



IP RESEARCH REPORT:

VIABILITY OF USING SLEEP CONTRACTS AS A CONTROL
MEASURE IN FATIGUE MANAGEMENT

IP RESEARCH REPORT:
VIABILITY OF USING SLEEP CONTRACTS AS A CONTROL
MEASURE IN FATIGUE MANAGEMENT

February 2006

Published by
ENERGY INSTITUTE, LONDON
The Energy Institute is a professional membership body incorporated by Royal Charter 2003
Registered charity number 1097899

The Energy Institute gratefully acknowledges the financial contributions towards the scientific and technical programme from the following companies:

BG Group	Maersk Oil North Sea UK Limited
BHP Billiton Limited	Kuwait Petroleum International Ltd
BP Exploration Operating Co Ltd	Murco Petroleum Ltd
BP Oil UK Ltd	Shell UK Oil Products Limited
ChevronTexaco Ltd	Shell U.K. Exploration and Production Ltd
ConocoPhillips Ltd	Statoil (U.K.) Limited
Encana Corporation	Talisman Energy (UK) Ltd
ENI	Total E&P UK plc
ExxonMobil International Ltd	Total UK Limited

Copyright © 2006 by the Energy Institute, London:
The Energy Institute is a professional membership body incorporated by Royal Charter 2003.
Registered charity number 1097899, England
All rights reserved

No part of this book may be reproduced by any means, or transmitted or translated into a machine language without the written permission of the publisher.

The information contained in this publication is provided as guidance only and while every reasonable care has been taken to ensure the accuracy of its contents, the Energy Institute cannot accept any responsibility for any action taken, or not taken, on the basis of this information. The Energy Institute shall not be liable to any person for any loss or damage which may arise from the use of any of the information contained in any of its publications.

The above disclaimer is not intended to restrict or exclude liability for death or personal injury caused by own negligence.

ISBN 978 0 85293 455 5

Published by the Energy Institute

Further copies can be obtained from Portland Customer Services, Commerce Way,
Whitehall Industrial Estate, Colchester CO2 8HP, UK. Tel: +44 (0) 1206 796 351
email: sales@portland-services.com

CONTENTS

	Page
Foreword	vii
Acknowledgements	viii
Overview	ix
1 Introduction - What is a sleep contract?	1
1.1 Initial interpretation of the term	1
1.2 Definition of a sleep contract	1
1.3 Sleep contracts are agreed via a process of consultation	2
1.4 Benefits of a sleep contract	2
2 Emergence of the sleep contract concept	3
2.1 The Hours of Work approach to managing fatigue	3
2.2 Regulatory requirements and sleep contracts	4
3 Integrating sleep contracts into a Safety Management System	7
3.1 Safety Management Systems	7
3.2 Contributory factors	7
3.3 Purpose 1: A tool for monitoring contributory factors	8
3.4 Purpose 2: A negotiated framework for responding to fatigue	8
4 Methodology for the industry review	11
4.1 Formal questionnaire	11
4.2 Informal discussion	11
5 Details of three operational sleep contracts	13
5.1 Case study 1: Mining company	14
5.2 Case study 2: Road transport company	15
5.3 Case study 3: Power company	15
6 Content of a sleep contract	17
6.1 Identifying how tired is too tired	17
6.2 Clear response to fatigue reports	20

Contents Cont....	Page
7 Considerations for an effective sleep contract	23
7.1 The importance of management commitment and support	23
7.2 Reasons for not reporting fatigue	24
7.3 An ineffective sleep contract could increase fatigue risk	24
8 Conclusions	25
Annex A - References	27
Annex B - Industry review - Formal questionnaire	29
Annex C - Glossary of terms and abbreviations	37
Figures	
Figure 3.1 Factors that contribute to incidents	8
Figure 6.1 The mining company's response to fatigue within their FFW framework	21
Tables	
Table 3.1 Example of one part of the procedural content of a sleep contract	9
Table 5.1 Details of companies that contributed to the review	13
Table 5.2 Classification of fatigue and required employee and employer response	15
Table 6.1 Parameters of the Basic Sleep Formula for identifying when an individual is fatigued	19
Boxes	
Box 6.1 Worked example of the Basic Sleep Formula	19

FOREWORD

Sleep contracts, a negotiated procedure for managing day-to-day fatigue risk, offer possibilities in safety critical operations; yet, to date their use has been limited. In addition, knowledge of their theoretical background and guidance on their practical application are lacking.

As part of a programme of activities on the 'top ten' human factors issue of fatigue, the Energy Institute's Human Factors Working Group commissioned Clockwork Consultants Ltd. to review the potential role of sleep contracts. The aim of the review was to provide a snapshot of current knowledge in managing fatigue risk and to report the experiences of companies with operational sleep contracts.

This IP Research Report provides the findings of that review. It defines sleep contracts and describes how they can be used alongside Hours of Work controls to better manage fatigue risk. Findings from the industry case studies are used to help outline the attributes of a sleep contract, and to set out preliminary thoughts on how they should be negotiated between management and the workforce. Some of their potential benefits are reviewed. The report notes that sleep contracts should be integrated into a company's existing Safety Management System, thereby providing the supporting structure necessary for identified fatigue risks to be recorded, addressed and reviewed.

Given that the concept of sleep contracts is in its infancy and that only a small number of qualitative industry case studies are reported, this IP Research Report proposes further research to quantify their efficacy; hence, it is premature to define a good practice framework for their implementation. Note that the report purposively avoids addressing political issues relating to working time.

The report should be read by those wishing to explore use of sleep contracts as an option in fatigue management; however, it forms an adjunct to the more general publication IP *Improving alertness through effective fatigue management*, which covers the broader topic of fatigue risk management in the petroleum and allied industries.

The information contained in this publication is provided as guidance only and while every reasonable care has been taken to ensure the accuracy of its contents, the Energy Institute, the research contractor and the technical representatives listed in the Acknowledgements cannot accept any responsibility for any action taken, or not taken, on the basis of this information. The Energy Institute shall not be liable to any person for any loss or damage which may arise from the use of the information contained in any of its publications.

The findings of this Research Report may be further reviewed from time to time. It would be of considerable assistance if users would send comments, experiences or suggestions for improvement to:

The Technical Department
Energy Institute
61 New Cavendish Street
LONDON W1G 7AR
Email: technical@energyinst.org.uk

ACKNOWLEDGEMENTS

This project was carried out by Dr. Alexandra Holmes, Dr. Angela Baker and Dr. Paul Jackson (Clockwork Consultants Ltd.¹) and was commissioned by the Energy Institute Human Factors Working Group, which comprised during the project:

Robin Bryden	Shell International Exploration and Production B.V.
Bill Gall	Kingsley Management Services
Kerry Hoad	Energy Institute
Peter Jefferies	ConocoPhillips
Rob Miles	Health and Safety Executive
Graham Reeves (Chairman)	BP Oil UK Ltd.
Dr Mark Scanlon	Energy Institute
Dr John Symonds	ExxonMobil Corporation
John Wilkinson	Health and Safety Executive

The Energy Institute gratefully acknowledges the valuable contributions that the following individuals and companies made to this project:

Peter Jefferies	ConocoPhillips (UK)
Darren Nolan	Nolan's Interstate Transport (Queensland, Australia)

Public Transport Authority (Western Australia)

In addition, the Institute acknowledges the contributions of those companies and individuals who wished to remain anonymous. Affiliations refer to the time of participation.

The Institute acknowledges the Health and Safety Executive for co-sponsoring the project.

Mark Scanlon (Energy Institute) co-ordinated the project.

¹ Clockwork Consultants Ltd., 83 Victoria Street, London, SW1H 0HW. Tel: +44 (0) 207 078 6485.
email: alex@clockworkconsultants.com.

OVERVIEW

Initial discussions with stakeholders revealed that there was very little knowledge and no agreed definition of the term 'sleep contract'. Therefore, the first task of the review (Section 1) was to establish a definition for the term. Introductory guidance on how to negotiate the content of a sleep contract is provided and some of the potential benefits of a sleep contract are discussed.

The concept of a sleep contract is developed further in Section 2 by exploring it within the broader context of fatigue risk management. Sleep contracts are thought to have emerged as the result of an improved understanding of fatigue risk management and increasing regulatory requirements to address fatigue risk.

Section 3 provides a framework for the implementation and operation of a sleep contract. It is recommended that a sleep contract is integrated into an organisation's existing Safety Management System, thereby providing the supporting structure necessary for identified fatigue risks to be recorded, addressed and reviewed. In this context a sleep contract also acts as a data collection tool for assessing the effectiveness of other fatigue controls within the system.

Section 4 summarises the methodology that was utilised to identify and review current experience and the interpretation of sleep contracts within the petroleum and allied industries.

Three organisations were identified as having operational sleep contracts and their experiences are presented as a series of case studies in Section 5.

In Section 6 it is recommended that for a sleep contract to be meaningful it should include a clear statement of 'how tired is too tired' and what responses should be taken to fatigue reports. Information is provided on how different organisations define and identify 'how tired is too tired' and the different countermeasures that can be applied.

Section 7 reports stakeholders' beliefs about what considerations need to be taken into account to ensure that sleep contracts are utilised effectively and appropriately.

Finally, the report concludes in Section 8 with a brief summary and recommendations for further research, including a recommendation to develop an evidence-based template for organisations to use when designing a sleep contract.

