

Understanding Fatigue Risk Management

Fatigue Risk Management in the Energy Industry



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Introduction

What is the aim of this white paper?

This paper is designed to provide an overview of fatigue risk management guidance and what that means in practical terms for operators in the energy industry. It follows from the introductory paper in this series – ‘What are fatigue risk management approaches, and why do we need them?’

What are the Guidance materials and Regulations relevant to the energy industry?

In the energy industry, the regulatory requirements for fatigue risk management vary depending on the country and specific authority where operations take place. Additionally, the specific fatigue risks that require managing depend on the sector of industry you sit within (Upstream versus Downstream, remote workers, transportation workers, etc...).

However, there are some common global guidelines and standards that organisations can follow to address fatigue-related risks within industry. In the document “Report 626 - Managing Fatigue in the Workplace”¹ the International Association of Oil & Gas Producers (IOGP) and IPIECA provide guidance on implementing a Fatigue Risk Management Plan (FRMP). An FRMP allows the identification, assessment, and mitigation of fatigue risks. Report 626

also offers strategies for scheduling work, managing shift patterns, and promoting employee wellbeing.

An FRMP follows a safety management system (SMS) approach to managing fatigue, and the IOGP-IPIECA guidance material recommends that it consists of the following elements:

1. Fatigue risk management policy
2. Managing fatigue risk: Fatigue hazard identification, risk assessment, and implementing controls to mitigate risk
3. Fatigue reporting
4. Investigating fatigue incidents
5. Fatigue management training and education
6. Continuous improvement following internal and external audits and identification of corrective actions
7. Identification and management of sleep disorders

In addition to this guidance, countries may have specific legislation and standards addressing fatigue management in the energy industry. For example:

- In the United States, the Occupational Safety and Health Administration (OSHA) provides guidelines and regulations for managing fatigue in the workplace. The American Petroleum Industry (API) developed fatigue standards with

¹ IOGP-IPIECA (2019). Report 626 brings together and updates all the elements of the previous publications, which include Report 392 – Fatigue Management in the Workplace; Report 488 – Performance Indicators for Fatigue Risk Management Systems; Report 492 – Assessing Risks from Operator Fatigue and Report 536 – Fatigue Fly-in, Fly-Out Operations. The new report is now one resource to help organizations to implement, monitor and manage fatigue risk management systems.

API RP 755² designed for refineries, petrochemical and chemical operations, natural gas liquefaction plants, and other facilities such as those covered by the OSHA Process Safety Management Standard, 29 CFR 1910.119.

- In the UK, the Health and Safety Executive (HSE) sets out regulations and guidance on managing fatigue in the offshore oil and gas sector. Organisations are expected to comply with UK regulations on working time (including the Health and Safety at Work etc Act 1974, the Management of Health and Safety at Work regulations 1999, the Working Time Regulations 1998 and all other relevant regulations). They should also follow good practice as outlined in HSE's guidance on managing shift work (Managing Shift work: Health and Safety Guidance HSG 256). This includes paying appropriate attention to major accident safety issues e.g., under the COMAH (Control of Major Accident Hazards) Regulations, which may arise from poor control of fatigue and shift work.

What are the benefits of an FRMP?

Managing fatigue systematically through an FRMP allows for the understanding and management of fatigue-related risks. Simply following hours of work limitations cannot adequately control the risk of safety critical work across night shifts, account for the variability between individuals, or effectively adapt to local or national culture-related issues. For example, short-term mitigations against fatigue may be required during the month of Ramadan. Other specific advantages of FRMP include:

- Systematic and documented approach to fatigue management
- Comprehensive consideration of the various causes of fatigue
- Risk-based approach tailored to the specific site, avoiding generic strategies
- Proactive and reactive risk management
- Recognition and utilisation of unique fatigue controls available at the site
- Enhanced safety, prevention of fatigue-related incidents and accidents

- Improved employee health, work satisfaction, and wellbeing
- Increased staff retention, reduced absenteeism, and training costs
- Improved operational reliability and productivity
- Potential compliance with local regulatory requirements

What does understanding fatigue risk involve?

In the energy industry, one of the primary causes of fatigue is the requirement for round-the-clock or extended operations, leading employees to work in shifts across the 24hrs and that may include standby and long duties. Shift work refers to any work system that involves working or staying awake during typical nighttime sleep hours. Additionally, due to the remote locations, employees can work for extended periods with minimal days off, followed by extended 'field breaks' at home.

