

▷ *FATIGUE TOOLS*

▷ *For Vessel Owners*



Get your sleep
Reduce your risk

▶ *FATIGUE TOOLS
FOR VESSEL
OWNERS*

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INTRODUCTION

1.1 Who this booklet is for

This booklet is for vessel owners and operators who identify fatigue as a possible hazard in their operation. Fatigue is possible in any operation under exceptional circumstances, and in some operations is routine. Fatigue is likely to be an issue if:

- work (plus commuting) cuts across the times that people would normally be sleeping, eg work starting before 7.00 am or finishing after 10.00 pm
- people have to sleep on board the vessel
- there are demanding environmental stressors, eg excessive noise, vibration, heat, cold, rough sea conditions, bad weather
- work demands are unpredictable (especially the timing of work)
- work is physically or mentally demanding
- employees commute for long distances
- employees have health problems or personal issues that negatively affect their sleep
- employees report feeling excessively tired at work.

1.2 How to use this booklet

This booklet provides you with information to supplement that in your vessel specific guide. It answers questions about writing fatigue management plans. It also contains some tools that may be of use in identifying and managing fatigue. Use them as you see fit. Any of the material in this booklet can be freely copied for the purposes of managing fatigue on vessels.

This booklet works best if your fatigue management needs are discussed with your Safe Ship Management (SSM) company advisor, who has been trained in fatigue management. Your local maritime safety inspector should be able to provide direction, if you feel you need additional assistance.

Additional information is available from the Maritime New Zealand website www.maritimenz.govt.nz

1.3 Key actions for vessel owners

1. Involve crew and advisors in identifying fatigue issues and how to respond to them.
2. Develop contingency plans for the unexpected and make sure that everyone understands their role.
3. Make fatigue management part of the induction plan for new crew.
4. Implement a plan to measure regularly how well fatigue is being managed in practice.
5. Feed the results of fatigue-monitoring back to the crew and continue to seek their input regularly on changing circumstances.
6. Document your fatigue management plan in the SSM manual.
7. Be involved in making the programme work. You will need to demonstrate leadership, be firm in insisting that fatigue must be managed and be patient with your workforce as they learn new ways of operating.

The ultimate test

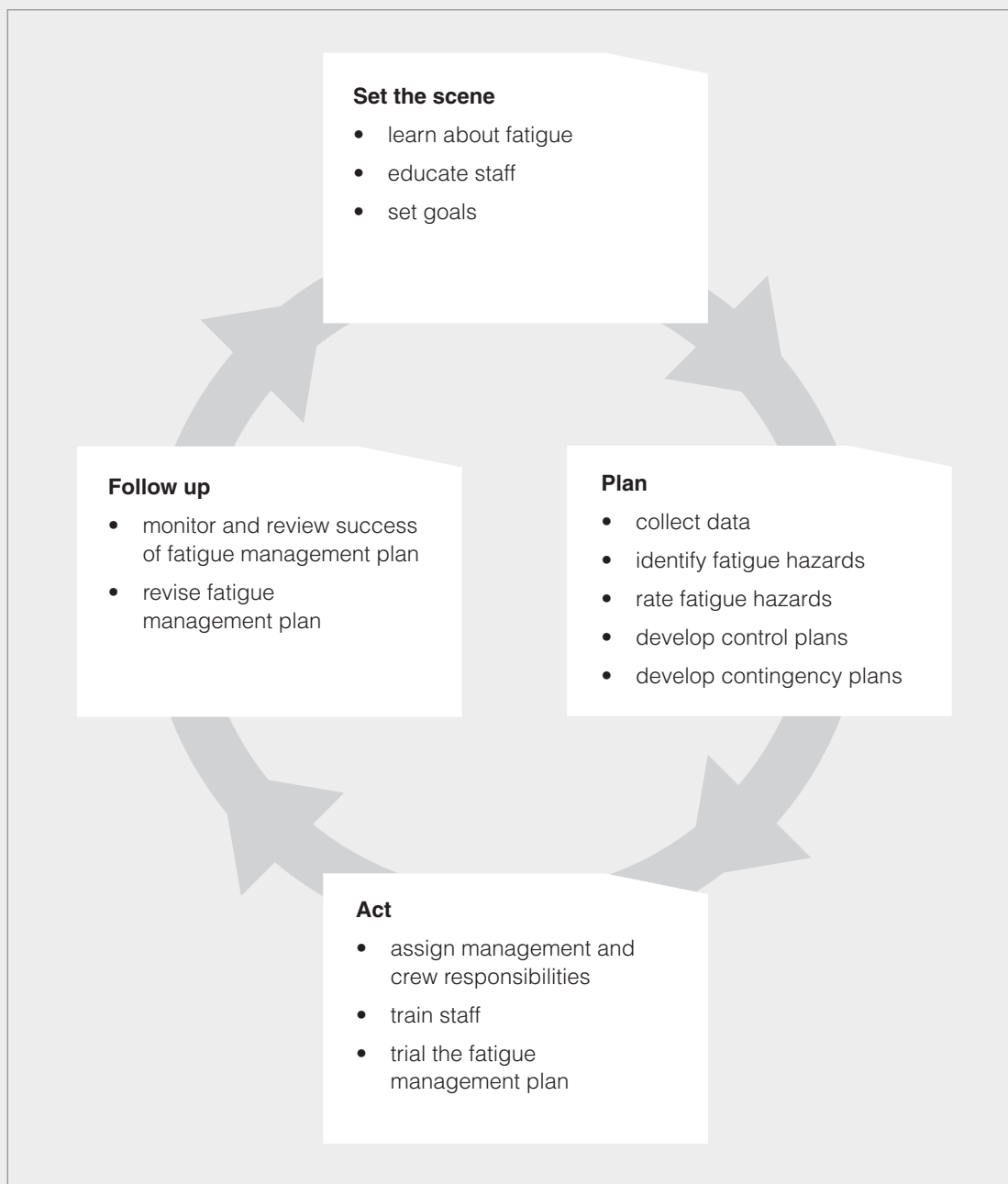
If your crew have a fatigue-related accident, will your actions pass the scrutiny of accident investigation?

DEVELOPING A FATIGUE MANAGEMENT PLAN

2

This section contains a series of frequently asked questions for each of the steps in developing a fatigue management plan. The questions follow the steps in the diagram below.

Figure 1: Steps for developing a fatigue management plan



2.1 Before you start

QUESTION	ANSWER	COMMENT
Why should I bother to have a fatigue management plan?	<p>SSM requires it.</p> <p>Your vessel and crew will be healthier and safer.</p> <p>Under the law you are exposed to big legal risks if fatigue is not actively managed. Having a well thought-out fatigue management plan reduces these risks.</p>	<p>All vessels in or entering SSM will have to include fatigue management as part of their safety management system, if fatigue is an issue in their operation.</p> <p>Well-designed and effectively implemented fatigue management plans reduce accidents and make people healthier and more productive.</p> <p>The Health and Safety in Employment Act 1992 specifies fatigue as a hazard that must be managed effectively by owners and employees. Fatigue is increasingly being recognised as a safety and health issue in many parts of society.</p>
What risks do I have to manage?	<p>Anything that results in injury or has the potential to injure. This applies to any person who is on your vessel or may be affected by the risk.</p> <p>Anything that results in damage to your vessel or has the potential to do so.</p>	<p>Follows from the Health and Safety in Employment Act 1992.</p> <p>Follows from the Maritime Transport Act 1994.</p>
How important is human biology in determining fatigue?	<p>It is critical. The human body needs sleep and is designed to be naturally alert at certain times and asleep at other times.</p> <p>People cannot be trained to need less sleep and function well. At best they can partially adapt to new shifts after several days. But they still need 7-8 hours of sleep to be refreshed and 100% fit for work.</p>	<p>For information on the importance of human biology and fatigue see the brochure <i>Understanding fatigue</i>. For more detailed information talk to your SSM company advisor or visit www.maritimenz.govt.nz</p>
What is the owner's or employer's role?	<p>To lead the risk management processes stipulated in the Health and Safety in Employment Act 1992 and by the SSM process.</p>	<p>See <i>Health & Safety: A guide</i> for details.</p>

QUESTION	ANSWER	COMMENT
What responsibilities do the crew have to manage fatigue?	To take all practicable steps to ensure their safety at work. This includes not turning up for work in an impaired state from any cause, including fatigue. To inform their employer if fatigue is an on-going issue.	Required by the Health and Safety in Employment Act 1992. Surveys show that crew resume work at times when fatigued from activities in their private life. Crew should be reminded that they have a responsibility under the Health and Safety in Employment Act 1992 to ensure their own safety.
What is the safety problem with small vessels?	Work demands and small crews mean it is often seen as difficult to plan and take rest breaks.	As commercial pressure is on-going and tasks rely on few people to complete them, there is tendency to keep on with the job.
Is the amount of work to develop a fatigue management plan less for those with a small operation?	Yes.	While the process is the same for all vessels, smaller operations generally have less detail to deal with.
As the owner of a small vessel, how do I minimise my costs?	Work with others who have similar vessels, especially if wanting to use your SSM company to run education sessions. Use a vessel specific guide.	This is a good way to share costs and local knowledge about safety. These have identified hazards and management options typical in your industry sector.