INTRODUCTION - WHAT IS A SLEEP CONTRACT?

In determining the role of sleep contracts in fatigue risk management, what is meant by the term 'sleep contract' should be established. This task proved more difficult than expected as no definition, or reference to sleep contracts could be found in searches of academic publications, publicly available company documents, or published material relating to fatigue management. In addition, prior to the review, a definition of the term could not be identified in discussions with stakeholders including fatigue management consultants and managers working to address fatigue, in the UK, USA, Australia, New Zealand or Canada.

1.1 INITIAL INTERPRETATION OF THE TERM

Despite the lack of a formal definition of the term 'sleep contract', stakeholders were relatively consistent in what they interpreted the conceptual basis of the term to be. Generally, a sleep contract was considered to refer to a formal obligation on behalf of the employee to obtain sufficient sleep prior to attending work. Some individuals suggested that a sleep contract included a statement of an employee's obligation to inform management when sufficient sleep is not obtained and/or fatigue is experienced in the workplace.

Stakeholders' initial interpretation of the intent of a sleep contract was generally cynical. They could see the value of encouraging employees to obtain sufficient sleep and to be honest about fatigue, but felt that this was not the true purpose of a sleep contract. The stakeholders essentially viewed a sleep contract as being an ineffectual or meaningless document produced by

management in order to comply with regulatory requirements, or to protect themselves from legal action should a fatigue-related incident occur. There was concern that an organisation could use a sleep contract as a disingenuous way of avoiding the effort and cost involved in effective fatigue risk management by placing responsibility for the issue with individual employees.

As a result of the dialogue with stakeholders, it was decided that it was necessary to create a formal definition of a sleep contract. The definition would need to describe a concept that promotes honesty about tiredness via recognition that fatigue risk management is the dual responsibility of the employee and the employer. For a sleep contract to be valuable it should not be merely a mechanism for management to, intentionally or unintentionally, step around fatigue risk management responsibilities.

1.2 DEFINITION OF A SLEEP CONTRACT

For the purposes of this report, a definition for a sleep contract was developed. The definition addresses stakeholders' concerns and describes what they felt would be a useful tool in effective fatigue risk management.

'A sleep contract is a negotiated and agreed framework for managing fatigue on a day-to-day basis that is integrated into an organisation's existing Safety Management System. The framework is formally documented and makes it clear that employees and management are jointly

responsible for the management of fatigue risk and states the responsibilities/accountabilities of each party.'

Under this framework:

Fatigue and how it should be identified is defined.

An employee who is not fit for work due to fatigue has a responsibility to inform his/her immediate supervisor or manager.

An employee whose state deteriorates during work – that is, they become fatigued whilst at work – should inform their immediate supervisor/manager regarding this change.

The supervisor has a responsibility to address the employee's reported fatigue in a formal manner utilising the potential actions/outcomes that are listed in the 'contract'.

The fatigue event, and how it is managed, is recorded, to enable trends to be mapped within the company.

1.3 SLEEP CONTRACTS ARE AGREED VIA A PROCESS OF CONSULTATION

As a sleep contract is a new concept it is not yet possible to provide evidence-based guidance for how a sleep contract should be best designed, implemented or operated. Nonetheless, experience with other fatigue risk management strategies strongly indicates that for a sleep contract to be effective the content should be agreed via a process of consultation and negotiation between employees, management and safety professionals. Moreover, for the sleep contract to be meaningful, all stakeholders need to be committed to the management of fatigue risk and feel comfortable that the sleep contract is a tool that they can use to achieve this aim.

The success of a sleep contract is also dependent on a number of pre-conditions including an existing mutual support between employee and management. If a supportive work culture exists then a sleep contract is more likely to be perceived as an operational tool that has been developed to jointly assist managers and employees, rather than a disciplinary tool or a mechanism for management to avoid their responsibility regarding fatigue.

A sleep contract will also only be effective if employees are honest about their tiredness. For this to be a reality the purpose of the sleep contract needs to be clearly communicated and its structure should be negotiated and agreed. If employees are to be expected to use the contract it should ensure that when they report fatigue or are found to be fatigued with a valid

reason they are not penalised, either explicitly (e.g. via disciplinary procedures) or implicitly (e.g. via the attitudes of more senior members of staff). It should also provide access to the appropriate support such as an employee assistance programme.

Where the source of fatigue is organisational, for example as the result of excessive rostered work hours, the contract states that the organisation is required to address the issue formally and to implement the necessary controls. Management should take this responsibility seriously and should be open with employees as to how the risk has been mitigated. Depending on the culture of the organisation it may also be appropriate to include in the sleep contract an outcome for management who are found to have failed to manage fatigue.

1.4 BENEFITS OF A SLEEP CONTRACT

The theory behind a sleep contract is that, by making it a formal requirement to obtain sufficient sleep, employees' commitment to obtaining sleep is more likely to improve. Similarly, by making it a formal requirement to report fatigue, and by providing a formal procedure for how this should be responded to, employees should be more likely to report fatigue.

When an individual reports fatigue to their immediate supervisor, a sleep contract would require that both parties respond to the case in a formal, structured manner and manage the immediate and long-term risk. In this way a sleep contract enables an organisation to know its actual fatigue risk and implement the necessary controls. For example, the sleep contract could require that: the employee is provided with an opportunity and suitable environment to obtain a nap; the source of fatigue (if known) is discussed; and both parties commit to a course of action that should address the associated risk for the remainder of the shift and – where relevant – on an ongoing basis. The accurate identification of fatigue is particularly important when the source of fatigue is organisational and thus affecting staff more widely.

An additional benefit of a sleep contract is that the data collected on the incidence of fatigue can be utilised to track trends and to identify potential causes and controls and the effectiveness of controls. For example, a sleep contract may highlight specific shifts, crews, or times of day when fatigue is repeatedly reported. In turn, this information can be used to refine the fatigue controls in place within the organisation and/or inform the introduction of further controls.

The benefits of a sleep contract are discussed further in sections 3.3 and 3.4.

2

EMERGENCE OF THE SLEEP CONTRACT CONCEPT

It is probable that sleep contracts have emerged primarily as the result of growing recognition that common controls, such as Hours of Work (HoW) restrictions, do not offer complete protection and as a response to the development of more comprehensive and demanding regulations regarding fatigue risk. The following section discusses sleep contracts in relation to both HoW restrictions and relevant legislation.

2.1 THE HOURS OF WORK APPROACH TO MANAGING FATIGUE

HoW restrictions are the primary control used by organisations to counter fatigue risk (Dawson et al. 2001). Examples of HoW controls include BP *Drivers' hours rules* and Shell *Limitations on driving and duty hours*. Both of these rule sets include limitations on daily and weekly driving and duty hours. For example, Shell's HoW limitations include the following restrictions:

- Maximum hours of duty during any 24 hour period = 12 hours.
- Maximum driving in any 24 hour period = 9 hours.
- (Extendable to 10 hours up to twice per week).
- Maximum period of continuous driving = 4,5 hours.

Discussions with organisations revealed that factors such as on-call, standby, overtime and emergency contingency planning are also typically approached using a prescriptive approach. For example, a trans-

European airline classifies time spent on standby and on-call as 'duty hours' and this time is included in the UK Civil Aviation Authority (CAA) flight and duty time limitations (CAA *Avoidance of fatigue in aircrews*).

Another example of a prescriptive approach to time spent on-call was provided by a company that provides domestic electricity services in Ireland. The company employs a fleet of over 1 500 maintenance engineers who are on-call around the clock. On-call time is managed using a prescriptive approach that considers whether or not the engineer is actually called out. When no call-out occurs, on-call time is classified as time off. Where an individual is called out, the number of hours taken to complete the task is calculated and subtracted from the hours the engineer is scheduled to work the next day. For example, if an engineer is called out at night and the job takes five hours to complete, the next day he/she starts work five hours later than his/her scheduled start time and finishes at the usual time.

HoW restrictions have undoubted value to managers and employees. They can provide consistent, unambiguous guidelines to scheduling personnel, and offer protection for employees by stating what is and is not allowed as far as work hours are concerned. As research regarding sleep and fatigue accumulates, however, there is growing recognition in the USA (Coplen and Sussman 2000), Canada (Rhodes and Gil 2002), Australia (Mahon and Cross 1999, Baker 2000, Civil Aviation Safety Authority 2000) and New Zealand (Gander 2000, Gander et al. 1998) that HoW restrictions in isolation do not constitute adequate protection for employers or employees.

HoW restrictions cannot provide comprehensive fatigue risk protection because they are based on broad assumptions and predictions about how much fatigue is experienced by employees when working a particular schedule. HoW limitations ignore the variation in fatigue risk that occurs from one day to the next, between individuals, across seasons, with different workloads and as roles and experience change. For example, an HoW rule set does not control for the increase in fatigue risk associated with an unusually hot summer night when employees are sleeping in non-air-conditioned accommodation, or the sleep disruption caused by having a new-born baby in the house. Similarly, HoW restrictions do not consider the variation in fatigue risk that occurs when workload or working conditions alter.

As understanding of the risk posed by fatigue matures HoW restrictions in isolation are increasingly being viewed as inadequate on the basis that they address broadly assumed fatigue risk, and do not consider actual risk. From this perspective, it may be argued that sleep contracts have evolved as a necessary complement to HoW limitations. By offering a process for determining actual day-to-day occurrences of fatigue, the implementation of a sleep contract can provide an organisation with a more realistic indicator of fatigue risk. This information in turn can be utilised to make informed decisions about fatigue risk management.

