

For background information on this series of publications, please see Briefing Note 1 - Introduction

FATIGUE: a feeling of weariness caused by prolonged or excessive exertion (not just physical exertion, but mental exertion for example from intense concentration).

fatigue

Case studies

1. Fatigue has been identified as having a significant role in many accidents, in road, rail, air and sea transport, in the nuclear industry, health care and space exploration. The cost in terms of accidents, lost productivity and liabilities runs into billions of dollars.

Source: *Fatigue and duty time limitations - An international review*
Royal Aeronautical Society (1997)

2. A corroded section of a 36 inch diameter pipeline ruptured discharging nearly 1m gallons of fuel oil into a river and surrounding area. No one was injured, but the clean up cost was \$20.5m. The pipeline controller did not react correctly or quickly enough to prevent or cut short the accident. Fatigue was suggested as affecting his alertness, vigilance, and responsiveness.

Source: www.nts.gov/publicctn/1998/PAR9801.htm

3. A tanker carrying 9 200 gallons of propane drifted across the road striking a barrier then an overpass column. It split and the propane ignited. The driver died, 23 people were injured, and a fireball with a 400ft radius engulfed the area. The driver had probably fallen asleep as a result of acute fatigue. The company's policy of paying by the load instead of by the hour appeared to encourage drivers to violate hours-of-service regulations. The driver might have rested before trying to complete his last load if he understood the effects of sleep loss and irregular or 'inverted' rest schedules.

Source: www.nts.gov/publicctn/1995/har9502.htm

4. A large petroleum distribution company needed to reduce its tanker fleet from 98 to 53 meaning that each vehicle would need to be on the road for over 30% longer per week. Management involved the workforce in the problem solving team. The team made substantial changes to the existing roster that actually **decreased** their average total hours worked per week but increased the length of each shift. Drivers were able to swap or change shifts with their colleagues with minimal involvement from supervisors or managers. Drivers now have more time away from the work place and thus a better family and social life.

Source: petroleum industry case study - www.unisa.edu.au/sleep/portfolio/default.htm



Is it common to find that people in your company:

1. Doze off suddenly during a shift?
2. Feel generally drowsy a lot of the time?
3. Regularly work a lot of overtime?
4. When changing from night shifts to day shifts, feel 'rough' for the first few days?
5. Are noticeably absent-minded or forgetful at work or find it hard to concentrate?
6. Sometimes feel that they just can't move or don't want to?
7. Suffer from a lot of heartburn, indigestion or generally upset stomach?
8. Find it difficult to get a good undisturbed sleep between shifts?
9. Drink more coffee or smoke more and eat badly on the nightshift?
10. Regularly find they are so busy that they can't take a proper break?

Some of these are normal and unavoidable effects of shiftwork, however, this doesn't mean that answering 'yes' to any of the above is acceptable.

If anyone is showing severe or long-term symptoms of fatigue, then you need to take action.

What can I do about it?

If anyone is experiencing fatigue, for example, some of the problems described in points 1 to 10 above, they should see if it's possible change things like: sleeping habits, what they eat and drink, the time, length and quality of breaks and their leisure time. If fatigue is common throughout the company, try to gather information on problems that people are experiencing:

i. Ask people, either face to face, or by giving out a question sheet, if they are fatigued. Find out if they answer 'yes' to any of the questions 1 to 10 above. You can get further questions from reference 1.

ii. Find out especially if:

- Sleeping at work is a common occurrence
- People have frequent disturbed sleep because of noise, vibration, too much light, or it's too hot or cold
- Anyone feels that they or their colleagues are at risk because of fatigue problems.

iii. Draw the information to the attention of company management.

