Workplace Safety & Health Guidelines

Fatigue Management

Contents

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Preface

Fatigue is a state of tiredness leading to reduced mental and/or physical performance that can endanger workplace safety. The onset of fatigue while at work can decrease a person's alertness and compromise his or her motor skills, reflex ability, judgement and decision-making. All these have obvious implications for workplace safety and health.

Inordinately long working hours and poorly planned shift work can result in employee fatigue. Specifically, inappropriate and/or ineffective management of work schedules can lead to quick onset of fatigue. Fatigue amongst employees can lead to workplace accidents and near-miss incidents arising from reduced alertness and concentration. Thus, factors contributing to the onset of fatigue must be addressed. Elements contributing to fatigue comprise:

- Organisational factors, e.g. the lack of a fatigue management policy to manage factors contributing to fatigue such as:
  - Unexpected increase in workload;
  - Lack of equipment;
  - Lack of manpower; and
  - Nature of work.
- Environmental factors, e.g. lighting and temperature.
- Individual factors, e.g. state of individual health and life style as well as social factors.

Although it is difficult to totally eliminate long working hours and night shift work, having a fatigue management policy and plan can help to eliminate or control adverse impact on workplace safety and health performance.

Currently, there are no national standards on fatigue management. This general guideline on fatigue management is developed to provide guidance to assist industries in managing fatigue from the safety and health perspective. It includes recommended measures to avoid long work hours and manage shift work effectively to prevent the onset of fatigue in the workplace.

This guideline serves to:

a) Raise awareness of workplace safety and health hazards and risks associated with fatigue;

b) Provide guidance on the recommended measures and practices to manage fatigue in the workplace; and

c) Establish guidelines for maintaining optimal work performance through a healthy lifestyle.

Executive Summary

This guideline aims to provide industries with relevant information on how to set up a fatigue management programme. It provides basic information to raise awareness of the impact of fatigue on workplace safety and health.

As industries vary in their specific operational context, working environment and services providing the same set of fatigue management policies would not apply uniformly to each industry.

The guideline presents information on the following:

- Factors contributing to fatigue;
- Effects and implications of fatigue on safety and health performance;
- Risk assessment as an approach to fatigue management;
- Good practices for fatigue management;
- Means of fatigue assessment; and
- Fatigue Management Programme.

The guideline serves as a source of reference for employers and employees to develop and establish a fatigue management policy and programme.

Chapter 1: Fatigue in the Workplace

1.1　Understanding Fatigue

1.1.1　Definition of Fatigue

There is a circadian rhythm in all humans (refer to Figure 1). The circadian rhythm is the body's biological clock which acts as the body's internal "alarm clock"; telling the body when to sleep, when to wake up and when to eat. The circadian rhythm can be disrupted by changes in daily schedule. Disruption in the circadian rhythm can result in the onset of fatigue. On average, an adult requires 8 hours of sleep in a 24-hour period. A continual sleep of less than that required will incur a sleep debt that cannot be recovered within one day. Recovery usually requires a few days of adequate sleep.
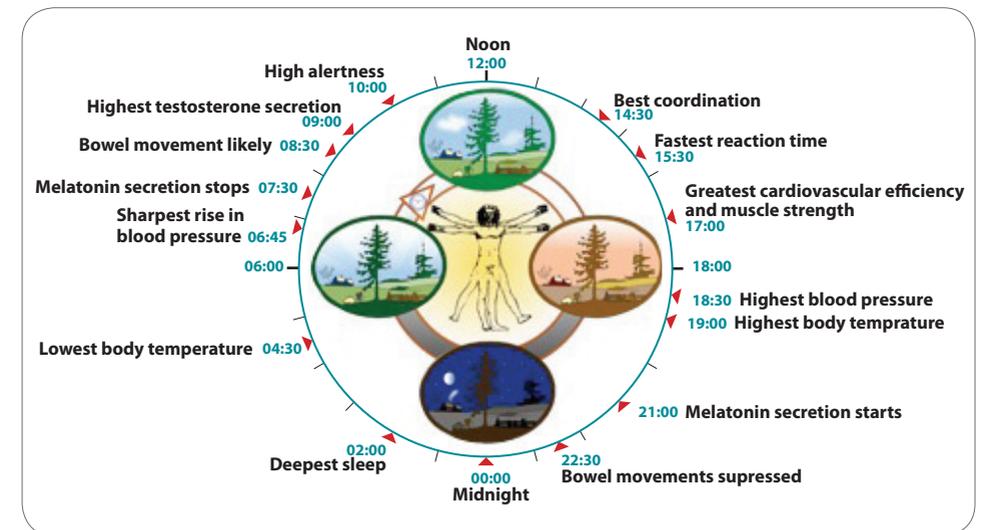
Figure 1: Circadian Patterns of Typical Human.

Fatigue is a state when a person feels physically and/or mentally tired. The types of fatigue include:

- Physical fatigue (reduced ability to do manual work); and/or
- Mental fatigue (decreased level of concentration, alertness).

Fatigue can be caused by:

- Long working hours without intervening rest/recuperation periods;
- Intense and sustained physical exertion;
- Intense and sustained mental effort;

- Working during some or all of the natural time for sleep (as a result of shift or long work hours); and
- Lack of adequate rest and sleep.

1.1.2 Identification of Fatigue

A fatigued person generally displays a set of symptoms that can be recognised but these may often not be identified as fatigue. The common symptoms of fatigue listed below can help managers and supervisors in identifying fatigue amongst employees:

- Undue tiredness;
- Higher level of irritability or impatience;
- Person speaks less than usual or is less clear in communication;
- Shorter attention span, easily distracted;
- Slower reaction speed;
- Compromised eye-hand coordination, increased clumsiness;
- Slowed thinking;
- Reduced short-term memory, forgetful;
- Inability to handle information especially under time pressure;
- Reduced ability for problem solving;
- Taking shortcuts to finish jobs, higher tendency of risk taking behaviour;
- Poor judgement of distance, speed, and/or time;
- Use/abuse of substances to cope (e.g. cigarettes, alcohol);
- Loss of appetite or problems with digestion; and
- Excessive sleepiness with Microsleep[1].

1.2 Factors Contributing to Fatigue

A person's circadian rhythm or body's biological clock can be disrupted by changes in daily schedule through various factors. These include work and/or non work-related factors.

1.2.1 Work-related Factors

Poor work schedules can disrupt a person's circadian rhythm as the body has to adjust to differing times thus contributing to the onset of fatigue. For example, it can include:

- Roster patterns;
- Length of shifts and time worked;
- Poor work scheduling and planning;
- Timing of shifts (e.g. night shift);
- Insufficient recovery time between shifts;
- Long period of time awake; and
- Inadequate rest breaks.