2.2 REGULATORY REQUIREMENTS AND SLEEP CONTRACTS

The emerging sleep contract concept can also be viewed as a strategy that organisations may utilise to formalise their legislative responsibilities regarding fatigue. Increasingly, fatigue appears to be located under the banner of Fitness for Work (FFW). Within this arrangement individuals are responsible for turning up to work in a fit state and this means not just being drug- and alcohol-free but rested as well. Employees are responsible for being well-rested at the beginning of a work shift, and maintaining alertness and performance levels while in the workplace. This responsibility therefore extends to non-work time and impacts on the way in which an individual manages his or her sleep and recovery time.

Simultaneously, FFW legislation states that the employer is responsible for providing a safe system of work. From a fatigue perspective, this entails providing a scheduling routine that ensures an adequate opportunity for sleep and rest between shifts, education and training regarding all identified workplace hazards

and effective management and control of said hazards. In recognition of the effects of non-standard work hours (i.e. shiftwork, long/extended hours, night work, split shifts etc.) the UK Health and Safety Executive (HSE) has identified fatigue as one of their 'top ten' human factors issues for workplace inspections.

An increasing number of countries and regions are starting to specifically address fatigue risk in legislation. For example, the European Commission Working Time Directive (WTD) contains several requirements related to working hours, including the employees' right to refuse to work more than 48 hours per week. The WTD also requires daily rest periods of 11 consecutive hours in each 24 hour period and a minimum weekly rest period of one day per rolling seven day period.

A recent legislative change that directly considers fatigue is the Mine (Safety) Act and Regulations in Papua New Guinea (PNG). The New (draft) PNG Mining (Safety) Regulations 2005 are particularly relevant to the concept of sleep contracts and state:

The methods below are to be employed to ensure that employees are provided with sufficient rest periods and are not exposed to personal fatigue through working excessive hours.

Each Relevant Person for a mine must ensure that: (a) employees and other persons undertaking work at the mine are adequately supervised and monitored to ensure that the ability of those persons to carry out their work safely is not materially affected by fatigue, heat strain, thirst or other similar conditions.

Where a person at a mine considers (acting reasonably) that, due to the effects of fatigue, heat strain, thirst or other similar conditions, they are not capable of safely undertaking their work they must:

- (a) cease undertaking that work until such time as the condition is remedied, such that the person may safely undertake that work; and
- (b) report their condition and the fact that they have ceased work to the person in immediate charge over them.

A person who receives a report must:

- (a) ensure appropriate action is taken to remedy the relevant person's condition; and
- (b) provide a written report to the registered manager summarising the relevant condition, the reasons why the condition appears to have arisen, and the steps taken to remedy the condition.

Each Relevant Person for a mine must ensure that appropriate measures are in place to minimise, so far as practicable, hazards arising due to employees suffering from fatigue, including ensuring:

- (a) employees are not required to work excessive hours; and
- (b) employees are provided with, and take, sufficient rest periods.

It is possible to see that the development and implementation of a sleep contract may assist an organisation to demonstrate their commitment and

compliance with the new draft PNG Mining Regulations. The Regulations require that individuals suffering from fatigue report to their immediate supervisor and that the supervisor actively takes measures to minimise the hazard as far as practicable. In this context a sleep contract could provide both the employee and supervisor with a clear and consistent approach to identifying fatigue and any actions or controls that need to be implemented. It could also provide a means to determine if actions taken were effective and appropriate.

3

INTEGRATING SLEEP CONTRACTS INTO A SAFETY MANAGEMENT SYSTEM

A stand-alone sleep contract, or indeed any fatigue management strategy operating in isolation, is unlikely to be effective. For a sleep contract to be successful its impact on key performance indicators (KPIs), safety outcomes and the behaviour of individuals - whether managers or employees - needs to be supported, measured, and reported. For a sleep contract to be supported by the necessary operational framework it seems reasonable to recommend that it is integrated into an organisation's existing Safety Management System (SMS).

The following section presents a brief introduction to an SMS and the role that a sleep contract plays within an SMS.

3.1 SAFETY MANAGEMENT SYSTEMS

HSE *Successful health and safety management* describes an SMS as a framework concerned with prevention through identifying, eliminating and controlling hazards and risks. An SMS ensures that adequate workplace risk precautions are provided and maintained via management arrangements, risk control systems and workplace precautions. Management arrangements include policy, organising, planning and implementing, measuring and reviewing performance. Risk control systems are needed for an operation's input, processes and output, and workplace precautions should consider products and services, information, by-

products, physical and human resources.

When fatigue is integrated into an SMS it is identified as a significant risk that should be considered and controlled in much the same way as other identified risks (e.g. using a likelihood and consequence risk matrix for tasks/conditions). The SMS approach recognises that a fatigue-safe organisation is not an end-point, but an on-going management process that should occur within a systematic framework.

The general purpose of any SMS is to:

- Identify the outcomes that the organisation wishes to manage (e.g. near misses, incidence of accidents, injuries).
- Identify the key factors that contribute to those outcomes (e.g. operational errors, maintenance errors, quality of supervision).
- Collect data regarding the status of outcomes and contributory factors (see 3.2).
- Analyse, interpret and feed back data to relevant stakeholders.
- Identify safety priorities and develop intervention strategies to address these priorities.
- Evaluate the effectiveness of these intervention strategies over time.

3.2 CONTRIBUTORY FACTORS

In order to manage fatigue, or any safety risk, within an

SMS an organisation needs to identify:

- The defences or controls that are in place to prevent incidents.
- The contributory factors that can compromise those defences.

The day-to-day operation of the SMS involves continually monitoring the state of the contributory factors, and responding to unacceptable risks by tightening the appropriate controls.

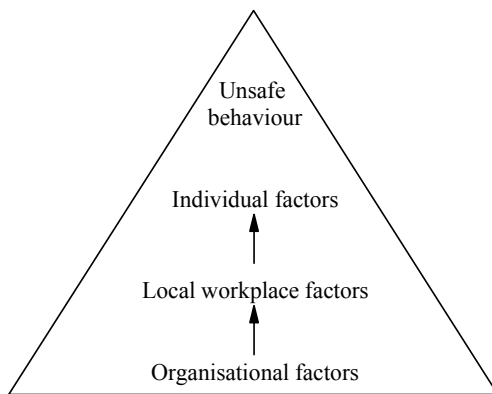


Figure 3.1 Factors that contribute to incidents

The factors that contribute to incidents occur at three different levels: organisational; local workplace, and individual levels (Figure 3.1). Examples of factors that contribute to fatigue-related incidents that should be monitored include:

- Organisational contributory factors – inadequate HoW restrictions, poor shift schedule design, no formal mechanism for employees and management to report fatigue, no public statement of commitment to addressing fatigue risk and no ongoing assessment of the operation’s fatigue risk.
- Local workplace contributory factors – excessive workload or overtime, lack of consideration of commute distances/times, seasonality, on-call, environmental temperature, access to food and water, type of work, staffing levels, shift breaks, education, training, support or supervision.
- Individual contributory factors – health, age, social and family obligations, disturbed sleep, sleep disorders, reduced sleep opportunity, commute distances/times and experience.

For general information on how the influence of fatigue contributory factors can be eliminated, reduced or mitigated see IP *Improving alertness through effective fatigue management*.

3.3 PURPOSE 1: A TOOL FOR MONITORING CONTRIBUTORY FACTORS

Within an SMS, the role of a sleep contract is twofold:

- It is a tool for monitoring fatigue and the state of contributory factors; and
- It provides a negotiated framework for reporting and responding to fatigue.

Traditionally, most organisations have relied on audits and incident reports to identify safety-related issues. These methods have obvious value, but also a number of limitations that include:

- The quality of data obtained (particularly relating to sleep and fatigue) can be poor.
- A limited range of contributory factors are typically considered.
- Information is obtained reactively, rather than proactively.

Sleep contracts offer an opportunity to overcome these limitations by providing a tool that monitors fatigue and contributory factors on both a day-to-day and longer-term basis. Sleep contracts require that personnel files or a database system that collects safety data (whatever has been chosen by the participating parties) contain reports on all occasions where the sleep contract is breached. These reports should include information on the reason that the employee was fatigued and chart the steps taken by both the employee and employer to address the risk, both immediately and on an ongoing basis (where appropriate).

The systematic assessment of the information collected by sleep contracts enhances an organisation’s understanding about how and when fatigue accumulates to a point where the individual worker decides they can no longer work in a safe manner. It also enables an organisation to acknowledge the size and identify the specific sources of its fatigue risk. Trend analysis of this information, for example across specific shift patterns, times of day and departments, can enable an organisation to identify fatigue 'hot spots' and apply the necessary controls in a proactive manner.

3.4 PURPOSE 2: A NEGOTIATED FRAMEWORK FOR RESPONDING TO FATIGUE

In addition to adding value as a monitoring tool, a sleep contract provides a negotiated procedure for how individuals and the company should respond to reports

of fatigue. Depending on the fatigue experienced and the job circumstances, a range of actions and outcomes can be determined. The content of a sleep contract may necessarily vary between organisations and departments or could even be negotiated on an individual employee basis.

