



The International Maritime Human Element Bulletin

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Alert!



This issue of the **Alert!** Bulletin introduces Phase 2 of our continuing project to improve the awareness of the Human Element in the maritime industry. Phase 2 of this award-winning project will run for another three years, under the sponsorship of Lloyd's Register Educational Trust, with the publication of a further 9 issues of the Bulletin (on a 4-monthly basis), and the re-launch of a more user-friendly website.

Through the first 12 issues of **Alert!**, we have focussed on a number of subject areas, each of which has concentrated on one or more elements of the lifecycle of a ship - as a reminder that Human Element considerations do not just start at the design stage and finish at build, but that they must be applied throughout its lifecycle, especially when updating its role or its manning philosophies or when retro-fitting new systems or equipment.

In the next 9 issues, we will be focusing on the application of the body of knowledge that has already been accumulated, to address the specific Human Element issues of: fatigue; effective communication; automation and alarm management; complacency and routinisation; slips, trips and falls; health, safety and wellbeing; recruitment, retention, education, training and competence; and information management.

To register for either an electronic or paper copy of the **Alert!** Bulletin, please go to the **Alert!** website at www.he-alert.org

Through the **Alert!** Project, we seek to represent the views of all sectors of the maritime industry - contributions for the Bulletin, letters to the editor and articles and papers for the website database are always welcome.

The Editor

Alert!

The International Maritime Human Element
Bulletin

The Nautical Institute

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Time to wake up to the consequences of Fatigue

Almost every accident investigation report these days will cite *fatigue* as one of the causal features of the accident. Many of these reports are of ship groundings or collisions due to the inattention of a 'fatigued' officer of the watch, because he was suffering from a lack of sleep brought about by a 6-on-6-off watchkeeping cycle and an excessive work load outside of his watchkeeping duties.

Such incidents mainly relate to minimum manned short sea shipping, where the bridge manning and watchkeeping patterns are clearly not conducive to the operating pattern of the ship, and where the master is also one of the 2 watchkeeping officers. In these cases, the solution is simple: increase the manning to remove the master from the watchkeeping roster, and consider an alternative watchkeeping pattern.

But, fatigue does not just result from minimum manning and watchkeeping patterns. Fatigue can manifest itself through a variety of environmental, operational, physiological, and psychological factors that can affect the health and performance of every person onboard, in one way or another.

'Fatigue management' should be high on the agenda for all ship designers, managers and seafarers. For the ship designer, this means being aware of, and as far as possible, 'designing out' the debilitating effects of noise, temperature, motion, vibrations, intensity of lighting etc. For the

shipowner/shipmanager it means developing a fatigue management plan to ensure that the correct resources, training and procedures are in place not only to ensure the safety of the ship, but also to protect the health, safety and wellbeing of the seafarer. And, for the seafarer, it means being able to identify the causes of fatigue and to work towards taking appropriate and early measures to prevent it.

The IMO guidelines on fatigue mitigation and management are comprehensive and provide practical advice to all the various stakeholders on how to combat it. The US Coast Guard's Crew Endurance Management program (see page 7) identifies the various environmental, operational, physiological, and psychological factors that can affect crew endurance, and addresses the specific endurance risks pertinent to ship operations. Both should be essential reading for those stakeholders involved in the design, management and operation of ships.

While the IMO does not currently advocate mandatory training in fatigue management, common sense and good practice would suggest that such training is essential.

It is time to wake up to the consequences of fatigue - such consequences can be costly...

The IMO Guidelines on fatigue mitigation and management can be downloaded from:
www.imo.org/en/OurWork/HumanElement/VisionPrinciplesGoals/Documents/1014.pdf



Seafarer fatigue: The Cardiff research programme

The long-awaited research study on seafarer fatigue, sponsored by the UK Maritime and Coastguard Agency (MCA), the UK Health and Safety Executive, Nautilus UK and the Seafarers' International Research Centre, Cardiff has just been published.

