Fatigue Risk Management Handbook

Australian Pipelines and Gas Association

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Contents

Part One

1 Introduction

1.1 Purpose of this handbook

The Australian Pipelines and Gas Association Ltd (APGA) is the peak national body representing the interests of Australia's transmission pipeline sector. APGA's current membership is predominantly involved in the high-pressure transmission of oil and gas, however, the association welcomes membership of companies and individuals involved in the transmission via pipelines of other products, including water. APGA has a diverse membership base with members including contractors, owners, operators, advisors, and engineering companies and suppliers of pipeline products and services.

APGA is committed to implementing strategies that promote good health and safety outcomes, recently focusing upon the risks associated with occupational fatigue within the industry. The purpose of this handbook is to provide member organisations with practical guidance on how to identify and systematically manage fatigue in order to minimise the risk to health and safety so far as is reasonably practicable.

The intent of this handbook is to encourage the adoption of uniform fatigue management practices across the industry, providing advice on how to develop and implement a Fatigue Risk Management System (FRMS) with specific applicability to the Australian pipeline industry. This handbook also addresses the cultural change elements required to adequately manage fatigue and safety in the industry.

1.2 Who should use this handbook?

These guidelines should be used by employers and workers in the pipeline industry. This includes:

- the person in charge of a business or undertaking
- principal contractors/syndicates, contractors, subcontractors
- industry participants such as managers, supervisors, team leaders, health and safety
- practitioners, human resource personnel and workers.

1.3 Definitions

Circadian rhythms	Circadian rhythms (or 'body clock') regulate physiological and behavioural functions on a 24-hour basis. Sleep and wakefulness are programmed, and sleepiness is greatest between 2am and 6am and to a lesser extent between 2pm and 4pm[1].
Fatigue	An acute or ongoing state of tiredness that affects worker performance, safety and health, and requires rest or sleep for recovery[1].
Hazard	A situation or thing that has the potential to harm a person[2].
Night work	Any work undertaken between midnight and 6am.
Night sleep	A continuous rest period taken between 10pm and 8am.
PCBU	Person conducting a business or undertaking
Risk control	The process of applying appropriate measures to eliminate or minimise any risks.
Risk assessment	The process of working out how big a risk is present and what risk factors are causing the problem.
Risk	The likelihood of an injury, illness or disease occurring and the severity of any injury, illness or disease that results from exposure to a hazard[3].
Short rest break	Any rest break between 15 minutes and one hour long[1].
Sleep opportunity	A continuous break to allow for good quality sleep. It should allow a worker to get 7-8 hours' sleep and will vary in length depending on the time of day[4].
Worker	A person is a worker if the person carries out work in any capacity for a person conducting a business or undertaking, including work as: a) a worker; or b) a contractor or subcontractor; or c) a worker of a contractor or subcontractor; or d) a worker of a labour hire company who has been assigned to work in the person's business or undertaking; or e) an outworker; or f) an apprentice or trainee; or g) a student gaining work experience; or h) a volunteer; or i) a person of a prescribed class[5].

1.4 Background to this handbook

In light of the existing fatigue-related research in similar industries, and to address the knowledge and data gaps within the Australian pipeline industry, APGA commissioned a Fatigue Management Study[6] (FMS) in 2011. The primary goal of the FMS was to quantify fatigue based on a single, large-scale Australian pipeline construction project. Data was collected from over 400 pipeline industry workers over a period of approximately one year; and included daily measurements of neurocognitive

performance, sleep/wake characteristics using actigraphs and sleep logs, subjective sleepiness and fatigue scales, and extensive self-reported health and medical profiling.

The FMS consisted of two phases. Phase 1 involved daily objective and subjective measurements of a cohort of pipeline workers over a 28-day on-site work roster consisting of 10-hour day-shifts. Phase 2 of the FMS consisted of generalised demographics, health and medical, and sleep and fatigue survey. The sample tested in this study was divided into three broad occupation groups:

1. Field (including labourers, welders, riggers and other tradespeople).
2. Driver (including general vehicle drivers, truck drivers and mobile plant operators).
3. Office (including management, administrators and safety advisors).

The primary results from both phases indicated that:

- Neurocognitive performance is gradually impaired over the entire work roster, with little to no apparent stabilisation occurring.
- Sleep is significantly shorter and of poorer quality on-site compared to off-site.
- There is an increased probability of sleep disorders in this sample based on the present risk factors such as loud snoring, obesity and weight management issues, smoking and alcohol intake.
- Drivers and mobile plant operators in particular have the highest probability of having sleep apnoea with 36 per cent of the sample placed in the 'high-risk' category.
- Increases in subjectively rated sleepiness and fatigue over the work roster, while statistically significant, were small and perhaps do not accurately reflect the magnitude of performance impairment.
- A large percentage of this sample (54 per cent) drive home using their own transport following the end of a work cycle, with an average commute time being 5-8 hours.

Based on these findings, it was suggested that there is an increased probability of fatigue- related risks in the sample studied. These risks are more apparent in the driving group who had more pronounced risk factors for sleeping disorders (such as sleep apnoea and shorter average sleep durations per night).

In consideration of the study findings, a number of suggested recommendations were provided to advance fatigue management practices, and generally continue the already admirable effort towards safety as a top priority in the pipeline industry. These suggestions were based on the current findings, interviews with industry professionals and stakeholders, and best practice fatigue management practices from comparable industries. One of the suggestions was to 'provide industry best practice guidelines on managing fatigue and sleep disorders in the Australian pipeline industry'. APGA accepted this suggestion and consequently commissioned the Fatigue Management Guidelines and supplementary Fatigue Management Handbook.

Part Two

2 Understanding Fatigue

2.1 What is fatigue?

The term 'fatigue' is a general term used to describe the feeling of being tired, drained or exhausted[7]. It is a physical condition that can result from inadequate or disturbed sleep, physical exertion, mental exertion, or prolonged waking times[8,9]. Fatigue can be, in some cases, a natural response to the mental and physical effort of everything we do, and adequate sleep is essential for restoring the balance and promoting recovery.

Signs and symptoms of fatigue can typically be grouped into three categories: physical, mental and emotional (see Table 1).

Table 1. Fatigue Symptoms Checklist[10]

Physical Symptoms	Mental Symptoms	Emotional Symptoms
• Yawning • Heavy eyelids • Blurred vision • Head drooping • Feeling tired after sleep • Reduced performance • Slower reaction time • Impaired hand eye	• Difficulty concentrating on task • Lapses in attention • Difficulty remembering what you are doing • Failure to communicate important information • Risk taking behaviour • Disorganisation	• More quiet than usual • Withdrawn • Increased stress levels • Reduced motivation • Lacking energy • Anxiety and decreased tolerance • Mood disturbances

coordination • Headache	• Lack of situational awareness • Accidently doing the wrong thing (error) • Accidently not doing the planned thing (omission)	• Emotional outbursts • Irritability

2.2 What causes fatigue?

The literature has identified many factors that have the potential to increase the risk of fatigue. These factors are categorised as work-related and personal factors as per Table 2 below.

Table 2. Factors contributing to fatigue[11]

Work-Related Factors	Personal Factors
• Cumulative hours worked • Task demands (workload, time pressure) • Predictability of roster • Type of work (physical/mental) • Accommodation • Time of day of work • Commuting • Recovery periods between shifts • Roster cycle length • Shift length • Payment incentives • Environmental stressors (e.g. light, noise, climate, vibration) • Organisational culture • Time awake (related to shift schedule)	• Medical conditions • Diet • Alcohol and drugs • Age and gender • Sleep quality and quantity • Time of day that sleep occurs • Family and social life • General health • Exercise • Lifestyle choices • Sleep disorders • Environmental factors affecting sleep (noise, heat, light) • Secondary employment and voluntary work • Time awake (related to personal factors)

2.3 What are the consequences associated with fatigue?

Fatigue is a risk that anyone can be exposed to on a daily basis. With the lines between work and home life being blurred by the use of technology and ever-increasing demands, the ability to balance family, work, and social activities is becoming complex.

While a certain level of fatigue can be a normal response to everyday living, high levels of fatigue can have a range of undesirable outcomes for the individual, organisation and community (see Table 3).

Table 3. Consequences of fatigue[11,12,13]

Individual	Organisation	Community
• Poorer health and wellbeing • Impacts to cognitive functioning • Impacts to short-term memory function • Increased likelihood of social alienation • Increased instances of	• Reduction in the frequency and consequences of fatigue-related incidents • Increased mortality rates • Increased costs associated with incident management • Increased levels of absenteeism and lost time	• Increased potential for incidents to occur in the community (i.e. road crashes) • Increased need for trauma counselling services • Increased use of

relationship problems • Increased likelihood of being involved in an incident	• Increased levels of presenteeism (i.e. coming to work despite injury, illness or other, resulting in reduced productivity) • Poorer workplace morale and satisfaction • Poor communication • Impacts to company image and reputation)	medical facilities and allied health services • Broader ripple effects of serious injury, disability and death in the community

Due to the nature of fatigue-related impairment, serious accidents are often the result of a human error or more regularly an inadequate organisational control of risk. For example, fatigue has been implicated in a number of high-profile accidents around the world such as the Three Mile Island nuclear disaster and grounding of the Exxon- Valdez oil tanker. Fatigue has also been found to be a contributing factor in up to 20 per cent of road traffic accidents[14].

