ENERGY SAFETY CANADA

Fatigue Risk
Management

How to Build and Use a Fatigue Risk Management Program

**National Safety Association
for Canada's Energy Industry**

Disclaimer

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Preface

Purpose

This guideline aims to help organizations design and implement an effective Fatigue Risk Management Program. The goal of the program is to reduce incidents, injuries and damage where fatigue is recognized as a risk factor.

This guideline is intended for energy industry supervisors, managers, health and safety personnel, senior management and executives, fatigue risk management committees, stakeholder groups and others responsible for designing and implementing a Fatigue Risk

Management Program.

This guideline can be used by any organization within or supporting the energy industry to identify and develop components necessary to manage risk related to fatigue. Organizations may use this guideline to implement a program of Fatigue Risk Management that addresses all or some of the elements. As some operations may not meet the requirements of all components, the guideline allows organizations the flexibility to accommodate their specific needs.

PROJECT SCOPE AND LIMITATIONS

This guideline includes information about workplace fatigue, fatigue risk management issues and strategies and how to design and implement a Fatigue Risk Management Program. The guideline does not explore the science of fatigue, remedies for fatigue or effective personal approaches to prevention.

This guideline does not replace any in-depth training. It is intended as a framework to help identify components to consider in a Fatigue Risk Management Program. Detailed

information on scheduling strategies and application of hours of service are not included.

This guideline describes several concepts and components. Built on industry best practices, it provides a non-prescriptive, flexible Fatigue Risk Management Program outline. While representatives from various companies have agreed that this advice seems appropriate for their organizations, the specific approach and its terminology might not be suitable for all.

Regulations

Each provincial and federal Occupational Health and Safety jurisdictional authority has a well-established occupational health and safety regulatory framework. The Occupational Health and Safety legislation in each jurisdiction defines the responsibilities of employers, supervisors and workers to work safely and follow safe work practices. The employer's legal obligation is to ensure compliance with current regulatory requirements and the required qualifications and competencies of all supervisors and workers. Workers engaged

in transportation activities may be further regulated by legislation regulating their work hours.

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1.0 Introduction

When assessing an organization's health and safety hazards, fatigue is an important subject for companies to include. Fatigue's impacts extend to both home and the workplace. Studies suggest that fatigue impacts an individual in similar ways that alcohol impairment does. Employers, therefore, have safety and business reasons to include fatigue as part of their overall safety and risk management program.

It is important to recognize the factors that impact fatigue. These factors extend beyond traditional factors such as scheduling and work types. Employers enhance workplace safety culture by identifying and managing fatigue risk factors.

The key steps, components, and practices for developing a Fatigue Risk Management Program are depicted in the diagram below. An employer building a Fatigue Risk Management Program needs to involve management leadership and multiple employee levels in the development process. A steering committee is often useful in this regard.

Fatigue risk management components can be selected and combined to create an effective program. Smaller organizations may develop fatigue risk management principles based on those components and safe work practices. When a program has been developed and implemented, consideration should also be given to building employee competency in managing fatigue and ongoing program evaluation.

Figure 1: Implementing a Fatigue Risk Management Program

1 Initiate a Fatigue Risk Management Program
- Assess the Need
- Identify Stakeholders
- Collect Information
- Engage Stakeholders

2 Develop Program Components
- Set Objectives
- Define Roles and Responsibilities
- Develop Safe Work Practices

  - Recognize Symptoms
  - Assess Contributing Factors →
    - Sleep Disorders
    - Scheduling
    - Task Risk Assessment
    - Environmental Conditions
    - Sleeping Environment
  - Investigate Incidents
  - Develop Countermeasures

- Develop Supportive Process Plans
- Implement Program

3 Evaluate the Program
- Continuous Improvement

This guideline provides companies with information on designing and implementing an effective Fatigue Risk Management Program to reduce fatigue-related incidents and injuries among their workers.

2.0 Workplace Fatigue

Workplace fatigue refers to a state of physical and/or mental exhaustion that can significantly affect an individual's ability to perform their job effectively. This condition can result from various factors, including prolonged work hours, high stress levels, inadequate rest, poor working conditions and repetitive tasks.

2.1 How Fatigue Affects Health And Safety

Fatigue has a significant influence on health and safety both at work and at home. Fatigue causes slower reaction times, resulting in poor decisions, more mistakes, decreased performance and dangerous memory lapses. No one is immune to fatigue, and its effects impact the fatigued person's workplace, family and community.

Shift work and fatigue have been linked to health issues and disruption to social and domestic life. The highest rate of industrial incidents is usually found among shift workers, with catastrophic incidents more likely at times when workers are most prone to sleep (e.g., 12 a.m. to 6 a.m. or 1 p.m. to 3 p.m.) Research examining work and fatigue demonstrates that the probability of a workplace incident rises with a decrease in alertness.

More vehicle collisions occur on the roads in the early morning than at other times. This is when the fewest vehicles are on the road but when people experience the greatest degree of sleepiness. An analysis of commercial truck incidents found that drivers in fatigue-related incidents had an average of five and a half hours during their last sleep compared to drivers with eight hours of sleep in non-fatigue-related incidents. Additionally, evidence shows that the one hour lost in the switch to daylight savings time increases collision rates by seven per cent. In the week following the change to daylight savings, fatal incidents, both on and off the job, increased by six and a half per cent (NTSB, 1995).

In 1999, Lamond and Dawson measured the effects of fatigue and rated them against those of alcohol impairment. Findings suggest that after only 20 hours of sustained wakefulness, a person may be as impaired as someone with a blood alcohol concentration of 0.10 per cent. The results of this study support the suggestion that even moderate levels of sustained wakefulness reduce performance to a greater extent than is currently acceptable for alcohol intoxication while driving.