The aim of this research programme was to provide a knowledge base to predict worst case scenarios for fatigue, health and injury; to develop best practice recommendations appropriate to ship type and trade; and to produce advice packages for seafarers, regulators and policy makers.

The results of the research show that the potential for fatigue at sea is high due to seafarers' exposure to a large number of recognisable risk factors, both operational (e.g. port frequency), organisational (e.g. job support), and environmental (e.g. physical hazards). But, it is the combined effect of these risk factors that is most strongly associated with fatigue and its both short and long term consequences

(fatigue symptoms, personal risk and reduced health and well-being).

The research has also shown that the consequences of fatigue are not only felt in terms of impaired performance and reduced safety but decreased well-being and increased risk of mental health problems, also known to be risk factors for future chronic disease.

The report makes a number of recommendations with regard to:

- **How working hours are recorded.** Knowing how long seafarers are working for is critical in terms of evaluating how safe current operating standards are. The study shows the current method for recording and auditing working hours is not effective and should therefore be reviewed.
- **Fatigue management training and information campaigns.** Fatigue management training and information campaigns for seafarers are likely to prove effective but only as part of a unified approach involving all levels of authority.

Such an approach will only be effective if crew are empowered to act on their training in terms of actively intervening with operations when required.

- **Industry standards to measure fatigue.** No 'gold standard' measure of fatigue currently exists which makes the task of comparing and evaluating the impact of research results extremely difficult. Work needs to be done which either sets out the case for adopting the use of one particular fatigue measure as the industry standard, or looks towards developing a new scale for industrial and research purposes.

- **Development of a multi-factor auditing tool.** The study has shown that it is the combination of different risk factors that puts an individual at risk of fatigue. A taxonomic or checklist-style auditing tool therefore needs to be developed to include not only work characteristics known to be risk factors for fatigue but also subjective experience of this factor.

Copies of the Report can be downloaded from:
http://www.vdks.org/pdf/seafarer_fatigue.pdf

Fatigue in the shipping industry

Dr Irene L D Houtman, Senior researcher TNO

This study on fatigue in the shipping industry was commissioned by the Dutch Ministry of Transport, Public Works and Water Management.

Central to the study was the relation between fatigue and the occurrence of collisions and groundings. The aims of the project were to assess the relationship between fatigue and collisions and groundings; to inventory measures to prevent and manage fatigue; and to map the consequences of these measures for the competitiveness of the sector as well as for maritime education.

The study concludes that fatigue may be a causal factor in 11 to 23 percent of collisions and groundings, but that fatigue as a cause of collisions and groundings is likely to be under-reported. However, any causal link between the two-shift system and fatigue was not proven.

The study report proposes a number of measures to reduce fatigue, through the proper implementation of the ISM Code; the optimisation of the organisation of work onboard; the lengthening of one of the resting periods per 24 hours;

and the reduction of administrative tasks onboard.

A number of options for these measures are discussed, together with the cost benefits and implications for maritime education. These include:

- Replacing the two-shift system with a three-shift system by adding an additional officer in charge of the watch.
- Adding a crew member designated with administrative tasks; appointing seafarers authorised for watch and being able to perform other tasks on board; and the use of Information and Communications Technology programmes to improve the possibilities to delegate administrative tasks ashore.
- Changing the 6-on-6-off shift system to one of 4-on-8-off-8-on-4-off.
- Setting up a Fatigue Management Program as an integrated part of the ISM Code.

The full report can be downloaded from: www.he-alert.org (Ref: HE00605)

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Fatigue and an alternative watch system

Capt Robert Sheen, FNI
Vice President, Operations
Ocean Shipholdings, Inc

Fatigue is one of the most significant causes of accidents at sea. Mariners can become fatigued through 'traditional' means, such as lack of sleep, insufficient rest time between work periods or experiencing poor quality of rest. However, they may also become fatigued through excessive work loads, monotonous tasking, excessive noise or vibration as well as ingesting certain types of nutrients and chemicals.