2.2 Set the scene

QUESTION	ANSWER	COMMENT
What is the best way to develop a fatigue management plan?	Involve those who are affected – the skipper, crew and shore staff. Expert advisers help make the task easy (talk to your SSM company or local maritime safety inspector). Develop the plan over a few meetings.	The Health and Safety in Employment Act 1992 requires you to provide reasonable opportunities for employees to participate. Practical experience has shown that fatigue management programmes work best when everyone is involved. (Warning: when employees' income directly links to hours worked, they have an incentive to work longer hours. This needs to be actively managed.)

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2.2 continued...

QUESTION	ANSWER	COMMENT
<p>What is the best way to educate crew about fatigue?</p>	<p>Make sure that every crew member (and your shore staff) have a copy of the brochure <i>Understanding fatigue</i>. If a video/DVD is available, use it to start the first meeting.</p> <p>Invite your SSM advisor to discuss fatigue management with you, the crew and shore staff.</p> <p>Make time available to allow everyone to discuss fatigue together.</p> <p>Make information available to the crews' partners and families.</p> <p>Your induction process for new crew should include education about fatigue, your fatigue management plan and what it means for the crew member.</p>	<p>Early establishment of a common knowledge base and understanding is a key step to being able to work together. Crew often are not aware of their own sleep problems or don't want to speak about them. Partners bring a useful reality check. Partners also need to be educated about sleep needs of crew, to allow crew to get better sleep at home.</p>
<p>Why should I have goals for fatigue management?</p>	<p>Goals tell your staff and crew what you expect of them. What they need is the balance between getting the job done, the level of safety you expect, and their sleep/social/personal needs.</p> <p>How to do it</p> <p>You will have thought about these things but may not have "talked them out" and written them down. Work with your SSM company, a business colleague, or the skipper and write down what is important to you.</p> <p>Examples of goals</p> <ul style="list-style-type: none"> • If crew end up operating under high-risk situations for falling asleep, there are always back-up systems in place. • Staff are encouraged to report fatigue problems and these will be addressed. • Fatigue risk will be addressed for all inward transits. 	<p>Having goals is part of your risk management – they let the crew and shore staff know what is important to you – and they are part of how you will be judged if something goes wrong. Designing a fatigue management plan requires you to make all sorts of decisions about where you make trade-offs between safety and costs. Establishing at the start what is important to you makes it easier for the skipper and crew to make decisions about safety.</p>

2.3 Plan

QUESTION	ANSWER	COMMENT
How can I collect data about fatigue and identify fatigue hazards in my operation?	<p>Involve the crew.</p> <p>Read the guide for your type of vessel.</p> <p>Analyse previous accidents and incidents in your operation, or others you know about.</p> <p>Talk to others who have a similar operation to yours.</p> <p>Discuss with your SSM company.</p> <p>Use the survey tools in Section 4.</p>	<p>You are required to identify fatigue hazards under the Health and Safety in Employment Act 1992. Having all crew complete at least one of the assessment tools helps demonstrate that you have involved everyone in assessing the fatigue risk. Each vessel needs to be assessed separately – as each is probably built differently, operates differently and has different crew.</p>
What do I have to take into account that affects the crew's sleep?	<p>Sleep needs:</p> <ul style="list-style-type: none"> • fatigue builds up (cumulative fatigue) if we get less than 7-8 hours sleep per night • sleepiness sets in after about 16 hours awake • the sleep drive is highest in the early morning hours and mid-afternoon • it is difficult to sleep late morning and later afternoon/early evening • sleep quality • split sleep is not as good as one long sleep • napping opportunities to make up lost sleep. <p>Do the sleeping quarters let crew get a good sleep?</p> <p>Psychological stress. Encourage crew to report anything in their lives that may affect their sleep quality.</p>	<p>Sleep quality is as important as the amount of sleep. Disturbed sleep will leave a person tired and this can significantly contribute to cumulative fatigue. People go through light and heavy stages of sleep in a cycle lasting about 90 minutes. In normal circumstances, to recover from a lack of sleep people need to go through 4-5 cycles per night. Splitting this pattern into several bouts of sleep is less restful than getting the same amount of sleep in one period.</p> <p>People who are stressed often have poor quality sleep. This can include skippers who have a “weather ear” listening, even when sleeping.</p>
How can a fatigued seafarer be identified?	<p>Place a copy of the <i>Wheelhouse fatigue checklist</i> in the wheelhouse and in the crew mess room.</p> <p>Encourage crew to report fatigue and be prepared to respond positively to the report.</p> <p>The skipper to assess crew fitness for duty, especially if fatigue would make the duty risky.</p>	<p>Go over the <i>Wheelhouse fatigue checklist</i> with all crew. Ask them to relate it to their own experiences.</p> <p>Crew can have a better understanding of their own fatigue than others.</p> <p>Crew do not always know they are fatigued, or they may not want to acknowledge the extent of their fatigue.</p>
How do I go about developing ways to control fatigue as a hazard?	<p>Use the same methods as above (identifying hazards).</p>	

continued...

2.3 continued...

QUESTION	ANSWER	COMMENT
What is the best balance between work and time off?	<p>The best balance between work and time off work is where the time off allows the crew member to get enough sleep, after taking care of his or her other needs.</p> <p>Time off work is not the same as rest or sleep. Crew need to eat, shower, have personal and family time, and commute if they don't sleep on board.</p>	<p>Experience has shown that people will skimp on sleep to be able to engage in personal and family activities when the time for these gets tight.</p> <p>Time off work is not the same as time available for sleep.</p>
What rest requirements does Maritime New Zealand recommend to assist crew to recover from accumulated fatigue?	A minimum of 77 hours rest in a 7-day period; and two consecutive nights available for sleep between 10.00 pm-8.00 am, at least fortnightly and preferably once per week.	Sleep is the only way to recover from fatigue and sleep loss. Work often results in less sleep than is desirable, so programming time off to allow recovery is necessary to ensure safety.
What minimum hours of sleep does Maritime New Zealand recommend?	A minimum of one block of sleep of 6 hours per 24 hours; and 14 hours of sleep in 48 hours.	These guidelines minimise risk on a short-term basis.
What about cumulative fatigue?	<p>As soon as a person gets less than 7-8 hours quality sleep a night they build a sleep debt and their accident risk increases.</p> <p>One night of little sleep, particularly if the crew member has cumulated a sleep debt, will increase risk substantially.</p>	When sleep is reduced by an hour or two a night (compared to a good night's sleep) performance drops off to some extent and the risk builds slowly over time. But where sleep is restricted by more than this, risk builds rapidly.
What if the crew have to work longer hours because the job suddenly demands it?	<p>Have a contingency plan. Mostly you will be able to anticipate what the extra demands may be (engines break down, rough sea, etc). What you can't predict is when they might happen.</p> <p>Build into the contingency plan your expectation of the amount of additional time off that crew will be allowed for recovery.</p>	<p>Seagoing life always has highs and lows of work demands. It can never be predicted when some tasks will occur, so it makes sense to think ahead about how to handle them. As the owner you are responsible for health and safety. When the vessel is at sea, your expectations provide a guide for the skipper and crew to follow.</p> <p>You need to ensure that your expectations do not place the crew at risk of harm due to fatigue. Potentially this can lead to large penalties if there is an accident.</p>

QUESTION	ANSWER	COMMENT
What is the best way to work out the manning levels?	Look at the highs and lows of the work and how they can be spread out more evenly. Also look at the goals you set for fatigue management. Use your goals as a guide to set your manning level and how you will spread out activities over time.	Work demands can vary a lot over a trip or day cycle. Some you can control. How you separate demands in time can influence the manning level/ safety trade off.
What is the best time to schedule risky, demanding or complex tasks?	Some tasks are very demanding and the person doing them needs to be at his or her most alert. People are naturally alert at some times of the day and not at others. The natural times for being alert (on average) are in the morning, especially late morning and from 6.00 - 9.00 pm. Demanding or risky tasks should be avoided, where possible, late at night.	Human biology has evolved so that we have a body clock, which makes us alert and sleepy at different times of the day. Some people will be early and some late in how their body clock works. When planning work schedules it can be useful to know if individuals are late or early types.
How do customers influence fatigue levels and how can I change this?	Customers operate to the demands on them, which often means they want to minimise the time they or their goods are in transit. Discuss the problems you have in operating safely, to meet their needs and see if a new arrangement can be reached. Address the issue in contracts, so that there is not a slide to unsafe practices.	Customers will be focused on their business, not yours, so are unlikely to be aware of the impact they have on the safety of your vessel and crew. While this may not work for everyone, many are understanding and willing to reach an agreement.
What are the best ways to manage fatigue-related risk at departure?	Do not leave so early that crew have to cut their sleep short to report for duty. Insist that all crew who will be on duty at departure time have been able to get to bed early the night before. Install a watchkeeping alarm and have a strict policy on its use at high risk times, such as departure. Until clear of the enclosed waters have two watchkeepers. If an early morning departure, have short watches at first.	Early morning departures usually mean that the crew have not had their full quota of sleep. They will have woken early, and their fatigue may be made worse if they also went to bed late. Watchkeeping alarms are a safety net for tired watchkeepers. Analysis of New Zealand fishing vessel groundings shows that about half occur shortly after departure.

continued...