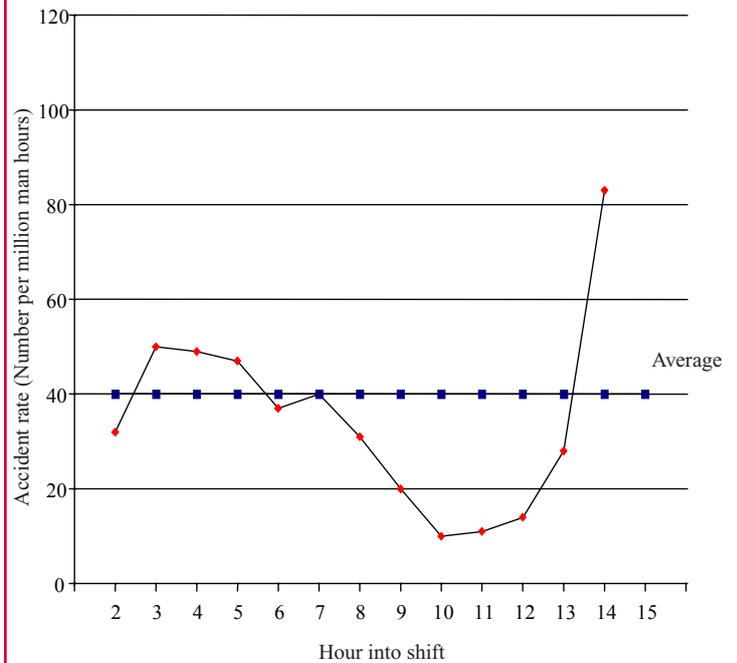
What can my company do about it?

There is evidence that offshore shift work systems, though still not ideal, are generally better than onshore. For example, arrangements for meal breaks and quiet/dark sleeping quarters help the shift worker to acclimatise better.

In all sectors of the petroleum industry, management should be aware of some key facts about fatigue:

- Length of sleep - everyone needs about eight hours sleep per day
- Bodyclock ('circadian rhythms') - it's not good to be awake at night nor is it good to try to sleep in the daytime
Note: 'forward rotating' shifts (i.e. mornings to afternoons to nights) are better
- Errors - are more likely between midnight and 6am and between the 2nd and 4th hours of a shift (2pm to 4pm are also high points for error)
- Adaptation - it takes a few days to adapt to a new shift
- Effects of fatigue - mainly: reduced alertness, increased reaction time (effects are very similar to those of alcohol), memory problems and irritability
- Denial - people can find it difficult to realise or admit that they are fatigued
- Health - as well as safety can be affected by fatigue (e.g. stomach problems or, in the extreme, heart problems)
- Individual differences - the above affect different people in different ways.

Accident rate and shift duration



Source: *The management of change: a case study from the railway industry*, Gall, W., paper presented to Safety and Reliability Society Annual Conference, October 1996

Management responsibility

The Management of Health and Safety at Work Regulations 1999 require management to assess and take steps to control all risks to the health and safety of their employees. This includes assessing working time arrangements. Risk assessment should consider the following:

- Night working and changing from one shift to another (e.g. nights to days)
- Length of shift including any overtime
- Length and quality of rest breaks during the shift
- Rest breaks between shifts and the amount and quality of sleep taken
- Type of work - try to schedule safety critical tasks, tedious work or work that needs close concentration to avoid known high error periods

- Bio-rhythms (working with or against your 'body clock')
- The environment - mainly temperature and lighting - effect on drowsiness
- Individual preferences and suitability of certain people for shift work
- Training/awareness raising among shiftworkers, and their families, supervisors and managers on the signs and problems of fatigue and also on sleep patterns, nutrition, effects on social life
- Contingency plans if a crew member is absent (don't overload everyone else)
- Monitoring of employees for signs of fatigue, particularly on safety critical work
- Examining accidents and incidents for evidence of fatigue.

It is possible to apply a 'fatigue index' to employees to get a measure of their level of fatigue. The answers given to a questionnaire are converted into a number that indicates the person's level of fatigue (see reference 3 for example).

Useful reference information

1. *An intervention using a self-help guide to improve the coping behaviour of nightshift workers and its evaluation* HSE Contract Research Report CRR 365/2001 HSE Books (2001) ISBN 0 7176 2093 X.
2. *Working time* Offshore Safety Division Safety Notice 4/96 HSE (January 2002)
3. *Validation and development of a method for assessing the risks arising from mental fatigue* HSE Contract Research Report 254/1999 HSE Books (2000) ISBN 0 7176 1728 9.
4. *Workshop on fatigue* The Institute of Petroleum (2001) ISBN 0 85293 314 2.
5. *OIM guidance for offshore rotas and rest periods* A Step Change in Safety website: www.stepchangeinsafety.net
6. *BEST - Bulletin of European Time Studies* Information Centre, European Foundation for the Improvement of Living and Working Conditions, Wyattville Rd, Loughlinstown, Dublin 18, Fax. +353(1)282 6456 or email info@eurofound.eu.int