The question then becomes how to mitigate fatigue.

In the case of my company, in 1998, we decided to institute an Alternative Watch System in our five 32,500 DWT product tankers. This scheme was based on one that had been developed by the West German Ministry for Technology and Research, for the operation of single person bridges.

The Alternate Watch System comprises

of a series of 2 hour and 6 hour watches. Each person stands one 2 hour watch and one 6 hour watch each day. For example, on a '3 Mate' ship, the Second Mate stands watch from 0001 to 0600 and again from 0800 to 1000 and is off, barring any other onboard operations or overtime work, until 0001 the next day. The Chief Mate stands 0600 to 0800 and 1200 to 1800, and is off until 0600 the next day, while the Third Mate stands 1000 to 1200 and 1800 to 2400 and is off until 1000 the following day.

This scheme allows onboard personnel to work 4 hours overtime each day, while fully complying with the requirements of STCW and the American Oil Pollution Act of 1990. It also allows each person to have enough time off to rest, conduct personal business, etc.

Initially, there was some hesitation, especially from older officers, to start

standing these types of watches. This was due, in large part, to the 6-hour watch segment. However, once these individuals actually experienced the benefits of the long, uninterrupted rest period, they quickly adapted to the new system.

The system has been entirely voluntary on the part of the ships' crews. We do not mandate that they work to the Alternate Watch System; however, not one ship has changed back to the traditional 4-on-8-off system.

We have found that the vessel crews fully support the Alternative Watch System and that they report being better rested, have a more 'normal' work experience, and feel that they have enough time off to accomplish their personal tasks without compromising their rest.

It has worked extraordinarily well, and has gone a long way to improving the quality of life onboard our vessels.

The alternative watch system												
	2	4	6	8	10	12	14	16	18	20	22	24
Second Mate		00-06			08-10							
Chief Mate				06-08			12-18					
Third Mate						10-12				18-24		



Towards a fatigue management plan...

Wayne Perkins
Human factors Analyst
Maritime New Zealand

Low manning levels and their impact on fatigue and seafarer wellbeing are a recurring theme in **Alert!** Articles. The practice of fatigue management guided by science is relatively new in all industries.

There are not many off-the shelf guides to help ship operators develop fatigue management plans, and they do not cover the full range of maritime operations. In New Zealand we are currently focusing on non-SOLAS vessels, including fishing vessels, harbour ferries, and workboats, where guidance materials are lacking. A key factor in making real progress has been to bring together expertise on fatigue and sleep with operational knowledge about the industry sectors of interest.

The cornerstone in fatigue management is education - equipping those at sea and on shore to better organise work places, systems, and their personal lives to mitigate causes and effects of fatigue. This includes the people who make policy decisions and allocate resources. The

effectiveness of education depends on ensuring that educational materials are attractive and relevant to the target audience; and by checking materials through talking to those who have used them and seeking views from a range of staff.

Accident investigations typically reveal a chain of responsibility extending well beyond the fatigued seafarer who falls asleep or makes a mistake. In fatigue management, making the chain of responsibility explicit is essential. Those at the top must make their expectations clear - a formal policy statement. Equally important is the need for regular feedback of information from the ship to management. This feedback helps keep fatigue issues 'on the radar' and provides current information on which managers can act. For larger operations, a fatigue oversight committee can provide a focus for on-going fatigue management. The committee should include not only those who can make decisions, but also those affected by them.

Information about fatigue can be gained in many ways. Processes for routine feedback can include talking

with seafarers (and listening to them!), or in larger operations having voluntary fatigue reporting forms, which are non-punitive, regularly evaluated, and acted upon when necessary. Surveys at regular intervals can track what is happening across a work group or an operation, and may bring out new and emerging issues. Where a particular fatigue issue is identified, more in-depth investigation may be warranted, such as asking seafarers to keep a sleep diary, or wear a watch-sized activity monitor (a wrist actigraph) to objectively measure their sleep/wake patterns across a duty period.