[1]Microsleep is an occurrence of sleep that comes against the person's desire. As it can occur anytime without warning and can last for seconds, this can be extremely dangerous when it occurs during situations which demand continual alertness, for example driving and working with machinery.

Other work-related factors include:

- Non conducive environmental conditions (e.g., hot weather, rain, sun glare);
- Type of work undertaken (mental or physical); and
- Sustained demanding work.

1.2.2 Factors Outside Work

Demographic characteristics:
- Age (e.g. older people may be less able to cope with night shifts); and
- Health status (e.g. underlying medical conditions).

Individual factors:
- Poor quality of sleep;
- Reduced sleep and rest due to social life and family needs;
- Other employment (part-time jobs);
- Excessive travel time (distance from home to workplace); and
- Sleep disorders.

1.3 Effects of Fatigue

1.3.1 Implications and Impact

Fatigue can result in sleep deprivation which can lead to:
- Physical and mental impairment;
- Increase in error rates;
- Slow reaction times to respond to situations;
- Increased risk of injuries; and
- Sleepiness and Microsleeps.

1.3.2 Effects of Fatigue on Safety and Health Performance

Short-term effects of fatigue can reduce the ability to:
- Stay awake;
- Concentrate on a specified task;
- Pay attention to safe work practices;
- React to changes in surroundings or information provided;
- Make error-free decisions;
- Think laterally and analytically;
- Remember and recall details;
- Control emotions, mood and handle stress;
- Recognise risks;
- Coordinate eye-hand movements (e.g. clumsiness and instability); and
- Communicate well.

1.3.3 Effects of Fatigue on Workplace Injuries

Fatigue can affect employees' ability to concentrate at work. This may result in:

- Increased workplace incidents; and
- Increased staff absenteeism and turnover, resulting in reduced performance and productivity at work.

1.3.4 Consequences to Businesses

Unmanaged work-related fatigue can lead to reduction in productivity. Employees who are fatigued may perform less efficiently. The consequences of this could range from relatively minor events to serious incidents. Refer to Case studies 1 and 2.

Case study 1

Incident

Near midnight, a group of workers was resting in an open yard area. Four of them slept beside a fabricated steel block and one slept in the path between the fabricated steel block and some steel pipes.

A forklift driver was transporting concrete blocks using a seven-tonne forklift in preparation for later work. The driver did not notice the worker in his path and and ran over him. The worker was sent to the hospital but succumbed to his injuries and was pronounced dead. Refer to figure 6.

Investigation Findings

- The group of workers (including the deceased) as well as the forklift driver had been working for long hours on the day of the accident (more than 14 hours).
- In particular, the forklift operator had worked for more than 20 hours on two separate days in the week before the accident.
- The accident area was poorly illuminated. In addition, the deceased was wearing dark coloured clothing without reflective materials or vest.
- The forklift was found to have no faults which could have contributed to the accident. The driver had not operated it in reverse mode, although his forward view had been obstructed by the concrete block he was transporting.
- There were designated rest areas and their respective locations were made known to all workers. The closest resting shed was less than a minute's walk from the accident area.

Position of 4 co-workers

Position of deceased

Position of deceased

Figure 2: Pictures Taken During the Investigation.

Systemic Failures

- Failure to ensure workers do not work extended hours and thereby inducing fatigue in them.
- Failure of workers to use designated rest areas.
- Failure of deceased to rest in a safe location.
- Failure to provide sufficient illumination in the work area.
- Failure of Forklift Operator to follow safe method of reverse-operation of forklift when forward view was obstructed.

Case study 2

Incident

At about 5am on the incident day, *Driver A* resumed work after his five-minute "Compulsory Short Break" and proceeded to transport a twenty-foot container with Terminal Prime Mover 1 (TPM-1). The short break was instituted by the occupier for night shift drivers. While transporting the container, *Driver A* saw TPM-2 and TPM-3 travelling in the opposite direction along the two-lane road. Suddenly, TPM-2 swerved into his lane. *Driver A* swerved his TPM-1 to his left to avoid a direct collision. As a result, TPM-2 collided into the rear of TPM-1. *Driver B* of TPM-2 was thrown out of his cabin and landed on the ground. TPM-2 continued to move forward and came to a stop after crashing into Container D. *Driver B* subsequently succumbed to his injury in the hospital from a fractured skull and was pronounced dead.

Schematic of Incident Site

TPM-3

TPM-2 swerved and collided to rear of TPM-1

TPM-2 came to a stop after colliding with Container D

To avoid collision, TPM-1 swerved to its left

D

Drawing not to scale
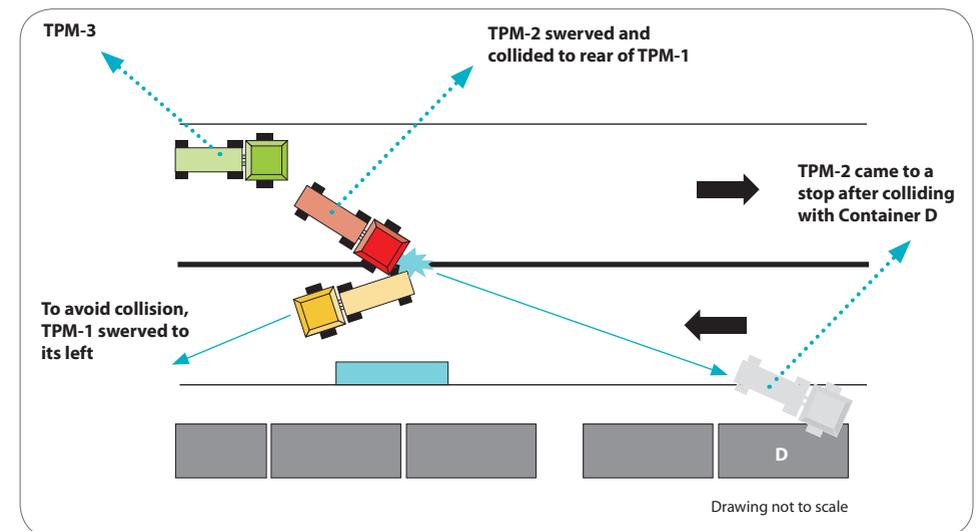
Primary Contributing Factors

- *Driver B* did not fasten his seat belt at the time of the incident. This caused him to be thrown out of the TPM when the collision occurred. If the seat belt had been properly fastened, he would not suffer the skull fracture that caused his death.
- Poor mental and physical conditions of *Driver B* due to long hours of work might have caused a lapse in his concentration, leading to the loss of control of his TPM.
- *Driver B* did not take the "Compulsory Short Break" mandated by the company's policy.