Fatigue and sleep loss/disruption can also lead to increased risk-taking behaviour, including in decision-making, over and above risks that we otherwise would not have taken. Coupled with the point that people are not necessarily good at predicting their relative degree of fatigue impairment and the potential for bad outcomes is readily apparent.

2.4 What are the advantages of managing fatigue?

The benefits of managing fatigue are significant on multiple levels.

2.4.1 Individual

The benefits of sleep extend far beyond just feeling better in the morning. Sleep assists individuals by allowing a recharge of the body's systems. For example, rest recharges the immune system and helps it to function at its best. A lack of sleep can hinder the immune system and make the individual more susceptible to disease and illness

Other individual benefits of obtaining adequate, restorative sleep include:

- Decreased risk of being involved in a fatigue-related accident.
- Improved performance at work.
- Increased ability to cope with and manage stress.
- Improvement to general health and wellness.

2.4.2 Organisational

Implementing practices to manage fatigue at the organisational level is ultimately about providing a safe workplace for all workers, contractors and visitors. Managing fatigue and sleep disturbances makes good business sense with respect to bottom-line productivity and operating costs. By effectively managing fatigue risk, organisations can expect to see the following benefits:

- A reduction in the frequency and severity of incidents attributable to fatigue.
- Increased levels of alertness and productivity.
- A reduction in lost time due to fatigue and fatigue-related illnesses.
- Improvements in worker morale, satisfaction and commitment.
- Reduced costs associated with fatigue-related performance impairment, incidents and accidents.

2.4.3 Societal

On a broader social level, implementing fatigue management practices in organisations helps to create general awareness about the importance of sleep and managing fatigue both personally and professionally. Over time, this heightened awareness will continue to influence a broader culture in Australia that supports practices towards the prevention of fatigue.

2.5 What are the legislative obligations for managing fatigue?

Fatigue is an issue that has a variety of contributing factors and the responsibility for managing fatigue lies with all parties in the pipeline industry. The action that each party can take will vary according to their level of control over the work undertaken in the workplace. It is important to remember that decisions made by any of the parties may impact on other people's health and safety in the workplace.

The PCBU has the responsibility to ensure fatigue risks are effectively identified and managed. To meet this duty of care, the PCBU should implement a FRMS that allows for:

- Appropriate and safe work design such as schedules that allow for adequate recovery periods during the shift and between shifts (ensuring heavy vehicle driver fatigue is managed in accordance with the National Heavy Vehicle Law where applicable).
- Safe work practices, such as scheduling sensible levels of overtime.
- Identification, assessment, control and monitoring of fatigue-related risks.
- Development of policies, procedures and practices to manage fatigue-related risk.

Workers are responsible for arriving at work fit for duty and acting in a safe manner that does not cause harm to themselves or others. To meet these obligations, workers can:

- Obtain sufficient sleep: by practising good sleep hygiene – such as having a regular bed time, maintaining a routine, avoiding stimulants before bed, using white noise and ensuring the room is at the right temperature.
- Manage personal life: by making sleep a priority and avoiding cutting back on sleep in order to fit everything in.
- Manage work tasks: by varying or rotating duties to stay alert, taking regular breaks and informing management of any fatigue-related issues.
- Maintain good health: by eating nutritious meals, drinking plenty of water, exercising regularly and ensuring adequate exposure to natural light.
- Manage alertness levels: by avoiding medications that cause drowsiness i.e. antihistamines, sleeping pills, travel sickness tablets, some cold preparations and pain killers.

2.6 The dual responsibility of fatigue: A cautionary tale

While the management of fatigue is clearly a dual responsibility between an organisation and workers, how the duties are proportionally divided (as a percentage) is a contentious issue in the industrial courts. Nevertheless, what is clear is that while there may be a dual responsibility and workers are responsible for ensuring they arrive at work in a fit and safe state for work, ultimately, organisations must have effective and proper systems in place to manage the risks arising from work.

Therefore, an excess reliance on expecting people to self-report if and when they are fatigued without proper systems to identify and control the risks of work that fatigue can influence, and without sufficient supervision, training and instruction may be a serious legal liability for an organisation.

Part Three

3 Implementing a Fatigue Risk Management System

Until recently, the primary method of reducing fatigue risk was with prescriptive methods to limit the maximum number of work hours and minimum number of rest breaks through hours of service regulations[15]. While these regulations are easy to interpret and implement, they are somewhat inflexible, often non-scientific and largely an issue of industrial relations negotiations[17]. Another perceived disadvantage of this type of framework is that safety may be inherently assumed if one simply follows the rules. Moreover, such an approach rarely has any actual connection or linkage to the occupational risks that the organization is trying to prevent with the fatigue intervention.

A FRMS is a scientifically based, data-driven set of integrated management practices, beliefs and procedures for identifying and managing fatigue and safety risks. A FRMS allows a systematic and structured approach to implementing processes to prevent and manage fatigue, and to audit the control processes for efficacy and compliance. It is therefore a subset of the safety management system (SMS), which allows fatigue to be managed in a flexible manner appropriate to the level of risk exposure and the consequences of an error within pipeline operations.

As a FRMS is a subset of a SMS, its core concepts can be conceptualised in a similar vein. Figure 2 outlines the elements required to effectively identify and manage fatigue. This approach can be described as a performance-based approach, given that it is based on scientific and data driven processes, which allows fatigue to be managed as a salient issue of workplace health and safety with greater potential for improved operational flexibility, legal defensibility and improved productivity and efficiency.

Figure 2. Key components of a FRMS[6]

3.1 Policies and procedures

As with a safety management policy, a fatigue management policy outlines what commitments an organisation will make in order to manage fatigue-related risk and how these mitigations will be conducted in the organisation. The fatigue management policy document is essentially the written version of the FRMS and aids the organisation in coordinating all of its efforts to improving safety.

When documenting fatigue management policies and procedures, the key elements in Figure 2 should be addressed. The organisation can tailor each of these elements to align with their SMS and cultural maturity with regards to the management of fatigue. When documenting policies and procedures, consultation and communication with workers is essential to ensure all fatigue-related hazards are identified and control measures are suitable for the business operations. A consultative approach will assist the organisation to implement and embed change, and ensure worker buy-in to the initiative; making it more likely to become 'something we do around here' rather than a separate process (see Section 3.3).

3.2 Roles and responsibilities

Clear designation of the roles and responsibilities of all persons in the organisation is necessary for a FRMS to function effectively[11]. This ensures empowerment at the organisational and individual levels and highlights the point that fatigue, as is safety, is the responsibility of all persons.

Responsibility for managing fatigue lies with all parties in the pipeline industry, but the action that each party should take will vary according to their level of control and corresponding legal duties. It is important to provide workers with a clear definition and understanding of their role and responsibilities in the workplace. This will provide them with a good understanding of the job and tasks they are to perform. It also provides information on where they fit within the organisation and who they report to, helping to avoid disputes and misunderstandings.

To help empower others through clear definition of roles, responsibilities and points of authority, organisations should undertake the following:

- Work with the human resource department and other work group members to institute clear and concise job descriptions for each role, if these do not already exist.
- Review and update job descriptions on a regular basis to make sure that roles and responsibilities remain both clearly focused and viable.
- Collaborate with workers to resolve any differences in role expectations and performance that may occur, and to fill any voids in responsibilities that may arise unexpectedly.

3.3 Communication and consultation

Organisations need to consult and communicate with workers throughout the risk management process to ensure the organisation has a comprehensive picture of the fatigue-related risks relevant to the business[11]. Consultation with workers and their health and safety representatives should occur:

- When fatigue is identified as a hazard in the workplace;
- When fatigue management practices and processes are being evaluated;
- When changes are proposed to elements of the FRMS;
- Prior to changes being introduced;
- At each step of the risk management approach;
- Where there are indications of fatigue affecting the health and safety of workers; and
- After an accident or near miss occurs.[2]

In instances where there is shared responsibility for health and safety with other business operators who share the same workplace or activities, operators should communicate with each other and work together to ensure fatigue-related risks are managed.

3.4 Risk management processes

While the policies and procedures can be seen as the governing principles of a FRMS, the fatigue risk management processes can be idealised as the working parts of the FRMS. Fatigue must be risk managed like any other workplace safety hazard. A step-by-step process, known as the risk management process, should be undertaken[2,11].

Each of these steps in relation to the identification and management of fatigue will now be discussed.

3.4.1 Establish risk context

In order to establish the risk context, the following questions need to be answered:

1. Why is this risk assessment being conducted?
2. What is the scope of the risk assessment?
3. Are there any limitations that need to be taken into consideration?