And if you are serious about fatigue management, encourage honest reporting of hours worked. Without reality being reflected in the hours of work (especially when everyone is being pushed) the crew will know it is all a fraud, and accidents will continue to be the real price of low cost shipping.

Wayne Perkins' paper *Development of a maritime fatigue management programme* can be downloaded from: www.he-alert.org/filemanager/root/site_assets/standalone_article_pdfs_0605-/HE00610.pdf

Fatigue Causes, effects and mitigation

Causes

Lack of sleep

Insufficient rest time between work periods

Stress

Noise / vibration

Ship movement

Food (timing, frequency, content & quality)

Medical conditions & illnesses

Poor quality of sleep

Poor quality of rest

Boring / repetitive work

Inadequate ventilation, poor lighting, excessive heat / cold, poor air exchange

Effects of alcohol, drugs & caffeine

Excessive work load

Poor workspace design

Mitigating fatigue

Seafarer

- Try to get deep, uninterrupted sleep 7 to 8 hours per 24-hour day
- Take strategic naps (up to 20 minutes)
- Develop pre-sleep routine, eg: warm shower, light reading, write up personal diary, meditation/yoga
- Ensure dark, quiet, cool sleeping environment & comfortable bed
- Avoid interruptions during extended period of sleep.
- Eat/drink lightly before bed
- Visit toilet before trying to sleep
- Avoid alcohol & caffeine prior to sleep
- Avoid caffeine at least 6 hours before bedtime
- Minimize disturbance of rest/sleep periods
- Take break between work periods
- Get sufficient sleep before high activity periods
- Maintain fitness for duty
- Eat regular, well-balanced meals
- Exercise regularly
- Accurately record hours of work & rest

Master

- Implement Company's fatigue management plan in respect of:
 - ISM Code requirements for clear, concise guidance on operational procedures
 - Adequate rest for joining crews before assuming duties
 - Allowing time for proper hand over on crew change
 - Language barriers, social, cultural and religious isolation
 - Interpersonal relationships, stress, loneliness, boredom, social deprivation & increased workload as a result of small crew numbers

- Shore leave, onboard recreation & family communication
- Workable & safe watchkeeping arrangements
- Job rotation
- Crew education & training to recognise & mitigate fatigue
- Monitoring & effective management of crew hours of work & rest
- Create open communication environment for reporting fatigue
- Establish procedures for scheduling shipboard work & rest periods
- Rotate tasks requiring high physical or mental demand with low-demand tasks
- Schedule potentially hazardous tasks for daytime hours, & ensure crew adjusted for working in their day time
- Ensure that adequate rest is received by all - encourage napping
- Promote individual record keeping of hours rested/worked.
- Re-appraise traditional work patterns & areas of responsibility to establish most efficient utilization of resources
- Ensure adequate heating, ventilation, air-conditioning & lighting
- Minimize noise & vibration
- Establish shipboard practices for dealing with fatigue incidents
- Encourage healthy lifestyle

Shipowner/Shipmanager

- Develop fatigue management plan to cover:
 - ISM Code requirements for clear, concise guidance on operational procedures
 - Adequate rest for joining crews before assuming duties
 - Allowing time for proper hand over on crew change
 - Voyage length, time in port, length of service & leave ratios
 - Language barriers, social, cultural and religious isolation

Effects

Inability to concentrate

Slow response

Loss of control of
bodily movements

Mood changes

Headaches

Heart palpitations / irregular
heart beats

Rapid breathing

Diminished decision
- making ability

Poor memory

Attitude changes

Giddiness

Sudden sweating fits

Insomnia

Loss of appetite

Leg pains / cramps

- Interpersonal relationships, stress, loneliness, boredom, social deprivation & increased workload as a result of small crew numbers
- Provision for shore leave, onboard recreation & family communication
- Workable & safe watchkeeping arrangements
- Job rotation
- Crew education & training to recognise & mitigate fatigue
- Monitoring & effective management of crew hours of work & rest
- Provide adequate & comfortable accommodation (including bunks)
- Provide adequate quality & quantity of food for proper nutrition
- Modify ship designs to minimize fatigue stressors
- Keep telephone calls & e-mails to the Master to a minimum & have due regard for time zone differences