Table 3.1 provides an example of a negotiated procedure that is currently being developed by a company and could constitute one part of a sleep contract. It should be appreciated that this example

outlines the company response where an individual is found to be fatigued without a valid reason. The organisation developing the document is yet to define the outcomes for where an individual is found to be fatigued for organisational reasons, for example as the result of having been asked to work long hours. In the UK, the process of negotiation should meet the requirements of the Health and Safety (Consultation with Employees) Regulations 1996.

Table 3.1 Example of one part of the procedural content of a sleep contract

Occurrence	Finding	Outcome
First	Found to be fatigued and sent to have a break	— Record in one page SMS document unless incident/accident related
Second	Found to be fatigued more than once in a one month period without a valid reason	— Record in one page SMS document unless incident/accident related — Engage Employee Assistance Programme (EAP) — Provide information sheet regarding fatigue awareness — Provide a medical assessment — First verbal warning
Third	Found to be fatigued three times in a month without a valid reason	— Record in one page SMS document unless incident/accident related — Engage EAP — First written warning
Ongoing fatigue problem identified	Found to be fatigued three or more times in a month without a valid reason	— Record in one page SMS document unless incident/accident related — Engage EAP/medical assessment — Final written warning
If found to have prepared for sleep and is sleeping ('nesting')	Found asleep	— Record in one page SMS document unless incident/accident related — Termination

Notes:

- 1 The table outlines the company response when an individual reports fatigue without a valid reason.
- 2 The company is yet to define the response to reports of fatigue that are found to have an organisational source.
- 3 If the same individual is reporting being fatigued/tired regularly or fatigue-related behaviours/symptoms are observed on a regular basis, they may be experiencing disrupted sleep and carrying a significant sleep debt; the reasons for this should be determined via interview/counselling.

4

METHODOLOGY FOR THE INDUSTRY REVIEW

Thus far, the term sleep contract has been defined and the emergence of the concept within the broader context of fatigue risk management has been discussed. It has been suggested that for a sleep contract to be effective it needs to be integrated into and supported by a SMS.

The remainder of the Research Report provides the results of a review of sleep contracts that are currently operational within the petroleum and allied industries.

The review considers information collected from the following sources:

- Interviews with petroleum and allied industry managers who are using a sleep contract, or something similar.
- Discussions with managers who have experience with fatigue management, but have not necessarily implemented a contract.
- Relevant case studies from our experience as industry fatigue management consultants.
- Publications relating to fatigue management that have been produced by regulators, for example the Civil Aviation Safety Authority of Australia (CASA).

Companies contributed to the review either via a formal questionnaire or informal discussion.

4.1 FORMAL QUESTIONNAIRE

Initially, managers were asked to complete the formal questionnaire (Annex B) that asks questions about the company's approach to fatigue management and fitness

for duty. Where the company had a sleep contract, questions were asked about its structure, implementation and success. Copies of company documents relating to sleep contracts were requested. Questionnaires were issued in July/August 2005.

Participants who completed the questionnaire were given the choice of contributing anonymously or having their contribution acknowledged.

Only a small number of invited participants completed the questionnaire and there were four main reasons for this:

- Respondents did not feel that they had any relevant experiences to report.
- Respondents felt the questionnaire asked questions pertaining to company-sensitive information.
- Respondents viewed the measures they had taken to manage fatigue as having given their operation a competitive advantage, and were thus unwilling to share information on their experiences.
- Respondents did not have time to complete the questionnaire.

4.2 INFORMAL DISCUSSION

To overcome the difficulties in collecting data using the questionnaire, we held informal discussions with participants either on the phone or in face-to-face meetings. These discussions provided further information on the structure and acceptance of sleep contracts. Moreover, they provided us with an insight into how managers who had not implemented a sleep

contract viewed the concept and how sleep contracts are seen within the broader evolving context of fatigue management.

5

DETAILS OF THREE OPERATIONAL SLEEP CONTRACTS

Four of the nine organisations that participated in the review had implemented a Fatigue Management System (FMS), or had incorporated fatigue into an SMS. A FMS is a system for managing the risk of becoming fatigued and the consequences arising. The most common countermeasures that organisations included within their FMS included education and training in fatigue management strategies and the use of fatigue modelling software in the design of shift schedules.

One of the companies with an operational FMS had an internal document that was formally recognised as a sleep contract (Table 5.1). A further two organisations had within their FMS a documented fatigue reduction strategy equivalent to a sleep contract, although it was referred to as a 'fatigue assessment tool' or 'fatigue management guidance form'. For the purposes of this report, these three organisations are referred to as having a sleep contract.

All three companies that were identified as having implemented a sleep contract commented positively on the concept and reported (subjectively) that it had reduced fatigue risk and had been well received by employees. The small sample size means that it is not possible to formally analyse why sleep contracts are perceived as being successful in these companies. Nonetheless, it is valuable to note that all three companies:

- Incorporated the sleep contract into an existing SMS for addressing fatigue, known specifically as a FMS.
- Provided training for employees and managers on how to manage fatigue risk at home and in the workplace.
- Provided employees and managers with information on the content of the sleep contract and how it operates.

Table 5.1 Details of companies that contributed to the review

Industry	Country	Sleep contract (or similar)	Fatigue Management System (FMS)
Mining	Australia	Yes	Yes
Road transport	Australia	Yes	Yes
Power	Australia	Yes	Yes
Transport	Australia		Yes
Petroleum	UK		
Petroleum	UK		
Petroleum	UK		
Petroleum	UK		
Petroleum	UK		

The experiences of the three companies with operational sleep contracts are reported in 5.1-5.3 as a series of case studies. These are intended to provide those who are considering implementing a sleep contract with examples of the different ways in which sleep contracts can be structured and can operate.

5.1 CASE STUDY 1: MINING COMPANY

An Australian mining operation interviewed for this project has had a sleep contract functioning as one component of a FMS since 2004. The sleep contract is known as a 'fatigue management guidance form' and requires that:

- Individuals alert their immediate supervisor when they are fatigued or tired and unsafe to work.
- The supervisor responds to instances where fatigue is identified using the 'Supervisor guidance notes' that are provided below. (Note that this is a confidential company document.)

'Supervisor guidance notes

The fatigue management guidance notes are designed as a framework for a step-by-step process for identifying fatigue and making decisions about how this should be responded to. The guidance notes assist the supervisor in managing isolated and repeated instances of fatigue and recording the actions taken.

Step 1 The first step is to record that an employee has reported fatigue or that you have noticed symptoms of fatigue in the employee. While most of us have an intuitive sense for when a person is tired, this simple checklist asks us to take specific notice of some of the known causes and symptoms of fatigue. It is worthwhile going through the checklist and checking the appropriate boxes. If the person is deemed to have had insufficient sleep [discussed further in Section 6] or reports/exhibits three or more of the typical symptoms of fatigue, or very marked symptoms in any one or two of the areas, proceed to Step 2. [Note that the checklist of fatigue symptoms is a confidential company document.]

Step 2 The second step is to estimate the degree of risk associated with the reported/observed fatigue. Risk depends on the likelihood and severity of the person's functioning or behaviour. There will be many factors that will influence your estimate of

risk for this person in his/her situation. Having assessed the level of risk involved, you must ask the question, 'Is this an acceptable level of risk?'. [Note that the tool provided to assist supervisors in assessing risk is a confidential company document.]

It is important for you to clearly record:

The symptoms of fatigue you have observed, or have been reported.

Your estimate of the risk associated with the employee's situation, i.e. if they continue to work. The rationale behind your estimate of the risk involved.

If you conclude that the risk is beyond an acceptable level proceed to Step 3.

Step 3 The third step is to engage the individual in conversation about his/her reported/observed symptoms. What is the employee's explanation for why they are fatigued or the symptoms that have been observed?

Your conversation with the employee should offer some answers to the next set of questions. [Note that the questions were not made available for this project.] The questions are designed to encourage the individual to assist you in identifying the source of their fatigue. Potential reasons for fatigue include inadequate sleep, high workload, harsh environmental conditions, inadequate breaks, inadequate nutrition or hydration, and personal stress. The employee should also be asked how they go about managing fatigue at home and in the workplace. This question highlights the individual's responsibility and will enable you to identify whether they take this seriously.

It is important to recognise that there are symptoms of fatigue that are not necessarily indicative of sleep loss. An individual may display signs of fatigue because they have not eaten recently and have low blood sugar levels, or because the work environment is physically demanding.'

The Supervisor guidance notes are supported by a list of strategies for the supervisor to consider implementing to reduce fatigue risk (see Section 7 for details). These strategies include providing a napping opportunity and assigning the employee to a task with relatively lower risk.

5.2 CASE STUDY 2: ROAD TRANSPORT COMPANY

An interstate road transport company in Australia has had an FMS in place since 1996. The company reported that, based on the results of company and industry accident statistics, the FMS has been effective in preventing fatigue-related incidents.

Although the company’s FMS does not specifically include a documented sleep contract, the FMS contains many of the key components of such a contract. Specifically, the FMS includes:

- A set of standards regarding how much sleep an employee must obtain prior to attending work.
- A statement of the employees’ responsibility to inform management when the standards are breached or they experience fatigue.
- When an employee reports fatigue he/she is not required to work and a 'management system' which manages the likely causes of fatigue is activated [Note that details of this system were not made available to this project.]
- There are no financial or other sanctions for reporting fatigue and counselling is provided where appropriate.
- Instances where employees report being unfit for duty due to fatigue are recorded in a database and these data are evaluated periodically to inform management how fatigue risk can be further reduced.