2.3 continued...

QUESTION	ANSWER	COMMENT
<p>What are the best ways to manage fatigue-related risk when approaching the coast?</p>	<p>Install a watchkeeping alarm and have a strict policy on its use at high-risk times, such as when approaching the coast.</p> <p>If all crew have been working long hours before approaching the coast (as is common with small fishing vessels), have a policy that at least one must have a nap before taking a watch.</p> <p>Have a policy of two watchkeepers when approaching the coast.</p>	<p>Approaching the coast only happens after the crew have been at sea working. Depending on the type of work, they can be tired – about half of all fishing vessel groundings occur when approaching the coast.</p> <p>Napping can provide some recovery. Use either a short nap (40 minutes maximum) or a long nap (either 2 or 3.5 hours). Naps of either length minimise the grogginess (sleep inertia) experienced when waking. These nap times are designed to reflect the sleep cycle and when sleep inertia is at its lowest.</p>

2.4 Act

QUESTIONS	ANSWER	COMMENT
What management responsibilities should I assign?	All actions to manage crew fatigue should be supported by a management action.	This confirms to crew that the actions are important.
Do I need to run a trial of my fatigue management plan?	Yes. During the trial, record the hours worked, problems discovered, solutions found. Involve the crew – hold regular safety meetings, and perhaps a survey if you have a large crew or several vessels.	The SSM process will require you to run a trial and document how it goes. Fatigue management is not a science – it is using science to make informed choices about what is likely to work best. It is most likely that what you first come up with will need refining.
What kind of records do I need of management activities?	Enough to demonstrate that you did something (like have a safety meeting with all crew) and what was discussed or decided. All this needs to be is a few handwritten notes. This has to be on-going, not just when you first set up your plan. (See “How often should I revisit my fatigue management plan?” in section 2.5).	What you do is subject to audit. A written record provides evidence that you did something. (Auditors may ask others questions to make sure that what is written down can be independently verified.)
How can I use shore staff?	To analyse the paperwork that comes off the vessel to check that the vessel is operating within your fatigue management plan. They may be in a position to assess fatigue levels when the vessel returns.	Shore-based staff generally have more time than crew to analyse the timesheets and other paperwork that comes off the vessel.
How do I assist the crew to manage their fatigue?	Provide them with the brochure <i>Understanding fatigue</i> and other education opportunities. Make sure that the crew have as much notice of their work schedule as possible. Display the <i>Wheelhouse fatigue checklist</i> where everyone has easy access to it.	Go over the brochure with them. Early notice of the work schedule lets crew plan how to use their down time.

continued...

2.4 continued...

QUESTIONS	ANSWER	COMMENT
How should a fatigued seafarer be managed?	<p>Where a seafarer is fatigued in the short-term, the skipper should follow the options in the fatigue management plan (also see the <i>Wheelhouse fatigue checklist</i>).</p> <p>If a seafarer is regularly fatigued, a staged approach is needed:</p> <ul style="list-style-type: none"> • Are the working conditions too demanding? If yes, alter them. • If the seafarer has a personal fatigue issue, a solution needs to be developed in consultation with the seafarer. 	<p>Lack of a demonstrated response to a fatigued seafarer places the employer at risk of legal action under the Health and Safety in Employment Act 1992.</p> <p>Crew with sleep problems may need to see a sleep specialist. They should be encouraged to see their GP in the first instance. A list of sleep clinics is on the Maritime New Zealand website: www.maritimenz.govt.nz</p>

2.5 Follow up

QUESTION	ANSWER	COMMENT
How do I monitor hours worked and fatigue?	Use a register that records what hours the crew worked, with start and finish times. These should be signed by the crew (see section 4.2).	This is an easy area to 'cheat' on, as many overseas accident reports verify. Cheating typically is found out after an accident. Audits will also be looking for this.
How often should I revisit my fatigue management plan?	<p>This depends on your operation.</p> <p>Options include:</p> <ul style="list-style-type: none"> • a formal annual review • review the plan at the end of a busy period (like the slow down after a tourist or fishing season) • hold regular safety meetings with fatigue on the agenda each time. This is a good way of keeping up with issues that might need tweaking. It also allows for new problems to be identified early. 	<p>Circumstances are always changing – crew have families, the ship ages, the nature of the job changes. Regular review keeps your fatigue management plan current.</p> <p>Regular review emphasises to the crew the importance you attach to managing fatigue. It helps keep it at the front of their minds.</p> <p>Fatigue is a hazard in most operations. The Health and Safety in Employment Act 1992 requires employers to monitor hazards and exposure to them. You will need to demonstrate that you are doing this.</p>
What about accidents and incidents that may be related to fatigue?	Record, report and investigate them.	<p>These are your warning signals that the fatigue management plan may not be working properly.</p> <p>Advice on how to investigate the role of fatigue in accidents and incidents is in section 4.3).</p>

3

FACTORS THAT CAN RESULT IN FATIGUE

This list is based on one published by the International Maritime Organization.

<p>Management of work practices – from ashore and aboard ship</p> <ul style="list-style-type: none"> • scheduling of work and rest periods • watchkeeping practices (includes watchkeeper alarms and policy) • manning levels • voyage planning • implications of commuting • scheduling of complex/high-demand tasks • whether employees have opportunity to influence roster • how often work goes beyond scheduled shift requirements • administrative duties • on-call work • assignment of duties • shore-ship-shore support and communication • standardisation of work procedures • recreational facilities <p>Ship-specific factors</p> <ul style="list-style-type: none"> • level of automation • reliability of equipment • motion characteristics • vibration, heat and noise levels • quality of working environment • quality of living environment • cargo/passenger characteristics/requirements • visibility from wheelhouse <p>Physical environment for sleeping</p> <ul style="list-style-type: none"> • bed comfort • bed size • amount of light • noise • vibration • heat/cold • dampness <p>Sleep countermeasures</p> <ul style="list-style-type: none"> • napping policy • use of coffee and energy drinks • assessing of new employees' sleep needs • diet • open communication system 	<p>Management actions</p> <ul style="list-style-type: none"> • discussion of fatigue at regular safety meetings • recording of actual hours worked/rested • ongoing monitoring of crew size to determine if it meets safety standards • investigation of accidents and incidents to determine if fatigue is an issue <p>Work environment</p> <ul style="list-style-type: none"> • boring or repetitive task • physically demanding task • ship's motion • vibration, heat and noise levels • cargo characteristics/requirements • pressure to maintain a tight schedule • ease of use of equipment • location of equipment <p>Crew-specific factors</p> <ul style="list-style-type: none"> • thoroughness of training • experience • age • crew composition • cohesiveness • crew competency and quality <p>Unusual or unpredictable events</p> <ul style="list-style-type: none"> • bad weather • wet weather • additional work demands • breakdowns • extra port visits <p>Personal circumstances</p> <ul style="list-style-type: none"> • development of contingency plans for those who did not sleep well • whether there is a policy to encourage reporting of immediate and long-term sleep problems • commuting problems • use of off-duty time • alcohol/drug use
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4

TOOLS FOR GATHERING INFORMATION

This section contains a range of tools for gathering and managing information relating to fatigue management.

4.1 Types of survey tools

There are different ways of finding out about fatigue from your employee's point of view.

4.1.1 Talk with employees

The simplest way to survey the crew is to sit around the table and discuss fatigue. Topics that could be covered include:

- what have they done in the past, eg what hours did they work on their last trips
- how fatigued were they in the past, eg how fatigued did they become on their last trips
- what incidents or accidents have they experienced that they attribute to fatigue
- their observations of fatigue in others on the ship, eg when do they see others making mistakes as a result of fatigue
- what their views are on the causes of fatigue, fatigue countermeasures, etc.

Make sure you record the main points covered during the discussion.

4.1.2 Use a survey form

The two survey forms included here are suggestions only. You can modify them or choose to use any other method of surveying employees.

Before asking anyone to participate in a survey, discuss with them the survey and the intended use of the information. The information you will get is likely to be more accurate if those completing the forms understand why you are asking them to do so and are confident that the information they provide will be protected.

Survey method 1: Tracking fatigue over time

Purpose: For tracking how fatigue changes over time. Helps in understanding how fatigue changes, so is particularly useful if there is a specific problem you are trying to understand (such as how fatigue changes over the days of a shift).

Who to use it with: When more information is needed to understand how a fatigue problem changes over time. Can be used with many employees or just one.