These findings have important implications when considering that approximately half of shift workers typically spend at least 24 hours awake on the first night shift of their work period. The results are also important for anyone working extended hours over multiple days or weeks without adequate rest periods. Similar performance impairments should be expected in workers fatigued by a sleep debt, which can accumulate over multiple shifts.
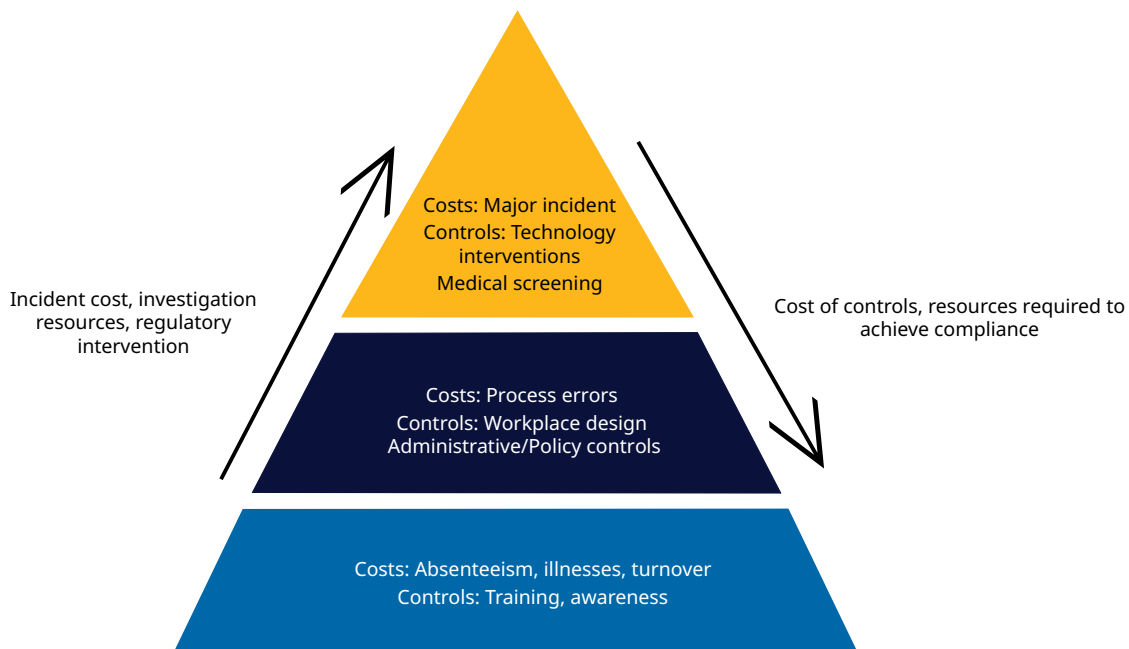
2.2 Why Manage Workplace Fatigue?

Employers are responsible for identifying and controlling hazards. Both employers and workers should consider fatigue a potential hazard contributing to mental or physical impairment. For employees, it can decrease cognition and productivity and increase incident risk and absences.

Fatigue is an issue that organizations can mitigate by implementing a Fatigue Risk Management Program. In the U.S. Refining and Petrochemical Industry, the American Petroleum Institute developed an American National Standards Institute Fatigue Risk Management for Personnel in the Refining and Petroleum Industries standard (ANSI-API RP 755, 2019). The standard guides employees, managers, and supervisors on understanding, recognizing and managing fatigue in the workplace. RP 755 also outlines how owners and operators should establish policies and procedures to address these issues in the workplace.

While each organization's risk profile differs, the graphic below represents potential costs and controls associated with fatigue risk management.

Figure 2: Costs and Controls Associated with Risk Management

Incident cost, investigation resources, regulatory intervention

Costs: Major incident
Controls: Technology interventions
Medical screening

Cost of controls, resources required to achieve compliance

Costs: Process errors
Controls: Workplace design
Administrative/Policy controls

Costs: Absenteeism, illnesses, turnover
Controls: Training, awareness

A Fatigue Risk Management Program demonstrates a company's due diligence and compliance with legal requirements. Organizations may reap substantial benefits by managing workplace fatigue, including avoiding incident costs and reducing worker absence and turnover.

When evaluating the need for managing fatigue within an organization, consider the following:

- Is there a commute to the worksite that may contribute to an extended workday?
- Are workers required to work irregular hours, shift work or be "on-call"?
- Are the worker's tasks mentally engaging?

- Are workers active or sedentary in their tasks?
- What could the outcomes of a fatigue-related incident be for workers in each role?
- Do the physical work conditions require heavy activity or work in extreme conditions?
- Have there been unexplained losses or incidents where no cause could be identified, but fatigue could not be ruled out?
- Is there a requirement for a critical response to an alarm or alert?
- Does the sequence of tasks or workflow induce fatigue-related errors?
- Is psychological safety low within the workforce? If yes, this could trigger mental and physical fatigue.

Organizations may find the evaluation process example in Appendix C helpful in determining an appropriate level of control for their evaluation. This example may not apply to all situations, but working through the evaluation may help identify gaps in an existing program.

2.3 How A Fatigue Risk Management Program Can Help

Similar to programs for substance use and dependency, a Fatigue Risk Management Program is part of an overall health and safety program. Often, it is part of a "fitness for duty" policy. A Fatigue Risk Management Program is intended to help companies increase employee awareness of fatigue and manage the associated risk factors to prevent or reduce fatigue-related loss, including injury, illness, productivity interruption, environmental or reputation.

3.0 Understanding Fatigue Risk Management

3.1 Impact Of Fatigue On Performance

Most individuals require around eight hours of sleep per day, some needing a bit more and others a little less. However, those who do not get enough sleep each day can develop a sleep debt that adds up over time. The fatigue can lead to the following hazardous conditions, effects or behaviours:

- More mistakes than usual
- Poor logic and judgment, including taking risks the worker would usually not take
- Decreased alertness and watchfulness
- Failure to respond to changes in surroundings or situations
- Slower reflexes and reactions
- Mood changes (e.g., giddy, depressed, irritable, impatient, boredom, restlessness)
- Microsleeps (See Glossary for definition)
- Automatic behaviour (See Glossary for definition)
- Prone to take shortcuts to get the work done faster

An accumulated sleep debt may also result in the inability to:

- Respond quickly or correctly to changes or alarms
- Make good decisions or plans (fit for duty)
- Solve problems
- Concentrate
- Communicate well

- Handle stress
- See clearly
- Recall

Studies also show that fatigued workers are more often absent from the workplace (i.e., sick) and cause more incidents than other workers. Fatigued workers tend to avoid complex tasks, work slower, check their work more and rely more on their co-workers.

3.2 Factors Associated With Fatigue

In addition to sleep debt conditions, fatigue can affect workplace health, safety and performance in various ways. The following factors can impact fatigue levels:

- Work scheduling
- Work task type and length

- Work and workplace conditions
- Worker health (fit for duty)
- Worker stress
- Workplace health and safety culture

These factors are covered in more detail below.

3.2.1 Work Scheduling

The time of day when people work has a significant impact on fatigue. For this reason, Fatigue Risk Management Programs should address work scheduling, which may include, but is not limited to:

- Long hours of physical or mental activity
- Breaks
- Rest between workdays

- Shift work
- Extended or compressed workweeks and day-off patterns
- On-call requirements
- Travelling across time zones
- Travelling between the work site and accommodations (i.e., during the shift)

Choosing an optimal schedule

When designing work schedules, risks can be better managed when companies consider employee needs in addition to operational efficiency and effectiveness. Optimal scheduling can be achieved by aligning shift schedules with natural body rhythms.

Optimal scheduling provides the following benefits:

- **Efficient:** Schedules poorly aligned to normal human sleep patterns and social

compatibility have been linked to increases in direct labour expenses and indirect cost factors such as absenteeism, turnover, incidents and injuries.

- **Effective:** Optimal schedules facilitate employees' fast adjustment to the schedule.
- **Appealing:** Optimal shift schedules better match employees' needs and preferences, which can increase competitiveness for attracting candidates.