Other Contributing Factors

- The lack of a properly designed work schedule for drivers had resulted in Driver B working for four consecutive night shifts. This might have indirectly caused the driver to be tired and to lose his concentration, which eventually led to the incident.
- Duration of the CSB is deemed inadequate for the drivers to recuperate sufficiently. The instituted duration of a five-minute break would only provide a break from the driving routine. As the circadian rhythm in human beings would affect ones ability to perform effectively, proper rest (including short duration sleep) could greatly improve a person's ability to work safely.

Recommendations

- Rules and regulation should not be violated. In this case, drivers should attend the "Compulsory Short Break" to recuperate. They should also utilise the seat belt properly.

- *Management* should have a properly designed work schedule for drivers. 12-hour night shifts should be limited to two to three consecutive nights, as advised by established guidelines.

- Longer CSB break durations would allow drivers to take short naps to recuperate, thus improving their performance and concentration. Breaks of 20 to 30 minutes (such as "power naps") are recommended for drivers of all shifts. Naps longer than 30 minutes will be less effective as the individual is likely to go into a "deep" sleep pattern. This will cause him to wake up with a post-nap grogginess. The improvements in alertness and performance for such longer naps would not be optimum. Individuals should also allow sufficient time for their drowsiness to wear off before resuming work.

- A person should exercise regularly to maintain a good level of physical fitness, so as to avoid getting tired easily during night shift.

1.4   Legislation

1.4.1 Workplace Safety and Health Act

The Act has the intent to inculcate good safety habits and practices in all individuals at the workplace; from top management to the front line worker. It requires every person at the workplace to take reasonably practicable measures to ensure the safety and health of every workplace and worker.

Employers have a duty to provide a reasonably practicable working environment that is safe and without risk to the health of employees. This includes removing or controlling the risks of fatigue by organising and planning shift work arrangements, optimising work schedules to minimise fatigue and providing rest breaks.

Employees not only have a duty to take reasonable care for their own health and safety but also for the health and safety of others in the workplace.

1.4.1.1   Risk Management Regulations

> For full details on the WSH Act, please visit MOM website at:
> http://www.mom.gov.sg/publish/momportal/en/legislation/Occupational_Safety_and_ Health/workplace_safety_and.html

Risk Management is a key component to reduce hazards at source. Under the Workplace Safety and Health Act, risk management duties are imposed on every employer, self-employed person and principal (including contractor and sub-contractor) to take all reasonably practicable measures to ensure that the workplace is safe for the employees.

> **Useful guides on Risk Management:**
> - Guide to Workplace Safety and Health (Risk Management) Regulations.
> - Quick Guide to Risk Assessment.
> - Risk Assessment Guidelines.
> - Activity Based Risk Assessment Form.
> - Trade Based Risk Assessment Form.
>
> For more information on risk assessment, refer to the Guidelines on Risk Assessment available on the MOM website at:
> http://www.mom.gov.sg/publish/momportal/en/communities/workplace_safety_ andhealth/maintaining_a_safe_workplace/occupation_safety/risk_management.html

Chapter 2: Risk Assessment Approach to Fatigue Management

Risk assessment can be adapted to the process of fatigue management. By identifying and assessing the various tasks that can result in undue fatigue, countermeasures can be easily chosen and planned. This chapter will concentrate on matters related to fatigue that can be implemented in the risk assessment process.

2.1   Hazard Identification

Fatigue amongst employees is a hazard in the workplace. Thus, it is important to establish the fatigue factors associated with the different work activities and the potential incidents that may occur as a result of fatigue. It is important to note that such factors are often interrelated to one another.

To identify fatigue hazards in the workplace, the following factors need consideration:
- Trends of accidents; and
- Rates of occupational health and injuries.

Consider if fatigue could have been a contributing cause to a workplace incident in the investigation process. When an incident occurred, the following questions can help to ascertain if fatigue had been a contributing factor:
- Time of accident:
  - Did the accident happen at night?
  - Did the accident happen when the worker's concentration was poor?
- Working hours:
  - Has the employee been working long hours and shift work continuously?
- Facility condition:
  - Is the facility conducive for the work carried out?
  - Was the employee exposed to adverse working conditions such as exposure to chemicals, heat, dust due to poor ventilation, noise due to poor acoustic design, and poor visibility due to dim lighting?

2.2   Risk Evaluation

Risk evaluation is the process of estimating the risk levels of the identified hazards and deciding whether the risks can be accepted. This is used as a basis for prioritising actions to control identified hazards and thereby, minimising risks.

2.2.1 Identify Existing Risk Controls that Can Control the Onset of Fatigue

Examples of identification of risk controls:
- Is there a fatigue management policy/set of guidelines in place?
- Are working hours audited and reviewed to eliminate excessive long work hours and inappropriate shift work by employees?
- Have manual or repetitive tasks been substituted with the use of equipment or machinery?
- Are machines used kept up-to-date?
- Is there any need to enhance existing equipment used, such as the installation of machine guards?
- Have the employees been assessed with regard to the use of the required Personal Protective Equipment (PPE)? For example: Any employee suffering from asthma or any health condition that affects his/her use of respiratory masks?

2.2.2 Determine the Potential Severity of Each of the Identified Hazards Assessed

Severity refers to the degree or extent of fatigue due to the identified hazard. It is classified into three categories: Minor, Moderate and Major. An example of determining the severity of identified hazards follows:
- Driving of powered vehicles over long shift periods, without appropriate rest breaks, can cause employees to be physically and/or mentally drained, and may result in fatal or serious injuries. Hence, the severity of the hazard can be classified as "major".

2.2.3 Establish the Likelihood or Probability of Occurrence of the Accidents, Incidents and/or Ill health Arising from the Identified Hazards

Similar to severity, likelihood is also classified into three categories: Remote, Occasional and Frequent. An example of establishing the likelihood of occurrence of the accidents, incidents arising from the identified hazards follows:
- Repetitive work (such as assembly line work) can quickly affect the mental concentration of employees, making the likelihood of fatigue frequent for such activities.

2.2.4 Determine the Risk Level of an Activity (Low, Medium or High)

The risk level is determined based on both the severity and likelihood of fatigue.