How to use it: Ask the employee to rate his or her level of fatigue at intervals that make sense for the job. Once every two hours is a useful time interval, though others can also be used, eg start, middle and end of a shift.

Privacy: With this type of form you will know who completed it. Before the form is used, you will need to discuss and agree with employees how the information about them will be used and stored. You will need to obtain employees' written consent.

Interpretation: Typically, scores of 7 or more indicate sleepiness levels to be concerned about.

Ongoing use: Where a fatigue hazard requires ongoing attention this can be a useful way to monitor its status regularly.

HOW DO YOU FEEL NOW?	TIME 1	TIME 2	TIME 3	TIME 4
1. VERY ALERT				
2.				
3. ALERT				
4.				
5. NEITHER ALERT NOR SLEEPY				
6.				
7. SLEEPY, BUT NO EFFORT TO STAY AWAKE				
8.				
9. VERY SLEEPY, FIGHTING SLEEP, EFFORT TO STAY AWAKE				

This form (known as the Karolinska Sleepiness Scale) can be photocopied or downloaded from the Maritime New Zealand website: www.maritimenz.govt.nz

Survey method 2: Rating fatigue at a point in time

Purpose: Provides a snapshot of how employees rate fatigue for your operation at a point in time. Can provide a lot of information rapidly. Provides areas for you to focus on.

Who to use it with: Any group of employees whose experience of fatigue in your operation you want to understand better. Each person completes their own form.

How to use it:

- Provide a quiet area and sufficient time for the form to be completed.
- Most maritime operations operate in different circumstances over the course of a year. For instance, tourism operators tend to have a high or low season, fishers operate differently when targeting different species of fish. For the information to be meaningful, the form is best completed separately for each type of situation.
- Change the form to meet your needs, if necessary.
- The form asks people to say what is their ideal amount of sleep. This is the hours of sleep a person has when there is no pressure or disturbance, eg when on holiday for a few days.

Privacy: Discuss and agree with employees before asking them to use the form, which does not ask for names.

Interpretation: Analyse separately for each type of situation and vessel. Where employees operate on more than one vessel, it is best to analyse the results separately for each vessel, as they all vary in design, use and crew.

Tally how many people rated an item as a 1, 2, 3, 4, or 5. This will give you a profile of scores. Do not average the scores, as this may mislead you. For instance, when the crew rated sleeping accommodation, four crew chose "1" and four chose "5". The average of all the responses is "3". In this example, for instance, half the crew may have quiet sleeping accommodation and half noisy sleeping accommodation. This doesn't add up to about half the time. Use commonsense to interpret the results.

When does the score indicate risk? The risk of a fatigue related accident varies with both the amount of fatigue and the nature of the task. Drying the dishes when fatigued is less risky than operating a winch. This means that there is no magic cut-off score. High scores indicate problem areas you will need to explore further.

Ongoing use: Some operators have found it useful to reflect on a season once it has finished. This method can be used every year to track trends.

The following form can be photocopied or downloaded from the Maritime New Zealand website: www.maritimenz.govt.nz

Fatigue rating form

Name of vessel: _____ Type of situation being assessed _____

Ideal amount of sleep per night: _____ (hours). (Amount you have when on a relaxing holiday.)

Instructions: Tick the option that best describes your experience.

	NEVER	SOMETIMES	ABOUT HALF THE TIME	MOST OF THE TIME	ALWAYS	DOES NOT APPLY
Sleep for 1–2 hours less than my ideal amount of sleep						
Sleep for 3 or more hours less than my ideal amount of sleep						
Poor quality sleep (disturbed by noise, light, ship motion, vibration)						
Sleep in split shifts over 24 hours						
Sleep mostly during daylight hours						
It is difficult to plan for rest periods						
No or limited opportunities to make up for lost sleep						
Start a trip when already tired						
I fall asleep at work						
I am forgetful or make mistakes						
Work long days (12 hours plus)						
My working hours are a danger to my personal health and safety						
High workload results in fatigue						
Work is mainly boring and uneventful						
Additional duties extend my working day						
I have trouble adapting well to working a shift after coming back from a break						
On the job not enough breaks or breaks are too short						
Time off between rosters is not enough to recover from fatigue						
Poor diet (lots of fried foods, high fat and sugar content)						
Frequent caffeine consumption						

continued...

Fatigue rating form continued...

Family or personal stress						
I don't have enough control over what happens						
Physical environment is extreme (high seas, heat, cold)						
During a working day (or night) I feel tired most of the time						
I am very tired when I drive home						
Others on board look tired						
There should be more information about fatigue (tick one)	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	

4.2 Watchkeeper's register

The following register provides basic information about watchkeeping hours. It can be kept in the wheelhouse and all watchkeepers required to sign it.

DATE	SIGNATURE	TIME ON	TIME OFF

4.3 Accident investigation

All accidents must be reported to Maritime New Zealand. This is the skipper's responsibility.

If the answer is yes to any of the four questions below, fatigue should be suspected and investigated:

- Did the accident occur in the early morning hours?
- Was the person's normal sleep pattern disrupted?
- Had the person been awake long enough to have become tired?
- Does the 72-hour sleep history suggest a lack of sleep?

Go back over the fatigue management plan. Was it followed? What actions can you take to stop this type of accident occurring again:

- Change the fatigue management plan?
- Improve monitoring of compliance with the fatigue management plan?
- Reduce pressures on vessel operation?
- Train staff?

STRATEGIES FOR MANAGING FATIGUE

5

Managing fatigue is a balancing act between safety, work demands and personal activities. This section shows how different practices can shift the balance from greater to lesser safety. Use these to help generate ideas for strategies to use in your own operation.

5.1 Why not run a brainstorming session?

A brainstorming session is simply getting a few people together to generate ideas. The main point is to let people's imaginations go, so that all ideas come out – sensible and not so sensible. Only at the end should there be any attempt to edit the ideas.

To run a group brainstorming session effectively:

- Be clear about the problem you want solved.
- Keep the session focused on the problem.
- Ensure that no one criticises or evaluates ideas during the session. Criticism introduces an element of risk for group members when putting forward an idea. This stifles creativity and cripples the free-running nature of a good brainstorming session.
- Encourage an enthusiastic, uncritical attitude among members of the group. Try to get everyone to contribute and develop ideas, including the quietest members of the group.
- Let people have fun brainstorming. Encourage them to come up with as many ideas as possible, from solidly practical ones to wildly impractical ones. Welcome creativity.
- Ensure that no train of thought is followed for too long.
- Encourage people to develop other people's ideas, or to use ideas to create new ones.
- Appoint one person to note down ideas that come out of the session.

5.2 Involving partners

The partners of employees are in a special position, in that they have to support the employee in obtaining good restorative sleep. They need to understand the work demands on the seafarer, and what he or she needs in the way of support at home.

Experience shows that workers in many industries – including seafaring – either underestimate the effect of fatigue on their lives or are simply unaware of it (fatigue has that effect). Partners are able to point out the obvious, as they see the effects at home. While some staff may object to partners being asked to contribute, gaining the partner's input is useful in building an understanding of the fatigue situation on a vessel.

In other industries, including workers' partners in the fatigue education process has led to a better understanding of how activities outside of work contribute to accident risk at work. This is important, given that six out of ten seafarers reported being tired when resuming work as a result of being busy in their own time away from the vessel.

To involve partners you can:

- encourage employees to take the brochure *Understanding fatigue* home
- invite partners to presentations about fatigue
- invite partners to discussions about fatigue, especially those that focus on identifying when fatigue is a problem.

5.3 Use a fatigue coach

Successful implementation of the fatigue management plan requires people (ship and shore) to change their work practices. Appointing an on-board coach is a method that the US Coast Guard has found works well for helping crew to make adjustments to the new work practices. This can work even with small crews – given the fatigue risk with small crews, having a fatigue coach may prove very useful in breaking old habits.

The on-board coach will take responsibility for both encouraging change, and monitoring that the fatigue management plan is working. While this may often be the skipper, it does not have to be the skipper – a volunteer who takes on the task may be best.