Shift work characteristics

Much research has been done to understand how shift work characteristics impact fatigue. Some key characteristics to consider include:

- Shift length (i.e., hours and times)
- Fixed shift schedules

- Rotation of shifts
- Days off
- Weekends off

Refer to Appendix B for additional guidance on shift work and fatigue risk management.

Breaks

Companies should generally schedule tasks for sufficient rest breaks and recovery time. Companies should consider providing guidance on proper nutrition, suitable rest areas and opportunities for physical activity.

Extended day and multiple-day schedules should be avoided whenever possible. If it is not possible, then increasing the number of rest breaks for workers should be considered.

Travel

For work in remote locations, companies should consider scheduling that will allow workers to get on-site or to dedicated accommodations before their shift. Before the shift, the workers should be expected to prepare for their shift, including getting adequate sleep.

Employees should treat their work-related travel time as regular work time regarding

fatigue risk management (e.g., scheduled rest, nutrition and physical activity breaks). After working away from home for extended periods, workers should be advised to rest before driving home.

For additional information on fatigue or drowsiness that may occur with work-related travel, refer to Energy Safety Canada's Journey Management Guideline.

3.2.2 Work Task Type And Length

Fatigue and its effects are made worse by two kinds of work:

- Simple or monotonous tasks lasting half an hour or more
- Complex, mentally challenging tasks

Simple or monotonous tasks are not stimulating enough to keep a tired mind on task, while challenging tasks are too stimulating for a tired mind to cope. When

designing jobs and assignments, the fatigue factor should be considered for effective fatigue management.

In general, jobs should be structured to minimize the duration of repetitive, monotonous tasks and tasks with a high cognitive workload. Table 1 lists some typical upstream petroleum tasks that carry these risks.

Table 1: Typical Upstream Petroleum Tasks Carrying Fatigue Risks

Simple/Monotonous Tasks	Mentally Challenging Tasks
Driving to and from a worksite (a complex task often treated as a simple one)	Driving to and from a worksite
Monitoring gauges	Flow rate calculations
Waiting on lease	Assessing load lift parameters
Repetitive tasks	Determining mud viscosity
Fire watch/safety watch	Determining G-force on centrifuges
Cleaning equipment	Equipment start-up

3.2.3 Work And Workplace Conditions

Work and workplace conditions can also aggravate fatigue. Tasking environments can increase a worker's susceptibility to fatigue. Some examples include:

- Working outdoors with exposure to extreme cold or heat
- Areas with high noise levels
- Poor ventilation
- Personal Protective Equipment (PPE) such as respirators and heavy clothing

In general, a company should take the following measures to mitigate work and workplace conditions that can contribute to fatigue:

- Create a work environment that promotes alertness
- Implement controls to mitigate the effect of or reduce exposure to fatigue
- Ensure sufficient resources of personnel, equipment and support
- Structure hours of work to avoid the hottest or coldest periods of the day
- Provide additional fluid and/or nourishment
- Adjust time factors to incorporate the additional physical requirements and challenging environmental and physical conditions
- Select PPE appropriate to the situation to limit the duration of tasks requiring PPE
- Design or select equipment that is engineered for ease of use with minimal opportunity for error or misuse
- Create a work environment that promotes psychological safety

3.2.4 Worker Health And Stress

A worker's health and stress levels can also contribute to how they are affected by fatigue. If they have conditions such as depression, diabetes or hypertension or short-term illnesses like colds or allergies, they can be more easily fatigued.

Over-the-counter or prescription medication could also affect sleep or cause drowsiness. For example, some medications for cold symptoms, back and muscle pain and nausea can cause drowsiness.

In addition, sleep disorders can worsen fatigue.

Physical or neurological sleep problems such as insomnia, sleep apnea, Rapid Eye Movement (REM) behaviour disorder, sleepwalking, restless legs syndrome, or periodic limb movement syndrome may increase fatigue.

Stress is known to have a detrimental effect on physical, mental and emotional health. Whether it is due to issues at work or at home, stress can increase a worker's vulnerability to fatigue at the workplace.

Some examples of stress-related symptoms are included in Table 2.

Table 2: Stress-related symptoms, which may increase vulnerability to fatigue

Chest pain	Stomach/bowel problems	Forgetfulness
Decreased sex drive	Substance abuse	Irritability
Headaches	Weight changes	Resentment
Indigestion	Anxiety	Insomnia
Muscle aches	Depression	Fatigue

Health and stress levels also determine whether a worker is considered fit for duty. "Fit for Duty" refers to a condition in which an employee's physical, physiological, and psychological state enables them to safely and continuously perform assigned tasks.

Refer to Appendix A for more information on this topic.

3.2.5 Workplace Health And Safety Culture

Sound fatigue risk management considers the role of health and stress in an effective workplace safety culture.

A workplace that rewards productivity over health and safety is not likely to take fatigue seriously as a hazard. To be successful, a Fatigue Risk Management Program should be built within the foundation of an effective and

functioning workplace safety culture.

If a positive health and safety culture has not been established within the company, introducing a Fatigue Risk Management Program can be a crucial step toward enhancing it.

A company culture that supports a Fatigue Risk Management Program would demonstrate the following:

- Promote and communicate a corporate message stressing the importance of fatigue risk management

- Recognize individuals who apply fatigue risk management strategies
- Include fatigue risk management planning as a measure of job performance and post-job evaluations
- Ensure that incentive programs do not promote worker fatigue
- Manage people who are deemed unfit for work because of fatigue with fairness
- Not penalizing workers who refuse to work due to work-related fatigue (e.g., rest periods will not be deducted from sick days, holidays, or banked-time days).

4.0 Initiating a Program

This section outlines some options for initiating a program for Fatigue Risk Management.

4.1 Program Development

Groups or individuals may lead the effort to develop a company Fatigue Risk Management Program. Initial research should include a risk evaluation and needs assessment. To make the business case, they may be asked to provide evidence of the issues associated with fatigue and the solutions available, including the

associated costs and benefits to the company. Senior management and leadership need to support the program financially and through policy direction. Program success will be greatest if senior management and leadership involvement, commitment and accountability are secured at the beginning.

4.2 Collecting Information

Before assembling a stakeholder group to design a Fatigue Risk Management Program, a file of applicable, credible and useful information should be collected on the topic of fatigue relevant to the business. The information can then be shared with stakeholders about relevant fatigue hazards. This ensures that all stakeholders have the same knowledge base from which to draw conclusions and contribute to program development.

Recognizing the need to help reduce the number of incidents and injuries related to fatigue, other industries in Canada have started to develop Fatigue Risk Management Systems. Below are examples:

- In 2007, Transport Canada commissioned a set of tools and guidelines to help the Canadian aviation industry set up fatigue risk management systems.
- The North American Rail Industry also developed online educational resources

to educate members of their industry on fatigue, such as the North American Rail Alertness Partnership and Railroaders' Guide to Healthy Sleep.

- In 2012, The American College of Occupational and Environmental Medicine (ACOEM) developed a guidance statement on fatigue risk management in the workplace. The guidance statement assists with developing, implementing and sustaining fatigue risk management systems.