This transport company was the only company that formally recorded how many instances employees had reported being too tired to work. The company employs approximately 200 drivers and in the last six months four drivers had informed the company that they were unfit to work due to fatigue.

5.3 CASE STUDY 3: POWER COMPANY

An Australian power company has had a documented Fatigue Risk Management System (FRMS) since 2004. The FRMS provides definitions of fatigue and outlines management and employee responsibilities/accountabilities.

The FRMS is contained in the company safety manual and includes a sleep contract - by that name. The sleep contract states that employees have a responsibility to report to their supervisor if they are symptomatic of a fatigue impaired state, or have not obtained sufficient sleep as per the 'Basic Sleep Formula' detailed in Section 6. The Basic Sleep Formula provides an individual with a fatigue score that is classified as moderate, high or extreme. This classification in turn informs how the employee and manager should respond to the identified risk, as set out in Table 5.2.

Table 5.2 Classification of fatigue and required employee and employer response

Fatigue classification	Employee and manager response
Moderate (score <3)	Self-management strategies
High (score 3-7)	Joint decision making with management, including consideration of risk reduction strategies such as having two or more people complete the task so they can check each other’s actions.
Extreme (score ≥8)	Cease work and instigate mitigation strategies with management. It may be decided that the employee cannot attend or continue work.

When an employee is deemed too tired to work and the source of fatigue is work-related, for example as the result of a call-out or overtime, the employee can take time off as per a nine hour rest break allowed for in a local enterprise bargaining agreement. Where the source of fatigue is identified as being personal, the employee can elect to take time off in lieu, or as sick leave. In this scenario the employee is not required to respond to a call-out or work overtime.

6

CONTENT OF A SLEEP CONTRACT

The respondents from three companies with operational sleep contracts consistently commented that for a sleep contract to be functional it should include clear statements of:

- How tired is too tired for work and how this should be identified.
- The risk reduction strategies that should be activated when fatigue is reported.

In this section some of the different ways in which organisations (not just those with sleep contracts) identify fatigue and the risk reduction strategies that can be applied in response to fatigue are described. It is not realistic to prescribe how organisations should approach these procedures, as the content of a sleep contract is necessarily negotiated locally between the employee and the employer. Sleep contracts reflect the culture of the organisation in which they operate and are influenced by a variety of factors, including the degree of trust that exists between employees and management, and how committed the organisation is to addressing fatigue. Nonetheless, when designing a sleep contract it is useful to consider the approaches that other organisations have taken.

6.1 IDENTIFYING HOW TIRED IS TOO TIRED

6.1.1 Devices for detecting fatigue

Fatigue is broadly defined as the decreased capability to

perform mental or physical work, or the subjective state in which one can no longer perform a task (Folkard and Tucker, 2003). A more comprehensive definition is provided by the Australian Fatigue Expert Group, which defined fatigue as:

'a combination of symptoms including: impaired performance (loss of attentiveness, slower reaction times, impaired judgement, poorer performance on skilled control tasks and increased probability of falling asleep) and subjective feelings of drowsiness or tiredness'.

While alcohol and drugs can be detected relatively easily using biochemical tests of the breath, blood, urine or sweat, there is no biochemical test for fatigue. The accurate measurement of sleepiness involves monitoring the electrical activity of the brain using multiple electrodes placed on the individual's head. Clearly such a complex and expensive technique would be impractical and inappropriate in a work environment. As an alternative, a range of devices have been developed that do not detect fatigue *per se*, but infer it from changes in an individual's performance or behaviour. The most frequently used measures of performance include reaction time, eye blinks and vigilance.

None of the organisations involved in the review was utilising a device for detecting fatigue and it is generally accepted that further research is required before a reliable and effective device could be entrusted to monitor the fatigue of safety critical workers (e.g. Barr et al. 2005).

An organisation considering introducing fatigue testing should carefully scrutinise the scientific credibility of any device. The test should be supported by multiple scientific investigations, published in peer-reviewed journals, and having addressed the following issues:

- Specificity:
Does the test specifically measure fatigue, or is it influenced by other variables?
- Selectivity:
How often does the test report false negatives, i.e. does it fail to detect a fatigued individual?
How often does the test report false positives, i.e. does it indicate that someone is fatigued when they are not?
- Sensitivity:
How fatigued does a person have to be for this to be detected by the test?

In addition, the test should be assessed for usefulness, ease of implementation, time requirements and hidden costs.

6.1.2 Determining fatigue from sleep history, wakefulness and symptoms

Many regulations and policy statements relating to fatigue do not define how tired someone has to be in order to be unfit for duty. Vague statements such as 'having had sufficient sleep' or 'non-fatigued-state' are commonly used. Stakeholders consistently criticised these statements on the basis that they can be interpreted in a multitude of different ways, thus leading to confusion. Ambiguous statements were considered to be of limited value in an operational setting because neither employee nor employer can conclusively know when the contract has been breached.

Respondents consistently commented that, for a sleep contract to be of practical value, it should include a clearly defined threshold for 'too tired to work'. Accordingly, the three companies that have operational sleep contracts have each developed their own fatigue threshold. In each case the threshold was defined by one of more of the following parameters:

- The amount of sleep an individual has had recently.
- The amount of time an individual has been awake.
- The symptoms of fatigue an individual is experiencing.

It is not possible to state conclusively how many hours

of sleep employees would need to obtain for an organisation to be fatigue-safe or how to decide when an employee is too tired for work. This is because within any workforce there are inter-individual differences in sleep need, for example due to age. Moreover, the amount of sleep and alertness required to complete a task safely depends on the risk (frequency and consequence) associated with the task and the level of risk the organisation and individuals are willing to accept. It is clear however, that whatever threshold(s) relating to sleep or fatigue are implemented, they should be reviewed on an ongoing basis as part of the company SMS. Where individual differences in sleep are problematic it may be appropriate for individuals to negotiate specific sleep contracts with their managers, i.e. individually tailored sleep contracts.

Below are two examples of how companies with operational sleep contracts define when an individual is too tired to work.

6.1.2.1 The 6 and 16 rule

The mining company (Case study 1) takes a relatively simple approach to fatigue whereby, if either of the parameters below is breached, the individual is identified as fatigued and risk reduction strategies should be considered:

- If an individual has obtained less than six hours sleep in the 24 hours prior to attending work; or
- If an individual has been awake for more than 16 hours.

6.1.2.2 Basic Sleep Formula

The approach taken by the power company (Case study 3) was relatively more complex and arguably more comprehensive. This company utilises a 'Basic Sleep Formula' to define when an individual's fatigue level needs to be addressed via mitigation strategies (Table 6.1). The formula, also known as the 'Prior Sleep Wake Model', was developed in recognition of the need for a formal method for identifying when an individual is acceptably rested to be fit-for-work. The formula is based on a review of research investigating the relationship between fatigue and risk (Dawson and McCulloch, 2005) and the authors of the formula clearly state it 'should be considered provisional, tentative and subject to ongoing refinement on the basis of post-implementation evaluation'.

$$W1 < S1 + S2 (=S3) > 12$$

Table 6.1 Parameters of the Basic Sleep Formula for identifying when an individual is fatigued

Parameter	Definition	Limit
S1	Hours of sleep in the last 24 hour period	Should be at least 5 hours
S2	Hours of sleep in the prior 24 hour period	Should be at least 6 hours
S3	Number of hours of sleep in last 48 hours	Should be at least 12 hours
W1	Number of hours from time of waking to time returned home from work	An individual is considered too tired for work if W1 exceeds S3

Tom is calculating his fatigue points using the Basic Sleep Formula

- It is 8 p.m. and Tom woke this morning at 6 a.m.; therefore he has been awake for 14 hr. (W1 = 14).
- Tom had 4 hr. sleep in the last 24 hr. (S1 = 4).
- Tom had 5 hr. sleep in the previous 24 hr. (S2 = 5).
- (S3 = S1 + S2 = 9).

$$W1 < S1 + S2 (=S3) > 12$$

Calculation of accrued fatigue points:

- Tom accrues 2 points for sleeping 1 hr. less than 5 hr. required in the last 24 hr. (S1 = 4)
- Tom accrues 3 points for sleeping 3 hr. less than 12 hr. required in the last 48 hr. (S3 = 9)
- Tom accrues 5 points for being awake for 5 hr. longer today than his sleep in the previous 48 hr. (W1 = 14, S3 = 9)

Required limits		Actual hours	Accrued fatigue points
S1	5	4	2
S2	N/A	5	No points
S3 (S1 + S2)	12	9	3 (12 – 9)
W1	Same as S3	14	5 (14 – 9)
Total			10

Accrued fatigue points = 10
 Level of risk = Extreme
 Response = Cease work and instigate mitigation strategies

Box 6.1 Worked example of the Basic Sleep Formula

According to the formula, an individual is classified as being fatigued if they had less than five hours’ sleep in the most recent 24 hours (S1) or less than six hours’ sleep in the previous 24 hours (S2) or if the amount of sleep obtained in the last 48 hours is less than 12 hours (S3). An individual is also classified as fatigued if the number of hours since they woke up to the time they returned home from work (W1) is greater than the amount of sleep obtained in the last 48 hours (S3).