2.3   Risk Control

Risk Level	Risk Acceptability	Recommended actions
Low Risk	Acceptable	No additional risk control measures may be needed. However, frequent review may be needed to ensure that the risk level assigned is accurate and does not increase over time.
Medium Risk	Moderately acceptable	A careful evaluation of the hazards should be carried out to ensure that the risk level is reduced to as low as is practicable within a defined time period. Interim risk control measures, such as administrative controls, may be implemented. Management attention is required.

		High Risk level must be reduced to at least Medium Risk before work commences.
High Risk	Not acceptable	There should not be any interim risk control measures and risk control measures should not be overly dependent on personal protective equipment or appliances. If need be, the hazard should be eliminated before work commences.
		Immediate management intervention is required before work commences.

Figure 3: Risk Matrix to Determine Risk Levels.

It is essential for hazards to be eliminated or reduced at source. The control of hazards and reduction of risks can be accomplished by following the **Hierarchy of Control Measures**. These control measures are not usually mutually exclusive e.g. engineering controls can be implemented together with administrative controls like training and safe work procedures.

Elimination
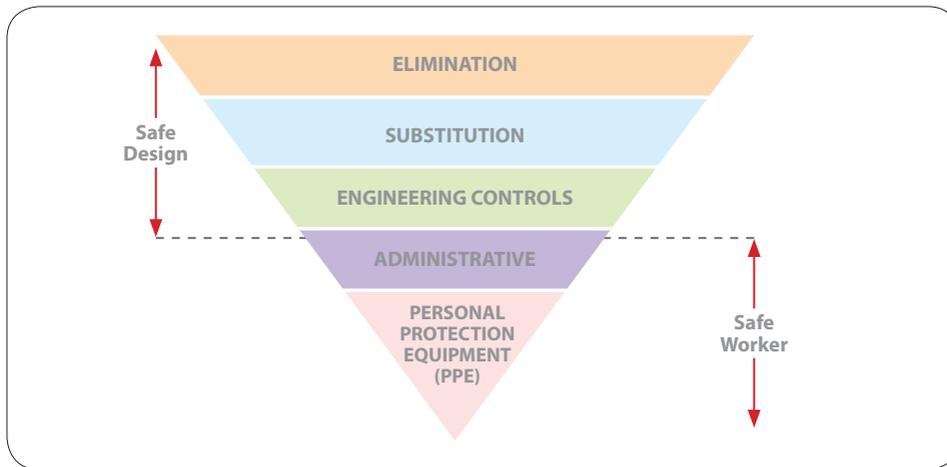
Figure 4: Hierarchy of Control Measures.

Elimination refers to the total removal of the hazards and hence effectively preventing possible accidents and incidents.

This is a permanent solution and should be attempted in the first instance. If the hazard is eliminated, the risk associated with the hazard will be eliminated.

Substitution
This involves replacing the hazard by one that presents a lower risk.

Engineering Controls
Engineering controls are physical means that limit exposure to the hazard. These include structural changes to the work environment or work processes such as erecting a barrier to interrupt the transmission path between the employee and the hazard.

Administrative Controls
These reduce or eliminate exposure to a hazard by adherence to procedures or instructions. Documentation should emphasise all the steps to be taken and the controls to be used in carrying out the activity safely.

Personal Protective Equipment (PPE)
PPE usage may contribute to the onset of fatigue, if the disadvantages outweigh the advantages. For example, it is important to assess employees' suitability to use the required PPE, especially the use of respirators. Alternative methods should be considered, wherever possible.

The success of this control depends critically on the protective equipment being chosen correctly, fitted correctly, worn at all times and maintained properly.

2.4   Monitoring and Review of the Risk Assessment Plan
Regular review of the risk assessment plan is critical to ensure that the control measures are effective. A review should take place whenever:

• New information on safety risks surfaces; or

• There are changes to the area of work; or

• After any incident.

Employers are required to review their plans at least **every three years**.

The risk assessment team should undertake the same three steps (hazard identification, risk evaluation and risk control) when conducting a risk assessment review. Regular auditing is required to ensure that risk control measures have been implemented and are functioning effectively.

Example of risk assessment, please refer to Annex A.

Chapter 3: Preventing and Controlling the Effects of Workplace Fatigue

A customised safety management system with risk controls measures that are specific to the fatigue risks of particular business/operations should include the following good practices and tools:

3.1   Good Practices and Tools

Muscles can recover with rest or non-activity. The mind too can be restored through rest and sleep. The best approach to prevent fatigue is having adequate sleep or rest. However there are methods which can slow down the onset of fatigue and control the risk. This is done by recognising the contributing factors that lead to the onset of fatigue.

As fatigue is caused by a combination of factors, the most effective way to manage it is by adopting a combination of risk control measures and good practices. An account follows on some good practices to prevent and control the effects of workplace fatigue:

3.1.1 Engineering Controls

Fatigue can be related to the type of work and its workload. Engineering controls can reduce the potential risk the employee is exposed to.

Changes to Work Environment

Environmental factors contribute to the onset of fatigue. Employees are easily fatigued if their working environment induces sleepiness. Factors known to induce sleepiness include insufficient lighting and warm temperatures. The following are some measures to improve the work environment:

- Ensure adequate lighting, as dim environment strains the eyes and creates a tendency to sleep. Sufficient lighting in the workplace can help to improve the alertness and performance. Refer to Spring Singapore Standard, SS 531 – Code of Practice for lighting of workplaces.
- Provide adequate ventilation in the work environment to ensure work condition is not at extreme temperatures (neither too hot nor cold). When the temperature of the work environment is too hot, the following measures can be adopted:
    - Insulate hot surfaces or pipes with aluminum or paint to reduce the amount of heat radiated;
    - Provide localised air conditioning;
    - Provide anti-glare windows; and
    - Locate workstations away from heat radiation places or provide cool observation booths.
- Provide shelters in hot working conditions.
- Provide facilities for breaks, such as a pantry and bathroom facilities.

3.1.2 Administrative Controls

Fatigue in the workplace can be managed through procedures or instructions to carry out the activity safely.