- In 2014, a consortium of government and industry agencies developed the North American Fatigue Management Program (NAFMP) for the commercial trucking industry. The NAFMP is a comprehensive approach to address the issue of driver fatigue, including extensive information and online education.

- The mining industry faces significant fatigue-related risks, particularly in remote locations with long shifts. Mining companies in Canada have implemented FRMS to manage the demanding work schedules and ensure workers' safety.

- The oil and gas industry, particularly in remote operations like offshore platforms, requires strict management of fatigue due to the hazardous nature of the work. Companies have adopted FRMS to ensure workers are well-rested and alert.

- CSA Z1615:22, First responder fatigue risk management system: This Standard sets out requirements and provides guidance to support Canadian first responder organizations in mitigating the risk of harm if fatigue is present by identifying hazards and assessing and controlling risks.

Additional information and references are provided in Appendix A.

4.3 Stakeholder Engagement

A program that helps promote increased input and wider support can be developed using a Learning Team approach. All phases of program development and implementation include multifunctional teams from different levels and types of work, such as:

- Frontline workers
- Supervisors
- Managers
- Occupational health and safety personnel
- Executives
- External stakeholders, (e.g., prime contractors, subcontractors, regulators, etc.)

It is also important to include individuals responsible for work scheduling. Consider whether the staff selected by management, or their coworkers will provide quality input or lend credibility to the program.

Learning Team members' roles and responsibilities should be clear at the outset. The tasks could be divided equitably based on skills and available time. As many people with individual commitments and priorities are involved, the team's work can often go off course or become delayed. To counteract this, the Learning Team should set clear, achievable work goals and timelines at the beginning to track and refocus the team's progress.

5.0 Developing the Components

A fatigue Risk Management Program can include many components. Some are essential, such as a statement of the program's objectives. Other components, such as practices and procedures for shift work, should be included only if applicable.

The typical components of a Fatigue Risk Management Program may include, but are not limited to:

- Objectives
- Roles and responsibilities
- Safe work practices and procedures
- Supportive process plans
- Program implementation
- Program sustainability and continuous improvement

Components are selected based on their application to the company's business and can be customized for large and small organizations. The components can be integrated with existing health and safety management systems. Based on the components and safe work practices, a fatigue risk management program may be developed for smaller organizations.

5.1 Objectives

A well-received and implemented program has a clear objective statement that is easy to understand and includes:

- A brief introduction that provides context
- Objective, purpose or over-arching goal of the program
- A policy statement
- The intended audience (e.g., safety critical positions)
- Situations the program components apply and do not apply, (i.e., scope and limitations)
- How the objectives are monitored, enforced, upgraded and sustained
- Costs required to implement and maintain the program

Example Fatigue Risk Management Policy

[Company Name] is committed to providing a safe work system and a safe and productive workplace by eliminating conditions and work practices that could lead to personal injury, productivity losses and damage to equipment, property or the environment.

Fatigue can impair fitness to work and may have negative impacts in the areas of health, safety, security and the environment. **[Company Name]**'s objective is that all employees recognize this threat to manage and minimize the associated risks.

5.2 Roles And Responsibilities

The employer has responsibilities in a Fatigue Risk Management Program. These responsibilities may include, but are not limited to:

- Ensuring safe work practices
- Ensuring adequate resources are available to develop, implement and sustain a Fatigue Risk Management program
- Ensuring an appropriate work shift design that allows for adequate recovery periods
- Ensuring adequate assessment, control and monitoring of fatigue-related hazards and risks
- Developing policies and procedures that support fatigue risk management (e.g., overtime, napping, commuting, etc.)
- Building competency and disseminating information regarding fatigue risk management
- Stopping work when the activities are unsafe due to fatigue

Supervisor and planning scheduler responsibilities in a Fatigue Risk Management Program may include, but are not limited to:

- Providing adequate time for workers to perform their assignments without unduly increasing fatigue risk
- Monitoring workers
- Being informed on the symptoms of fatigue and intervening where the symptoms of fatigue are discovered
- Stopping work when the activities are unsafe due to fatigue

Employees have responsibilities in a Fatigue Risk Management Program. These responsibilities include, but are not limited to:

- Arriving at work fit for duty by obtaining adequate sleep
- Managing lifestyle to minimize fatigue
- Reporting all fatigue-related near-misses and incidents
- Maintaining an awareness of fatigue
- Supporting and participating in risk mitigation strategies
- Stopping work when the activities are unsafe due to fatigue

5.3 Safe Work Practices And Procedures

Safe work practices are the guidelines or rules that must be followed to ensure safety in the workplace. Procedures are the exact steps to be taken to execute tasks safely. Both discuss rationale, roles and responsibilities. Safe work practices and procedures should be developed to address the following four areas:

- Recognizing the effects, signs and symptoms of fatigue and assessing the level of fatigue risk
- Assessing the causes and contributing factors for fatigue, including fit for duty

- Investigating incidents and near misses which may be fatigue-related
- Developing appropriate preventative actions to eliminate fatigue or reduce the impact of fatigue

Each of the four safe work practices is described in greater detail below. Refer to Section 3.0: Understanding Fatigue Risk Management for information on fatigue risk management issues and strategies that may relate to your company. Other fatigue information sources are listed in Appendix A.

5.3.1 Recognize Symptoms Of Fatigue In Workers

Workers and employers should be able to identify when they or others are fatigued.

Table 3 outlines several methods for to identify fatigue.

Table 3: Methods to Identify Fatigue

Recognizing Fatigue as a Hazard	Surveys and/or technologies (e.g., actigraphy) may be used to gather information about the prevalence and impact of fatigue. Refer to Appendix C for additional details on recognizing fatigue proactively as a hazard.
Self-Assessments	Workers may use self-assessments to manage fatigue. Fatigue assessment tools assist workers in deciding their potential fatigue-related risk level.
Alertness Monitoring Devices	Monitoring devices may be utilized in real-time to identify symptoms of drowsiness. These include devices that alert the worker if symptoms of low alertness are detected.

5.3.2 Assess Fatigue Contributing Factors

Characteristics of the people and processes (i.e., schedules, tasks or environment) may contribute to the fatigue risk level. These can be assessed and managed within the Fatigue Risk Management Program. These include the following.

Sleep Disorders

Some people may not achieve an appropriate quantity and quality of rest due to sleep disorders. Sleep disorders such as sleep apnea, insomnia or restless leg syndrome can interrupt normal sleep patterns and compromise health. Self-assessment tools or medical consultations with sleep specialists may be used to identify if a worker may have a sleep disorder.

Shift Schedules

Some shift schedules may not provide sufficient sleep opportunities for workers, resulting in an increased risk of fatigue. Scheduling strategies should be used to ensure adequate opportunities for employees to sleep and recover. At a minimum, rosters should comply with any applicable hours of service regulations.