This will allow the organisation to define the boundaries for the fatigue risk management process to maintain focus and avoid scope creep.

3.4.2 Identify hazards

Organisations should use a number of sources to fully understand the extent and severity of fatigue-related risks. This may include one or more of the following:

- Consultation with workers.
- Workplace inspection (i.e. environment, equipment, materials, substances, tasks).
- Consideration of the organisation and management of work.
- Literature review.
- Data analysis (i.e. hours of work records, incident data).

An example Fatigue Hazard Checklist has been provided in Appendix A to assist organisations identify the factors that may contribute to fatigue. Appendix B provides an overview of the workplace data that can be gathered to help determine the potential seriousness of the consequences associated with fatigue, as well as the likelihood that worker health and safety could be affected.

Workplace data can provide valuable and objective information to help inform the decision-making process in the assessment of risks. It is important that appropriate data be reviewed across a period of time to ascertain any common themes and trends. Organisations also need to be wary of drawing firm conclusions from the data in isolation. A holistic approach should be undertaken to inform and verify any conclusions drawn from workplace data.

3.4.3 Assess risks

Once the hazards have been identified, the next step in the process is to assess the risk in order to prioritise the implementation of control measures. This step involves:

- Identifying control measures currently in place to manage the risk by either reducing the consequence or likelihood of the risk;
- Assessing the effectiveness of current control measures;
- Identifying the likelihood of the risk occurring with current control measures in place;
- Identifying the potential consequence or impact that would result if the risk was to occur; and
- Determining whether additional control measures are required.

3.4.4 Treat risks

Adopting a hierarchy of risk control measures allows organisations to effectively eliminate or minimise, so far as is reasonably practicable, the level of risk associated with business undertakings.

Appendix C provides a comprehensive list of control options that may be adopted and tailored to the organisation, dependent on the hazards identified and the level of risk posed by fatigue.

3.4.5 Monitor and review

The risk management process should be continually monitored and reviewed to ensure:

- Controls are working effectively.
- Changes in the workplace have not affected the effectiveness of current controls.
- New hazards are identified.
- The impact resulting from changes to Legislation and best practice are considered.

3.4.6 Record keeping

Accurate records of the risk management process should be kept, including:

- Risk assessment attendance sheet
- Signed risk assessment template outlining:
  - hazards identified;

    - assessment of the risks associated with those hazards;
    - decisions on control measures to manage exposure to the risks;
    - timeframes and responsibilities for implementation; and
    - any checklist/s used during the process.
- Evidence of monitoring and review of the effectiveness of control measures.

3.5 Training and education

Workers should be provided with appropriate training and education to assist them in their ability to identify the signs and symptoms of fatigue, and provide them with information and techniques to manage their own fatigue effectively. It is important this training also includes familiarisation with the relevant policies and procedures, and covers how to report a fatigue-related incident correctly as per organisational procedures.

Information and training for pipeline workers and their families (that can be used for the organisation's in-house training or for workers to reference) might include:

- Obligations and responsibilities for managing fatigue.
- Methods to improve good quality restorative sleep.
- Health and lifestyle factors that impede on good quality sleep.
- Signs and symptoms of fatigue in self and others.
- Provision of self-assessment tools and risk management strategies for use on a daily basis.

Management, supervisors and rostering personnel should be provided with training in the form of competency-based or awareness training, dependent on their role in managing fatigue in the workplace. Training and education should provide the knowledge and skills to:

- Identify the causes of fatigue and potential consequences.
- Understand and apply the relevant legislation.
- Understand obligations and responsibilities for various roles.
- Identify signs and symptoms of fatigue in others;
- Implement risk management strategies to minimise fatigue.
- Identify the lifestyle factors that can help to reduce individual fatigue and enhance wellbeing.
- Understand the importance of a workplace culture that supports fatigue management and reporting.
- Appreciate the importance of good leadership practices in achieving effective fatigue management.

3.6 Reporting systems and processes

Reporting systems and processes need to consider setting up limits or guidance to workers as to when they need to report to their direct manager and guidance on when additional controls might be required. The reporting system should also include guidance for colleagues to identify fellow workers who may be fatigued and the processes that should follow post identification.

3.6.1 Fitness for Work

When setting up reporting systems in regards to fitness for work, it is important to focus on setting guidelines for times that workers should report to management for further advice or instruction. With regard to fatigue, the organisation may establish minimum sleep and maximum wake thresholds to provide workers with guidance on whether they have had sufficient sleep to start work.

These reporting mechanisms can be introduced in one of two ways depending on the organisation's maturity with regard to fatigue risk management:

- the introduction of the Prior Sleep Wake Model[18].
- the introduction of an individual alertness assessment and/or minimum sleep limit.

The Prior Sleep Wake Model is a sophisticated tool used for quantifying a person's fatigue risk level/s based on the amount of sleep obtained in the prior 24 and 48 hour period, which can then be used to assess the required degree of hazard control. This tool is used for qualifying a person's fatigue risk level/s based on the amount of sleep obtained in the prior 24 and 48 hour period and the time awake at the end of the shift. A point system is then used to determine what course of action a worker and/or the organisation may take.

As an alternative, a simple statement requesting workers to report to their supervisor if they have had less than six hours sleep in a 24-hour period or when their subjective alertness level reaches an organisational threshold may be enough as an introductory measure before progressing to the Prior Sleep Wake Model as part of an Implementation Plan. Management is then able to conduct a fatigue assessment on the affected worker and follow relevant recommendations.

Note: There is clearly a desire to use technology like the Prior Sleep Wake Model, individual alertness assessments, fatigue software models (e.g. FAID, SAFTE/FAST) and the like in order to establish ground rules and risk profiles for managing fatigue. While many of these methods can assist in building a layered system of risk controls and risk intelligence, they are just tools and should never be relied on as primary or as singular methods or controls to identify, monitor or control risk.

Appendix D Fatigue Assessment Tool and Appendix E Individual Alertness Assessment provide an example of self-reporting tools that may be tailored to the organisation's systems, culture and distance along the fatigue risk management journey.

3.6.2 Observation

The observation and reporting of fatigue-related symptoms and behaviour is an important element of the fatigue risk management process. Effective observations and review of reports can assist the organisation to:

- Identify whether the minimum sleep requirements set by the FRMS are appropriate (see Section 3.6.1).
- Identify whether hours of work and rostering processes are appropriate.
- Indicate whether personal factors are impacting upon the risk of workplace fatigue.
- Indicate whether individuals are at risk of a sleep disorder.
- Identify whether behavioural indicators of fatigue are associated with an increase in the risk of a fatigue-related error or occurrence.

Symptoms checklists (e.g. Table 1, p. 7) can be used to assist management and workers identify fatigue signs and symptoms in their colleagues. These tools can be provided as part of a training program or incorporated into organisation specific Fatigue Assessment Tools.

3.6.3 Errors, Incidents and Accidents

It is vital that fatigue-related hazards, errors, incidents and accidents are reported to allow for an organisation's fatigue statistics to be accurately monitored. Reporting of fatigue-related errors or occurrences offers a great opportunity to analyse the effectiveness of a FRMS, and identifies opportunities to improve the system, rosters or work tasks that require greater management efforts to reduce inherent risk.

Fatigue statistics can be used when reviewing the FRMS and ultimately result in reduced errors and incidents in the workplace by identifying trends and gaps in the overall process. An organisation that has a good culture in relation to fatigue reporting will allow workers to feel comfortable in coming forward and reporting fatigue-related incidents. It is the responsibility of all workers to promptly report any error, incident or accident relating to fatigue in accordance with the organisation's incident reporting procedures.

This system must be able to inform senior management of such events to enable change. The importance of management openly committing to safety cannot be under-estimated. Visible and clear commitment from senior managers and supervisors towards safe working environments have shown to be crucial in mediating the risk-taking behaviours of workers[19] and also shown to be a significant factor in the occurrence of workplace injuries[20].

A poor culture circulating around the perception of fatigue and the organisation/management handling of fatigue-related incidents and reports could clearly inhibit the truthful and forthcoming reporting of such fatigue-related incidents and impairment[22]; and, indeed, contribute to under-reporting of workplace injuries and illness in general[23]. Thus, fatigue cannot be a taboo topic. People must be able to openly speak about fatigue impairment without fear of discipline or abasement directed against them.

3.7 Workplace Culture and Leadership

Recent research in the area of safety demonstrates that investment into safety systems does not guarantee any improvement to safety performance in the absence of improvements to safety culture. Thus, focusing on having the right culture, the right leadership, considering the impacts of team dynamics, and considering the quality and effectiveness of safety communications will enhance the effectiveness of fatigue risk management practices.

Clear commitment from senior management, and indeed all stakeholders, in the prevention and management of fatigue should be intertwined with all procedures, hazard reporting processes, communication changes, procedures for investigating fatigue-related incidents and training and education. Leadership practices significantly influence culture, and so leaders should be educated on appropriate strategies to influence worker behaviour and manage performance. Workers should have an understanding of how culture is shaped within organisations, the impact that culture has on safety performance, and how to work together to develop a culture that supports excellence in safety.