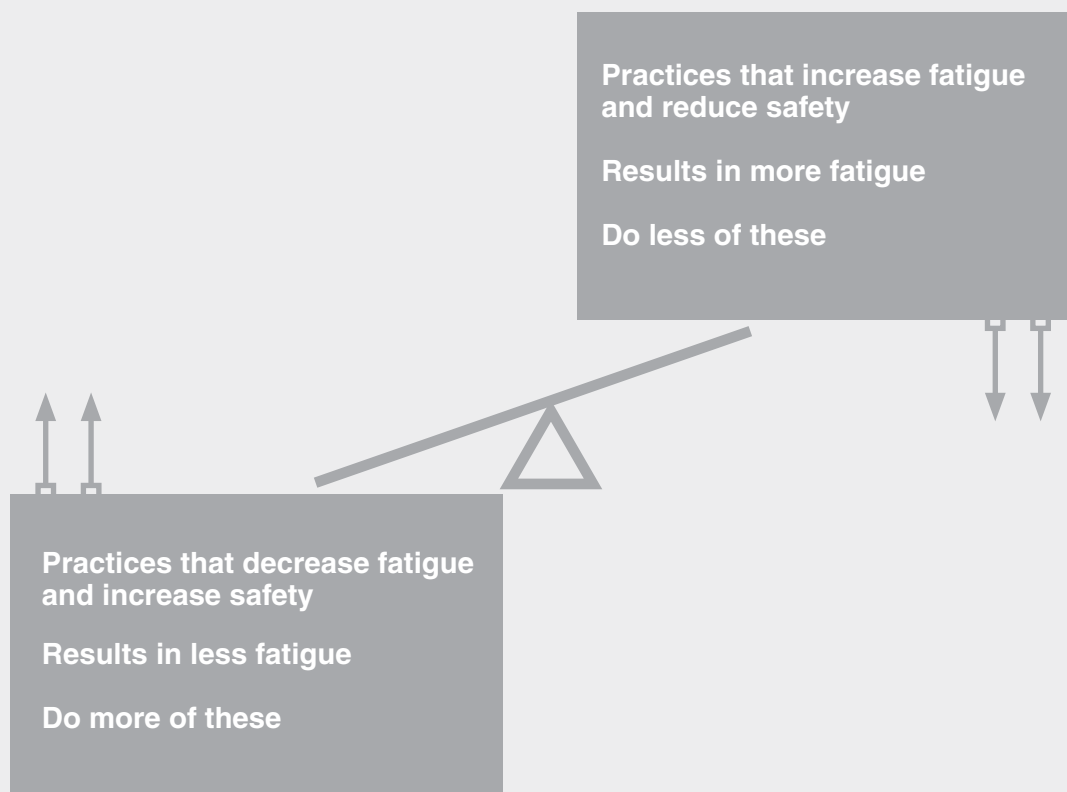
The coach needs to have a good understanding of what causes fatigue, its signs, its effects and how to manage it. The Maritime New Zealand website has a list of readings and websites, for those interested in learning more about fatigue management.

The coach, with the skipper or other senior officer, keeps a day-to-day eye on how the fatigue management plan is put in place. Encouraging people to make changes (to what for some will be life-long habits) may take time.

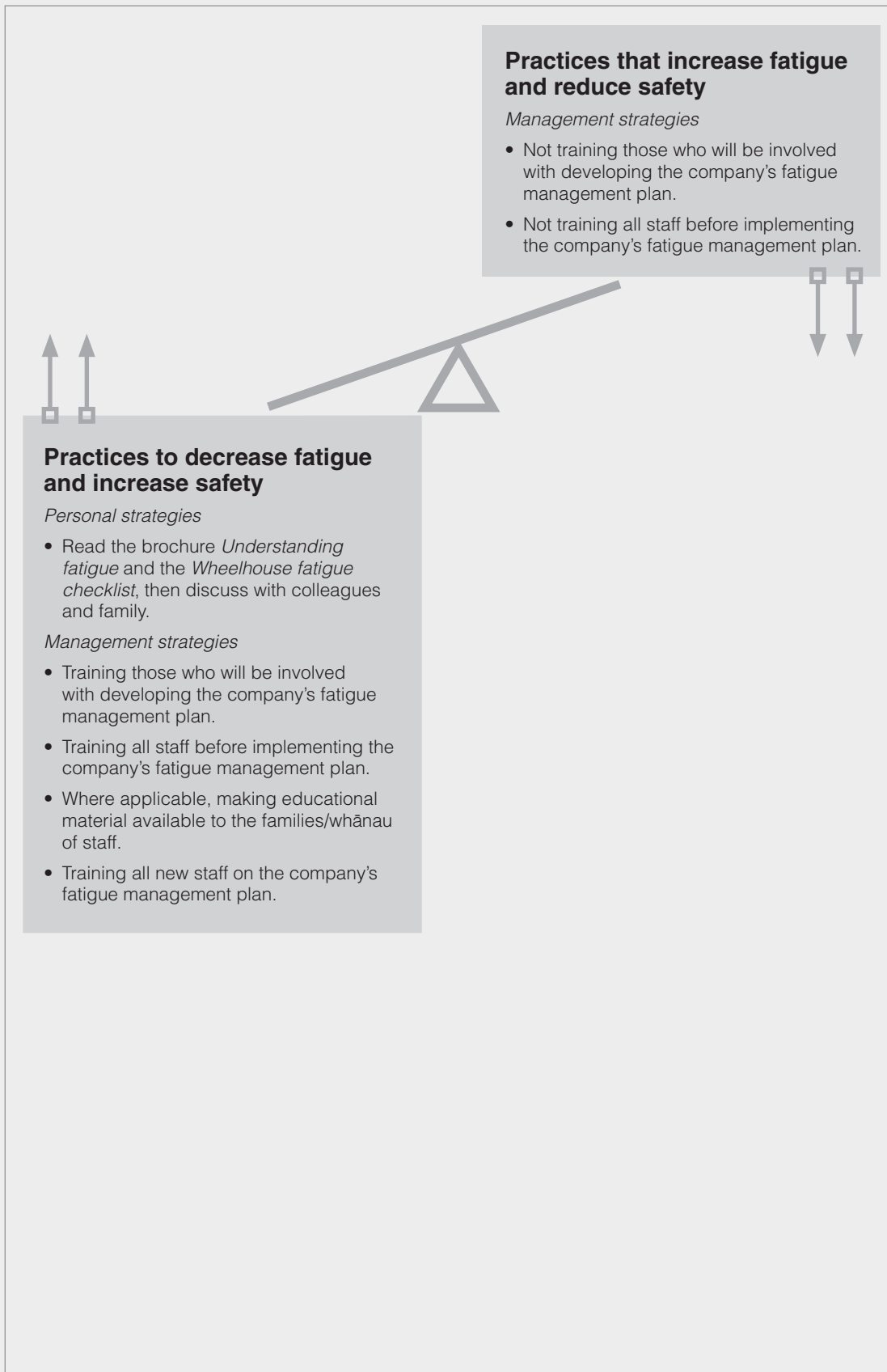
Schedule regular meetings with the coach. These should be held frequently when the fatigue management plan is first put in place. Later on, less frequent, but regular, meetings should be scheduled.

Strategic balance

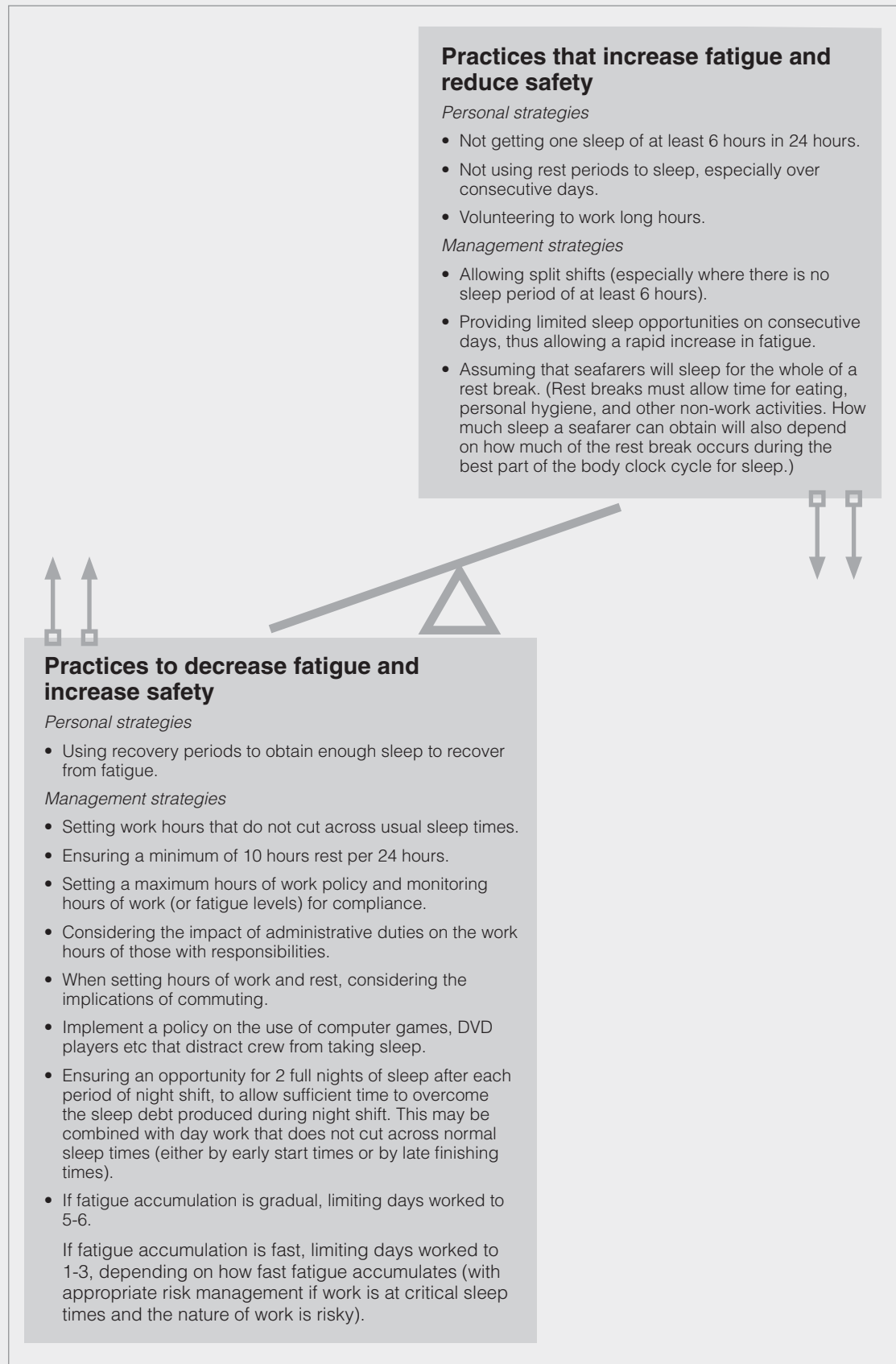
The following sections present strategies that can make fatigue better or worse. Shift the balance to meet your expectations.