Bio-mathematical models have been developed to quantify the effects of circadian and sleep/wake processes as they relate to fatigue and performance. These models use algorithms based on the time of day, i.e., circadian or natural body rhythms. The length of time asleep and awake throughout the overall pattern of work and non-work periods is used to predict an average level of work-related fatigue. Models may be used to assess the fatigue-related risk associated with certain schedules. Modelling may be used to prioritize remedial action for workers or work schedules that are at the highest fatigue-related risk.

Task Risk Assessments

Some tasks may be more likely to cause fatigue or induce fatigue-related errors. Activities with a high physically demanding workload (e.g., manual material handling) and/or mentally demanding processes may result in higher levels of fatigue. Tasks of long duration that are repetitive or monotonous also result in higher levels of fatigue. Workshops or surveys might be considered to provide an opportunity for workers to identify the tasks perceived to be related to fatigue. Consideration should also be given to prioritizing controls for fatigue-related tasks that are safety critical.

Environmental Conditions

Elements of the work environment can promote or reduce alertness. Conditions to consider that may contribute to drowsiness include:

- Low lighting
- High noise levels
- Hot or cold temperatures
- Poor ergonomic design of workspace

Sleeping Environments

Accommodation, both at work and home, and rooms used for napping should be evaluated to ensure they are conducive to undisturbed sleep.

Variables to consider include:

- Noise: The environment should be quiet or have low noise levels.
- Temperature: A slightly cool room temperature can help lower body temperature and signal the body for rest.
- Lighting: A dark room is preferred as lighting can interfere with the body's natural sleep-wake cycle.
- Bedding/mattress: Comfortable bedding and mattress ensure restful sleep and should be supportive enough for your body type.
- Distractions: Remove or minimize distractions to create a calm and organized space (e.g., electronic devices, television)

Mental Health

Poor mental health can exacerbate feelings of exhaustion and lead to a cycle where fatigue and mental health issues reinforce each other.

Mental health conditions such as anxiety and depression often lead to sleep disorders, which can cause significant fatigue.

Lack of restorative sleep can impair cognitive function and physical health, compounding fatigue.Creating a culture where mental health is openly discussed and supported leads to a supportive work environment. Offer training for managers and employees to recognize signs of mental health issues and respond appropriately.

Fit for Duty

"Fit for duty" directly relates to managing fatigue, as it encompasses ensuring that an individual is physically, mentally, and emotionally capable of performing their job

safely and effectively. Fatigue is a key factor that can impair an employee's ability to be fit for duty, and addressing it is essential for maintaining workplace safety and productivity.

Many organizations implement policies to

ensure employees are not fatigued when reporting to work. This might include limits on work hours, mandatory rest periods, and monitoring of shift patterns to prevent excessive fatigue.

5.3.3 Investigate Incidents

Managing fatigue requires recognizing and assessing fatigue as a possible factor in workplace incidents and near-misses. Normal incident investigation questions should provide the investigator with an indication of whether fatigue could have contributed to the incident. A review of the incident and near-miss reports may also be conducted to identify any trends of fatigue-related occurrences.

Bio-mathematical modelling may be used to assess the fatigue-related risk associated with the schedule used during incidents. The information may be used to determine the extent to which fatigue may have contributed.

Refer to Appendix C for additional details (i.e., investigation questions used to recognize fatigue as a contributing factor to incidents).

5.3.4 Develop The Appropriate Risk Mitigation Strategies

To eliminate or reduce the impact of causes and contributing factors of fatigue, appropriate

preventative/corrective actions should be taken. Consider the following:

Fatigue Mitigation Strategies

Workers are expected to use the time off work to obtain adequate sleep. If fatigue is experienced during work, workers can take actions to counter fatigue using various techniques. Actions to consider include:

- Eat low-fat, high-protein foods and avoid sugars and carbohydrates as they may cause a decrease in performance over the longer term (i.e., sugar-crashing)

- Drink water to avoid dehydration

- Use caffeine in moderation and avoid caffeine a few hours before sleeping, as the stimulant effect may make it more difficult to fall asleep

- Naps of about ten minutes in duration can have positive effects on alertness and performance. Time should be provided after the nap to recover from grogginess or sleep inertia that may occur.

Commuting

Workers who commute when tired present a serious risk to their safety and the safety of others. Strategies should be developed for workers who may leave their shifts tired. Support options should be implemented (e.g.,

Buses, taxis, or sharing transportation with a non-fatigued driver).

5.4 Supportive Process Plans

Supportive process plans are developed to implement the Fatigue Risk Management Program components. For example, some of the ways a company can eliminate or reduce the impact of fatigue is to:

- Have facilities for naps and consider the quality of rest accommodation (e.g., hotels, camps, etc.)
- Consider the proximity and location of the accommodations to other necessities (e.g., food, laundry, etc.)
- Make referrals to the EFAP (Employee & Family Assistance Program)

- Use proper scheduling to ensure adequate rest
- Minimize travel time between camps and workplaces (i.e., rigs and construction sites)

In addition, some components may require more work or new procedures for other staff or departments. For example, hiring practices may change and managers and the human resources department may need to adapt existing policies.

A benefit of planning a supportive process in the program is that these processes are not overlooked or rushed during implementation.

5.5 Program Implementation

When the research is complete, program wording can be finalized.

Relevant documents, such as policy, guidelines, etc., should be distributed to those who need them during the program launch. The stakeholder group should discuss a method for keeping documentation current. For documentation suggestions, refer to Appendix D.

The Fatigue Risk Management Program should clearly indicate what kind of training will be needed initially. Further training will be needed to support the program and reach staff not covered initially. The program should identify the ongoing training needs and implementation requirements.

5.5.1 Training

To maximize the program's value, staff should be trained in fatigue management.

The program should detail training specifics as outlined in Table 4.

Table 4: Details for program training

Training plan	When, where, and to whom training is given (e.g., initial training versus ongoing training, training during orientation, a special session, regular safety meetings, one time or regularly, etc.)
Trainers	Who provides the training (e.g. supervisors, management, safety personnel, consultants, etc.)

Training methods	How the training is delivered (e.g., self-directed, one-on-one, or in groups; paper, video, electronic, lecture-style or participatory, evaluation, Pass/fail marks, etc.).
Training resource material	Resources required for the training (e.g., slides and equipment for the trainer, handouts or information booklets or wallet cards for trainees, etc.)

Training Content

To ensure the success of the Fatigue Risk Management Program, employees should receive training in the following areas:

- Their roles related to fatigue
- How the program is customized to your company
- Where to find the fatigue risk management program within your health and safety program

Supervisors and senior management should have the following additional training:

- Assessing and documenting a worker's level of fatigue
- Monitoring and enforcing Fatigue Risk Management Program policy, practices and procedures
- Reporting fatigue assessment for incidents
- Considering fatigue in investigations
- Promoting effective fatigue prevention techniques
- Supporting the Fatigue Risk Management Program
- Reporting program feedback

5.5.2 Ensure Competency

The program should state how competency will be verified. Performance standards and mechanisms for verifying competency should be determined.