Naval Architect/designer

- Provide for adequate and comfortable accommodation, galleys, messrooms & recreational spaces, having due regard for variations in size, shape & gender of seafarers, and for the various environmental stressors such as noise, heat, cold, humidity & vibration
- Minimize fatigue inducing environmental stressors including ship movement, excessive noise, vibration, inadequate ventilation, poor lighting, excessive heat or cold, too much/too little humidity & poor air exchange in enclosed working & accommodation spaces. Minimize unnecessary sustained exertion (physical or mental) in the workplace
- Design operational maintenance tasks to be rapid, safe and effective to allow equipment & systems to achieve a specified level of performance, with the minimum of sustained exertion

- Design control centres, machinery control rooms, cargo control rooms etc, bearing in mind the integration of people with equipment, systems and interfaces, & the need to avoid boredom monotony, reduced vigilance and mental overload

Keeping awake & alert

- Bright lights, cool dry air, obtrusive or loud music, and some invigorating aromas (such as peppermint) may temporarily increase alertness
- Caffeine may combat sleepiness but only for short periods
- Running, walking, stretching & chewing gum can stimulate levels of alertness
- Active conversation can help you stay awake
- Mixing tasks requiring high physical or mental work with low-demand tasks can be beneficial

NB: Alcohol, caffeine and some over-the-counter medications DISRUPT sleep



Designing to Deal with Fatigue

Captain E W Lyons, FNI
Marine Director
FT Everard & Sons Limited

The nature of the north-west European short sea tanker trade is such that ship operators and sea staff are continually challenged to ensure that fatigue is effectively managed. Clearly that involves careful planning of watchkeeping routines and working practices, and a management structure that is sufficiently flexible to adapt to changing circumstances - ultimately allowing the vessel to be temporarily suspended from service to afford seastaff the opportunity to be properly rested.

The management of hours of work may well be the most critical element in mitigating fatigue, but there is a significant importance at the design and construction stages of a vessel which can produce a lifelong benefit to the onboard welfare of the crew. The penalty for failure to take proper account of crew wellbeing within the design concept is to create an inherent and irrevocable contribution to the underlying cause of fatigue.

It was at the conceptual stage of design for our *Speciality* class of vessels, that we recognised the importance of adopting an holistic approach to the combined effects on the seafarer of the onboard

working environment and the quality of life potentially available to seafarers when off duty. This included comprehensive consultation with seastaff.

Although many of the factors incorporated within the design were for primarily commercial or technical purposes, there has been an undeniably positive effect on seafarer fatigue. For example, the provision of a fully remote-controlled cargo and ballast system dramatically reduces the duration of exposure to a potentially harsh external working environment, and the automation of many previously manual tasks has reduced the physical workload expected of seafarers.

Significant attention has been given to minimising noise and vibration, by analysing all specified equipment and their methods of installation to ensure that, wherever possible, noise and vibration were eliminated at source. Electrical systems controlled by frequency converters replace high pressure hydraulics, and significant noise attenuation measures were introduced to minimise the impact of fans, exhausts, electrical generation and propulsion systems etc. The result is an exceptionally

quiet vessel with virtually no vibration, particularly within the accommodation spaces.

Additionally, the overall design of the vessel has resulted in a very stable platform that performs well even in the worst of sea conditions thereby reducing the effects of motion related fatigue.

Within the accommodation, great care has been taken to ensure that the highest possible standards of comfort are provided to seastaff. Large panoramic windows give the impression of space and freedom. The messroom is far larger and better appointed than would be expected for such a vessel, and the dining arrangements encourage interaction, integration and a sense of both professional and social teamwork and cooperation. Individual cabin temperature controls, and 'soft' lighting in cabins and common rooms provide a comfortable and relaxing 'feel' to the accommodation.

