobs.
- Workers may drink more caffeinated drinks.
- Adjust the temperature control of the cabin using air conditioning.
- Open the door to the cabin to keep a fresh flow of air.
- If possible, have a break in driving to get a mini-rest on the water.
- Ensure all workers stay hydrated.
- Have food options that are high in protein and low on the glycaemic index (GI).
- Encourage crews to stay onboard the tug in between jobs for rather than heading home if possible.
- Use rest areas, including onboard bunks.
- Minimise off-water maintenance and other work in between jobs to maximise rest periods.
- Encourage workers to change positions at controls – sitting instead of standing and vice versa when they can.
- Look at switching roles within the crew if other competent crew members (for example, other signed-off crew) are onboard.
- Launch – swap out roles while a job is underway to allow brief respites from heavy concentration.
- Line can swap roles between crew members; the procedure for short crewing applies. Do one end at a time only.
- Change the workers involved in the critical role of the crewing of tugs. If some crew members are suffering from higher levels of fatigue, put them in the operation of the lesser crew roles involved with the tug.
- If no crew can be replaced, delay shipping.

Case study 3: Making improvements through changing the roster

What was happening?

Workers at a port had a collective employment agreement that guaranteed 1,300 hours a year but did not specify when these hours would be provided. The company would attempt to give employees eight hours' notice of upcoming shifts but it could give as little as one hour's notice with no penalty. For this reason, all workers had to stay close to the port. The employment agreement also did not state the maximum number of hours that someone could work in the week. Because the workers did not have guaranteed hours, they took all the work that was available to them. As a result, some workers worked 80-hour weeks at times. The port did have a fatigue policy to limit shift duration and give minimum breaks between consecutive shifts. However, it did not monitor workers' hours to check that they complied with the policy.

Due to the long hours with no guarantee of any work, workers experienced a number of negative impacts. For example, their personal life was disrupted as they had limited time to spend time with family or do activities outside of work just in case they were called in. Some workers also became physically unwell and suffered side effects caused by fatigue.

Because the port's fatigue policy was not being followed, and because workers were experiencing excessive hours of work with no guarantee of work, the union delegate representative alerted Maritime NZ and WorkSafe New Zealand to the situation. After investigating the matter, Maritime NZ recommended that the PCBU review their Fatigue Risk Management System to check it was appropriate given that it appeared workers were at times fatigued. The Employment Relations Authority also decided on the correct way to interpret the collective agreement the guarantee of 1,300 hours per year for permanent full-time employees.

What changes happened

The company signed a new collective employment agreement that provided guaranteed hours of work and addressed the issue of fatigue. The agreement provides each worker three days on (available for work) and two guaranteed days off. Workers are required to be available from 8 am on the first day until 8 am on the fourth day. This approach allows the company to continue to be flexible but within a time frame. Staff are paid a daily rate for their guaranteed three days rostered on, regardless of how many hours they actually perform.

One worker stated: "The difference from then till now is phenomenal. A work–life balance now exists, people are happier at home and at work and everyone is cheerful and laughing and getting on. General health is much better, the team actually looks healthier."

Case study 4: Crew expected to work extra hours due to shipping delays

What happened?

The crew of a harbour tug who were on a 24-hour shift were due for an eight-hour break after attending to shipping throughout the night. The schedule of ships during the early morning hours indicated that the eight-hour break would fit in after the last early morning vessel and before the next scheduled ship in the afternoon. However, the last morning ship was delayed, with the result that the crew were late returning to the berth and tying up the tug.

The eight-hour break is not eight hours of sleep. An eight-hour break involves:

- driving home
- having a meal
- winding down to try to sleep during the day
- waking in time to return to the port and prepare the tug for the next job.

On this particular morning, the delay of the ship would mean around five hours of sleep in the best scenario. In reality, the crew managed about two hours.

The crew had expected that management would put the next scheduled ship back at least half an hour but it made no changes to the ship schedule. Therefore, the crew returned in the early afternoon in time for the next scheduled ship. It was only at this time that management became aware of the crew's delayed finish and immediately cancelled the last ship for the day. However, the crew were still expected to work another ship before that.

The crew spoke to the manager over the phone. During this conversation, the manager did not ask if they felt okay to keep working until late afternoon. Nobody came to physically monitor or check the workers for signs of fatigue

even though text exchanges covered this topic. Later a colleague noticed that one of the crew had sounded 'spaced out'.

The crew attended to the afternoon ship without incident and were released late afternoon. While in this case there was no incident, it could have led to incidents like those that had occurred in the last year such as:

- mechanical failure
- towline parting
- the vessel taking on water
- near miss with another vessel.

