

How to prevent and mitigate fatigue



Table of Content

- 1. **Bullet advice** 2
- 2. **Introduction** 3
- 3. **Fatigue**..... 4
 - 3.1. *Crew Specific Factors* 4
 - 3.2. *Management Specific Factors* 4
 - 3.3. *Ship Specific Factors* 5
 - 3.4. *Environmental Specific Factors* 5
- 4. **What Can Cause Fatigue?** 6
- 5. **Effects of Fatigue** 8
- 6. **How to Prevent and Mitigate Fatigue** 9
 - 6.1. *Guidelines* 9
 - 6.2. *Sleep* 10
 - 6.3. *Rest*..... 10
 - 6.4. *Strategic Napping*..... 10
- 7. **Rules and Regulations**..... 11

1. Bullet advice

In this chapter we have listed the most important guidelines regarding how to prevent and mitigate fatigue.

- Ensure compliance with maritime regulations (minimum hours of rest and/or maximum hours of work)
- Get between seven to eight hours of deep, uninterrupted sleep per 24 hour day
- Take breaks when scheduled breaks are assigned. When possible, take strategic naps
- Eat regular, well-balanced meals (including fruits and vegetables, as well as meat and starches), drink sufficient amount of water and exercise regularly.
- Use rested personnel to cover for those travelling long hours to join the ship and who are expected to go on watch as soon as they arrive on board (i.e. allowing sufficient time to overcome fatigue and become familiarised with the ship)
- Create an open communication environment by making it clear to crew members that it is important to inform supervisors when fatigue is impairing their performance and that there will be no recriminations for such reports
- Schedule drills in a manner that minimises the disturbance of rest/sleep periods
- Assign work by mixing up tasks to break up monotony and combining work that requires high physical or mental demand with low demand tasks (job rotation)
- Schedule potentially hazardous tasks for daytime hours
- Increase awareness of long-term health benefits from appropriate lifestyle behaviour (e.g. exercise, relaxation, nutrition, avoiding smoking and low alcohol consumption)
- Both shore and on board management is responsible to ensure that sufficient manning and resources are available so that the requirement to minimum hours of rest and maximum hours of work is met
- Please, read this guide.

2. Introduction

Fatigue can be defined in many ways. However, it is generally described as a state of feeling tired, weary, or sleepy that results from prolonged mental or physical work, extended periods of anxiety, exposure to harsh environments, or loss of sleep. The result of fatigue is impaired performance and diminished alertness.

The effects of fatigue are particularly dangerous in the shipping industry. The technical and specialised nature of this industry requires constant alertness and intense concentration from its workers. Fatigue is also dangerous because it affects everyone regardless of skill, knowledge and training.

Fatigue is a problem for all 24-hour a day transportation modes and industries, the marine industry included. However, there are unique aspects of seafaring that separate the marine industry from the others.

It must be recognized that the seafarer is a captive of his/her work environment.

- Firstly, the average seafarer spends between three to six months working and living away from home, on a moving vessel that is subject to unpredictable environmental factors (i.e. weather conditions).
- Secondly, while serving on board the vessel, there is no clear separation between work and recreation.
- Thirdly, today's crew is composed of seafarers from various nationalities and backgrounds who are expected to work and live together for long periods of time.

This booklet is based on the "Guidance on Fatigue Mitigation and Management" issued by IMO in MSC/Circ. 1014 June 2001.

3. Fatigue

The most common causes of fatigue known to seafarers are lack of sleep, poor quality of rest, stress and excessive workload. There are many other contributors as well, and each will vary depending on the circumstance (i.e. operational, environmental).

There are many ways to categorise the causes of fatigue. To ensure thoroughness and to provide good coverage of most causes, they have been divided into 4 general categories.

- Crew-specific factors
- Management factors (ashore and aboard ship)
- Ship-specific factors
- Environmental factors

3.1. Crew Specific Factors

The crew-specific factors are related to lifestyle behaviour, personal habits and individual attributes. However, fatigue varies from one person to another and its effects are often dependent on the particular activity being performed.