In all, the *Speciality* class provides for seafarers an environment that has been engineered to provide the best possible opportunity for the effective management of fatigue.

Use of light to improve alertness in marine operations

William G Sirois, Senior Vice President and Chief Operating Officer, Acacia Aguirre, MD, PhD, Medical Director, Circadian Technologies, Inc

Fatigue is a problem in the marine industry, due to the extended tours of duty and demanding watchkeeping schedules. Biological clocks automatically switch the human brain to low levels of alertness at night. Thus, we are not well equipped to sustain optimal performance during nocturnal hours.

There are innovative technologies to help optimize crew alertness and performance levels. Research studies have found that, in addition to supporting vision, light has other non-visual effects, such as resetting our biological clock to the 24-hour day and improving alertness. Shiftwork researchers are evaluating the most effective intensity and wavelength to improve alertness and performance at night. Sunlight is a broad mix of colors, perceived by the human eye as white. At first, experiments were done using high intensity white bright light.

Research studies have proved that short

wavelength blue or green light is more effective than white light, thus allowing the same alerting effects with lower intensity. For example, an exposure to 5 lux of blue light for 40 minutes had similar effects as exposure to 5000 lux of white light during longer periods. Two or three properly timed 20-minute exposure periods to short wavelength light can improve alertness and performance during the night.

The US Coast Guard has tested the effectiveness of low intensity green light to avoid accidents caused by fatigue, and has incorporated the use of timed green light exposure into their Crew Endurance Management System (see page 7).

Recent studies have compared the effectiveness of blue light and green light to improve alertness. Volunteers exposed to blue light rated themselves less sleepy, had quicker reaction times and fewer lapses of attention than those exposed

to green light. However, the authors of the study cautioned that further research is still needed, especially regarding safety with long term exposure, since there is concern that blue light may cause damage to the retina.

People most sensitive to eye damage are those with pre-existing eye conditions, diabetes and other diseases that predispose them to retinal damage or those taking photosensitizing medications. Moreover, some studies comparing blue and green light have suggested that the alerting effect of blue light may persist during the subsequent sleep period, reducing sleep quality.

www.circadian.com

The 24/7 nature of the maritime industry exposes crewmembers to a number of risk factors that can degrade their endurance (including physical stamina and mental alertness) and, thereby, their performance and safety. Crew endurance is a function of operational risk factors such as the psychological state of crew members, level of physical conditioning, threshold of motion discomfort, quality and duration of sleep, quality of diet, and the stability of their biological clocks.

The United States Coast Guard (USCG) has developed a non-regulatory program to help industry manage these risk factors. This Crew Endurance Management System (CEMS) uses a systematic, continuous-improvement approach based on years of science and field testing.

There are five basic steps in the CEMS process (Figure), a critical component of which requires a focused effort to identify each vessel's unique, specific endurance risks. In Step II, a working group composed of shore-side and vessel personnel identify how often crewmembers experience 15 primary endurance risk factors while living and working onboard. These risk factors address sleep quantity and quality, work and rest schedules, the work and living environment, and individual physical and personal stressors.

Since this working group knows their operations and people well, and the time and money available, they are best suited to develop a realistic plan with recommendations towards reducing the incidence of the risks. Any organization can 'do' CEMS as long as they are striving for continuous improvement within this circular process. Recommendations may involve a wide range of options, from physically changing staterooms to reducing noise and light, to implementing cost-free organizational policy changes

A holistic approach to improving crew performance

Cdr David R Bird, US Coast Guard, Chief, Human Element and Ship Design Division

such as courtesy or napping policies, to increasing education and training.