Any of the above scenarios requires quick thinking and decisive immediate action to maintain safety.

In this case, management did not monitor rest break opportunities. Although there were systems and tools for monitoring when rest breaks change, in this instance the organisation did not use them to establish that there was a delay. Management could have become aware of the situation hours before it did. At that earlier time, it could have adjusted shipping for the rest of the day to allow for a rest break. Instead, management did not become aware of the situation until the verbal report from the crew some hours later.

When the crew made management aware of the situation, the manager did not do a fatigue check. The manager should have come to the vessel to physically observe the crew for signs of fatigue. If signs were present, the manager could have then called a relief crew member. It appears that one of the crew was having some difficulty recalling and relating details.

What should have happened?

Software and computer systems can be refined to alert office staff to shipping and rest break timings. PCBUs should incorporate fatigue checks into their FRMS. They should also consider how recognising fatigue could be the difference between the crew carrying out a safe response to the scenarios above and the escalation into a major environmental and maritime disaster.

Case study 5: Calling back crew due to worker shortages

What happened?

The manager rang the crew of a tug boat requiring them to work on their day off to cover for a shortage. All of the crew declined this request. The manager then rang a second time, at which point some of the crew agreed to do the call-back. Those crew who agreed felt they were pressured to do so, with the argument that otherwise the commercial operations for the port would stop for a period. Of course, the crew did not wish to be responsible for that. The commercial pressure the manager applied in this case was highly risky as the crew would have been fatigued and needed a break.

What should have happened?

In the short term, the port should have delayed or cancelled shipping until sufficient tug crew were available again. For the longer term, the port needs to recruit enough tug crew to cover the roster when staff have annual leave, training or unplanned absences like sickness, injury or bereavement leave.

Example of the use of technology: Fatigue Guru

You may wish to explore technological solutions if appropriate for your circumstances. Fatigue Guru is one example. As with any app, it has not been verified scientifically so you need to understand its limitations see appendix 3 for more detail.

Fatigue Guru is an online FRMS tool that calculates total fatigue load (actual and/or forecast) and uses information from the roster design and prior sleep–wake data, as well as a sleepiness assessment. Workers can use it to assess their individual fatigue level by simply downloading the app onto their phones. You can also use it when investigating an incident that has occurred by retrospectively entering the required data to calculate the fatigue state of the individual/s at the time of the event. Fatigue Guru is a dynamic fatigue risk assessment tool so provides a realistic assessment and real-time management options. Note that this app like any apps may have privacy and liability issues that you need to address before using.

Appendix 16: Examples of fatigue Safety Performance Indicators (SPIs)

The following are examples of possible data that could be used as fatigue SPIs to monitor the functioning of the FRMS. Some of these might also be used as fatigue metrics to monitor the day-to-day functioning of the FRMS. It is also important to determine the acceptable level of each indicator. The possible fatigue SPIs are:

- number of vacancies
- time to fill vacancies – that is, whether people want to come and work for the organisation
- timeliness of scheduled fatigue risk assessments and risk management plans
- proportion of workers that have received fatigue management training.
- frequency of workers reporting that they are not fit for duty or are tired before or during a shift
- proportion of shifts that exceed organisation's tolerable levels in planned work allocation and actual hours worked
- amount of overtime worked
- number of observations related to fatigue
- percentage of near misses, incidents or injuries of any type occurring during times in the work allocation when fatigue-related impairment is more likely
- percentage of near misses, incidents or injuries of any type that identified overtime and callouts as a factor contributing to reduced sleep, resulting in fatigue
- frequency of sick leave taken during times in the work allocation when fatigue-related impairment is more likely
- frequency of injury reports and claims.

Appendix 17: Example of a communications and engagement plan template

FRMS communication and engagement framework

This template sets out the core elements of a communications and engagement plan as part of an effective FRMS. **It is a guide only and is not a communications plan in itself**. You may choose to use some or all of the suggested elements, depending on the specifics of your FRMS.