The crew-specific factors include the following:

- Sleep and rest
 - quality, quantity and duration of Sleep
 - sleep disorders/disturbances
 - rest breaks
- Biological clock/circadian rhythms
- Psychological and emotional factors, including stress
 - fear
 - monotony and boredom
- Health
 - diet
 - illness
- Stress
 - skill, knowledge and training as it relates to the job
 - personal problems
 - interpersonal relationships
- Ingested chemicals
 - alcohol
 - drugs (prescription and non-prescription)
 - caffeine
- Age
- Shift work and work schedules
- Workload (mental/physical)
- Jet lag

3.2. Management Specific Factors

The management factors relate to how ships are managed and operated. These factors can potentially cause stress and an increased workload, ultimately resulting in fatigue. These factors include:

- **Organisational factors**
 - staffing policies and retention
 - role of riders and shore personnel
 - paperwork requirements
 - economics
 - schedules-shift, overtime, breaks

- company culture and management style
- rules and regulations
- resources
- upkeep of vessel
- training and selection of crew
- **Voyage and scheduling factors**
 - frequency of port calls
 - time between ports
 - routing
 - weather and sea condition on route
 - traffic density on route
 - nature of duties/workload while in port

3.3. Ship Specific Factors

These factors include ship design features that can affect/cause fatigue. Some ship design features affect workload (i.e. automation, equipment reliability), some affect the crew's ability to sleep, and others affect the level of physical stress on the crew (i.e. noise, vibration, accommodation spaces, etc.). The following list details ship-specific factors:

- ship design
- level of automation
- level of redundancy
- equipment reliability
- inspection and maintenance
- age of vessel
- physical comfort in work spaces
- location of quarters
- ship motion
- physical comfort of accommodation spaces

3.4. Environmental Specific Factors

Exposure to excess levels of environmental factors, e.g. temperature, humidity, excessive noise levels, can cause or affect fatigue. Long term exposure may even cause harm to a person's health. Furthermore, considering that environmental factors may produce physical discomfort, they can also cause or contribute to the disruption of sleep.

Ship motion is also considered an environmental factor. Motion affects a person's ability to maintain physical balance. This is due to the extra energy expended to maintain balance while moving, especially during harsh sea conditions. There is a direct relation between a ship's motion and a person's ability to work. Excessive ship movement can also cause nausea and motion sickness.

Environmental factors can also be divided into factors external to the ship and those internal to the ship. Within the ship, the crew is faced with elements such as noise, vibration and temperature (heat, cold, and humidity). External factors include port and weather condition and vessel traffic.

There are a number of things that can be done to address these causes. Some contributors are more manageable than others. Opportunities for implementing countermeasures vary from one factor to another (noise can be better addressed during the vessel's design stage, breaks can be addressed by the individual crew member, training and selection of the crew can be addressed during the hiring process, etc.).

4. What Can Cause Fatigue?

Fatigue may be caused and/or made worse by one or a combination of the following:

Lack of sleep

Only sleep can maintain or restore your performance level. When you do not get enough sleep, fatigue will set in and your alertness will be impaired. (Refer to Section 3)

Poor quality of sleep

Fatigue may be caused by poor quality of sleep. This occurs when you are unable to sleep without interruptions and/or you are unable to fall asleep when your body tells you to. (Refer to Section 3)

Insufficient rest time between work periods

Apart from sleep, rest (taking a break) between work periods can contribute to restoring your performance levels. Insufficient rest periods or postponing assigned rest times (to finish the job early) can cause fatigue. (Refer to Section 3)

Poor quality of rest

Disturbances while resting such as being woken up unexpectedly, on call (during port operations), or unpredictable work hours (when arriving in port) can cause fatigue.

Stress

Stress can be caused by personal problems (family), problems with other shipmates, long work hours, work in general, etc. A build up of stress will cause or increase fatigue.

Boring and repetitive work

Boredom can cause fatigue. You may become bored to the point of fatigue when your work is too easy, repetitive and monotonous and/or bodily movement is restricted.

Noise or vibration

Noise or vibration can affect your ability to sleep/rest, and it can affect your level of physical stress, thus causing fatigue.

Ship movement

The ship's movement affects your ability to maintain physical balance. Maintaining balance requires extra energy, which can then cause fatigue. A ship's pitching and rolling motions mean you might have to use 15-20% extra effort to maintain your balance.

Food (timing, frequency, content and quality)

Refined sugars (sweets, doughnuts, chocolates, etc.) can cause your blood sugar to rise rapidly to a high level. The downside of such short term energy is that it usually results in a rapid drop in blood sugar. Low blood sugar levels can cause weakness, instability and difficulty in concentrating and in the extreme cases unconsciousness. Eating large meals prior to a sleep period may disrupt your sleep.