Where the formula indicates that an individual is

fatigued the degree of fatigue is calculated using the following:

- Accrue two points for every hour of sleep less than five in the prior hours (S1).
- Accrue one point for every hour of sleep that is less than 12 hours in the prior 48 hours (S3).
- Accrue one point for every hour of wakefulness (W1) in excess of the amount of sleep obtained in the prior 48 hours (S3).

The calculated score is classified as moderate, high or extreme, which in turn informs how the employee and manager should respond to the identified risk (see Table 5.2). If the fatigue score calculated is moderate (score <3) self-management strategies are employed. If the score is high (score 3-7) joint decision making with management, including consideration of risk reduction strategies, is required. Where fatigue is classified as extreme (score ≥8) the employee ceases work and mitigation strategies are instigated by management. It may be decided that the employee cannot attend or continue work. Box 6.1 provides a worked example of the calculation of fatigue using the formula and the identification of the appropriate response.

6.2 CLEAR RESPONSE TO FATIGUE REPORTS

The three companies with operational sleep contracts commented that sleep contracts should include a clear statement of how tiredness is identified, and the risk reduction strategies that should be activated when fatigue is reported. From a risk perspective, the most conservative response when fatigue is identified is for the individual to cease, or not attend, work. For the road transport company (Case study 2) this was their only response to fatigue, presumably because driving is a high risk task that is particularly prone to the effects of fatigue.

The other two companies that have implemented a sleep contract rate fatigue, or fatigue risk, on a severity scale and use this to inform their response. When fatigue, or fatigue risk, is considered to be high the individual may cease, or not attend, work. However, when fatigue is classified as being low, the individual can often continue to work so long as risk mitigation strategies are considered and applied where appropriate:

The risk mitigation strategies considered by the power company (Case study 3) are:

- Being assigned to a lower risk task.
- Making rest facilities available so the individual can have a recovery nap, particularly where work

start time can be delayed and compensated for, for example by reorganising priorities. Rest facilities may also be useful when work continues for much longer than planned and personnel may need to sleep before they can safely drive.

- Contacting a senior person to determine if the work can be deferred to another day.
- Rotating with a fresh crew.
- Having two or more people work on a task so they can check each other's actions.

The mining company (Case study 1) utilises a flow chart (Figure 6.1) to illustrate how fatigue fits within their FFW strategy and how they respond to reports of fatigue. According to the flow chart, an individual is either deemed fit for normal duty, fit for modified duty or unfit for duty. Importantly, where an individual is unfit for duty, they are removed from the workplace and taken home – as opposed to driving themselves home, which is itself a high risk task.

A UK petroleum refinery that participated in the review did not have an operational sleep contract, but provided details of a relevant risk assessment process that is carried out when the company contemplates extensions to company HoW limits. This process considers the influence of the following factors that could inform the development of strategies to be applied when an individual reports fatigue:

- Opinions and ideas of the work group.
- Fitness of the individual.
- Alertness level required to execute the task.
- Type of work being carried out.
- Type of hazards.
- Complexity of work.
- Physicality of the work required.
- Previous work history of the individuals in the day(s)/shift(s) up to the planned extension.
- Working environment, e.g. high or low temperatures, high humidity, etc.
- Travel/commute time the individuals may have or will be exposed to.
- History of complications in this type of work.

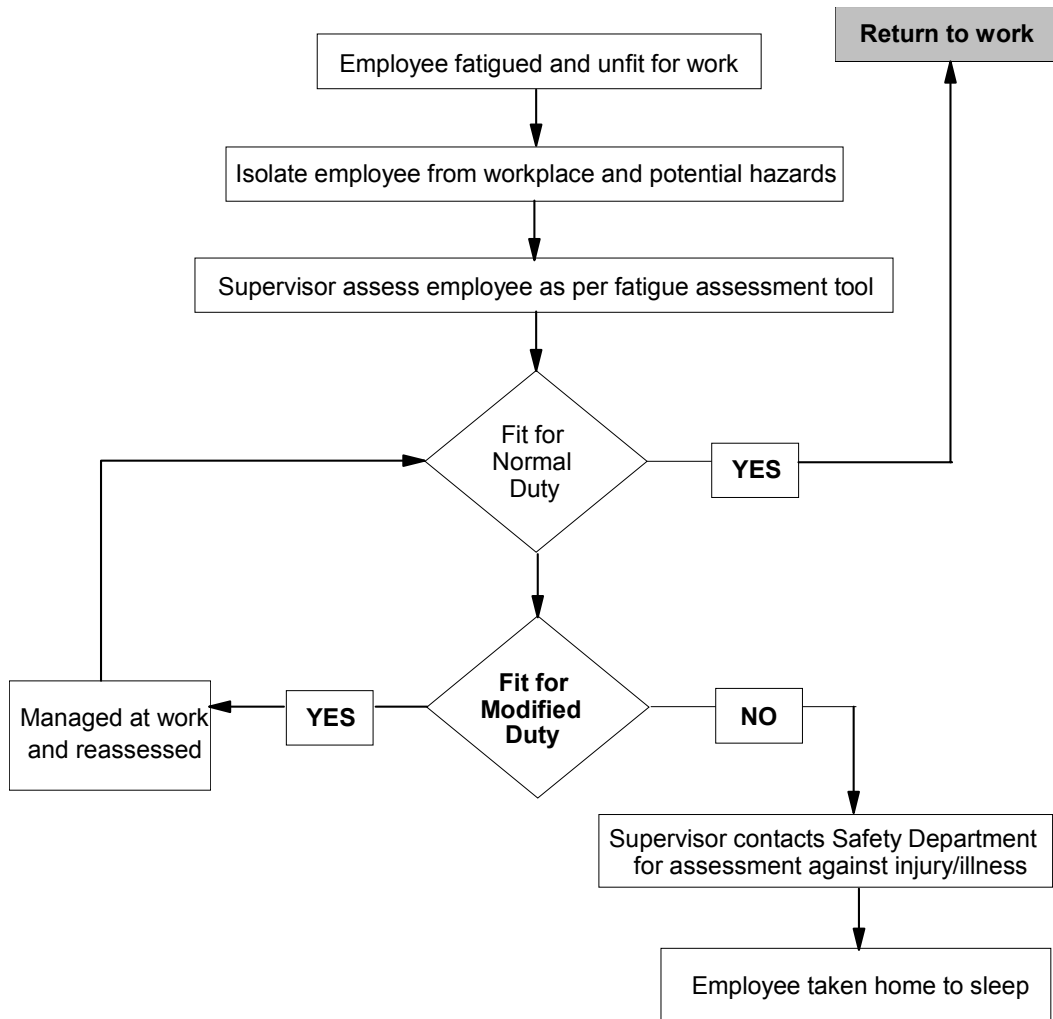


Figure 6.1 The mining company's response to fatigue within their FFW framework

CONSIDERATIONS FOR AN EFFECTIVE SLEEP CONTRACT

Stakeholders consulted in this project agreed that a sleep contract is a valuable complement to HoW restrictions and offers enhanced fatigue risk protection so long as:

- It is implemented and operated responsibly.
- It recognises that fatigue risk management is the joint responsibility of employees and management.
- It is implemented as part of an existing SMS.

The stakeholders also felt that the following three additional considerations should be taken into account to ensure that a sleep contract is effective:

- Without management commitment and support a sleep contract may not reduce fatigue risk.
- It should consider the coercive cultural, financial and operational reasons for not reporting fatigue.
- An ineffective sleep contract could increase fatigue risk.

These considerations are described in the following sections and supported by case studies.

7.1 THE IMPORTANCE OF MANAGEMENT COMMITMENT AND SUPPORT

For employees to be honest about their fatigue in the workplace there should be visible commitment from local and higher level management. An organisation's commitment to the sleep contract needs to be demonstrated in:

- Management's response to an employee who reports being too fatigued to work safely.
- Management's response to repeated fatigue events.
- The provision of a consistent framework for responding to fatigue that has been negotiated between the employee and the employer.
- An open, visible framework for responding to fatigue to which everyone in the organisation is privy.
- Regular review of existing data to determine patterns or trends and to make any necessary changes to control measures.

An example of a FMP that was implemented without universal commitment and support from senior management can be found in the Australian mining industry. The FMP was implemented in 2003 and required an individual to: report when they were tired at work; and use a napping facility if they felt tired prior to driving home or before they commenced work.

Employees reported fatigue according to the FMP, but the success with which this was managed was very reliant on the attitude and understanding of the front-line supervisors to whom individuals reported. Where the supervisor was committed and proactive the process for assessing the individual, and deciding on an outcome, worked effectively. However, where there was no such perceived support or commitment to fatigue management, reports of fatigue were less likely to be followed by the application of appropriate risk mitigation strategies.

CASA has one of the most advanced regulatory approaches to fatigue risk management and this

approach explicitly recognises management commitment as a necessary component of an effective SMS. CASA acknowledge that, in isolation, the flight and duty restrictions prescribed by Civil Aviation Order (CAO) 48 offer limited protection, and in response have developed a 'safety case' approach. According to this approach, flight operators can apply for an exemption to the prescriptive CAO 48 regulations on the basis that they will implement a FRMS.

In assessing FRMS applications, CASA assessors are trained to look out for statements and policies that are not supported by management commitment. CASA's publicly released Guidance Instructions (Form 104), which are used to assess a company's application for a FRMS, includes the following guidance:

“Be alert to subtle words or phrases such as “In accordance with CASA’s latest view on fatigue, our FRMS...” or “in accordance with the *arbitrary* score of 80 that CASA has set...” or “it is the *ultimate* responsibility of *flight crew* to manage fatigue...””