Certain shift patterns disrupt the natural sleep/wake cycle and contribute to fatigue more than others. Challenging shifts from a fatigue perspective include:

- Night shifts
- Extremely early or late shifts
- Unpredictable shifts (with variable start, end times or durations communicated with short notice)
- Long shifts
- Swing shifts requiring adjustment from days to nights or vice-versa over a short period of time
- Extended periods of consecutive shifts without days off
- Being on call which may result in difficulty in planning sleep opportunities
- Work that requires travelling across time zones

An effective FRMP should be tailored to the specific operation it is developed for, taking into account the nature, size, and complexity of the operations and organisational arrangements. The level of detail and

² API (2019). RP 755 Fatigue Risk Management Systems For Personnel in the Refining and Petrochemical Industries.

complexity may vary based on factors such as the work hours, commuting, and safety-critical tasks involved. An organisation with long periods of night shifts which involve safety critical work will require a more complex and extensive FRMP than one where operations are restricted to day time, for example.

The FRMP should rely on evidence and experience. Experience comes from those familiar with the operation and subject matter experts. The evidence comes in the form of data that shows where fatigue hotspots may be in the operation and where they come from. The two main approaches to this data are:

1. Using past safety events to identify safety risks (reactive data)
2. Identifying fatigue risks before they occur

1. Using past events to identify safety risks (reactive data)

Safety reports

The internal safety reporting scheme for incidents and near misses is an essential part of the safety management system. This system should also capture fatigue-related events. This may be:

- Events, errors or near misses that occur due to fatigue
- An instance of elevated fatigue, even if there was no further outcome. This may be due to fatiguing features of the working pattern (e.g. insufficient rest), and/or features of the task (e.g. workload), for example

Questions can be added to existing safety reports to capture helpful fatigue-related information. This will allow the trending of reports to identify when and where fatigue is elevated, and where fatigue-related errors or events are occurring. This trending enables hazards to be identified, and risk management to take place. For safety reporting to be effective, personnel must be trained, and there must be an effective safety culture where the reporting system is trusted.

Investigations

Fatigue investigations are similar to other types of safety investigation. The aim is to understand the factors that lead to an incident to minimise the likelihood of them reoccurring. When investigating fatigue, we are looking to understand whether fatigue played a role in an incident or accident, by ascertaining whether:

- The people involved were fatigued at the time (e.g. their sleep was reduced or disrupted prior to the event) and the possible contributors
- Their performance at the time of the event was consistent with fatigue-related performance
- Fatigue contributed to the event³

2. Identifying safety risks before events occur

We cannot only rely on reactive data collection, as it would mean only identifying risks after accidents and incidents occur. This cannot account for the impact of changing operations and context, or the variability in performance in the present. Identifying safety risks may involve asking the following questions:

- Do our current shift patterns support adequate sleep opportunities between shifts?
- What are predicted fatigue levels if overtime is worked?
- When do we see the highest level of fatigue during a shift, and how high is that fatigue?

Fatigue modelling

Bio-mathematical or fatigue models are software tools that can be used to estimate (predict) the fatigue level associated with different types of schedules. Most of these tools give predictions for any time during the shift, whilst others give one average score for the whole shift.

Fatigue models use scientific principles of sleep and the circadian rhythm to estimate fatigue levels based on working times. The data that the fatigue model provides can

³ Clockwork Research (2017). A framework for investigating fatigue. Whitepaper 17/01.

be used to quantify and evaluate shift-related fatigue, provide safety performance indicators (SPIs), and help you develop working patterns that promote alertness and manage fatigue risk. Whilst fatigue models are useful for predicting shift-related fatigue, they should not be used in isolation, as they cannot reflect all factors that can contribute to fatigue, so do not provide the full picture.

Fatigue models are recommended by the IOGP-IPIECA 'Managing fatigue in the workplace' guide as part of implementing your FRMP. This guide also provides details on different fatigue models available.

Fatigue surveys

Fatigue surveys can be used to take a 'snapshot' of fatiguing aspects across the operation. They must be well-designed and anonymous to obtain quality information you can act on. There are two main types of fatigue survey:

1. Retrospective surveys: These ask people about sleep and fatigue in the past. They are usually completed once a year, and can be used to identify:
 - Workers' experience and approach to fatigue – for example their sleep on particular patterns, and the strategies they use to manage fatigue
 - Fatigue contributors in the operation
2. Prospective surveys are used for 'real-time' data collection – i.e. how sleepy are you right now? These may be used to measure sleepiness on night shifts by asking staff to complete the Karolinska Sleepiness Scale (KSS) at the beginning, middle and end of each shift for a week. Alternatively, sleep patterns might be measured across a period of time using research grade sleep monitors and/or sleep diaries. Exactly what you use depends on the questions you are looking to answer.

How do we implement an FRMP?