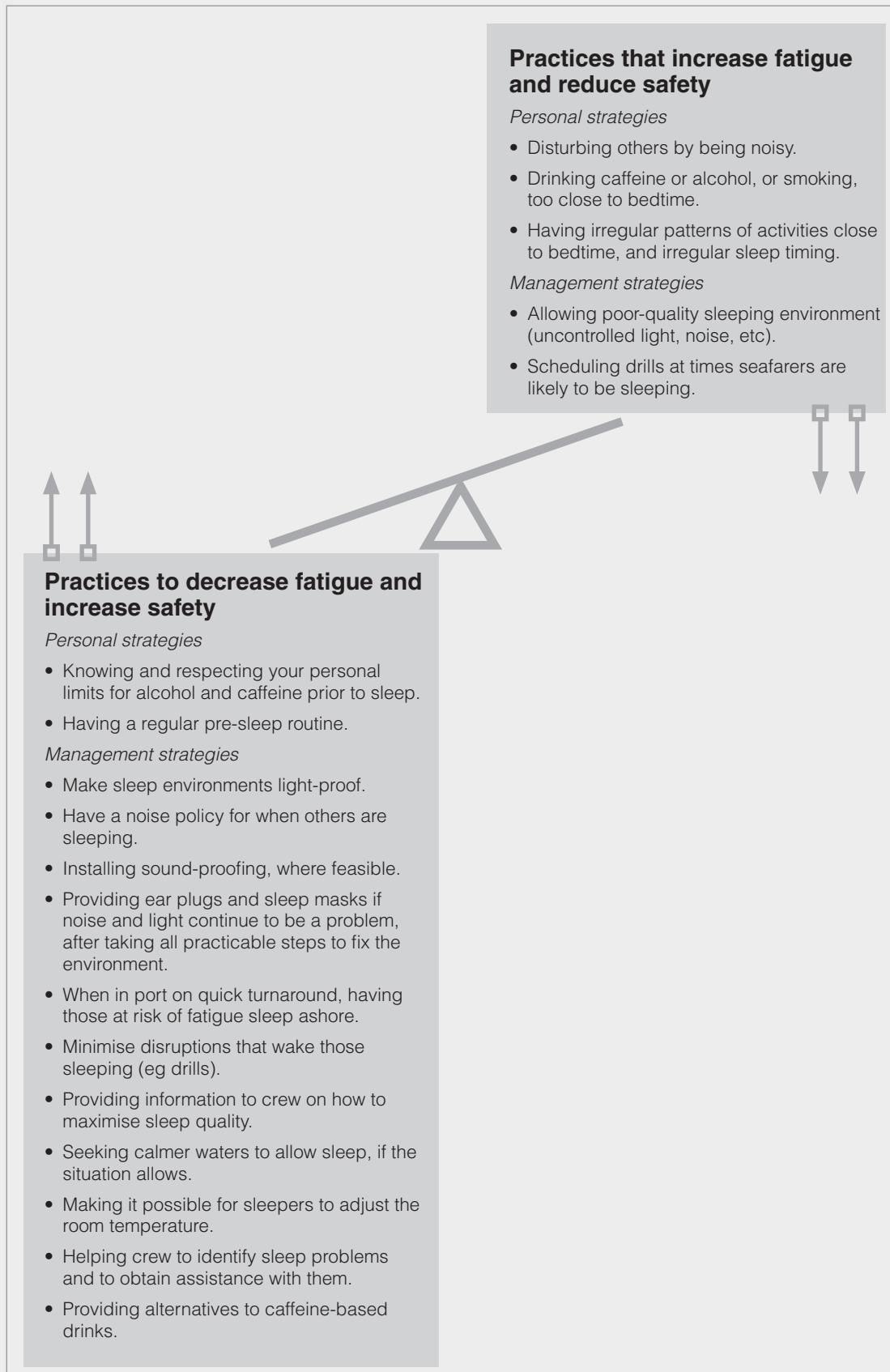
5.4 Education



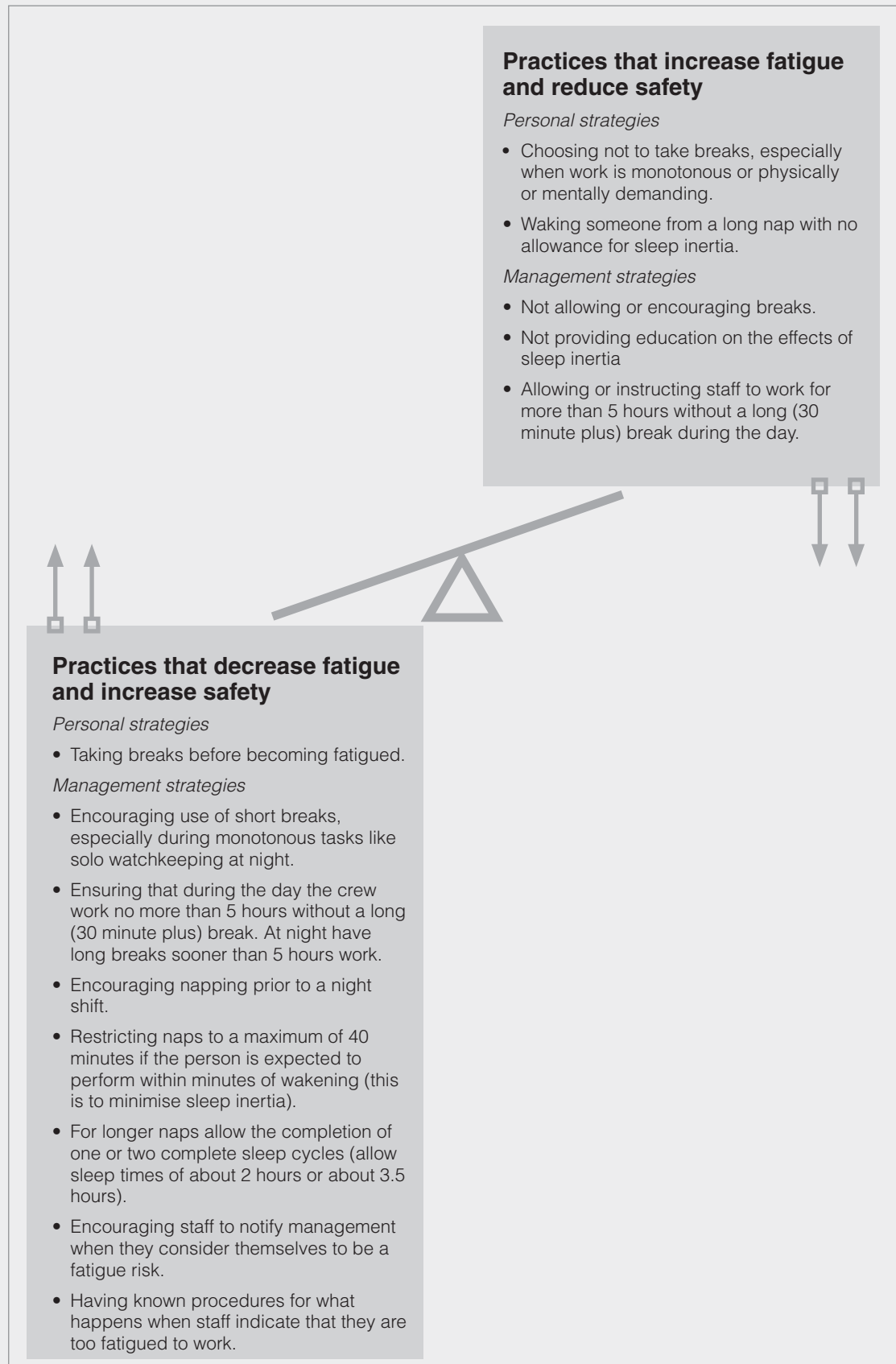
5.5 Minimum rest and maximum hours of work



