Second Stakeholder Meeting for the Development of a Proposed Worker Fatigue Rule

OFWN O14B6
April 19, 2002
Rockville, MD

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Introductions and Opening Remarks

- Introductions
- Background
- Meeting Objectives
- Meeting Format

2

Attachment 3

Agenda

8:30 – 8:45	Introductions and Opening Remarks
8:45 - 9:15	Policy Assessment Overview
9:15 - 10:15	Overview of Fatigue Research
10:15 - 10:30	Break
10:30 – 11:00	Industry Activity Plan
11:00 – 11:30	Discussion
11:30 – 12:30	Lunch
12:30 – 12:40	UCS Proposal
12:40 – 12:50	"Straw Man" Concept for Thresholds
12:50 – 1:00	Practical Constraints
1:00 – 1:45	Threshold Development Breakouts
1:45 – 2:00	Break
2:00 – 2:30	Breakout Presentations
2:30 – 3:00	Consensus Building
3:00 - 3:30	Future Activity Planning

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Rulemaking Plan Option 2

- Thresholds
- Risk-Informed Deviation Process
- Fatigue Management Methods

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Current Regulatory Framework
Policy Statement

- Licensees Shall Assure that Personnel Alertness and Decision-making Ability is Not Impaired
- Applies to Staff Who Perform *Safety-Related Functions*
- Assumes
  - *Normal 8-hr Day, 40-hr Week*
  - Maintain adequate shift coverage without routine heavy use of overtime
- However, for
  - *Unforeseen Problems*, or
  - During *extended periods* of Shutdown, Major Maintenance or Major Plant Modifications
  - On a *Temporary Basis*
- Apply Guidance
  - Max. 16-hr day (excluding shutdown)
  - 16 hrs in 24, 24 hrs in 48, 72 hrs. in 7 days
  - 8 hr. Break between work periods (including turnover)
  - Except *during extended periods of shutdown*, consider OT on *individual basis*, not entire shift staff
- Exception for *Very Unusual Circumstances*
  - Waiver from Plant Manager or Designee

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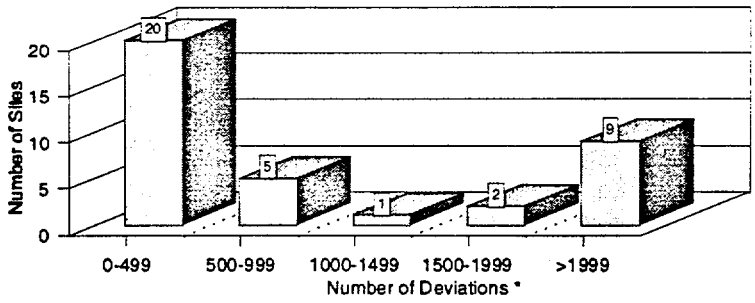
Distribution of Sites by Number of Deviations Authorized During Outage Periods - 1999



37 of 66 sites reporting data * Range: 7 – 7,553 Deviations

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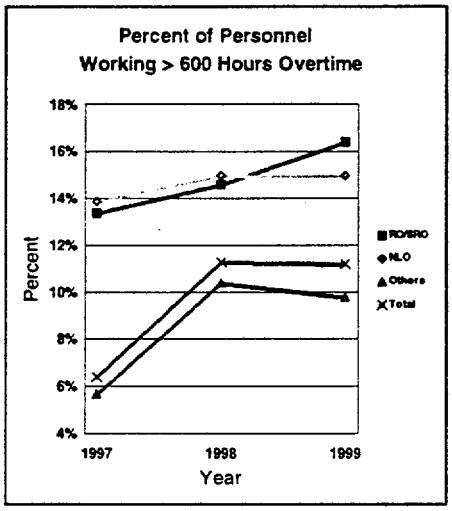

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Challenges to Assessing Influence of Fatigue on Events

- Depth of assessment
- Root cause assessment tools
- Lack of objective proof
- Ease of substantiating event causal factors
- Accuracy of post-event observations
- Accuracy of self-assessment
- Veracity of self-assessment

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Frequency of Significant Events Per Shift (3 French NPPs)

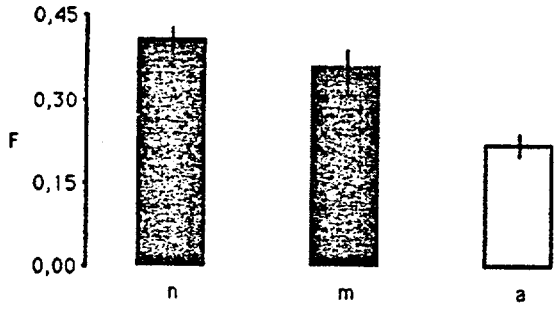

Figure 12.1 Frequency per shift.
The ⟨Shift⟩ and ⟨Power station⟩ variables are independent: $p = 0.81$.
F(*Y*-axis) is the mean relative frequency of human failures.
The *X*-axis shows the successive night (n), morning (m) and afternoon (a) shifts.