Senior leadership and management commitment and trust can be achieved through several means. These include (but are not limited to):


Health and safety budget and resource allocation


Good two-way communication and reporting mechanisms


Education and training


Personnel involvement, engagement, support and flexibility


Senior management having personal involvement in safety activities


Proactive approach to safety and risk management


High organisational risk awareness and willingness to ALARP those risks

Recognition and rewarding of safe behaviours and practices

A just culture and a learning approach to organisational improvement

These factors can be seen not just as essential components for leadership and management commitment but as essential components to creating a positive safety culture within an organisation.

3.8 Incident investigation

All of the fatigue elements discussed so far are concerned with measures to minimise the likelihood of a fatigue-related error or occurrence[23]. Investigating whether fatigue contributed to an incident or accident provides the opportunity to identify the presence (or absence) of appropriate and effective hazard control measures in the system.

Defining an event as a fatigue-related error or occurrence requires a review to determine whether:

- The work schedule provided sufficient sleep opportunity for the worker(s).
- The worker(s) actually obtained sufficient sleep.
- The event was preceded by the presence of fatigue-related behaviours.
- The error was consistent with a fatigue-related error.

Where fatigue is suspected of contributing to a safety-related occurrence, the collection of the following information may help establish if this is the case:

- Time of day and time awake.
- Time on task/duty.
- Work conditions that have the potential to impact fatigue levels, for example, temperature, humidity, weather conditions, lighting.
- History of hours worked prior to the occurrence.
- Sleep history of all workers involved.
- Evidence of fatigue-related behaviours preceding occurrence.
- If available, any documented or self-reported medical history of sleep disorders.

3.9 Audit and assurance

The FRMS should be monitored for continuous improvement and to ensure it is flexible to change with changing work practices or functions. There are many ways in which assurance can be achieved including:

- Monitoring and reviewing fatigue control measures.
- Evaluating the effectiveness of the FRMS through lead and lag indicators.
- Conducting internal and external audits.

3.9.1 Review controls

Firstly, the risk assessment process needs to be monitored and reviewed on a regular basis to identify what is working well and what needs improvement.

When working through this step, it is useful to ask:

- Have the controls been implemented as required?

- Are the controls working?
- Are there any new problems caused by the controls themselves?

Evidence is needed to support the answers. Reviews should be conducted regularly to ensure continued effectiveness of fatigue management controls.

3.9.2 Evaluate

One way to improve the effectiveness of a FRMS is to change the way it is measured. Finding the perfect measure is a difficult task; however, a combination of lag and lead indicators of safety performance can assist in providing a proactive and holistic approach to the management of fatigue[24].

Lead indicators are focused on future safety performance and continuous improvement. These measures are proactive in nature rather than reactive and report what workers are doing on a regular basis to prevent injuries. Lag indicators, on the other hand, measure an organisation's incidents in the form of past accident statistics. Lag indicators are the safety metrics used to indicate progress toward compliance with safety rules. These are the metrics that evaluate the overall effectiveness of safety within the organisation. If the organisation only uses lag indicators of safety performance, data will not be available to detail how well the organisation is doing at preventing fatigue-related incidents and accidents.

Appendix F provides examples of the type of lead and lag indicators[25] that could be implemented as part of a FRMS.

3.9.3 Internal audits

Organisations should conduct an annual audit of their FRMS. This includes assessing contractor management of fatigue risks. Set criteria should be developed to measure each element of the system and collect evidence to assure the organisation that the system is operating as intended.

When undertaking these audits, organisations should be able to demonstrate compliance with any regulatory or legislative requirements through:

- Evidence of a fully documented FRMS including policies, procedures, instructions and training.
- Evidence the FRMS is current and available to all workers and contractors.
- All documents are reviewed regularly and modified as required.
- All records are legible, stored, maintained and available.
- Documents are retained for the time required by law.

3.9.4 External audits

In addition to undertaking an audit process as an internal auditor would, there are also some additional benefits to engaging an external auditor. These benefits include:

- External auditors have experience conducting audits within a broad range of organisations and industries, and can therefore benchmark audit results.
- External auditors are impartial and thus may be more likely to remain objective and unbiased in their findings and recommendations.
- External auditors provide a fresh perspective on the work environment and may identify issues overlooked by internal staff that have become over-familiar with the work environment.
- External auditors tend to have specialised knowledge that is up-to-date with best practice approaches and the latest legislation and safety standards.

3.10 How do employers implement and embed a FRMS?

A FRMS must be embedded into the organisation's SMS and subsequently the workplace culture. The senior management team plays a key role, like in any change management process, by creating and promoting the values and behaviours that are expected to be demonstrated by the workforce.

Organisations will need to use a structured, tailored and pragmatic organisational change management approach to support workers through the transition from the current to the future state. The figure below indicates how this challenge can be met as workers move from the diagnosis to the commitment phase, but only by firstly having an awareness for the need to change, understanding the change, and then perceiving it positively. Organisations must enable people to understand why the change is required, how it impacts them, and address the 'what's in it for me?' factor.

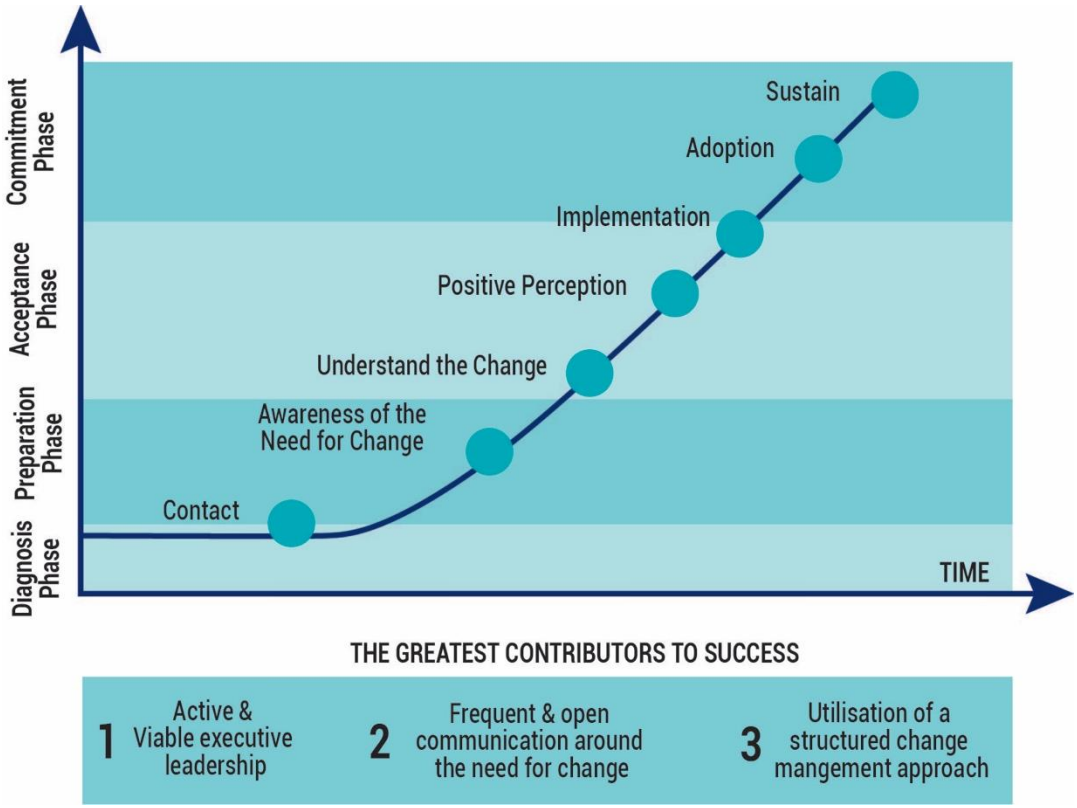

Figure 3. A structured approach to embedding lasting behavioural change[6]

Activities to encourage commitment to proactive fatigue risk management might include:

- Development of a fatigue vision, goals and behaviours.
- The identification of individuals to champion the relevance and importance of this safety risk.
- Regular and direct communication from the senior leadership team regarding fatigue management activity.
- Recognition of fatigue management achievements.
- The formation of a fatigue management steering committee to strategically coordinate and monitor all fatigue information sources, make recommendations and provide resources for priority areas.

To fully embed the importance of fatigue risk management, it needs to be promoted at every level of the organisation and at every stage of the worker life cycle. Recognising fatigue as a genuine safety risk can be promoted:

- During the recruitment process by identifying and assessing appropriate behavioural and motivational competencies before appointing an individual to a role.
- At the induction, to optimise a new starter's understanding of the roles and responsibilities within the FRMS from the outset.
- Within performance management systems and frameworks to reinforce good fatigue risk management practices.
- As part of the organisation's safety objectives and targets. Key performance indicators at the individual, team and company level can demonstrate that there is individual accountability and positive recognition for any work that is undertaken to encourage continual improvement.
- As part of the information sharing and transfer of knowledge sessions amongst peers, as well as a standing agenda item on any relevant committees, team meetings, and pre-start briefings.