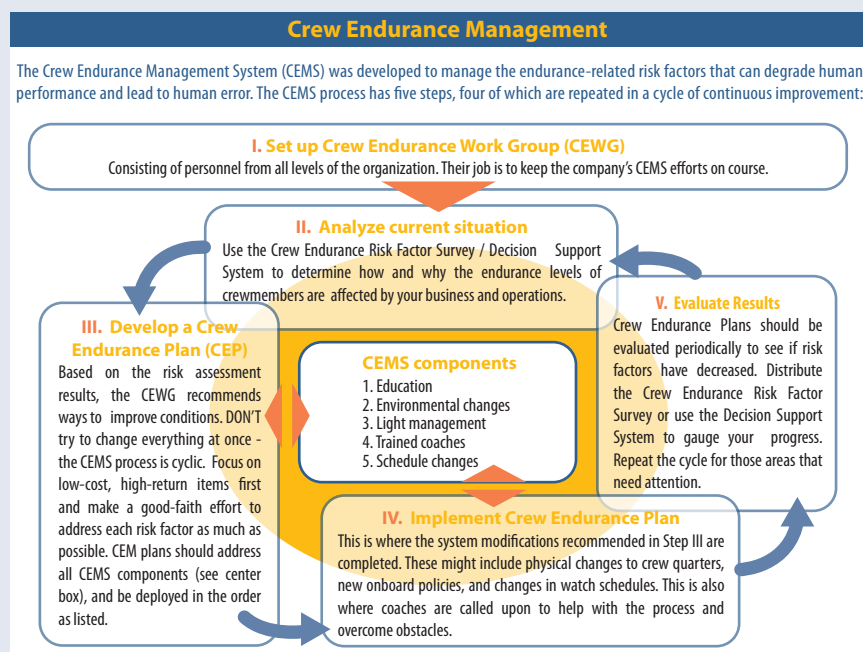
After the plan is first implemented, the group then conducts periodic evaluations to validate whether or not the recommendations were effective. From there, they can gauge their progress and repeat the cycle for old or new areas that still need attention. The process should be continued until risk factors are reduced as much as realistically possible.

Education is another critical component of a successful CEMS program; indeed, it's the cornerstone for involved shore-side personnel and vessel crews. Through a USCG-sponsored training and certification

program, over 1200 certified CEMS 'Coaches' have been trained since 2003, to help implement and maintain an effective CEMS program.

There is little risk and much to gain from implementing CEMS. Over 100 companies from the US and abroad who have been practicing CEMS, have documented improvement in employee performance, morale, and general health and well-being.

For more information about the CEMS program, go to: <http://www.uscg.mil/hq/cg5/cg5211/cems.asp>



Fatigue and tiredness or alertness and performance?

Rob Miles, Principal Specialist Inspector: Human Factors, Offshore Safety Division, UK Health & Safety Executive (HSE)

Workers at all levels in a complex sector such as transport are safety critical elements in a large man/machine system. They may not see themselves that way and they may not be treated that way but if they fail to deliver an action when required because they are not sufficiently alert then the importance of their role becomes obvious.

Organizations have programmes for improved performance and up-time for equipment, and invest in training and development for staff; but, they generally fail to link the importance of individual performance and alertness to ability to deliver the knowledge and decision making capacity that they have invested

in, and that they explicitly rely on, for safe and effective operations. The Safety Management System is the ideal place to set out policy and performance standards for alertness along with measures for monitoring and mitigation.

Although this is an emerging area it is possible to make some suggestions for good practice:

- Have an alertness policy along with performance standards that are intended to deliver alert staff where and when needed.
- Treat that lack of alertness as a hazard and introduce monitoring and mitigation so that tired staff can speak up and get

assistance or rest when they judge their performance to be falling to dangerously low levels.

- Link alertness to training so that staff are trained in monitoring their own performance and understand the basics of human performance and how important this is. This needs to be linked to the mitigation measures put into place.

It is not uncommon to find a multi-million dollar complex system dependent on an operator making critical decisions, based upon his ability to analyze and recall complex training and procedures, undermined by a failure to manage his alertness.

Tanker explosion and fire

This report features an explosion, and subsequent fire, in a newly-delivered 2159gt tanker, causing significant damage to the vessel's structure and systems.