Suggestions on Work Scheduling

- Schedule complex tasks to be performed only during the day;
- Schedule critical safety work activities outside of the 2am to 6am window, and to a lesser degree, between 2pm and 4pm where low circadian rhythm results in less optimal performance;
- Keep or limit night shift work to a minimum. An example is to limit shift work to essential jobs and tasks that must be completed at night;
- Limit shift work to not more than 12 hours including overtime;
- Avoid quick shift changeovers, such as finishing at 11pm and starting again at 7 am;
- Adopt forward-rotation shift (i.e. morning to afternoon, afternoon to night), if shift rotation cannot be avoided;
- Provide transportation after work for employees working long shifts or night shifts;
- Plan shift schedules ahead of time and communicate them to employees;
- Allow time for communication of shift handovers;
- Avoid providing incentives to encourage employees to work excessive hours. Incentive-based programmes may encourage employees to work excessive hours and may cause employees to work despite feeling fatigued;
- Introduce job rotation;
- Implement a buddy system for work exigencies, long work hours or critical safety work activities where a reschedule is not possible;
- Conduct an assessment to ensure adequate staffing/manpower on a shift so that the plant can operate safely;
- Consider the skill level of the shift team;
- Provide sufficient supervision, particularly during periods of high fatigue (such as night time or in the latter half of shifts) and especially for hazardous work;
- Have in place contingency plans if employees become fatigued — this would involve removing fatigued employees from work activities where there is a considerable risk to safety and/or health (e.g. operating heavy machinery or plant); and
- Incorporate fatigue management in the planning of emergency responses plan.

Job Redesign

By redefining aspects of certain jobs, it may be possible to prevent unnecessary build up of fatigue.

- If the work is not required to be done in the night shift, it should be scheduled to daytime hours; and
- Redesigning work practices so that routine administrative tasks are minimised for night shift employees, allowing them to focus on core duties during night work.

Strategies on Coping with Demands of Work

Include rest periods in the work schedule. When deciding on the length and frequency of breaks, consider:

- The type of work being performed, for example, a task requiring greater physical and/or mental effort would need a longer total break time per shift;
- The length of shifts worked; the longer the shift, the longer the total break time required per shift;
- A facility for resting;
    - Provide and designate proper facility for employees to rest.
    - The facility should be conducive to rest/sleep (e.g. clean, dim lighting, quiet, and temperature of the room).
- Include power nap[2] of at least 20 minutes and at most 30 minutes to avoid falling into the deeper stages of sleep;
- Avoid safety critical work immediately after a nap to avoid adverse sleep inertia effects.
- Include activity breaks. For example, certain work activities can be monotonous and require a person to stand or sit in a fixed position for extended periods of time:
    - Include short period of exercise, for example, stretching of the limbs and body, to provide a short term boost to alertness, mainly due to the change in posture of the affected persons; and
    - Encourage employees to take scheduled breaks to relieve fatigue due to monotony of task.

Manual Tasks

Manual tasks are workplace activities that require the use of force or exertion by a person such as to lift, push or pull an object/load. Examples include manual handling of heavy loads, retrieval of items from shelving, and stacking of items. The prolonged performance of repetitive tasks, without adequate chance of rest and recovery, may result in an occupational injury.

The risk of a musculoskeletal injury occurring may also be increased with extended shifts due to the cumulative effects of muscle fatigue, strains and sprains. Twelve hours shifts increase the risk of injury occurring. In general, workers involved in repetitive manual tasks should have regular breaks.

- Ensure adequate manpower to avoid excessive demands and overloading on employees;
- Increase supervision during period of low level of alertness; and
- Encourage interaction among employees to maintain alertness.

[2] Power nap is a short duration of sleep of about 20 minutes to 30 minutes.

3.2 Fatigue Management Techniques

3.2.1 Measurement of Fatigue

Both quantitative and qualitative measurements can assess whether fatigue is prevalent in the workplace.

Quantitative measurement examples include:

- Medical leave records;
- Staff turnover records; and
- Incidents relating to effects of fatigue.

Indicator	Description
Absentee rates	Fatigued employees tend to be absent from work more often.
Staff turnover rates	Fatigue can result in job dissatisfaction.
Use/abuse of substances	E.g. Alcohol, cigarettes, sleeping pills etc.
Work-related strains	Fatigued employees tend to get injured easily. A rise in injury claims is a factor that may be indicative of fatigue.
Stimulant usage	Fatigued employees are likely to smoke and take prescribed or non-prescribed stimulants, such as caffeine.
Lost productive time	Fatigued employees will result in lower productivity due to poorer work performance and health-related issues.

Table 1: Indicators for Determining Level of Fatigue.

Qualitative measurement through management and employees consultation. Examples include:

- Employee surveys;
- Focus groups; and
- Exit interviews.

Question	Guidelines
How long have you kept yourself awake?	The longer a person stays awake, the deeper the extent of fatigue. Generally, performance begins to deteriorate greatly after 18-20 hrs of continuous wakefulness.
How long have you worked without taking a break?	Working shifts that are longer than eight or nine hours can result in an increased probability of having accidents or making errors.

How much sleep have you taken the previous night?	Most people require about eight hours of sleep every 24 hours for optimum alertness and performance. Research has shown that just two hours of sleep loss produces the same sedative effect as consuming 0.54g/kg of ethanol (two to three bottles of beer (12-oz)). Likewise, four hours of sleep loss results in effects similar to consumption of 1.0g/kg of ethanol (5-6 bottles of beer).
Was the sleep of good quality, or were there disturbances?	Disruptions during sleep reduce the restorative effects of the sleep. The presence of bright light can also disrupt sleep.

Table 2: Questions and Guidelines to Determine the Onset of Fatigue.

3.3 Examples of Fatigue Management Technologies

Fatigue Calculator

The fatigue calculator (refer to Figure 5) is used to pre-assess the fatigue levels at any given point in the day. When used at the beginning of a shift, it will determine a person's ability to work before fatigue risk becomes unacceptable. It helps to provide a means to plan and minimise the effects of fatigue risk to production or the task at hand.

The fatigue calculator can also be used to determine the duration an employee is able to continue working before the restricted risk score is reached. For example, if a user were to obtain a high risk score working until 6pm, he could utilise the functions of the calculator to determine when the score would drop to medium then to low.
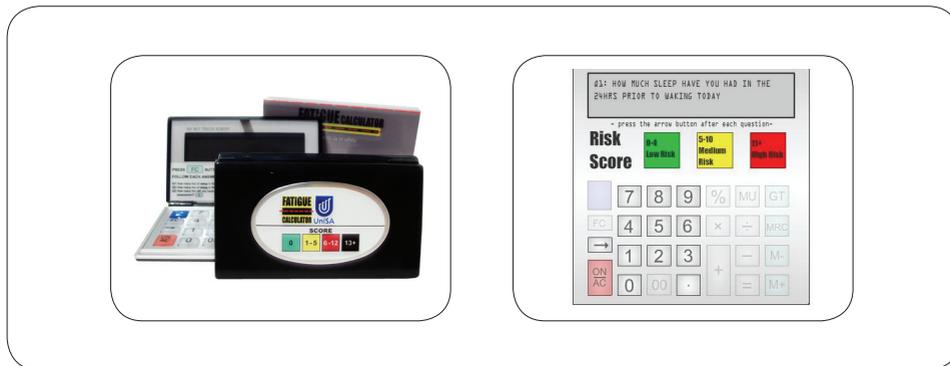

Figure 5: Fatigue Calculator.