Medical conditions and illnesses

Medical conditions (i.e. heart problems) and illnesses, such as the common cold, can cause or aggravate fatigue. The effect depends on the nature of the illness or medical condition, but also the type of work being carried out. For example, common colds slow response time and affect hand-eye co-ordination.

Ingesting chemicals

Alcohol, caffeine and some over-the-counter medications disrupt sleep. Caffeine consumption can also cause other side effects such as hypertension, headaches, mood swings or anxiety.

Jet-lag

Jet-lag occurs following long flights through several time zones. It is a condition that causes fatigue in addition to sleep deprivation and irritability. It is easier to adjust to time zones while crossing from east to west as opposed to west to east. The greatest difficulty in adjustment results from crossing 12 time

zones, the least from crossing one time zone. Our bodies adjust at the rate of approximately one-hour per day.

Excessive work load

Working consistently “heavy” workloads can cause fatigue. Workload is considered heavy when one works excessive hours or performs physically demanding or mentally stressful tasks. Excessive work hours and fatigue can result in negative effects such as the following:

- increased accident and fatality rates
- increased dependence upon drugs, tobacco or alcohol
- poor quality and disrupted sleep patterns
- higher frequency of cardiovascular, respiratory or digestive disorders
- increased risk of infection
- loss of appetite

5. Effects of Fatigue

Alertness is the optimum state of the brain that enables us to make conscious decisions. Fatigue has a proven detrimental effect on alertness this can be readily seen when a person is required to maintain a period of concentrated and sustained attention, such as looking out for the unexpected (e.g. night watch).

When a person's alertness is affected by fatigue, his or her performance on the job can be significantly impaired. Impairment will occur in every aspect of human performance (physically, emotionally, and mentally) such as in decision-making, response time, judgement, hand-eye co-ordination, and countless other skills.

Fatigue is dangerous in that people are poor judges of their own level of fatigue. The following are examples of fatigue's known effect on performance.

- Fatigued individuals become more susceptible to errors of attention and memory (for example, it is not uncommon for fatigued individuals to omit steps in a sequence).
- Chronically fatigued individuals will often select strategies that have a high degree of risk on the basis that they require less effort to execute.

6. How to Prevent and Mitigate Fatigue

There are a number of steps that can be taken to prevent fatigue. Many of the measures that reduce fatigue are unfortunately beyond a single person's control, such as voyage scheduling, ship design, and work scheduling.

6.1. Guidelines

Steps such as the following are important in the prevention of fatigue on board ship, and are within the Ship Officer's ability to influence and implement:

- Ensure compliance with maritime regulations (minimum hours of rest and/or maximum hours of work)
- Take strategic naps
- Develop and maintain good sleep habits, such as a pre-sleep routine (something that you always do to get you ready to sleep)
- Eat regular, well-balanced meals (including fruits and vegetables, as well as meat and starches)
- Exercise regularly
- Drink sufficient amount of water
- Use rested personnel to cover for those travelling long hours to join the ship and who are expected to go on watch as soon as they arrive on board (i.e. allowing proper time to overcome fatigue and become familiarised with the ship)
- Create an open communication environment (e.g. by making it clear to crew members that it is important to inform supervisors when fatigue is impairing their performance and that there will be no recriminations for such reports)
- Schedule drills in a manner that minimises the disturbance of rest/sleep periods
- Establish on board management techniques when scheduling shipboard work and rest periods, and using watch-keeping practices and assignment of duties in a more efficient manner (using, where appropriate, IMO and ILO recommended formats – “Model format for table of shipboard working arrangements” and “Model format for records of hours of work or hours of rest of seafarers”)
- Assign work by mixing up tasks to break up monotony and combining work that requires high physical or mental demand with low-demand tasks (job rotation)
- Schedule potentially hazardous tasks for daytime hours
- Emphasise the relationship between work and rest periods to ensure that adequate rest is received; this can be accomplished by promoting individual record keeping of hours rested or worked. Using (where appropriate) IMO and ILO recommended formats in “IMO/ILO Guidelines for the Development of Tables of Seafarers' Shipboard Working Arrangements and Formats of Records of Seafarers' Hours of Work or Hours of Rest”
- Re-appraise traditional work patterns and areas of responsibility on board to establish the most efficient utilisation of resources (such as sharing the long cargo operations between all the deck officers instead of the traditional pattern and utilizing rested personnel to cover for those who have travelled long hours to join the ship and who may be expected to go on watch as soon as they arrive)