The ultimate goal is for fatigue risk management to become the 'way we do things around here'.

3.11 Working together to reduce the fatigue risk in the pipeline industry

Much can be gained by industry members supporting each other to achieve positive outcomes regarding fatigue management. This occurs on two levels: within organisations and across the industry.

Within organisations, this involves bringing all stakeholders together to discuss the best strategies for the organisation in mitigating fatigue risk. All levels of the organisation should be included in consultation processes and provided with opportunities to make suggestions and recommendations. All relevant groups need to be educated on their role in managing fatigue and equipped with the necessary knowledge, skills and abilities to enact such practices.

At the industry level, strategies to manage fatigue can be enhanced through a defined commitment to share knowledge and information about tried and tested fatigue management approaches. The pipeline industry has a relatively transient workforce, with workers moving around between projects and employers. With a broader commitment, and the establishment of a minimum benchmark for fatigue management, the industry should expect to see improvements in safety performance through improvements to the fatigue management culture and decreases in fatigue-related incidents.

This can be achieved through:

- Holding regular safety forums for organisations throughout the industry.
- Finding opportunities to learn from mistakes and achievements, such as conferences.
- Sharing information with other industry members about effective fatigue management practices.
- Disseminating safety alerts and safety communications regarding fatigue.
- Maintaining individual networks with other professionals within the Industry.
- Each individual organisation taking responsibility for implementing this Fatigue Management Handbook to establish a benchmark and shared expectations across the industry about fatigue management practices.

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Appendices

A. Fatigue Hazard Checklist Example
B. Workplace Data Sources
C. Example Fatigue Hazard Controls
D. Fatigue Self-Assessment Tool Example
E. Individual Alertness Assessment Example

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Appendix A: Fatigue Hazard Checklist Example

CATEGORY		HAZARD		HAZARD IDENTIFICATION QUESTIONS
A	SHIFT TYPE & LENGTH	A1	Consecutive shifts	• Does the work schedule roster workers for greater than six days in a row? • Are workers required to work longer than a 14-day cycle? • Does the rostered cycle allow for at least two days off in a 14-day period? • Are heavy vehicle drivers working for more than 11 hours including 60 minutes rest in 15-minute blocks? • Are heavy vehicle drivers rostered for more than 144 hours in a 14-day period? • Are heavy vehicle drivers required to work more than 72 hours working time in a seven-day period?
		A2	Night work	• Are workers scheduled for permanent night shifts? • Do any shifts/call outs fall between midnight and 6am? • Are workers required to work more than four consecutive night shifts?
		A3	Early morning work	• Do rostered shifts start before 6am? • Can workers be called in before 6am including travel time to worksite and pre start meetings?
		A4	Shift length	• Are shift lengths regularly 12+ hours or greater including travel time to worksite?
		A5	Irregular shifts	• Are rostered hours irregular? • Are workers required to work rotating shifts (e.g. morning, afternoon, night shifts)?
		A6	Unpredictable shifts	• Are workers required for on-call, call outs or call backs outside their standard shift?
		A7	Backward rotating	• Do rostered shifts tend to start earlier each day (for e.g. 8am, 6am, 4am, 2am) • Do shift starting times progress in a backward manner (e.g. night shift to afternoon shift to day shift)?
		A8	Rotating speed	• Do shift starting times rotate rapidly (e.g. on a daily basis)?
		A9	Split shift	• Are there large gaps of time between split shifts? • Do split shifts provide adequate sleep opportunity if working times coincide with the circadian low (i.e. midnight to 6am)?

CATEGORY		HAZARD		HAZARD IDENTIFICATION QUESTIONS
		A10	Travel/ commute time	• Do workers have long commute times (greater than one hour) to get to and from their accommodation to work site? • Are workers required to travel/commute consistently during the circadian low (i.e. midnight to 6am)? • Are workers required to travel solo during circadian low (i.e. midnight to 6am)?
B	**REST BREAKS**	B1	Number of workdays to rest days	• Does the work schedule prevent workers having at least one full day off every seven days? • Does the roster allow sufficient rest days after continuous days of work?
		B2	Minimum rest break within shifts	• Do workers regularly have less than 10-hour break between each shift? • Are workers often required to work split shifts? • Are workers likely to be called out during their rest break between shifts?
		B3	Minimum consecutive nights off	• Does the work schedule make it difficult for workers to consistently have at least 2 consecutive nights sleep every seven days?
C	**OVERTIME**	C1	Emergency	• How often are workers called in for emergency situations? • Is there a process in place to assess individual risk prior to attending an emergency situation? • Are workers required to attend emergency training drills during their rest periods?
		C2	Unplanned	• How often are unplanned shifts or overtime arranged? • Are workers exceeding shift length limits to work overtime in these situations? • Are workers undertaking safety critical roles during overtime?
		C3	On call	• Are workers carrying out safety critical roles when on call? • How often are call outs received? • Is there a process in place to identify individual fatigue risks and manage these prior to the worker accepting a call out?
		C4	Staffing levels	• Are staffing levels adequate for current and projected work levels?
		C5	Worker control of overtime	• Is there a process for overtime to be approved by management or supervisors? • Do workers control/determine who will work overtime?

CATEGORY		HAZARD		HAZARD IDENTIFICATION QUESTIONS
		C6	Employer control of overtime	• Do maximum daily working hours apply to any overtime conducted? • Is there a process to manage excessive overtime? • Is there a process for determining how workers will be assigned overtime?
		C7	Pay incentives	• Do shift times lend themselves to overtime to enhance pay levels? • Are workers given the opportunity to conduct overtime on a regular basis for financial gain?
		C8	Sickness or unplanned short notice absences	• Do the trends indicate that certain shifts/rosters are more likely to result in workers calling in sick or unable to attend the shift?
D	**SLEEP**	D1	Sleep opportunity	• Does the roster provide adequate sleep opportunity and sufficient time off between shifts to allow for sleep?
		D2	Insufficient or inadequate sleep	• Do workers obtain adequate restorative sleep in between shifts? • Are there any trends of times/shifts where workers find it more difficult to obtain restorative sleep?
		D3	Rest and recovery facilities	• Are onsite sleeping facilities conducive to obtaining recovery sleep (e.g. dark environment, temperature control, isolated, optional white noise)? • Does security play a role in ensuring camp accommodation areas are free from noise during sleep hours, including curfew times for worker's consuming alcohol in common areas?
		D4	Education	• Have workers been provided with education and training on the biology of sleep, how to set up an environment that is conducive to obtaining restorative sleep and strategies for identifying and managing fatigue? • Have workers been provided with education and processes for reporting when adequate sleep has not been obtained?
E	**FITNESS FOR WORK**	E1	Sleep disorders	• Does the organisation screen for sleep disorders in safety-critical workers? • Does the organisation's medical team have training in the signs and symptoms consistent with fatigue and sleep disorders? • Are there any health promotion activities focused on prevention of fatigue-related issues through enhancement of health and wellness?

CATEGORY		HAZARD		HAZARD IDENTIFICATION QUESTIONS
		E2	Alcohol	• Does the workplace supply alcohol? • Does the workplace conduct alcohol testing? • Are workers educated on the effects of alcohol and its impact on fatigue levels? • Is alcohol consumption monitored and limited at the wet mess? • Does security have the responsibility to ensure alcohol curfews are adhered to in common living areas?
		E3	Drugs	• Does the workplace conduct drug testing? • Are workers educated on the effects of drugs and its impact on fatigue levels?
		E4	Illness	• Have workers been provided with the education and processes for reporting when adequate sleep has not been obtained due to illness? • Does the workplace have a culture that supports the reporting of fatigue and lack of sleep?
		E5	Medication	• Are workers educated on the impact of some medications on fatigue levels? • Is there a process in place for workers to report when medications may cause drowsiness? • Are workers advised that they must notify medical staff of any prescription medications?
		E6	Occupational stress	• Does the organisation have in place psychosocial risk management processes? • Are workers educated on how to identify and manage stress that may impact on fatigue levels?
F	**PERSONAL FACTORS**	F1	Family and social commitments	• Are workers informed of strategies to balance work and home life? • Are workers provided with training and education on strategies to minimise disruptions to sleep in the home environment (particularly when working shift work)? • Are workers provided with contact details for support and assistance services for themselves and families?
		F2	Secondary employment or volunteer work	• Do workers have secondary employment (i.e. alternative jobs on their days/weeks off)? • Is there a process in place to outline workers' responsibilities in regards to secondary employment or volunteer work? • Are workers' total hours of work assessed to minimise risk of fatigue-related to hours of work? Are workers' bags and luggage spot-checked for alcohol before entering camp and site?