The ship had loaded a cargo of ultra low sulphur petrol (ULSP), some of which migrated into the forward space, housing the gas freeing fans, from the interconnected cargo and gas freeing systems. A spectacle plate between these systems had not been fitted in the blanked position, the associated isolating valves had not been closed and a non-return valve leaked. Motor spirit and vapour then drained into the spaces beneath the gas freeing room through the scuppers and an open hatch; the vapour was eventually ignited by electrical equipment not intended for use in an explosive atmosphere.

Several human element issues were identified, including crew familiarisation; fatigue aggravated by unfamiliar technology, equipment and systems; the lack of ship specific operational procedures in the ship's Safety Management System (SMS); and the reluctance of the deck officers to report the spill to the master, or to the designated person.

The report concludes that the chief officer was overloaded and fatigued by the evening before the accident, when he used the gas freeing system and decided to delay the proper shutting down of the system until the following morning - which he ultimately failed to properly do. When he found that the ULSP had drained to a lower level, he decided that the forecastle could be cleaned up and made safe, without the need to report the situation to the master, with whom he had a difficult working relationship.

Despite there having been a full crew of 9 standing by in the latter stages of the build, all of the crew on board at the time of the accident had joined at the end of the delivery voyage. Both the master and chief officer had spent 2 weeks understudying their respective predecessors, but during this period, the chief officer was also performing the duties of second officer. Consequently, the two second officers who joined only some 19 days before the accident had received no handover.

The report criticises the lack of guidance on the operation of the gas-freeing system in the ship's generic Safety Management

System (SMS). The three deck officers were accustomed to having ship-specific operations manuals, but such manuals had not been provided.

The ship's managers had a well-established generic safety management/quality assurance system for vessels under its control, which included details about the role of the designated person and his link between ship's staff and senior company management. Yet, no call was made to the designated person to report the fuel spillage.

The report recommends that the International Chamber of Shipping highlight to its national ship owner associations, the importance of having adequate procedures in place within ISM documentation, to safely introduce new, or newly acquired, vessels into commercial service. And, that these procedures should include: selection, numbers, familiarisation and briefing of crews; identification of operational hazards minimising risks; and preparing safe operational procedures.

The full report can be downloaded from: <https://www.gov.im/lib/docs/ded/shipregistry/formsdocs/reports/casualty/borderheather.pdf>

Reports & Studies



THE FATIGUE FORUM

The Nautical Institute has set up a web forum as part of their programme to raise the awareness of fatigue on board and to promote best practices for management and mitigation techniques.

For further information go to: www.nautinst.org/en/forums/fatigue/index.cfm

w: www.he-alert.org
e: editor@he-alert.org

OCCUPATIONAL SAFETY AND HEALTH IN THE MARITIME INDUSTRY - A CIS BIBLIOGRAPHY

International Occupational Safety and Health Information Centre (CIS)

A list of information resources (standards, books, articles, CD-ROMs, etc.) on occupational safety and health (OSH) issues associated with the maritime industry. It comprises material on accident prevention and working conditions of seafarers, fishermen and dockworkers. References contain full bibliographic descriptions, including abstracts and links giving access to the documents on the Internet when available.

Downloadable from: http://staging.ilo.org/public/libdoc/ilo/2006/106B09_12_engl.pdf

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FATIGUE AT SEA - A REVIEW OF RESEARCH AND RELATED LITERATURE

The Swedish National Road and Transport Research Institute

The review of research and related literature contained in this document is in support of the VTI *Fatigue at Sea* study, which started in 2005, and is planned to run for at least two years.

Document no longer available

TOOLBOX FOR TRANSIT OPERATOR FATIGUE

Transportation Research Board, National Research Council

This 'Toolbox' documents principles, techniques, and strategies that are used in the development of fatigue-mitigation plans. It includes a 'how to' component on the design, implementation, and evaluation of fatigue-mitigation plans.

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