Fatigue is a shared responsibility between employers and employees. Employers should provide opportunities for restorative sleep, while employees should ensure that – so far as reasonably practicable – they use this time to obtain sufficient sleep. Engaging the workforce, involving them in FRMP development and implementation, and providing appropriate training are essential for success. Involving the workforce in the development of the FRMP also supports the safety culture and trust in the system.

The FRMP should be integrated into existing management systems for health and safety, this allows it to use existing processes such as safety reporting, risk assessment, and the risk reporting and decision making processes that are already established. It should also be integrated with employee assistance programmes (EAP) and contractor management arrangements. This is to ensure that contractors are not facing excessive fatigue levels, and ensures that anyone identified through the FRMP who needs additional support can receive it through the EAP. When implementing any programme, it is important to address the complex interaction of individual and organisational factors in this way.

Conclusion

For organisations who work in the energy industry, fatigue risk management is an extension to the safety management system. Extensive guidance has been published by IOGP-IPIECA, and implementing a Fatigue Risk Management Plan represents best practice. Regulations in different nations require organisations to manage the risks associated with hours of work, and implementing an FRMP allows an organisation to demonstrate compliance with this. Organisations should involve the workforce in designing and implementing fatigue risk management approaches, and integrate it into existing safety management infrastructure.

References

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Authors

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SENIOR MANAGER, BAINES SIMMONS

Sarah Booth is our Senior Manager of Fatigue Risk Management. A specialist in human performance in the aviation and aerospace environments, Sarah has worked with operators to develop and implement Fatigue Risk Management Systems (FRMS) across multiple regulatory environments, and provides scientific support to Regulators assessing FRM submissions and scientific safety cases.

Sarah specialises in the integration of key data streams into the FRMS. A highly experienced user of bio-mathematical fatigue models, Sarah develops key metrics for the analysis of roster-related-fatigue levels and roster-related fatigue contributors. Sarah also works closely with operators to implement effective, data-rich fatigue reporting systems, and to identify barriers to reporting.

In the last two years, Sarah has undertaken scientific safety cases, fatigue management diagnostics and implemented Fatigue Risk Management in some of the world's largest airlines, as well as in the rail and maritime industries and for search and rescue helicopter operations.

Sarah obtained an honours degree in Physiological Sciences from the University of Oxford, focusing on cardiovascular physiology and immunology, a Master's degree in Space Physiology and Health at King's College London, and a Master's Degree in Sleep Medicine at the University of Oxford.

Dr Cristina Ruscitto

SENIOR RESEARCHER, BAINES SIMMONS

Dr Cristina Ruscitto is a Senior Researcher in the Fatigue Risk Management Team. She specialises in the psycho-behavioural predictors of jet lag and fatigue in the aviation sector. Her role involves a wide range of tasks, including the development of fatigue surveys and survey analysis, development of fatigue investigation process, review and recommendations of procedures, scientific study of roster patterns and the use of bio-mathematical models to conduct roster analysis.

Cristina joined the team in April 2018, having previously completed her PhD in Health Psychology exploring the psycho-behavioural predictors of jet lag amongst long-haul cabin crew at the University of Surrey, UK. Her research examined the relationship between subjective (symptom perception) and objective (shift in melatonin acrophase) jet lag in order to provide a comprehensive account of jet lag in long-haul cabin crew. The nature of subjective jet lag was further explored in terms of how long-haul crew make sense of jet lag and how this affects their adaptation to jet lag. Finally, based on recent evidence about the circadian resetting properties of food timing, Cristina also evaluated the impact of mealtimes for reducing jet lag in long-haul crew.

Cristina's interest in the field of jet lag and fatigue in aviation is not only academic but also personal having worked as long-haul cabin crew for 24 years. Cristina also works as a Visiting Researcher and Academic Tutor in Psychology for the University of Surrey. She is a Chartered member of the British Psychological Society and an Associate Fellow of the Higher Education Academy.

Reviewer

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Alexandra Holmes PhD is a fatigue risk management (FRM) specialist at Baines Simmons, an aviation safety risk management consultancy. For over 20 years, Alex has worked with operators to undertake large-scale scientific safety studies of pilot fatigue and performance, including pilots operating ultra long-range trips between the Middle East and the USA, to island hopping seaplane pilots.

Alex is currently on the EASA Scientific Committee reviewing research into the effectiveness of flight time limitations. She was on the Flight Safety Foundation (FSF), Fatigue Countermeasure Group that authored Guidance for Operators for controlled rest, and a member of the ICAO Helicopter Fatigue Management Task Force that developed the revised SARP and guidance material on fatigue management for helicopter operations.

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