7.2 REASONS FOR NOT REPORTING FATIGUE

For a sleep contract to be effective not only should it be supported by obvious management commitment, but there should also be consideration of the coercive cultural, financial and operational reasons for individuals not reporting fatigue. The organisational culture needs to encourage individuals to self-report and this can only be achieved by providing clear guidelines for both employees and employer to follow. The sleep contract needs to be balanced so that employees feel they can report valid cases of tiredness without fear of sanction, and at the same time a disciplinary process can be instigated if the individual cannot provide a valid reason for the fatigue episode.

7.2.1 Pervasive culture within the workplace

Within an organisation, the individual may not make use of the sleep contract for a variety of reasons. The culture of the workplace may perceive tiredness as a weakness, particularly if it is a male-dominated or military environment. Alternatively, the organisation may have in place a culture that inadvertently rewards employees for hiding their fatigue, or attaches a penalty to tiredness. One example of such a system was provided by a petroleum refinery. It requires that drivers

report to their supervisor when they are experiencing fatigue. At the same time the refinery has in place a bonus scheme that rewards drivers with a £100 bonus for every month of work without a break (other than annual leave entitlement), and a £500 annual bonus for continuous attendance across the year. This bonus scheme inadvertently discourages drivers from reporting tiredness because if they do they lose their monthly attendance bonus and forfeit the £500 bonus paid annually. As one driver commented, “*It costs me £600 to tell the company I’m tired*”.

7.2.2 Commitment to the employer

An employee may also not utilise a sleep contract if they feel that doing so would be problematic for the employer. Employees who have developed a particularly strong bond with their employer might feel uncomfortable reporting tiredness because in the short-term the employer is faced with an increased workload or inconvenience. An example of such an attitude was evident amongst chauffeurs working for a UK company. They drove for the company directors and were provided with training to assist them in identifying the symptoms of fatigue. The chauffeurs were also informed by the company that they were not to drive when tired. Interviews with the drivers revealed that the majority of them were regularly driving while tired despite the training they had received. One of the primary reasons for this behaviour was that they did not want to inconvenience the people for whom they drove.

7.3 AN INEFFECTIVE SLEEP CONTRACT COULD INCREASE FATIGUE RISK

In addition to making recommendations regarding what needs to be considered for a sleep contract to be effective, stakeholders also commented on what they felt the disadvantages of an ineffective sleep contract would be. Where a sleep contract is not working the actual fatigue risk of the organisation will not be acknowledged, and proactive controls cannot be applied. Moreover, where a sleep contract is not being used because it is not considered reasonable by the workforce, there is a risk that the organisation may interpret this lack of use as indicating that none of the workforce is tired. In this way, the sleep contract may actually mask fatigue risk. The organisation may conclude that they have no fatigue risk and fail to establish meaningful and proactive practical solutions.

8

CONCLUSIONS

For the purposes of this report a sleep contract was defined as being part of a negotiated framework for comprehensively identifying, reporting and responding to fatigue in the workplace on a day-to-day basis. A sleep contract recognises that fatigue risk management is the joint responsibility of employees and management and documents how both groups should identify fatigue and what response is required when fatigue is flagged. The contract stipulates what the consequences are should either party fail to meet their responsibilities.

The concept of a sleep contract has evolved as the result of a maturation of understanding regarding the management of fatigue risk. HoW restrictions, probably the most commonplace countermeasure to fatigue, are increasingly being viewed as inadequate, on the basis that they address broadly assumed fatigue risk and do not consider actual risk. By offering a process for determining actual day-to-day occurrences of fatigue a sleep contract is a valuable, and arguably necessary, complement to HoW restrictions. A sleep contract can provide an organisation with a more realistic indicator of fatigue risk and this information in turn can be utilised to make informed decisions about fatigue risk management.

As the sleep contract concept is new and evolving it has not been possible within this document to formally quantify or critique its effectiveness. However, the three companies we identified that are currently operating a sleep contract were all supportive of the concept and agreed that it had enhanced fatigue risk protection. It is recommended that future research should formally quantify the effectiveness of sleep contracts by collecting information from organisations

on: the frequency with which the contract has been breached; the short and long term responses to these breaches; and whether these responses have reduced the degree to which the organisation is exposed to fatigue risk.

For a sleep contract to be supported by the necessary operational framework it seems reasonable to recommend that it is integrated into an organisation's existing SMS. A second reason for placing a sleep contract within an SMS is that it can act as a gauge for assessing the effectiveness of fatigue controls that are in place. For a sleep contract to operate effectively within an SMS, stakeholders suggested that the following factors should be considered:

- There should be management commitment and support.
- The contract should clearly define what constitutes being too tired for duty and how the employee and employer should respond when fatigue is reported.
- Training should be provided for employees to help them recognise and manage their fatigue.
- Fatigue reports, and the response to these, should be formally recorded.
- For a sleep contract to be meaningful, organisational culture should support employees in reporting fatigue and consider the various reasons why they may be reluctant to report fatigue.
- The data collected via the sleep contract should be analysed periodically for 'hot spots'.
- Where fatigue risk is identified the employee and employer should be committed to addressing this risk.

The success of a sleep contract is likely to be largely dependent on how well it is negotiated and whether employees and management see it as a workable tool. Considering the potential value of sleep contracts it is recommended that further research is conducted to develop guidelines for the process of negotiating a sleep contract.

It is also recommended that future research seeks to develop an evidence-based template for organisations to

use when designing a sleep contract. The template should include guidance on the types of outcomes that can be considered when a sleep contract is breached. Further research into the behavioural markers for fatigue and how these can be used to detect fatigue in the workplace and a critique of the different countermeasures that can be applied would also be valuable.

ANNEX A

REFERENCES

Australian Transport Safety Bureau

Fatigue Expert Group (2001).

BP

Drivers' hours rules (unpublished).

Civil Aviation Authority

Avoidance of Fatigue in Aircrews, Civil Aviation Publication 371, (4th Edition) (2004) UK.

Civil Aviation Safety Authority

Fatigue management system trial, Australia (2000).
Guidance Instructions (Form 104).

Department of Mining (Papua New Guinea)

The New (draft) PNG Mining (Safety) Regulations 2005.
Mine (Safety) Act and Regulations in Papua New Guinea Chapter 195A.

European Commission

Council Directive 93/104/EC Concerning certain aspects of the Organization of Working Time (O.J. No. L307, 13.12.93, p.18) ('Working Time Directive').

Her Majesty's Stationery Office

Health and Safety (Consultation with Employees) Regulations 1996 (SI 1996/No. 1513).

Health and Safety Executive (published by HSE Books)

Successful health and safety management, HSG65 (1995) (2nd Edition).

IP (published by Energy Institute)

Improving alertness through effective fatigue management (2006)

<http://www.energyinst.org.uk/humanfactors/fatigue>

Shell

Limitations on driving and duty hours (unpublished 'yellow book').

Research papers

Baker A. (2000) Freight Corp: fatigue management program report, Adelaide: Centre for Sleep Research.

Barr L., Howarth H., Popkin S. and Carroll R. (2005) A review and evaluation of emerging driver fatigue detection measures and technologies. International Conference on Fatigue Management in Transport Operations. 11-14 September 2005, Seattle, USA.

Coplen M. and Sussman D. (2000) Fatigue and alertness in the United States railroad industry part II: Fatigue research in the Office of Research and Development at the Federal Railroad Administration, Transportation Research Part F: Traffic Psychology and Behaviour 3(4): 221-228.

Dawson D., McCulloch K and Baker A. (2001) Extended working hours in Australia: Counting the costs. Department of Industrial Relations.

Dawson D and McCulloch K. (2005) Managing fatigue: it's about sleep. *Sleep Medicine Reviews* 9(5) pp. 365-380.

- Folkard S. and P. Tucker (2003) Shiftwork, safety and productivity. *Occupational Medicine* 53: 95-101.
- Gander P. (1998) An integrated fatigue management programme for tanker drivers in Hartley L. (Ed.) *Managing fatigue in transportation: proceedings of the 3rd Fatigue in Transportation Conference*. Fremantle: Australia, Pergamon.
- Gander P. (2000) *Fatigue management in air traffic control: the New Zealand approach* (unpublished).
- Mahon G. and Cross T. (1999) *The fatigue management program: alternatives to prescription*. Queensland: Queensland Transport.
- McCallum M. and Rothblum A. (1996) *Procedures for investigating and reporting human factors and fatigue contributions to marine casualties*. U.S. Department of Transportation, United States Coast Guard.
- McCulloch K., Fletcher A. and Dawson D. (2003) *Moving toward a non-prescriptive approach to fatigue management in Australian aviation: a field validation*. Canberra: Civil Aviation Safety.
- Rhodes W. and Gil V. (2002) *Development of a fatigue management program for Canadian marine pilots*. Montreal: Transportation Development Centre, p. 90.

ANNEX B

INDUSTRY REVIEW – FORMAL QUESTIONNAIRE



Research into the viability of using sleep contracts as a control measure in fatigue management

Instructions

The questionnaire should take approximately 25 minutes to complete. To assist you please use the Glossary of Terms.

Please answer as many of the questions listed in this questionnaire as possible and we would be grateful for copies of any of the relevant documents (listed on page 6) you can make available.