Measures of Driver's Eyelid Opening

The driver state sensor (see Figure 6), is installed in the vehicle to measures the driver's eyelid opening. The system uses this data to determine the presence or onset of fatigue. It also measures head orientation, providing information on distraction. Eyelid closure information is processed to determine the level of driver fatigue, and by tracking head movement, the sensor is able to detect driver's distraction.

On-board Crew Rest Facilities

Long-haul flight operations can involve extra flight crew to rotate through flight deck duties when flying long hours. These aircrafts are generally equipped with on-board rest facilities to allow covering flight crew to sleep while the active flight crew are manning the flight.

The Alertness Warning System

The flight deck computer system is another designed-in factor. As aviation operations become highly automated, the human operator becomes passive or less active in monitoring the system. One example of using technology to address fatigue issue is an alertness warning system in some commercial aircrafts. This system alerts the flight crew when no interaction with the flight deck computers occurred within a certain time period. After a predetermined interval of no response, the signal intensity is increased automatically to initiate a response. This system is in operation on several long-haul aircrafts, and flight crews have reported success in using it.

Figure 6: Driver State Sensor.

Chapter 4: Safety and Health Management System

The Safety and Health Management System (SHMS) is a systematic process for managing workplace safety and health.

The SHMS provides for goal setting, planning and measuring performance. It sets out clear management commitments, direction and approaches for workplace safety and health. Safety and health management adds value to businesses by helping to improve overall performance.

Integral to the SHMS is the risk management. Risk Management is a key component to reduce risks at source. Under the Workplace Safety and Health Act, risk management duties are imposed on every employer, self-employed person and principal (including contractor and sub-contractor) to take all reasonably practicable measures to ensure that the workplace is safe for the employees. Risk Management includes:

- Conducting risk assessment on any work activity;
- Controlling and monitoring of such risks; and
- Communicating these risks to all persons involved.

> Responsibilities by different staff levels, please refer to Annex B.
>
> Steps in risk management, please refer to Annex B.
>
> For more information on SHMS, please refer to:
> http://www.mom.gov.sg/publish/momportal/en/communities/workplace_safety_and_health/maintaining_a_safe_workplace/occupation_safety.html

4.1 Fatigue Management Programme

Fatigue management programme can be integrated as part of the organisation safety and health management system. A fatigue management programme helps to increase awareness to issues of fatigue, identify the hazards and manage associated safety and health risks.

An effective fatigue management programme includes several components. The programme is designed to be integrated with an organisation's existing safety and health system. As industries vary in their specific operational context, the following list, while not exhaustive, provides an outline when designing a fatigue management programme.

4.1.1 Organisation Roles in Developing and Implementing a Fatigue Management Programme

Organisation roles in developing and implementing a fatigue management programme can be done by:

- Involving the management levels. The leadership and commitment from management is the essential foundation for an effective fatigue management programme. A clear safety and health policy statement communicates the organisation's safety and health objectives and how it seeks to achieve its commitment.
- Establishing a multidisciplinary team approach to identify safety and health issues, analyse trends, implement control measures, evaluate outcomes and make recommendations.

4.1.2 Fatigue Risk Assessment

Risk assessment is the fundamental basis in safety and health management. Risk assessment enables the identification of hazards at the workplace and implementation of effective risk control measures before any incidents or injuries escalate. This includes:

- Identifying the risks associated with fatigue;
- Assessing the level of risk (likelihood and severity);
- Implementing the control measures; and
- Evaluating the control measures.

> Refer to Chapters 2 and 3 for more details.

4.1.3 Safety Inspection/Observation

Supervisors and employees can actively look out for fatigue amongst employees/colleagues by recognising the signs and symptoms of fatigue when performing observation rounds.

Table 3 shows an example of a pre-work inspection checklist that can be used when conducting regular safety and health inspections in the workplace. It can be used to identify potential hazards, unsafe acts and unsafe conditions, and monitor any changes in the work process.

Factors	Checklist	Yes	No	Actions
Driver	Driver is qualified to drive and familiar with the class of vehicle?			
	Driver has no track record of traffic accident for the past three years?			
	Driver has not exceeded six hours of continuous driving without breaks?			
	Frequency and duration of break time are sufficient?			

	Driver is not under medication that causes drowsiness.			
	Driver has been made aware and trained on managing fatigue?			
Schedule	Work schedule results in no more than extended work hours (of more than 12 hours)?			
	High risk work activities are not performed at low body clocks (between 2am and 6am)?			
	Resting facilities are provided?			
	Break time is included?			
	Frequency and duration of break times are adequate (20 minutes to 30 minutes)?			
	Work schedule is appropriately scheduled to avoid time pressed to complete deliveries?			
Environment	Working environment is not at extreme conditions, e.g. hot or humid?			

Table 3: Example of a Pre-work Inspection Checklist for Vehicular Driving.

4.1.4 Fatigue Reporting Mechanism

Fatigue reporting mechanism forms part of the baseline assessment on the effectiveness of the programme. Fatigue amongst employees can be identified through consultation or feedback session between employers and employees. Communication can occur when:

- The organisation identifies fatigue as one of the workplace hazards;
- There are changes to work schedules and procedures; and
- An incident or near-miss occurs.

Fatigue-related hazards and incidents should be identified and recorded as part of the organisation's incident reporting process. It is important to ensure that:

- Employees are encouraged to be open about reporting fatigue-related hazards and incidents;
- Audit results are used for continuous improvement of the fatigue management programme; and
- Information is presented to a fatigue management steering committee, such as the WSH committee.

4.1.5 Monitoring Fatigue Management Programme

The baseline profile helps to determine the programme effectiveness in controlling the fatigue-related risks and to identify areas for improvements.

Identify indicators to measure the impact of control measures. Examples of indicators include:

- Trends of incidents/injuries associated with fatigue;

- Staff turnover rate;
- Medical leave records;
- Compliance with control measures, such as engineering control measures and administrative control measures;
- Training records; and
- Surveys.

4.1.6 Fatigue Management Training

Proper training in work processes can improve competency of the employees. In turn, this will allow them to work more effectively, thereby reducing unnecessary fatigue and stress.