Core elements for the plan	Explanation of the element and reason for including it
Section 1: Goals and explanation **Goals** It is important for your communications and engagement plan to have clear goals to support your FRMS goals. By identifying communications and engagement goals, you will be able to identify methods for measuring your success. The following are some examples. **FRMS goals** / **Communications goals** Reductions in absenteeism and staff turnover / Improved trust and understanding in both directions Better performance and productivity / Clear commitment and responsibilities Better health and safety outcomes, including fewer incidents and injuries in the place of work / Visibility of best practice, impact and results Workforce buy-in / Language and ways of engaging are fit for purpose and accessible **Explanation** Carefully think through how to explain the following academic definition of an FRMS: **"A data-driven means of continuously monitoring and managing fatigue-related safety risks, based upon scientific principles and knowledge as well as operational experience that aims to ensure relevant personnel are performing at adequate levels of alertness."** The following is one potential way of simplifying this definition while keeping its meaning. Note this is an example idea only – do not accept this as being correct or your circumstances. **"We are putting in place a set of processes that allows us to always be looking for signs of fatigue, and when we find fatigue we can act quickly to do something about it so that workers can stay safe at work."**	Communications and engagement are not supplementary activities, sitting outside your core planning. To be effective they need to be a fundamental part of the FRMS, with goals that complement and support the FRMS. The messaging will change at different stages of the FRMS development and you will need to regularly review whether your messaging remains consistent with your goals. Setting goals gets people away from thinking of the communications plan as a media plan and focuses thinking on impact – both for the organisation and for individuals personally. How you explain an FRMS will set the tone for all your communications, so use appropriate language for your audience. Using academic or technical language may miss the point from the audience's perspective – or simply not be understandable – so it may need rewording to make it more accessible. You will need to support your initial explanation with key messages and examples (see section 2 below).

Core elements for the plan	Explanation of the element and reason for including it
Section 2: Key messages Your set of key messages needs to be brief, understandable, relevant and at a high level. In this circumstance, they might summarise examples only. Your key messages state: › what you are doing, for example: "We are developing a **system** to reduce fatigue on the port." › why you are doing it, for example: "People becoming fatigued is one of the major causes of accidents and we want an approach that helps **all of us** identify the risks." › the intended impact, for example: "We want people to be safe when they come to work, and managing fatigue will reduce accidents." › how you are implementing the system, for example: "The system will be incorporated into all our staff training programmes." › who is involved, for example: "**Everyone** needs to be involved in both developing the system and making it work." › how you are measuring it, for example: "We will publish fatigue reporting rates, monthly, quarterly and annually." › what sort of timelines you are working to, for example: "The system will be fully up and running in 12 months and we will want everyone to contribute to make sure it is comprehensive." › why workers should embrace the new system, for example: "Safety comes first. No one is going to come down on you for reporting that you are fatigued. Your manager or supervisor may even recommend fatigue leave."	Key messages are a way of organising your communications. They underpin everything you say and write. You will not always use the words in your key messages, but everything you put out to your audiences should relate back to them. Do not have too many key messages because it will water down your focus and effectiveness. You do not have to explain absolutely everything in your key messages – that will come later as you are working through specific audiences and activities (see section 3 below). However, you will be able to relate your explanations back to your key messages.

Core elements for the plan	Explanation of the element and reason for including it
Section 3: Key audiences and engagement Your key audiences will range from those directly involved with the FRMS, both internally and externally, to those who are not directly involved but will have a role in making it successful. When you work through who your core audiences are, it is important to consider not only the stakeholder, but also objectives, message content, delivery mechanism and when you are going to be communicating (including frequency). The template below will help you organise your audiences and engagement.	Group your key audiences as they relate to the FRMS. Some will be core to the project implementation; others will be important to keep informed or to engage with regularly so they remain supportive. Still others might not be directly involved but could be highly influential in gaining commitment (for example, workers' families). As you develop the table think of: › fitting into everyday life › using a variety of forums and channels – consider what people are already used to › what the audience cares about › who the best messengers are › channels, including electronic media such as websites, Facebook, Instagram, LinkedIn, online forums and discussion groups, email, texts; newsletters; bulletins; poster campaigns in strategic locations › regular meetings and forums; seminars; discussion, focus and continuous improvement groups › the advantages of face-to-face engagement › linking to training programmes › how you will measure success.

Stakeholder/ stakeholder group	Objectives (desired actions)	Message content
Stakeholders will be organisations, groups and individuals.	Objectives will change over time. For example, initial information gathering might later become actions taken.	Message may be two-way – that is, you want feedback from stakeholders. Messaging will change as the project develops.

Delivery methods/ venue	By when (frequency)
Engagement might be multi-channel. Think in terms of ongoing engagement, not just a one-off communication.	Include milestones.