CATEGORY		HAZARD		HAZARD IDENTIFICATION QUESTIONS
		F3	Physical activity	• Do workers have sporting commitments outside of work that may impact on sleep and fatigue levels? • Do workers rise early or stay up late to attend the gym while on cycle and, in turn, reduce available sleep time?
G	**WORKING CONDITIONS**	G1	Temperature	• Is work carried out in harsh or uncomfortable conditions e.g. cold, hot, humid? • Are there sufficient areas for breaks provided with appropriate shelter?
		G2	Noise	• Are workers consistently exposed to loud noise? • Are the standards for hearing protection enforced in the workplace?
		G3	Lighting	• Does the workplace have poor lighting or excessive glare? • Are the standards for lighting enforced in the workplace?
		G4	Vibration	• Do workers need to use equipment or machinery that has excessive vibration?
		G5	Ergonomics	• Is the workplace ergonomically suitable for the work being undertaken?
		G6	Hazardous chemicals	• Do workers use hazardous chemicals? • Are MSDSs readily available to workers required to use chemicals?
H	**WEATHER CONDITIONS**	H1	Snow	• Do workers undertake work for long periods of time in the snow? • Are workers educated on the effects of frost bite and hypothermia? • Are workers provided with appropriate PPE to protect against effects of the snow?
		H2	Sunlight	• Do workers undertake work for long periods of time in the sun? • Are workers provided with sunscreen, hard hat brims and tinted safety glasses to protect themselves for direct sunlight?
		H3	Rain	• Do workers undertake work for long periods of time in the rain? • Is there a process for monitoring road and driving conditions during and after excessive rain?

CATEGORY		HAZARD		HAZARD IDENTIFICATION QUESTIONS
I	CULTURAL EXPECTATIONS	I1	Work ethic	• Does the organisation expect workers to work long hours? • Is there a culture of long working hours? • Is there a high emphasis on production over safety?
		I2	Reporting	• Are there processes in place to report fatigue-related errors, near misses, incidents and accidents? • Do workers feel that they can openly report unfit for duty due to fatigue without negative repercussions?
J	FATIGUE CRITICAL TASKS	J1	Emergency situations (including drills)	• Does the organisation have in place on-duty controls for ensuring potential fatigue related errors are mitigated or managed during emergency situations?
		J2	Safety critical tasks (working at heights, confined space, driving, high pressure testing, hot work)	• Does the organisation have in place on-duty controls for ensuring potential fatigue- related errors are mitigated or managed during emergency situations or when carrying out safety critical roles?
K	WORK DEMANDS	K1	Repetitive tasks	• Are repetitive tasks carried out for long periods of time?
		K2	High mental workload (e.g. high levels of vigilance or continuous concentration required, work performed under pressure, tight deadlines)	• Are workers required to maintain a high mental workload for long periods of time? • Are regular rest breaks provided during times of high workload?
		K3	Low mental workload (e.g. monotonous, tedious tasks, long drives)	• Are workers required to undertake monotonous or tedious tasks at night? • Are monotonous tasks carried out for long periods of time?
		K4	High physical demands (e.g. concrete pouring, laying pipe, manual labour)	• Are workers subjected to high physical demands during the shift? • Are regular breaks taken for tasks with high physical demands? • Are worksites equipped with sufficient water outlets and sufficient protection from the elements to reduce dehydration?

Appendix B: Workplace Data Sources

WORKPLACE RECORDS	THINGS TO CONSIDER
Hours of work records	• Number of hours worked on a weekly, fortnightly, monthly basis • Number of hours worked on overtime • Bio-mathematical modelling of planned and actual hours worked • Distribution of hours worked (including overtime) among workers • Percentage of shifts that exceed organisation's tolerable limits for planned roster and actual hours worked • Percentage of shifts where shift swaps have taken place to minimise the adverse impact of fatigue • Number of workers stood down to prevent shifts exceeding organisation's tolerable limits • Percentage of safety critical tasks scheduled between midnight and 6am
Hazard reporting database	• Number and nature of hazards related to fatigue • Outcomes of fatigue-related hazard reports • The number of workers having reported less than six hours sleep in a 24-hour period • The number of workers having reported a high or extreme risk on the prior sleep wake calculator • Frequency of workers reporting fatigued, not fit for duty or 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/accidents that occur during periods of the rosters where there is an elevated risk of fatigue (i.e. midnight to 6am, at the end of a shift)
Records of current and recurring industrial issues in the workplace	• The nature of industrial activity and recurring themes, particularly in regards to rostering and hours of work
Data on leave usage, including sick, annual and long service leave	• Increasing leave usage during certain periods of the roster • Accrual of leave over a long period • Leave taken in frequent short bursts during certain periods of the roster • Frequency of unscheduled leave • Accrual of time in lieu
Minutes of workplace safety meetings and staff meetings	• Whether any agenda items relate to fatigue • Evidence of issues raised across a period of time with no apparent resolution

WORKPLACE RECORDS	THINGS TO CONSIDER
Workplace health and safety issues register	• Recurring issues related to fatigue, hours of work, roster design • Whether issues raised have action plan in place
Workers compensations claims data	• Causal or contributing factors • Period of absence associated with claims of a fatigue nature
Workplace inspections records and action plans	• Workplace conditions such as inadequate lighting, excessive vibration, 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 site-based sleeping facilities that comply with sleep hygiene assessment • Number of reports that site-based sleeping facilities are inadequate (e.g. noise, light, vibration, climate control, bedding)
Fatigue-related survey data	• Workers' self-reported sleep quality and quantity • Self-reported sleep hygiene practices • Reporting culture • Fatigue-proofing strategies being adopted during certain work conditions or rosters • 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
Medical and health assessment records	• Sleep disorders (self-reported and assessment identified) • BMI >30 • Number of reported medical conditions that may impact on sleep • Age distribution of workers • Percentage of workers that are being actively managed following a medical diagnosis that may impact on sleep/fatigue or alertness for work • Percentage of random drug and alcohol tests that indicate drugs known to impact on sleep/fatigue or promote alertness • Percentage of workers who present to the medical facility with a condition or illness that has been aggravated or caused by onset of fatigue in the workplace
Sleep data	• Data recorded from the use of actigraphs
Performance data	• Data recorded from the use of vigilance and reaction time tests

Appendix C: Example Fatigue Hazard Controls

CATEGORY		HAZARD		POTENTIAL CONTROL MEASURES
A	SHIFT TYPE & LENGTH	A1	Consecutive shifts	Assessing work schedules for susceptibility to fatigue-related risk should be based on the amount of sleep opportunity it provides. Working hours should be designed to allow for good sleep opportunity and enough recovery time between shifts for travelling, eating, washing and sleeping. When planning work schedules and rosters, consideration should be given to control measures such as: • Implement fatigue monitoring software (e.g. FAID, FAST) to assess planned and actual hours of work • Use roster risk assessment tools to determine on-duty control measures required depending on the shift • Avoid split shifts or consider the timing of them. For instance, whether sleep disruption is likely because of the times workers are required to work • Set shift rosters ahead of time and avoid last-minute changes to allow workers to plan leisure time • Where possible, workers should be notified of their shift type (day/night) prior to commencement of their cycle as this will enable them to adjust sleeping patterns to allow for an easier transition into the working cycle • Allocate shift and night workers consecutive days off to allow for at least two full nights' sleep - shift and night workers can often accumulate more sleep debt than day workers and would therefore benefit from consecutive days off work to allow for restorative sleep to occur • Develop and implement hours of work procedures outlining processes for assessing rosters, altering rosters, assessing shift changes, monitoring actual hours of work and managing fatigue risk during emergency or unplanned situations where shifts may extend beyond set limits, on-call work and work- related travel • Consider commuting times in roster development and implementation • Monitor actual time worked against the allocated roster to identify whether excessive hours are being worked
		A2	Night work	
		A3	Early morning work	
		A4	Shift length	
		A5	Irregular shifts	
		A6	Unpredictable shifts	
		A7	Backward rotating	
		A8	Rotating speed	
		A9	Split shift	
		A10	Travel/ commute time	

CATEGORY		HAZARD		POTENTIAL CONTROL MEASURES
				• Plan an appropriate and varied workload • Limit shift length to a maximum 12 hours including overtime or eight hours for night shifts and/or demanding, monotonous, dangerous and/or safety critical work • Avoid keeping workers on permanent night shifts - long-term night shift can have detrimental effects to an individual's health • Limit the number of consecutive early morning starts (to 4 if possible) – continual early morning starts can contribute to accumulated sleep debt • Allow minimum of 12 hours between shifts and avoid quick return of eight hours if possible – this encourages workers to attempt to gain a minimum of 6-7 hours of consecutive sleep • Use forward rotation (morning/afternoon/night) - this is much less disruptive to sleep patterns than in the reverse order • Keep timing of shifts predictable – keeping consistency in the time of day of a worker's shift can prevent sleep difficulties by allow the body clock to wake up and go to sleep at a similar time each day • Schedule safety critical work outside low body clock periods (e.g. between midnight and 6am) • Monitor sick leave for trends related to roster design
B	**REST BREAKS**	B1	Number of workdays to rest days	• Consider the number of workdays to rest days and minimum break between shifts and after night work • Consider minimum rest breaks between shifts to allow for sufficient sleep to take place as well as daily routine activities such as meals, housekeeping • Assess regularity of rest breaks, taking into consideration the tasks being undertaken during the shift • Consider use of suitable break out facilities
		B2	Minimum rest break within shifts	
		B3	Minimum consecutive nights off	