In addition, employees can be educated on the symptoms and signs of fatigue, as well as the application of the various mitigation methods.

Provide training and information on fatigue management to employees. Arrangements should be made for shift workers to be included in such training programmes. This can be done by adjusting the work schedules for employees to attend training.

Training on fatigue management should include the managers, supervisors and employees. Training content can include:

- Workplace safety and health responsibilities in the workplace;
- The body's biological clock and its effects;
- Risk factors associated with onset of fatigue in the workplace;
- Recognition of fatigue symptoms;
- Control measures to prevent and reduce fatigue;
- Individual lifestyle management to reduce fatigue;
- Responsibility of employees to rest during their rest days; and
- Fitness for duty on roster shifts.

Employers and persons conducting a business or undertaking should:

- Provide training and instruction for employees and supervisors on fatigue. A Training Needs Analysis (TNA) should be developed especially for shift workers; and
- Provide adequate supervision to ensure that control measures are being adhered to correctly.

4.1.7 Safety and Health Promotion/Campaigns

A fatigued employee is at higher risk to himself and to others around him, and is therefore a danger in terms of workplace safety and health. Fatigue-related information and practices need to be refreshed in the minds of employees from time to time; otherwise, the impact may be lost over time due to the practices becoming routine. Employees may simply carry out the practices that are meant to counter fatigue without understanding or remembering the intention or purpose of such practices. They may then over time decide to stop such practices or forget them altogether.

Therefore, a safety and health promotion or campaign should include the fatigue topic as part of the programme to promote safety and health in the workplace.

Possible topics include:

- Recognition of fatigue symptoms. Information on recognising the symptoms of fatigue can help prevent incidents due to fatigued employees or avert undesirable health effects.
- Importance of healthy personal habits.
- Quality of sleep. Having good sleep habit, balanced nutrition and regular exercise.
- Tips to manage fatigue.

Tips to Manage Fatigue

Individual factors play a part in effective fatigue mitigation or minimisation. The following are some good personal practices to avoid fatigue during work.

Tips to Optimise Sleep Opportunities

- Ensure seven hours to eight hours of uninterrupted sleep by:
  - Choosing a quiet place to sleep; and
  - Darkening the room and allowing more time than normal to fall asleep.
- Wake up and go to bed at the same time every day to avoid circadian disruptions.
- Keep the sleep environment cool (approximately 26°C).
- Move the alarm clock out of sight to prevent 'clock watching'.
- Avoid using alcohol as a sleep aid. Even though alcohol will induce drowsiness, the quality of sleep will be poor.
- Avoid cigarettes or other sources of nicotine just before bedtime.
- Do something relaxing until there is sleepiness if sleep does not come within 30 minutes.
- Allow some time to recover from the "groggy" state after waking up. For example:
  - Doing moderate exercises such as walking or jumping up and down; and
  - Starting a conversation with someone.

Tips on Diet Management

Digestive problems are common in shift workers due to disruption of the body's biological clock and poor diet. The following can help to improve the situation:

- Have regular light meals/snacks rather than a single heavy meal.
- Choose foods that are easy to digest such as pasta, rice, bread, salad, fruit, vegetables and milk products. This is especially useful if there is a pressing need to have some food before sleep to avoid significant hunger.
- Avoid fatty, spicy and/or heavy meals as these are more difficult to digest. They can make you feel drowsy when you need to be alert. They may also disturb sleep when you need to rest.
- Avoid sugary foods such as chocolate. They provide a short-term energy boost followed by a dip in energy levels.
- Choose fruits as snacks as their sugar is converted into energy relatively slowly, and they also provide vitamins, minerals and fibre.
- Drink plenty of fluid as dehydration can reduce both physical and mental performance. Avoid drinking too much fluid before sleeping as this may overload the bladder.
- Avoid caffeinated drinks in the afternoons/evenings.

Adopt an Exercise Regime

- Improve fitness by spending 30 minutes a day on a physical activity. Regular physical exercise would improve overall health.

Tips to Improve Alertness at Work

- Perform moderate exercise before starting work to help increase alertness during the shift.
- Take scheduled breaks during the shift.
- Interact/talk with co-workers.

Reaching Home Safely after Work

It is important to note the state of fatigue after work on the journey home. For example:

- Take enough rest before driving. If there is a need to rest along the way, ensure that the vehicle is parked in a safe location.
- Take public transport if feeling severely fatigued.

Drugs and Alcohol

- Seek medical advice if regular medication is required.
- Avoid excessive consumption of alcohol as it affects the quality of sleep.
- Avoid stimulants such as caffeinated drinks, for example, coffee/tea as they delay sleep.

Medical Conditions

- Seek medical advice for excessive snoring, irregular heart beat and insomnia.
- Seek medical advice for an alternative medication if current medication causes drowsiness while at work.

4.1.8. Management Review

The facility's top management should review the fatigue management programme to ensure its continuing suitability, adequacy and effectiveness. Such reviews should be conducted at intervals (e.g. quarterly or annually) set by the management and of duration suitable for the type of facility. Management review of the programme should include:

- Frequency of review;
- Review dates;
- Management's commitment to conduct the reviews as scheduled;
- Mechanism for feedback involving all affected personnel; and
- Review of identified indicators to monitor effectiveness of the programme.

4.1.9. Documentation and Review of Fatigue Management Programme

There should be a system for the documentation and regular review of the workplace safety and health management programme. This is to facilitate the retrieval of relevant documents and to ensure that the programme remains relevant and effective. All revisions to the safety and health manual should be dated and endorsed by authorised personnel. Recommendations that result from such reviews should be considered and implemented wherever possible.

Fatigue-related incidents should be recorded and investigated. A proper Risk Assessment review

must be conducted as part of the investigation to identify and address potential gaps in the processes. Such records should be tabled for discussion as part of the organisation's management review.

Example of a Fatigue Management Programme checklist, please refer to Annex C.