Endnotes

1. Fransen M, Wilsmore B, Winstanley J, et al. Shift work and work injury in the New Zealand Blood Donors' Health Study. *Occupational and Environmental Medicine* 2006;63:352–358.
2. Uehli K, Mehta AJ, Miedinger D, et al. Sleep problems and work injuries: a systematic review and meta-analysis. *Sleep Medicine Reviews* 2014;18:61–73.
3. National Transportation Safety Board. *Grounding of the US Tankship Exxon Valdez on Bligh Reef, Prince William Sound near Valdez, Alaska, March 24, 1989*. Washington, DC: National Transport Safety Board; 1990.
4. US Nuclear Regulatory Commission. *Investigation into the March 28, 1979 Three Mile Island Accident by the Office of Inspection and Enforcement*. US Nuclear Regulatory Commission; 1979.
5. Riedy S, Dawson D, Fekedulegn D, et al. Fatigue and short-term unplanned absences among police officers, *Policing: An International Journal*, 43(3): 483–494.**doi.org/10.1108/PIJPSM-10-2019-0165**.
6. For example, Lee E, Jang I. Nurses' fatigue, job stress, organizational culture, and turnover intention: a culture–work–health model. *Western Journal of Nursing Research* 2019;42:108–16. **journals.sagepub.com/doi/abs/10.1177/0193945919839189**.
7. O'Neill C, Panuwatwanich K. The impact of fatigue on labour productivity: case study of dam construction project in Queensland. *Proceedings of the 4th International Conference on Engineering, Project, and Production Management (EPPM 2013)*. **research-repository.griffith.edu.au/bitstream/handle/10072/60153/89623_1.pdf?sequence=1**.
8. International Civil Aviation Organization, Doc 9966: *Manual for the Oversight of Fatigue Management Approaches*, 3rd edition, Version 2 (Revised), 2020, p 5–1.
9. Itani O, Jike M, Watanabe N, Kaneita Y. Short sleep duration and health outcomes: a systematic review, meta-analysis, and meta-regression. *Sleep Medicine* 2017;32:246–256.
10. Tsuno N, Besset A, Ritchie K. Sleep and depression. *Journal of Clinical Psychiatry* 2005;66(10):1254–69.
11. Hirshkowitz M, et al. National Sleep Foundation's sleep time duration recommendations: methodology and results summary. *Sleep Health* 2015;1(1):40–43.
12. Dawson D, Reid K. Fatigue, alcohol and performance impairment. *Nature* 1997;388: 235.
13. Kecklund G, Axelsson J. Health consequences of shift work and insufficient sleep. *BMJ* 2016;355:i5210.
14. Ibid.
15. Adapted from Safer Nursing 24/7 Project. *National Code of Practice for Managing Nurses' Fatigue and Shift Work in District Health Board Hospitals*. Wellington: Safer Nursing 24/7 Project; 2019, p 17.
16. Gurubhagavatula I, Barger LK, Barnes CM, et al. Guiding principles for determining work shift duration and addressing the effects of work shift duration on performance, safety, and health: guidance from the American Academy of Sleep Medicine and the Sleep Research Society. *Sleep* 2021.
17. Adapted from Safer Nursing 24/7 Project, 2019, op cit, p 26.
18. For international guidance on the duration of work shifts, see Gurubhagavatula et al, 2021, op cit.
19. Adapted from Safer Nursing 24/7 Project, 2019, op cit, p 29.
20. Adapted from Napier *Port, Fatigue Risk Management System*, December 2020.
21. Adapted from PHI International.
22. Adapted from Safer Nursing 24/7 Project, 2019, op cit, appendix F.
23. Taken from International Civil Aviation Organization, 2020, op cit, appendix H, with amendments.
24. Bio-mathematical Fatigue Models: Guidance Document **icao.int/safety/fatiguemanagement/ArticlesPublications/biomathematical_fatigue_models.pdf**.
25. Adapted from WorkSafe Victoria, *Work-related Fatigue: A guide for Employers*, 3rd edition; 2020, appendix 1.
26. Ibid, Appendix C.

27. Reproduced from Safer Nursing 24/7 Project, 2019, op cit, appendix B.
28. Adapted from WorkSafe Victoria, 2020, appendix 2.
29. Adapted from International Civil Aviation Organization et al, *Fatigue Management Guide for Air Traffic Service Providers*, 1st edition; 2016, appendix D.
30. Adapted from ibid, Appendix C.
31. WorkSafe New Zealand, *Managing the risks of shift work: guidance for PCBUs*, April 2021.
32. Ibid, table 3, p.14.
33. Ibid, table 4, p.14 (with minor modifications).
34. Ibid, appendix 7.
35. Ibid, table 5, p.15 (with minor modifications).
36. Ibid, table 6, p.16 (with minor modifications).
37. Ibid.
38. Knutsson A, Bøggild H. Gastrointestinal disorders among shift workers. *Scandinavian Journal of Work, Environment & Health* 2010;36(2): 85–95.
39. Kecklund G, Axelsson J. Health consequences of shift work and insufficient sleep. *BMJ* 2016;355:i5210.
40. Adapted from PHI International's self-assessment tool (with edits).

PORT
HEALTH & SAFETY
LEADERSHIP
GROUP