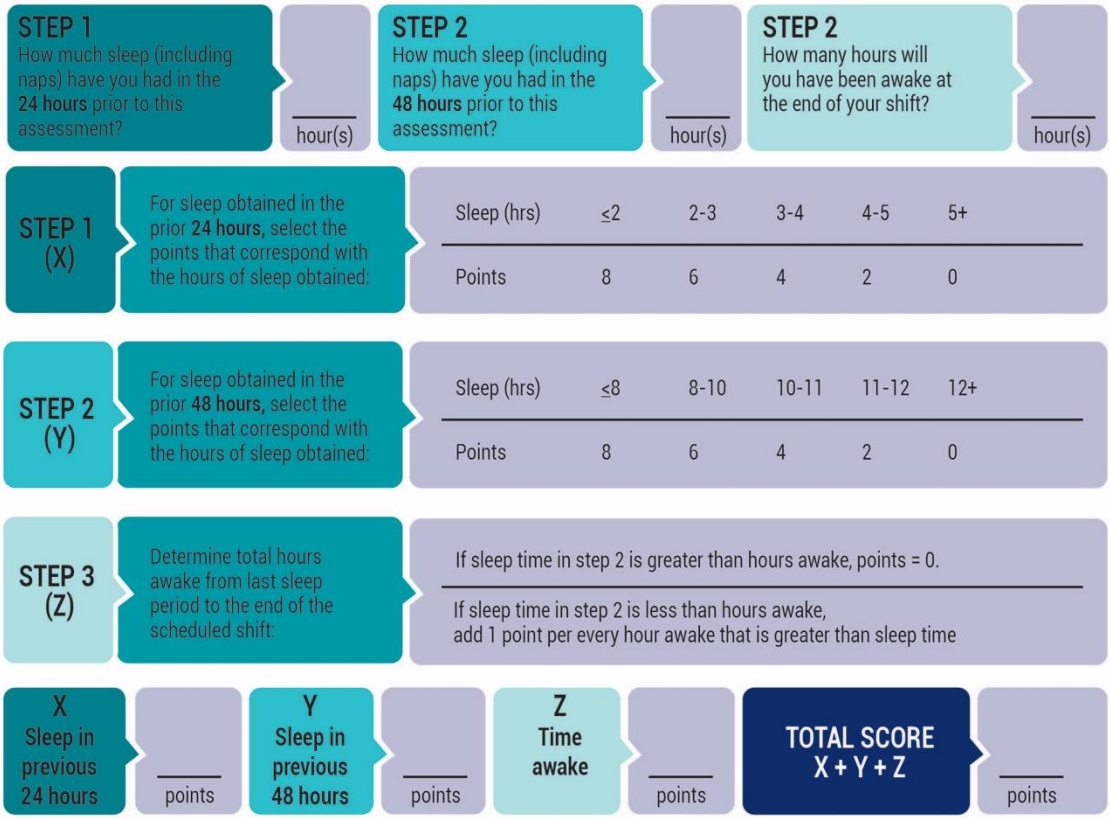
CATEGORY		HAZARD		POTENTIAL CONTROL MEASURES
C	**OVERTIME**	C1	Emergency	• Ensure any required overtime is communicated to workers well in advance to allow them the opportunity to plan ahead and implement individual fatigue management strategies if required • Implement overtime limits and processes for controlling risks where approval is given to exceed these limits in unforeseen circumstances • Develop processes for controlling and assigning overtime to consider fatigue and impact of pay incentives - bonuses and other financial incentives may encourage workers to work in excess of standard working hours or roster lengths • Establish on call checklists and procedures for assessing individual fatigue risks • Undertake workforce planning to ensure adequate resources are available • Consider the provision of transport (bus, taxi) for longer or extended shifts, call- ins, commuting home at end of cycle etc. • Encourage carpooling or buddy systems to minimise driving alone on commute
		C2	Unplanned	
		C3	On call	
		C4	Staffing levels	
		C5	Worker control of overtime	
		C6	Employer control of overtime	
		C7	Pay incentives	
		C8	Sickness or unplanned short notice absences	
D	**SLEEP**	D1	Emergency	• Provide fatigue management training and education for all workers during induction to the organisation, as well as periodic refresher training to maintain knowledge and skills • Roll out fatigue self-assessment tools (e.g. prior sleep wake model) to allow for fatigue risk based on sleep to be identified and appropriate control implemented • Implement observation checklists to identify symptoms consistent with fatigue in the workplace • Provide appropriate camp facilities that are conducive for sleep (e.g. security to monitor noise levels in camp after 10pm, posters and reminders to workers at meetings to be mindful of those sleeping when making way around accommodation areas, provide earplugs for individuals who find the camp environment noisy during sleep hours) • Provide sleeping pods to allow for napping to reduce fatigue levels by allowing for restorative sleep • Implement napping handbook (including strategies to overcome sleep inertia) where rest facilities are provided
		D2	Unplanned	
		D3	On call	
		D4	Staffing levels	

CATEGORY		HAZARD		POTENTIAL CONTROL MEASURES
				• Conduct medical assessments to identify medical conditions and lifestyle factors that may contribute to poor sleep • Develop a sleeping facilities checklist to provide a means of identifying and rectifying factors in the sleeping environment that may contribute to sleep loss • Provide access to suitable catering facilities providing nutritional food and beverages consistent with diet handbook that maximise the ability to work extended hours. Diet choice can contribute to poor sleep quality and wellbeing issues
E	**FITNESS FOR WORK**	E1	Sleep disorders	• Enable regular medical surveillance of workers to monitor and assess any conditions that could affect sleep quality • Encourage regular health checks (e.g. blood pressure, weight) • Implement an alcohol and drug policy and testing process • Ensure training and education programs include sleep hygiene practices and individual fatigue management strategies • Ensure medical assessments include consideration of sleep disorders and fatigue-related conditions • Establish a health assessment program comprised of comprehensive assessments on a bi-annual basis for safety-critical workers • Implement reporting processes that encourage workers to inform their supervisor if they have a fatigue concern and mechanisms in place to support workers once they have reported their concerns
		E2	Alcohol	
		E3	Drugs	
		E4	Illness	
		E5	Medication	
		E6	Occupational stress	
F	**PERSONAL FACTORS**	F1	Sleep disorders	• Implement a secondary employment policy to define the process workers must take to gain approval for secondary work and outline the worker's responsibility to ensure they receive sufficient rest and recovery before returning to work to commence a cycle. Secondary employment has the potential to reduce sufficient rest and recovery time. • Ensure the fatigue management policy outlines worker responsibilities and fatigue management strategies • Provide health promotion programs to educate workers on factors that influence fatigue i.e. sleep hygiene, diet, exercise, medications, stress etc.
		F2	Alcohol	
		F3	Drugs	
		F4	Illness	

CATEGORY		HAZARD		POTENTIAL CONTROL MEASURES
G	WORKING CONDITIONS	G1	Temperature	• Implement a workplace inspection checklist to identify and monitor working conditions to ensure fatigue risks are controlled • Ensure the hazard reporting system allows for workers to identify fatigue- related hazards or workplace hazards that could contribute to fatigue • Conduct risk assessments to identify any potential fatigue risks present in the workplace • Ensure signs showing requirement for hearing protection / double hearing protection in high noise level areas are installed • Ensure fit for purpose machinery and equipment is available for use in the workplace • Ensure machinery guards are in place for any machinery with rotating parts
		G2	Noise	
		G3	Lighting	
		G4	Vibration	
		G5	Ergonomics	
		G6	Hazardous chemicals	• Ensure procurement processes assess human factors and ergonomics associated with machinery and equipment • Provide appropriate lighting and temperature control • Ensure vibration management controls are in place including effective PPE and procedures for work involving vibration hazards • Encourage workers to use the hazard reporting system to identify and effectively rectify workplace hazards • Develop heat stress procedures to provide guidance on preventing and managing heat illness
H	WEATHER CONDITIONS	H1	Snow	• Avoid work during periods of extreme temperatures - strain on the body due to extreme temperatures can lead to fatigue issues • Provide access to covered areas and water - heat illnesses can contribute to an increase in fatigue levels • Provide cooling devices in hot work environments (e.g. air conditioning in truck cabs, fans, cooling bands) • Provide education and awareness around hydration - maintaining good hydration levels can assist in reducing fatigue levels
		H2	Sunlight	
		H3	Rain	