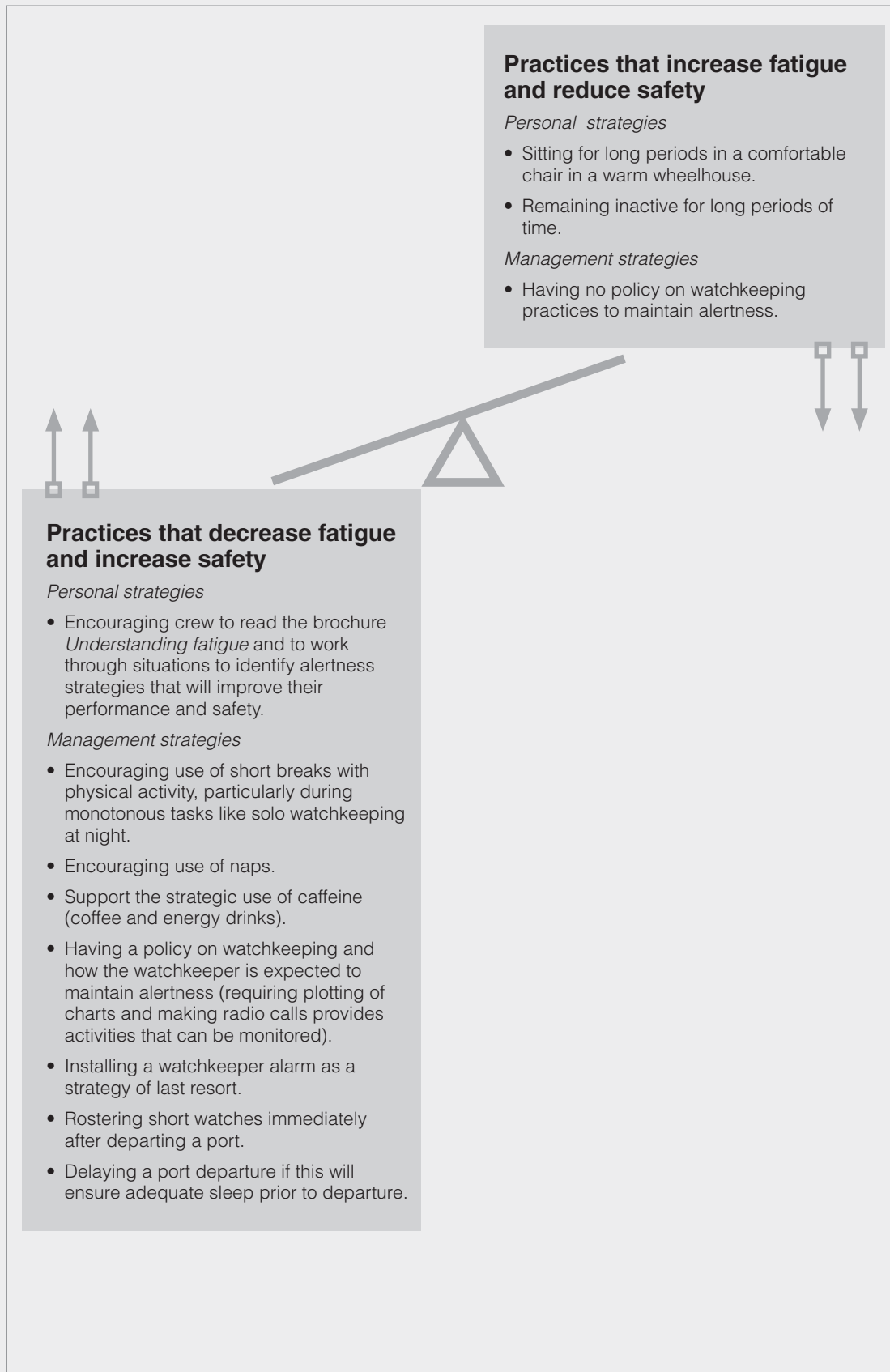
5.6 Sleep quality



5.7 Work breaks



5.8 Managing alertness



6

MANAGING SHIFTWORK RISK FACTORS

6.1 What is shiftwork?

Shiftwork is any work pattern that requires someone to be awake and active when he or she would normally be asleep. For most people this means going to bed later than they are usually inclined to and getting up earlier (before 6.00 am is a good rule of thumb).

6.2 What is it about working shifts that makes people fatigued?

- The human body is programmed for sleep at night and active wakefulness during the day. There is no such thing as the perfect shift or roster.
- Working at natural sleep times can impair alertness, skills, decision-making and the ability to stay awake.
- The more work overlaps with a person's preferred sleep time, the faster they will accumulate a sleep debt across a roster.
- In general, people working nights will have 2-3 hours less sleep per 24-hours than what they need to be fully rested.
- The more days worked, the more cumulative fatigue and the greater the risk.
- Working more than scheduled hours also adds to the fatigue risk, as this cuts into often limited sleep opportunities.
- Allowing only short rest breaks between shift changeovers will mean that recovery from fatigue is not complete.

6.3 Useful sources for finding shiftwork risk factors

- Talking to those who work shifts
- Incident and accident reports
- Complaints from employees
- Advice from those with technical expertise in shiftwork.

6.4 Designing shiftwork rosters

All rosters are a balance between safety (through the effects on sleep and fatigue), business needs and family/personal life. As a result there is no such thing as the perfect roster. Each type of roster has its own strengths and weaknesses. Getting the balance right is a matter of judgement and trial and error.

Changing rosters is a major exercise and can be disruptive of the lifestyle of those affected. Once a satisfactory roster is in operation, only make significant changes when a clear problem has been identified.

Designing a roster that works well has three major steps.

6.4.1 Using science

The science of sleep and fatigue provides principles that need to be considered in roster design. For instance, complex tasks are best done during daylight hours when people are more alert. Educating all those involved in roster design or who are affected by the roster is a key fatigue management strategy.

6.4.2 Using operational knowledge

Operational knowledge brings to life the science of sleep and fatigue. In designing rosters it is important to bring together a wide range of operational knowledge about how fatigue affects different people. Often those who design rosters have had some experience in working the rosters. However, as each person is different and circumstances change over time, they should not rely on their own experience to second guess how others experience a particular roster. Experience across a range of industries has shown that involving employees in the design of rosters generally leads to increased employee satisfaction with the roster, decreased absences from work and lower staff turnover.

As rosters are a balance between safety, business needs and family/personal life, it will not be possible to please all of the people all of the time. Be open about this and continue to discuss it during the roster design process. This will assist everyone to understand how the final roster is reached.

6.4.3 Monitoring the roster

There are four reasons for monitoring the effects of a roster:

- rosters are always a compromise between safety, business needs and personal/family life. When designing a roster, predictions are made about how well the balance between these will work. The predictions need to be tested
- new rosters can have unintended consequences. Monitoring assists in identifying what these are
- over time circumstances can change and a roster may become less functional at providing an optimal balance
- even if circumstances do not change, the behaviour of those affected by the roster may change.

It is recommended that new rosters are put in place for several weeks then assessed. Discuss with and/or survey those affected. Is any adjustment needed? Finalise the roster and plan a formal review. With most, maritime operational work is seasonal. Many operators have found it useful to review fatigue management at the end of each season.

7

SHIFTWORK RISK FACTORS

7.1 Management

FATIGUE HAZARD	WHY IT IS A FATIGUE HAZARD	OPTIONS TO ELIMINATE, ISOLATE OR MANAGE THE HAZARD
Poor management	Fatigue issues not addressed systematically or not monitored.	<p>Appoint a manager with responsibility for rostering and fatigue management.</p> <p>Educate this manager, and those who design rosters, in fatigue management.</p> <p>Put a monitoring system in place, including time worked (especially overtime), incident and accident investigation and a complaints procedure.</p>
Incentives to work long hours	Employees will often want to work excessive hours when incentives are in place for them to do so. These can range from “share of the catch” to overtime to several consecutive days off work.	<p>Eliminate incentives.</p> <p>Analyse the effects of work incentives and develop a policy to manage their effects on fatigue risk.</p>
Not allowing employees to have time off when their families and friends also have time off	Employees will want to interact with their families and friends. If the shift system makes this difficult, they are likely to sacrifice sleep to be with their families and friends. This will add further to their fatigue levels.	<p>Ensure a fair distribution of evenings and weekends off.</p> <p>Allow workforce input into roster design.</p> <p>During breaks at work provide facilities for contact with families and friends.</p>