You can send your answered questionnaire and relevant documents to us electronically or by post.

Please email your answers, documents and any questions to Dr Alexandra Holmes
alex@clockworkconsultants.com

If you are posting your response please use the following address:

Dr Alexandra Holmes
Clockwork Consultants Ltd.
83 Victoria Street
London
SW1H 0HW

At the end of the questionnaire there is a section where you can nominate whether you wish to be acknowledged as contributing to the project or whether your responses need to remain anonymous. You can also request multiple copies of the final report.

Please return your response by Friday, 2nd September 2005.

Thank you for your time and participation.

1. Introductory information

- 1.1 Company Name:
- 1.2 Company Address:
- 1.3 Your Name and Job-Title:
- 1.4 Your email address:
- 1.5 Type of organisation: (please circle those that apply)
 - Manufacturing
 - Mining/Minerals
 - Petroleum
 - Health
 - Finance
 - Education
 - Aviation
 - Transport
 - Entertainment
 - Public Service
 - Other (Please specify)

2. Fatigue Management System (FMS)

- 2.1 Does your organisation have an FMS? Yes No
If yes, please attach a copy or describe below.
.....
.....
.....
When was your FMS implemented?
- 2.2 In preventing fatigue-related accidents/incidents, the FMS has been: (Please circle one)
Very effective Effective Average Not very effective Not at all effective
- 2.3 How do you know how effective your FMS is in preventing fatigue related accidents/incidents?
.....
.....
.....

3. Fitness for duty

- 3.1 Does your organisation have a policy relating to fitness for duty?
Yes No
If yes, please attach a copy or describe below.
.....
.....
.....

3.2 Does your organisation have a policy on drugs and alcohol?
Yes No

If yes, please attach a copy or explain below.

.....
.....
.....

3.3 What is your organisation’s approach to drugs and alcohol (circle as many as apply)?

- a. Random testing
 - b. Due cause testing
 - c. Testing for drugs and alcohol following all incident/accidents
 - d. Zero tolerance (both alcohol and drugs)
 - e. 0.02% BAC for alcohol (breath testing)
 - f. Includes prescription and non-prescription medication
 - g. Includes only non-prescription medication
 - h. Includes only prescription medications
 - i. Performance based
 - j. Urine testing only (for drugs)
 - k. Saliva screening then confirmation using urine in laboratory (for drugs)
 - l. Three strikes and your job is terminated
 - m. One strike and your job is terminated
 - n. Other (please explain)
-
.....
.....

3.4 Does your organisation have a policy relating to second jobs?
Yes No

If yes, please attach a copy or describe below.

.....
.....
.....

4. Sleep contract – about your organisation

4.1 Does your organisation have a sleep contract with its employees?
Yes No

If yes, please attach a copy or explain below.

.....
.....
.....

When was the sleep contract implemented?

Who is covered by the sleep contract?
.....
.....
.....

What hours do people covered by the FMS work? (please circle those that apply)

- Standard office hours (between approximately 08:00 and 18:00)
- Early shifts
- Late/afternoon shifts
- Night shifts
- Standby
- On-call

4.2 What do you see as the major strengths of the sleep contract?

.....
.....
.....

4.3 What do you see as the major weaknesses of the sleep contract?

.....
.....
.....

4.4 In preventing fatigue-related accidents/incidents, the sleep contract has been (please circle one):

- Very effective Effective Average Not very effective Not at all effective

4.5 How do you know that the sleep contract has been effective/ not effective?

.....
.....
.....

4.6 Does the sleep contract stipulate how tired 'too tired' for work is?

.....
.....
.....

4.7 Does the sleep contract specify how many hours of sleep employees need to obtain to be fit for duty?

- Yes No

If yes, please explain

.....
.....
.....

4.8 Does your organisation use any devices for detecting fatigue?

- Yes No

If yes, please name and describe the device

.....
.....
.....

5. Sleep contract – about your employees

5.1 What happens when an employee reports too tired for work?

.....
.....
.....

5.2 What are the sanctions (e.g. financial consequences, disciplinary etc.) for an employee when he/she reports being too tired for work?

.....
.....
.....

5.3 Are days off due to tiredness classified and included as sick days?

Yes No

If yes, please explain

.....
.....
.....

5.4 Do you provide support services (e.g. Employee Assistance Program (EAP)) to employees when they report being too tired for personal reasons?

Yes No

If yes, please explain

.....
.....
.....

5.5 Do you have a policy for dealing with employees who are found to have falsely reported being too tired for work?

Yes No

If yes, please explain

.....
.....
.....

5.6 How was the sleep contract communicated to employees?

.....
.....
.....

5.7 How was the sleep contract received by employees?

.....
.....
.....

6. Facts and figures and how they are used

6.1 Does your organisation record instances where individuals report being unfit for duty due to sleep loss?

Yes No

If yes, please explain

6.2 How many employees have reported being unfit for work due to sleep loss in the past 6 months?

.....

6.3 Have there been any significant changes in the frequency with which employees report unfit for duty since the introduction of sleep contracts?

Yes No

If yes, please explain

6.4 How is information on the frequency with which employees report too tired for work used?

.....

7. Sleep contract implementation

7.1 What was required to set up sleep contracts within your organisation?

.....

7.2 Who was involved in developing and implementing the sleep contract? (circle all that apply)

- Union representatives
- Health and Safety representatives
- Supervisors
- Managers
- Board of management
- CEO
- Worker representatives
- Workers
- Fatigue experts
- Legal representatives
- Fatigue management committee
- Human resources
- Other (please specify)

7.3 Was there any union involvement before, during or after the sleep contract implementation?

Yes No

If yes, please explain

7.4 What difficulties were faced during implementation?

.....
.....
.....

8. Training and education

8.1 Have employees been specifically trained in how to identify when they are too tired for work?

Yes No

If yes, please explain

.....
.....
.....

8.2 Have managers been specifically trained in how to manage sleep contracts?

Yes No

If yes, please explain

.....
.....
.....

Documents

We would be grateful if you could provide (hard-copies or electronic) of any of the following documents:

- a. FMS
- b. Fitness for Duty Policy
- c. Drugs and Alcohol Policy
- d. Sleep Contract

Data protection

- a. Would you like your responses to this questionnaire and/or any documents you have provided to be presented anonymously in the report? Please tick the appropriate boxes.
- Questionnaire responses must remain anonymous
 - Documents must remain anonymous
 - No need for questionnaire responses or documents to remain anonymous

- b. Would you like to be acknowledged as having contributed to the report in the 'Acknowledgements' page?
- Yes
 - No

If yes, how would you like to be acknowledged (please tick the appropriate boxes):

- By my name and my company's name
- Only by my company's name (not including my name)
- By my name alone (no company name)

- c. A copy of the final report will be posted to the name and address you provided on page one of this survey. If you require it to be sent elsewhere please indicate to whom and where in the space below.

Name:..... Phone contact:.....

Address:.....

Email Address:.....

Name:..... Phone contact:.....

Address:.....

Email Address:.....

Name:..... Phone contact:.....

Address:.....

Email Address:.....

ANNEX C

GLOSSARY OF TERMS AND ABBREVIATIONS

For the purpose of this Research Report, the interpretations in C.1 and C.2 apply, irrespective of any meaning the words may have in any other connections.

C.1 GLOSSARY OF TERMS

Sleep contract: A negotiated and agreed framework for managing fatigue on a day-to-day basis that is integrated into an organisation's existing Safety Management System. A sleep contract provides a formal documented structure for: identifying and reporting fatigue risk; the immediate response to fatigue reports; and, how reports of fatigue risk should be recorded, reviewed and addressed on an ongoing and long-term basis. The document makes it clear that employees and management are jointly responsible for fatigue risk management and states the responsibilities/accountabilities of each party.

Safety Management System (SMS): A framework concerned with prevention through identifying, eliminating and controlling hazards and risks (as defined in HSE *Successful health and safety management*). An SMS ensures that adequate workplace risk precautions are provided and maintained via management arrangements, risk control systems and workplace precautions. Management arrangements include policy, organising, planning and implementing, measuring and reviewing performance. Risk control systems are needed for an operation's input, processes and output, and workplace precautions should consider products and services, information, by-products,

physical and human resources.

Fatigue Management System (FMS) or Fatigue Risk Management System (FRMS): A system for managing the risk of becoming fatigued and the consequences arising (as defined by CASA). The key attributes of a FMS/FRMS are: a policy which includes the objectives for managing fatigue risk; management commitment to the establishment, implementation and maintenance of a FMS/FRMS; joint responsibility and authority for the identification and treatment of fatigue risk; resources for education, training, verification and review; sponsorship and support of senior management; policy development and communication; and ongoing monitoring of fatigue risk and effectiveness of the fatigue risk management process.

C.2 ABBREVIATIONS

CAA	Civil Aviation Authority (UK)
CASA	Civil Aviation Safety Authority (Australia)
CAO	Civil Aviation Order
EAP	Employee Assistance Programme
FFW	Fitness For Work
FMP	Fatigue Management Plan
FMS	Fatigue Management System
FRMS	Fatigue Risk Management System
HSE	Health and Safety Executive (UK)
HoW	Hours of Work
KPI	Key Performance Indicator
PNG	Papua New Guinea
SMS	Safety Management System

WTD Working Time Directive (European
Commission Council Directive 93/104/EC
Concerning certain aspects of the Organization
of Working Time)