CATEGORY		HAZARD		POTENTIAL CONTROL MEASURES
I	**CULTURAL EXPECTATIONS**	I1	Work ethic	• Conduct regular safety climate/culture assessments to determine the perception of safety practices in the workplace • Provide cognitive behavioural safety training to address behaviours and attitudes that contribute to poor fatigue management • Conduct a fatigue culture evaluation to determine the culture surrounding fatigue management and fatigue reporting • Ensure the fatigue reporting systems are supported by good workplace culture surrounding fatigue management
		I2	Reporting	
J	**FATIGUE CRITICAL TASKS**	J1	Emergency situations	• Confine higher risk activities to times when two or more workers are present • Avoid higher risk activities during the low point in the circadian rhythm (i.e. 3am to 5am) • Establish double-checking processes to scan for errors • Encourage working in pairs or teams where the task allows (buddy system) • Provide opportunities for task rotation to prevent boredom or complacency • Develop task checklists to ensure all work processes and procedures are followed correctly and no critical steps are missed • Develop self-assessment checklists for workers to identify signs and symptoms of fatigue • Ensure communication/briefings are conducted at shift handovers (written/verbal/face-to-face) to ensure consistency and transference of critical information
		J2	Safety critical tasks	
K	**WORK DEMANDS**	K1	Repetitive tasks	• Schedule tedious and boring tasks for times of the day when alertness is high and leave the stimulating and motivating tasks for times for the day when alertness is lower • Provide opportunity for regular rest breaks at least every three hours for normal work tasks and every two hours for driving (self-managed and scheduled) • Redesign jobs to limit periods of excessive mental and physical demands • Introduce job rotation to limit build-up of mental and physical fatigue • Provide supervision to monitor work process and worker fatigue • Provide opportunities to increase interaction with peers - increased communication with co-workers can assist with remaining alert and focused on the job • Provision of appropriate break facilities (e.g. lunchroom, access to vending machines with healthy snacks, caffeinated drinks, etc.)
		K2	High mental workload	
		K3	Low mental workload	
		K4	High physical demands	

Appendix D: Fatigue Self-Assessment Tool Example



Fatigue controls guide

Based on total prior sleep wake score, determine the Fatigue Risk Band and appropriate actions (table below).

PSW score	Fatigue-risk band	Actions
0	Low	No additional risk mitigation strategies required. Monitor for signs and symptoms of fatigue and report to immediate Supervisor if/when these are noted.
1 – 4	Moderate	Personal risk mitigation strategies required (e.g. task rotation, self- managed rest breaks, double checking processes).
5 – 10	High	Personal and supervisory risk mitigation strategies required (scheduled rest breaks, supervisory checks, task reassignment to non-safety critical duties, team work).
10 +	Extreme	The individual is to be considered "not fit for duty" and relieved from duty as soon as possible. Alternative transport is to be offered to return worker to place of accommodation. Consider providing alternative transport back for next shift where own transport has been used to get to work.

Note: The above tool cannot provide a definite measurement of fatigue, so should only be used as a guide and in conjunction with consideration of other factors and individual differences. Should a worker experience alertness scores in the red-black zone on a regular basis, it is recommended advice from a medical practitioner be sought.

Appendix E: Individual Alertness Assessment Example

This assessment is a subjective assessment of your individual alertness using the Karolinska Sleepiness Scale[26] and could assist in predicting potential impairment as the shift progresses. If you assess your alertness to be a 6, 7, 8 or 9, talk to your supervisor and work together to determine the control measures that should be put in place based on the controls guide.

1	Extremely alert
2	Very alert
3	Alert
4	Rather alert
5	Neither alert nor sleepy
6	Some signs of sleepiness
7	Sleepy, but no effort to keep awake
8	Sleepy, some effort to stay awake
9	Very sleepy, great effort to keep awake, fighting sleep

Fatigue controls guide

The following table provides a guide to the controls that could be adopted following an individual alertness assessment.

Alertness Score	Risk Level	Controls
1-3	Low	• No specific controls necessary • Maintain good sleep hygiene to keep fatigue levels controlled
4-5	Moderate	• Rotate high risk, mundane and physically and mentally demanding tasks between workers • Ensure regular breaks throughout shift (i.e. every three hours) • Increase supervision and monitoring of worker • No solo work on high risk tasks • Overtime should be avoided where practically possible
6-7	High	• Supervisor to conduct fatigue assessment on worker • Worker shall not lead high risk tasks • Rotate high risk, mundane and physically demanding tasks between workers • Supervisory checks to be conducted regularly • Implement fatigue proofing strategies • No driving of vehicles or operating heavy machinery
8-9	Extreme	• Intolerable risk – no worker to commence or continue work beyond this threshold • Worker suspended from all work tasks until sufficient sleep obtained and fatigue is deemed to be controlled • Alternative transport to be offered to return to place of accommodation

Note: The above tool cannot provide a definite measurement of fatigue, so should only be used as a guide and in conjunction with consideration of other factors and individual differences. Should a worker experience alertness scores in the red-black zone on a regular basis, it is recommended advice from a medical practitioner be sought.

Appendix F: Potential Key Performance Indicators[2]

FRMS Element	Example Lead Indicator Metrics	Example Lag Indicator Metrics
Policies and Procedures	• Percentage of audit findings where a deficiency in fatigue management policies and procedures was evident • Fatigue management policies and procedures are updated and controlled within scheduled dates • Percentage of sites that have received communication regarding the fatigue management policy and procedure requirements	• Percentage of workers that have read fatigue management policies and documents
Roles and Responsibilities	• Percentage of sites that have established a fatigue management committee or working group • Percentage of sites where roles and responsibilities are clearly defined and documented • Percentage of contractors who have a FRMS in place	• Percentage of investigations in which a lack of clear roles and responsibilities with regard to fatigue was identified
Risk Management Processes	**Hours of work**	
	• Percentage of shifts that comply with rostered work hours • Percentage of shifts that exceed organisation's tolerable level in planned roster and actual hours worked • Percentage of hours worked on overtime • Percentage of unfilled positions	• Percentage of near misses or incidents occurring during times in the roster where the likelihood of fatigue-related impairment is increased • Percentage of near miss or incidents that identified overtime and callouts as a contributing factor to reduced sleep resulting in fatigue
	Work tasks	
	• Percentage of safety critical tasks scheduled during the circadian low period	• Percentage of investigations in which task performance impairment was identified due to fatigue

FRMS Element	Example Lead Indicator Metrics	Example Lag Indicator Metrics
	Environmental conditions	
	• Percentage of shifts that have facilities in place for managing working conditions that may impact on fatigue levels • Percentage of site-based sleeping facilities that comply with sleep hygiene assessment	• Percentage of investigations that showed evidence that fatigue-inducing environmental conditions had been experienced leading up the event
	Fitness for work	
	• Frequency of workers reporting fatigued, not fit for duty or tired before or during a shift • Percentage of workers diagnosed with a medical condition that may impact on sleep or alertness at work • Percentage of random drug and alcohol tests conducted	• Percentage of investigations identifying underlying health issues or sleep disorders that contributed to fatigue in these incidents • Percentage of investigations that show an individual's medication contributed to fatigue associated with the incident
	Risk assessment	
	• Percentage of sites that have undertaken a fatigue risk assessment • Percentage of existing fatigue risk assessment reviewed within scheduled dates • Percentage of fatigue risk assessments that have considered the work environment • Number of individual risk assessments triggered as a result of a self report or observation	• Percentage of incident investigation that show that no assessment of the potential fatigue risks had been conducted prior to incident • Percentage of investigations that show that effective fatigue mitigation strategies had not been implemented prior to incident

FRMS Element	Example Lead Indicator Metrics	Example Lag Indicator Metrics
Reporting System and Processes	• Percentage of corrective action close outs	• Percentage of hazard reports related to fatigue • Percentage of self-reports related to fatigue • Percentage of observations related to fatigue
Auditing and Assurance	• Percentage of audit/assurance templates that include assessment questions regarding fatigue • Percentage of audit/assurance findings regarding fatigue	• Percentage of investigation reports which found an absence or systematic issue with internal and external assurance and auditing processes.
Communication and Consultation	• Number of safety interactions/walk arounds undertaken at each site location	• Percentage of workers who attended a fatigue-related toolbox talks/pre-start briefing • Percentage of workers involved in fatigue risk assessment processes
Training and Education	• Percentage of workers that have been provided with fatigue management training • Percentage of workers assessed as competent in fatigue management training	• Percentage of near miss and incident investigations in which a lack of adequate training in fatigue management has been identified • Percentage of investigations in which fatigue management processes and tools were not used effectively
Investigation	• Percentage of safety investigators who have received fatigue investigation training	• Percentage of investigation reports that assess the contribution of fatigue • Percentage of near miss reports that make reference to fatigue
Culture and Leadership	• Percentage of workers that have been provided with cognitive behavioural safety training • Percentage of leaders that have been provided with cognitive behavioural safety training	• Results from safety climate/culture surveys