7.2 Time of work

FATIGUE HAZARD	WHY IT IS A FATIGUE HAZARD	OPTIONS TO ELIMINATE, ISOLATE OR MANAGE THE HAZARD
Working at night, especially after 11.00 pm	<p>At 11.00 pm most people have been awake for at least 16 hours and have a reasonably high sleep need, especially if they have an accumulated sleep debt.</p> <p>Mistakes are more likely, especially with complex tasks.</p>	<p>Eliminate or limit night work.</p> <p>Limit the complexity of tasks – mistakes are more common at night. Focus on core tasks only.</p> <p>Limit the number of consecutive days worked.</p> <p>Actively discourage unscheduled work – this cuts into critical sleep opportunity.</p> <p>Encourage crew to take frequent short breaks if this is possible. If it is not, ask that they try to vary what they are doing.</p>

FATIGUE HAZARD	WHY IT IS A FATIGUE HAZARD	OPTIONS TO ELIMINATE, ISOLATE OR MANAGE THE HAZARD
<p>Early starts that require waking earlier than usual</p>	<p>Cuts sleep short. Cumulative fatigue builds day by day.</p> <p>Difficult to fall asleep earlier than usual in the evening, ahead of an early start, because of the body clock.</p>	<p>Eliminate or minimise risk by starting later. BUT if the morning shift takes over from a night shift, the night shift should be going off duty before it gets too light.</p> <p>Limit the number of consecutive days worked.</p> <p>Schedule a minimum of 10 hours rest per 24 hours.</p> <p>Where possible, use individuals who are morning types.</p> <p>Where possible, provide napping opportunities mid-afternoon.</p> <p>Encourage crew to drink an early morning cup of coffee.</p>
<p>Late finishes that delay normal bedtime</p>	<p>These cut sleep short, and cumulative fatigue builds day by day.</p>	<p>Limit the number of consecutive days worked.</p> <p>Schedule a minimum of 10 hours rest per 24 hours.</p> <p>Actively discourage unscheduled work – this cuts into critical sleep opportunity.</p> <p>Where possible use individuals who are evening types.</p>
<p>Long work days</p>	<p>Accident risk begins to increase significantly, especially after around 10 consecutive hours work.</p> <p>This can be made worse by call-backs (especially kick shifts) and extending the normal working day.</p> <p>Commuting can become high-risk.</p>	<p>Monitor hours of work, especially additional time worked.</p> <p>Reduce working hours.</p> <p>Increase number of employees available.</p> <p>Actively discourage unscheduled work including overtime – this cuts into critical sleep opportunity.</p>
<p>Irregular hours of work</p>	<p>Difficult to plan sleep and other life activities.</p> <p>Sleep patterns can become disrupted – is similar to jet lag.</p>	<p>Make rosters and work patterns predictable to the extent possible.</p> <p>Provide as much advance notice of work requirements as possible.</p>

7.3 Shift characteristics

FATIGUE HAZARD	WHY IT IS A FATIGUE HAZARD	OPTIONS TO ELIMINATE, ISOLATE OR MANAGE THE HAZARD
Shift length, rotation and speed of rotation	<p>If fatigue cumulates rapidly, limit days worked to 1-3 days (3 or more hours lost sleep per 24 hours).</p> <p>If fatigue cumulates slowly limit days worked to 5-6 days (2-3 hours lost sleep per 24 hours).</p> <p>Shifts can rotate forward (day-afternoon-night) or backward (night-afternoon-day). Rotation can be fast or slow. While most shifts rotate forward, the research is unclear if forward or backward rotation is best.</p>	<p>At times employees choose to work long work shifts that increase risk while working, as these give them extra days off. This increases the employer's liability if risk is knowingly increased. Avoid this situation.</p> <p>Ensure that shifts are predictable, so employees can plan their lives ahead.</p> <p>Consult with employees about preferred direction of shifts and their lengths and timing.</p>
Split shifts	<p>These often involve early starts and late finishes.</p> <p>Difficult to sleep during the day, especially from late morning to mid-afternoon.</p>	<p>Try to eliminate split shifts.</p> <p>Encourage napping during the late afternoon (3.00 – 5.00 pm) if the opportunity exists.</p>
On-call shifts	<p>Being on call can disturb sleep quality when anticipating being called.</p> <p>Being on call also makes it difficult to plan sleep and other life activities.</p>	<p>Limit time on on-call duty.</p> <p>Do not count on-call time as rest – some additional rest may be required. Monitor affected employees to determine what is required.</p>

7.4 Breaks

FATIGUE HAZARD	WHY IT IS A FATIGUE HAZARD	OPTIONS TO ELIMINATE, ISOLATE OR MANAGE THE HAZARD
Number of duties worked before a change of shift	<p>Over successive night duties in particular, accident risk increases. Where the employee obtains little sleep, the risk will probably become larger with each duty.</p>	<p>If fatigue accumulation is slow, limit days worked to 5-6.</p> <p>If fatigue accumulation is fast, limit days worked to 1-3, depending on how fast fatigue accumulates.</p> <p>Have a policy on additional rest after unexpected longer hours are worked.</p>

FATIGUE HAZARD	WHY IT IS A FATIGUE HAZARD	OPTIONS TO ELIMINATE, ISOLATE OR MANAGE THE HAZARD
Breaks between shift changeovers too short to allow for recovery sleep	If there is significant cumulative fatigue and at least 2 full nights sleep opportunity are not available, recovery from fatigue is not possible.	Change shift roster to allow for at least 2 full nights sleep opportunity at least once per fortnight. For those on night shift, 5-7 days consecutive work should be followed by 3 or more recovery days. For those who work long blocks of time at sea, additional time off is required.
Infrequent breaks	Breaks provide an opportunity for some short-term recovery and use of fatigue countermeasures (caffeine, napping, etc). They are also essential for food and liquid intake.	Provide more breaks. Provide adequate staff to cover breaks. At least one 30 minute break per 5 hours work, more frequently at night.

7.5 Nature of work

FATIGUE HAZARD	WHY IT IS A FATIGUE HAZARD	OPTIONS TO ELIMINATE, ISOLATE OR MANAGE THE HAZARD
Monotonous work	Effects of unstimulating work are made worse by fatigue.	Provide for job rotation where possible. Use alarms where safety is critical and sleep is possible – especially watchkeeping.
Complex work	Fatigue reduces ability to perform complex tasks.	Encourage breaks. Ensure robust shift changeover procedures. Use alarms where safety is critical and distraction or sleep are possible. Where possible, demanding or risky tasks should be avoided late at night.

7.6 Other

FATIGUE HAZARD	WHY IT IS A FATIGUE HAZARD	OPTIONS TO ELIMINATE, ISOLATE OR MANAGE THE HAZARD
Long commuting trips	<p>These extend the working day to times when it often natural to sleep.</p> <p>At the end of a long working day, driving requires a worker to be awake and alert when he or she may have been awake for a long time and driving conditions are often monotonous.</p>	<p>Build commuting times into your shift design, especially where commuting is early or late in the day and follows long hours of work.</p> <p>Provide alternative travel arrangements, so the person does not have to drive.</p> <p>Provide sleep-over facilities. Inform families as to why it is safer for the employee to sleep over rather than travel home each day.</p>
Employees failing to show for duty	<p>Can place additional pressure on those who are at work.</p>	<p>Cancel the work if it creates an unacceptable safety situation.</p> <p>Have staff available (part-time, casual) who can stand-in at short notice.</p> <p>Encourage employees to give advance notice of not being able to work.</p>
Food and liquid intake	<p>Poor food and drink choices give the wrong energy over the day and can lead to longer-term health problems.</p>	<p>For those working on night shift avoid the easy solution of high-fat food.</p> <p>Provide facilities for employees to prepare/heat their own food.</p> <p>Encourage grazing over a night shift with lighter foods (low fat and sugar). Protein-rich foods (meats, fish, dairy products, dried beans and peas) are a good choice for meals during the night or afternoon shift.</p> <p>A small snack during the 3.00-4.00 am low time is a useful pick-up.</p> <p>Seek advice from a dietitian. See www.dietitians.org.nz or check with the main hospital in your area.</p> <p>Avoid caffeine within 4 hours of wanting to sleep. This is especially important for older workers who have broken sleep patterns.</p> <p>Avoid heavy meals and spicy food before going to bed.</p> <p>Provide good access to drinks.</p>

FATIGUE HAZARD	WHY IT IS A FATIGUE HAZARD	OPTIONS TO ELIMINATE, ISOLATE OR MANAGE THE HAZARD
<p>Individual factors</p>	<p>People can bring a number of sleep-related problems to the job. These include sleep disorders, disrupted sleep patterns that are a result of aging, and problems from home (eg young children, stress) that can impact on their safety at work.</p> <p>Young (under 18 years of age) seafarers are still learning adult sleep patterns. They need about 1 hour more of sleep per 24 hours than adults. Adolescents find it difficult to go to sleep early and tend to sleep later, if given the opportunity.</p> <p>Fatigue can make a person more vulnerable to motion sickness.</p>	<p>Employers are required to monitor for signs of impairment. Check with employees for sleep/fatigue problems on a regular basis.</p> <p>Educate employees on fatigue and encourage them to report problems that might impact on safety at work. Discourage bravado.</p>



Get your sleep Reduce your risk

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