6.0   Program Evaluation

Any effective program requires regular, formal evaluation (e.g., quarterly, annually, etc.) to determine its effectiveness. Program evaluations measure the success of the program's goals and objectives. Regular evaluation ensures the program is working and allows for continuous improvement.

During program development, an evaluation plan should be created, which could include, but is not limited to:

- Pre-determined review dates
- Commitment from senior management and executives to carry out and act on reviews as scheduled
- A feedback method involving all affected personnel and incorporating management accountability and participation
- Development of key measurements
- A reliable data collection method, i.e., empirical and anecdotal

- A meaningful analysis process with evaluation criteria based on overall program goals and specific performance objectives
- An efficient program document revision process

Reviews can help ensure that processes and work practices align with the program.

7.0   Summary

Understanding and addressing workplace fatigue is crucial for maintaining a healthy, productive workforce and ensuring overall organizational efficiency. Both employers and employees have a responsibility to manage risks related to fatigue. This guideline provides a framework of key components, safe work practices and considerations to help Canadian oil and gas industry members establish a Fatigue Risk Management Program for their organization.

The information in this document, along with other information sources referenced, is intended to help build an effective risk-based program that is scalable to suit a variety of operational capabilities.

ENERGY SAFETY CANADA

Appendix A: References and Resources

The list of documents and information sources provided below includes any documents or websites consulted in the research for this guideline or referred to within this guideline. Several additional sources are provided that are useful for reference for basic information on fatigue science, health and safety and programs. This list is not exhaustive. Web addresses listed are current at the time of publication but are subject to change.

Document Name Or Information Source	Availability
ACOEM (2012). Fatigue Risk Management in the Workplace. American College of Occupational and Environmental Medicine.	https://acoem.org/Guidance-and-Position-Statements/Guidance-and-Position-Statements/Fatigue-Risk-Management-in-the-Workplace
API Recommended Practice 755, 2nd Edition: Fatigue Risk Management Systems for Personnel in the Refining and Petrochemical Industries.	https://www.api.org/products-and-services/standards/important-standards-announcements/recommended-practice-755
Canada Safety Council – Fatigue	https://canadasafetycouncil.org/workplace-safety/fatigue
Canadian Centre for Occupational Health and Safety – Rotational Shiftwork	https://www.ccohs.ca/oshanswers/ergonomics/shiftwrk.html
Canadian Centre for Occupational Health and Safety – What is fatigue?	http://www.ccohs.ca/oshanswers/psychosocial/fatigue.html
Canadian Sleep Society	http://css-scs.ca
CSA Z1615:22 First responder fatigue risk management system	https://www.csagroup.org/store/product/CSA%20Z1615%3A22/?format=PDF
Energy Safety Canada: Journey Management Guideline	https://www.energysafetycanada.com/Resource/Guidelines-Reports/JOURNEY-MANAGEMENT-A-PROGRAM-DEVELOPMENT-GUIDE
Energy Safety Canada: Fit for Duty	https://www.energysafetycanada.com/Resource/Guidelines-Reports/Fit-For-Duty

Energy Safety Canada: Life Saving Rules	https://www.energysafetycanada.com/Standards/Industry_Standards/Life-Saving-Rules
Ild Care Foundation: Fatigue Assessment Scale (FAS)	https://www.wasog.org/dynamic/media/78/documents/Questionairres/fas_en_anon.html
Ild Care Foundation: How to use the Fatigue Assessment Scale (FAS)?	https://www.ildcare.nl/index.php/how-to-use-the-fas-fatigue-assessment-scale/
IPIECA – IOGP (2019) Managing fatigue in the workplace.	https://www.ipieca.org/resources/managing-fatigue-in-the-workplace
Lamond, N and Dawson, D. (1999). Quantifying the performance impairment associated with fatigue. J. Sleep Res. 8, 255-262.s	https://fatiguemanagersnetwork.org/wp-content/uploads/Lamond-et-al.1999_Quantifying-Performance-Impairment-Associated-with-Fatigue.pdf
National Sleep Foundation	http://www.sleepfoundation.org
NAFMP: North American Fatigue Management Program: A Comprehensive Approach for Managing Commercial Driver Fatigue.	http://www.nafmp.org/
NTSB. Factors that affect Fatigue in Heavy Truck Accidents Volume II: Case Summaries; National Transportation Safety Board	http://trid.trb.org/view.aspx?id=447928
Transport Canada: Fatigue Management Plans: Requirements and Assessment Guidelines	https://tc.canada.ca/sites/default/files/migrated/fatigue_mgmt.pdf
Railroaders' Guide to Healthy Sleep: Improve your life	https://railroadersleep.fra.dot.gov/

WorkSafe Alberta – Fatigue Management Program and Training, Hours of Service and fatigue management	https://www.alberta.ca/fatigue-management-program-and-training https://www.alberta.ca/hours-of-service-and-fatigue-management
WorkSafeBC: Managing the risk of fatigue in the workplace	https://www.worksafebc.com/en/resources/health-safety/information-sheets/fatigue-risk-in-the-workplace?lang=en
Fatigue impairment	https://www.worksafebc.com/en/health-safety/hazards-exposures/fatigue-impairment
WorkSafe Saskatchewan: Workload management	https://www.worksafesask.ca/resources/psych-health-safety-resource-centre/workplace-psychological-health-and-safety/workload-management/

Appendix B: Work Scheduling

Choosing an optimal schedule requires an understanding of shift work characteristics and how aligning schedules with natural circadian rhythms can help reduce the effects of fatigue. The cumulative nature of fatigue requires a strategy to control fatigue risk.

Shift Work Characteristics

Shift Length (Hours) and Times

People have a daily internal clock that sets circadian rhythms. These circadian rhythms are the times for sleep, alertness, eating, digestion and other body functions. These rhythms are repeated approximately every 24 hours and are designed for high activity during the day and low at night when people usually sleep. For this reason, circadian principles are more easily applied to eight-hour shifts. This relates to the effectiveness of the schedule. However, many employees favour 12-hour shifts, as they get one-third more days off than employees working eight-hour shifts. This relates to the appeal of the schedule. Worker age can be an important factor for the appeal of shift length. Older workers may find it more challenging to adjust to the frequent changes required by shift work, making an eight-hour day shift a better fit for them.

Strategies exist to try to help shift work less intrusive into natural sleep habits and social activities. One strategy is to have the shift end at a time when the shift worker can still get some sleep during "normal" sleep time e.g., a shift of 10 am to 6 pm, 6 pm to 2 am, and 2 am to 10 am. Also, staggering the length of shift can be assistive. For example, a day shift is ten hours, afternoon eight hours and night only six hours.

Another consideration for selecting shift hours and times is the timing of the shift change. Research on incident rates, performance, employee health and the social well-being of shift workers all point to the value of having later start times: shifts requiring workers to wake up before 5 am causes more circadian de-synchronization than night shifts. Finishing a shift in the early morning, e.g., between 2

am and 5 am is also considered undesirable, especially related to driving.