Acknowledgements

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Annex A Example of a Risk Assessment (Hazards and Control Measures Listed are Not Exhaustive)

RISK ASSESSMENT FORM (Example)			
Company	ABC Logistic Pte Ltd	**Conducted by:** (Names, designations)	Monica Liao, Supervisor
Process / Location	Transportation and logistic		
Approved by: (Name, designation)	Teo Kit Han, Managing Director	**Conducted on:** 4 Aug 2009 **Last Review Date:** 6 Aug 2009	**Approved on:** 6 August 2009 **Next Review Date:** 6 August 2012

1. Hazard Identification				2. Risk Evaluation				3. Risk Control		
No.	Work Activity	Hazard	Possible Accidents/Ill Health & Persons-at-Risk	Existing Risk Control (if any)	Likelihood	Severity	Risk Level	Additional Risk Controls	Action Officer, Designation (Date)	
1.	Driving within workplace premise.	• Poor lighting of driving route. • Length of shift exceeding 12 hours. • Consecutive night shifts.	Possible injury to other road users and drivers.	• Improved lighting condition. • Increased supervision. • Observed speed limit by having signage of speed limit. • Designated foot path.	Remote	Major	Medium Risk	• Activity breaks. • Designated facility for rest. • Buddy system. • Work scheduling to avoid consecutive night shifts and to limit shift work to not more than 12 hours, including overtime. • Fatigue awareness and training.	Transport Manager (30 Aug 2009)	
2.	Loading and unloading of goods from trucks.	• Hot weather. • Heavy loads.	Possible musculoskeletal injuries to material management staff.	Shelters at loading/unloading bay to shield the sun.	Frequent	Moderate	High Risk	• Activity breaks. • Designated facility for resting. • Use pallet jacks and trolleys to lift heavy goods.	Materials Management Manager (30 Aug 2009)	
3.	Transporting a 20-foot container.	• Extended shift work of more than 12 hours. • On shift for 4 consecutive nights.	Possible injury to other road users and drivers.	Work scheduling to avoid consecutive night shifts/long working hours.	Remote	Major	Medium Risk	• Fatigue awareness and training. • Activity breaks.	Transport Manager (30 Aug 2009)	

Annex B Workplace Safety and Health Management System

Management

Members of the management must be made aware of the effects of fatigue in the workplace on productivity, costs, and safety. Managers will then be able to better understand the importance and magnitude of fatigue management. Fatigued employees are neither effective in their work nor capable in carrying out work safely.

The management can reduce the fatigue risk by designing jobs or work processes that do not impose excessive stresses, and allowing employees to take breaks. Management should also have an open communication channel for employees to report fatigue situations. For example, employers are encouraged to develop and implement a comprehensive Workplace Safety and Health management programme to establish a safe and healthy working environment so as to prevent workplace accidents and work-related illnesses.

Supervisors

The main role of supervisors is to provide close and direct supervision of the tasks performed by the employees under them. Therefore, knowledge of the symptoms of fatigue is particularly important to supervisors so that they can detect fatigue amongst their employees, and carry out countermeasures to prevent potentially unsafe work.

Employers

Responsibilities of employers include:

• Developing and implementing an effective workplace safety and health programme;

• Informing all staff of workplace hazards and ensuring that workplace safety and health rules, training schedules and safe work procedures are followed;

• Providing adequate training;

• Providing proper equipment including personal protective equipment;

• Providing welfare facilities such as rest areas;

• Providing first aid boxes; and

• Documenting the workplace safety and health policy and keeping records of all reported accidents, incidents and diseases.

Employees

It is important to highlight that the responsibility for fighting fatigue belongs to everyone at the workplace. Employees must also do their part by ensuring that they use time away from work properly - of particular importance is ensuring that they get enough sleep.

Risk Management

The steps in a risk management exercise are summarised in the flowchart below:

Select activities and equipment for analysis

↓

Identify the hazards involved

↓

Assess the hazards and risk involved

↓

Implement measures to control the hazards

↓

Evaluate effectiveness of control measures and record findings

Useful Guides for Risk Management can be found in Useful Guides for Risk Management can be found in http://www.mom.gov.sg/publish/etc/medialib/mom_library/Workplace_Safety/files2.Par.18078.File.tmp/Risk Assessment Guidelines.pdf

- Guide to Workplace Safety and Health (Risk Management) Regulations
- Quick Guide to Risk Assessment
- Risk Assessment Guidelines
- Activity Based Risk Assessment Form
- Trade Based Risk Assessment Form

Annex C Example of a Fatigue Management Programme Checklist

The checklist is intended to assist organisation in assessing its Fatigue Management Programme.

(The following checklist serves as a generic guide and not industry-specific).

S/N	Elements	Questions	Yes	No	Remarks
1	Organisation roles in developing and implementing a fatigue management programme	Is there a policy statement that reflects the management's commitment to fatigue management?			
		Is there a team approach to manage the risk of fatigue? For example, adopt multidisciplinary approach through engaging management, supervisors and employees.			
		Are there strategies to communicate the importance of fatigue management to all employees? For examples, meetings; notice boards; emails.			
2	Fatigue risk assessments	Has the organisation identified the types of fatigue-related hazards? For examples, poor work scheduling and planning; Insufficient recovery time between shifts.			
		Has the organisation identified and assessed fatigue risks? For example, are working hours audited and reviewed to eliminate excessive long work hours and inappropriate shift work by employees?			
		Are there measures to control fatigue risks? For examples, changes to work environment to provide adequate ventilation; changes to work schedule to limit shift work to not more than 12 hours including overtime.			
3	Safety inspection/observation	Has recognition of the signs of fatigue been incorporated in routine safety inspection/observation rounds?			
		Is there pre-work checklist before work commencement to identify fatigue?			
4	Fatigue reporting mechanism	Are there channels for employees' consultation and feedback? For examples, meetings; face-to-face; focus group sessions.			
		Is fatigue reporting included in the organisation incident reporting process?			
		Has incident reports been documented?			

5	Monitoring fatigue management programme	Is the organisation monitoring the effectiveness of the programme? For examples, trends of incidents/injuries associated with fatigue; compliance with control measures, such as engineering control measures and administrative control measures; training records; surveys.			
6	Fatigue management training	Has the organisation include fatigue management as part of its safety and health training?			
		Are there arrangements made for shift workers to be included in such training programmes? For example, adjusting the work schedules for employees to attend training.			
		Are training records documented?			
		Are there measures to monitor effectiveness of training content? For example, training evaluations.			
7	Safety promotion/campaigns	Is fatigue included as a topic in safety promotion or campaign to raise awareness?			
8	Management review	Is there a management review process to ensure the programme continuing suitability, adequacy and effectiveness? For example, established frequency of review.			
		Are management reviews documented?			
9	Documentation and review of workplace safety and health management programme	Is there a system for the documentation and regular review of the fatigue management programme?			
		Are revisions dated and endorsed by authorised personnel?			

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Contact Information

- For enquiries, please email the WSH Council at: contact@wshc.gov.sg

- To report unsafe practices at workplaces, please call the MOM hotline at 6317 1111.

- To report accidents, dangerous occurrences and occupational diseases, visit
  www.mom.gov.sg/ireport