- Ensure that shipboard conditions, within the crew's ability to influence, are well maintained i (e.g., maintaining heating, ventilation and air-conditioning (HVAC) on schedule, replacing light bulbs, and contending with sources of unusual noise at the first possible opportunity)
- Establish shipboard practices for dealing with fatigue incidents and learning from the past (as part of safety meetings)
- Increase awareness of long term health benefits of appropriate lifestyle behaviour (e.g. exercise, relaxation, nutrition, avoiding smoking and low alcohol consumption)

6.2. Sleep

Sleep is the most effective strategy to fight fatigue. Sleep loss and sleepiness can degrade every aspect of a person's performance: physical, emotional and mental. To satisfy the needs of your body, you must acquire the following:

- deep sleep
- between 7 to 8 hours of sleep per 24-hour day
- uninterrupted sleep

Here is some general guidance on developing good sleep habits:

- develop and follow a pre-sleep routine to promote sleep at bedtime (examples are a warm shower or reading calming material)
- make the sleep environment conducive to sleep (a dark, quiet and cool environment and a comfortable bed encourages sleep)
- ensure that you will have no interruptions during your extended period of sleep
- satisfy any other physiological needs before trying to sleep (examples are, if hungry or thirsty before bed, eat or drink lightly to avoid being kept awake by digestive activity and always visit the toilet before trying to sleep)
- avoid alcohol and caffeine prior to sleep (keep in mind that coffee, tea, colas, chocolate, and some medications, including cold remedies and aspirin, may contain alcohol and/or caffeine)
- avoid caffeine at least six hours before bedtime
- consider relaxation techniques such as meditation and yoga, which can also be of great help if learned properly

6.3. Rest

Another important factor that can affect fatigue and performance is rest. Rest, apart from sleep, can be provided in the form of breaks or changes in activities. Rest pauses or breaks are indispensable as a physical requirement if performance is to be maintained. Factors influencing the need for rest are the length and intensity of activities prior to a break or a change in activity, the length of the break, or the nature or change of the new activity.

6.4. Strategic Napping

Research has identified "strategic napping" as a short term relief technique to help maintain performance levels during long periods of wakefulness. The most effective length for a nap is about 20 minutes. This means that if you have the opportunity to nap, you should take it. However, there are some drawbacks associated with napping. One potential drawback is that naps longer than 30 minutes will cause sleep inertia, where situational awareness is impaired (grogginess and/or disorientation for up to 20 minutes after waking). A second is that the nap may disrupt later sleeping periods (you may not be tired when the time comes for an extended period of sleep).

7. Rules and Regulations

The following international organisations have issued various conventions and other instruments that deal with the fatigue aspects:

The following ILO instruments contain guidance on fatigue related aspects:

- **Convention No. 180**
This convention introduces provisions to establish limits on seafarers' maximum working hours or minimum rest periods so as to maintain safe ship operations and minimize fatigue. The text from the Convention is provided in the Appendix.
- **Other Conventions**
Other ILO Conventions related to fatigue include the following convention numbers: 92, 133, 140, 141 and 147. Each introduces minimum habitability requirements (e.g. noise control and air conditioning) on board ships.

The following IMO instruments contain guidance on fatigue related aspects:

- **ISM Code**
This Code introduces safety management requirements on shipowners to ensure that conditions, activities, and tasks (both ashore and afloat) that affect safety and environmental protection are planned, organized, executed and verified in accordance with company requirements. The fatigue related requirements include:
 1. Manning of ships with qualified and medically fit personnel;
 2. familiarisation and training for shipboard personnel; and
 3. issuance of necessary support to ensure that the shipmaster's duties can be adequately performed
- **STCW Convention and STCW Code**
The STCW Convention requires that Administrations, for the purpose of preventing fatigue, establishes and enforces rest period requirements for watchkeeping personnel. In addition, the Convention sets minimum periods and frequencies of rest. Part A of the Code requires posting of the watch schedules. Part B of the Code recommends that record keeping is useful as a means of promoting compliance with rest requirements.
- **Resolution A.772(18) – Fatigue Factors in Manning and Safety**
This Resolution provides a general description of fatigue and identifies the factors of ship operations which may contribute to fatigue.
- **MSC/Circ. 1014**
A guidance on fatigue mitigation and management.

In addition to the international standards, company and flag administration policies, which may be more stringent in some cases, should be followed on board all ships.

For more information and to find more guides, please visit www.skuld.com – loss prevention



www.skuld.com