Whatever shift schedule a company uses their employee input will be important. With

employee input and using some of the above shift scheduling techniques in this section and sections below, a schedule can be set up that serves both employer and employee needs.

Fixed Shift Schedules

Fixed shift schedules are ones where employees are placed on a particular shift with the intention that they will remain on the shift throughout their time with the company, or at least until they are reassigned to another fixed shift. Rotating shifts involve continual movement of employees across two or more shifts. Many researchers and shift workers alike have argued strongly for fixed shift systems as they enable employees to reset their internal clocks, thereby reducing the stress caused by changing work schedules.

However, being assigned to a permanent

night shift has one area of major concern: fixed night schedules work best only if workers maintain the same sleep/wake pattern on their time off—not reverting to daytime schedules on their time off. This will likely not happen, as most of the world operates on day schedules. Similarly, fixed afternoon shifts can create social desynchronization because the most desirable social time of the day is between 5 pm and 9 pm. So, although fixed work hours provide stability, they do have some drawbacks.

Rotation of Shifts

Whether using long or short rotations of shifts, companies need to keep in mind that it takes at least one week for the circadian rhythm to adapt to a schedule change. A long rotation consists of working night shifts for four to six weeks. With this long stretch of time, a worker would probably need to work nights only twice a year with staff rotation. With a long period, a person's circadian rhythm has a better chance of changing to the night shift time. But again, to make this work, workers must keep their sleep/wake times the same even on their days off. This poses a problem for many people, as they tend to return to a day-oriented lifestyle on their days off, leaving their circadian rhythm chronically disoriented.

A short rotation would involve no more than three night shifts in a row. This quick changeover keeps the circadian rhythm from fully resetting and creates less circadian de-synchronization than weekly or long rotations. An example of a short rotation is the 1/1/1 rotation: one day shift, one afternoon shift, and one night shift followed by two days off.

Whether long or short rotation is used, a clockwise direction is the easiest on the circadian rhythm. A counterclockwise direction runs counter to the natural circadian rhythm (See Figures 1 and 2 below).

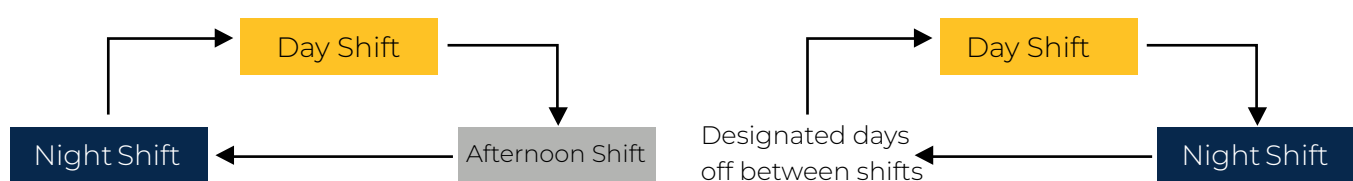**Figure 3: Clockwise Rotation of Shifts (Recommended)**

Figure 4:Counterclockwise Rotation of Shifts (Not Recommended)

Days Off

One factor related to the quality of off-time is the number of consecutive off-duty days available in the work schedule. Employee preference and scientific research both support the use of schedules with at least two consecutive days off after each set of shifts. Where this is not possible, due to efforts to create longer periods of off time elsewhere in the shift cycle, a minimum of 48 hours is recommended to follow every on-duty period, with some shift sets followed by three or more days off.

A second factor to consider in designing quality off time is the timing of those off-duty periods. Many eight-hour schedules assign an extended off-duty period to follow the day- shift sequence, leaving only minimum off-time after the evening, night, or both shifts. Yet, the latter shift places the most stress on employee health and welfare and, therefore, requires the most restoration effort. Employees not granted sufficient leisure time are often drawn to activities that tax their bodies to maximize their free time. Younger workers frequently shorten their sleep periods, returning to work fatigued. Older workers need to use their off time to recover and return to work resentful that they slept their time away.

Work schedules involving night shifts must design recovery time into the off-duty pattern so there is sufficient opportunity for rest and recuperation following the night shift.

Weekends Off

North American culture traditionally follows a five-day workweek and places great value on weekend time. Like the rest of the workforce, shift workers generally want to maximize their time off. It is important to consider the days of the week on which each new shift starts and stops. For example, a schedule that maximizes weekend time and allows for recovery time would make Thursday the last shift of the night shift assignment. This would let employees use Friday as a recovery day and still benefit from a free weekend to remain connected to their family and community.

Workers in certain segments of the upstream petroleum industry face schedules out of sync with a five-day workweek. This is usually due to operational requirements such as 24-hour operations in remote and temporary locations. This poses a greater challenge in managing fatigue. Workers need to be able to plan ahead. Schedules should be set well in advance to provide predictability.

On–call Scheduling

Like others, the oil and gas industry require some groups of individuals to remain on standby for immediate deployment. These schedules are often dictated by the need for a specific sequence of services at the worksite (cementing, transportation services) or to provide emergency support (technical, medical, and firefighting). Although

challenging, on-call scheduling should consider work/rest cycles and circadian rhythms to minimize risk to the worker and operation.

Appendix C: Recognition and Assessment of Fatigue as a Hazard

Hazard Assessment

When a supervisor suspects that a worker is too fatigued to be fit for work, having a standard procedure to follow ensures consistency. The following questions may be helpful for developing of a worker fatigue assessment tool for supervisors:

- How many hours did the employee work in the past week?
- What is the pattern of hours worked in the past week?
- Is the employee suffering from acute sleep loss?
- Does the employee have a sleep debt?
- Is the employee required to work at a time out of sync with the waking cycle of the employee's circadian rhythm?

- Do environmental factors pose an additional fatigue load?
- Does the employee's condition match the mental, physical, and emotional demands of the work?
- What is the physical intensity of work?
- Does the employee's physical fitness match the work demands?
- What events are currently going on away from work? Is the employee experiencing life stressors?
- How well has this employee coped in the past?
- Does the employee get support at work and at home?

Incident Analysis

Managing fatigue requires the recognition and assessment that fatigue is a possible factor in workplace incidents. Incident investigation questions should provide the investigator with an indication of whether fatigue could have been a contributing cause of an incident. If fatigue is considered a potential cause, the investigator can examine additional fatigue-related questions such as the following:

- When did the worker last sleep?
- Where did the worker last sleep?
- How long did the worker sleep the last time?
- Did the worker have a restful sleep?
- What was the time of the shift?
- How many consecutive hours had the worker worked?

- What and when was the worker's last break between shifts?
- How many days had the worker worked in a row?
- How many hours did the worker work on those days?

If an investigator knows or strongly suspects fatigue as a contributing cause of an incident, the investigator could also assess the following:

- Work schedule
- Work task type and length
- Work and workplace conditions
- Worker health and stress
- Workplace health and safety culture

An in-depth examination should reveal if and to what extent fatigue is a cause or contributing factor in a workplace incident.

Figure 5:Fatigue Risk Management – Decision Tree
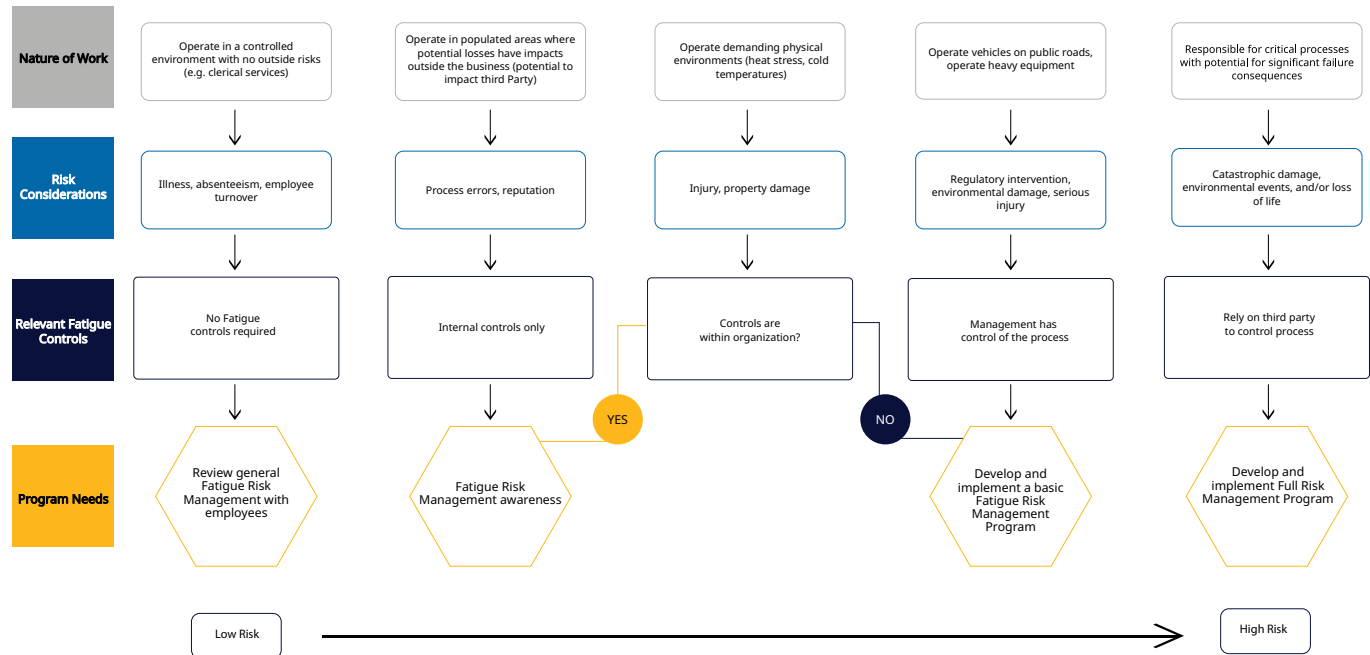
Appendix D: Documentation

Writing Up The Program

Once the research is complete and the stakeholder group has agreed on what to include in the program, the wording can be finalized. As usual for safety documentation, the needs and limitations of the readers should be considered during the writing. The document's style should be consistent with the company's other health and safety-related policies, practices and procedures.

Other documents may also need to be modified or created because of the new program, for example:

- Additional training component to orientation checklist forms for new staff
- Additional checkboxes and spaces added to hazard report forms or incident report forms
- Additional questions on incident investigation forms
- Additional topics for safety meeting forms
- Additional criteria to annual performance review forms
- Additional elements to safety recognition programs

During program design, company forms and health and safety documentation should be reviewed to check for and revise any cross-over points or address any gaps by adding new documents.

Getting Feedback And Approval

A document approval process may require the Fatigue Risk Management plan to be circulated for feedback and approval. Feedback and approval of the document validates the fatigue-related concerns and treatments expected. Management must have a leadership role in acknowledging and implement the Fatigue Risk Management Plan.

Planning For Implementation

Program implementation should be considered during program design. The guideline can be printed or provided online to employees and corresponding policy information. A communications program to increase employee awareness of the program should be considered. For example, use safety meetings or build interest by providing facts about fatigue up until the release of the program.

Before implementation, ensure that all the supportive processes required for the program are in place.

Glossary

Term	Definition
Accumulated sleep debt	Shortened or disrupted sleep that adds up over time.
Actigraphy	Watch-like or clip-on devices that can detect motion to help assess the sleep/wake patters of users.
Automatic behaviour	A situation where the worker is completing routine tasks but is not having any conscious thoughts.
Bio mathematical models	These models use algorithms based on the time of day, i.e., circadian or natural body rhythms. The length of time asleep and awake throughout the overall pattern of work and non-work periods is used to predict an average level of work-related fatigue.
Circadian rhythms	People have a daily internal clock that sets circadian rhythms. These circadian rhythms are the times for sleep, alertness, eating, digestion and other body functions. These rhythms are repeated approximately every 24 hours and are designed for high activity during the day and low at night, when people usually sleep.
Competency	The ability of a worker to carry out a job with a certain, accepted level of expertise.
Fatigue	A state of reduced mental and physical alertness or functioning caused by sleep-related disruption or deprivation. Fatigue is a feeling of tiredness or exhaustion that comes from physical or mental exertion. It is a message to the body to rest. Fatigue can be aggravated by acute lack of sleep or an accumulated sleep debt.

Fit for duty	SA condition in which an employee's physical, physiological and psychological state enables them to continuously perform assigned tasks safely. This definition is an umbrella strategy that includes: · Physical requirements - physical demands, vision, hearing, etc. · Physiological conditions - fatigue, alcohol and drugs, workplace exposures, etc. · Psychological condition - risk tolerance, culture, emotional state, etc.
High cognitive workload	A heavy amount of mental effort being used in working memory.
Learning team	Small teams put together to proactively break down and analyze normal day-to-day work tasks or a topic and share learnings across their team, their group or across the organization.
Long rotation	A long rotation consists of working a stretch of night shifts for four to six weeks.
Microsleeps	A state of up to 60 seconds where the brain goes to sleep and the worker blacks out no matter what they are doing.
Optimal scheduling	Schedules that align with normal human sleep patterns and social compatibility, in addition to operational efficiency and effectiveness.
Short rotation	A short rotation would involve no more than three-night shifts in a row.
Simple or monotonous tasks	Routine tasks lasting half an hour or more.
Sleep disorder	Physical or neurological sleep problems such as insomnia, sleep apnea, REM behaviour disorder, sleepwalking, restless legs syndrome, or periodic limb movement syndrome may increase fatigue.
Social Compatibility	The degree to which there is a match with a group or person's lifestyle preferences, fundamental rights and principles.

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