Dorel (1996) Human Failure in the Control of Nuclear Power Stations: Temporal Logic of Occurrence and Alternating Work Times

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Frequency of Significant Events as a Function of Time of Day (3 French NPPs)

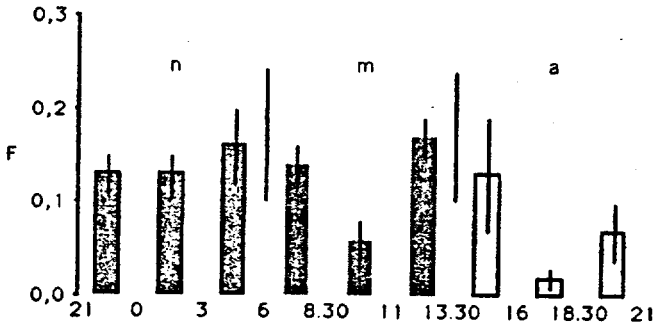

Figure 12.2 Frequency at beginning, middle and end of shift.
F(*Y*-axis) is the mean relative frequency of human failures.
The *X*-axis represents, for each of the shifts (changing at 6 h, 13 h 30, and 21 h), three successive time periods of equal length.

Dorel (1996) Human Failure in the Control of Nuclear Power Stations: Temporal Logic of Occurrence and Alternating Work Times

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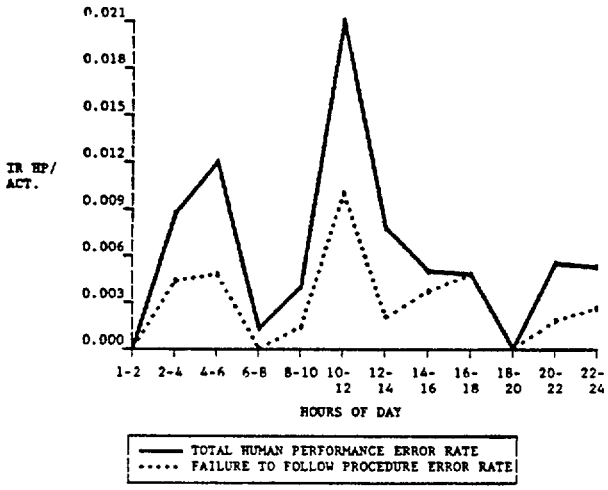
Human Error Rate at a U.S. NPP as Function of Time of Day



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Frequency of LERs as a Function of Time of Day

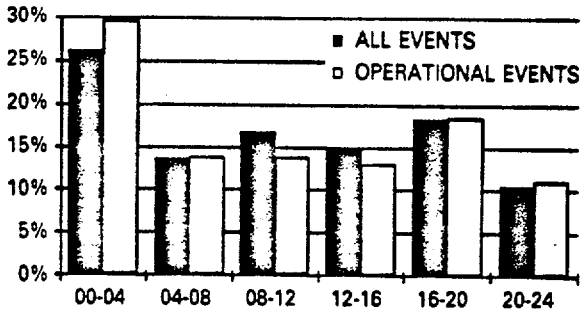

Fig. 1. Operator error events resulting in LERS from 1980 to present.

Maloney (1992) Transactions of the 1992 Annual Meeting of the American Nuclear Society

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National Institutes of Health - National Heart, Lung and Blood Institute

"Research has shown that when healthy adults are allowed to sleep unrestricted, the average time slept is 8 to 8.5 hours." Some people need more than that to avoid problem sleepiness; others need less."

Facts About Problem Sleepiness

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Fatigue and Duty Time Limitations - An International Review

"Scientific data are clear regarding the human physiological requirement for 8 hours of sleep to maintain performance and alertness.

From Laboratory to Flightdeck - Promoting Operational Alertness - M. Rosekind et. al

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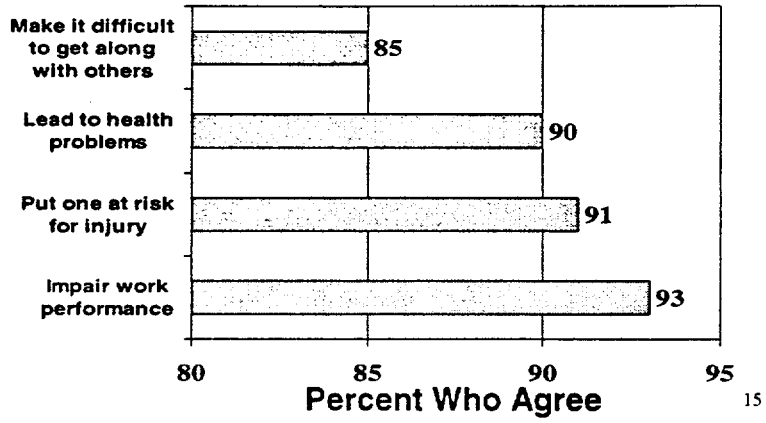
National Sleep Foundation
2002 Sleep in America Poll

Not Getting Enough Sleep Can …



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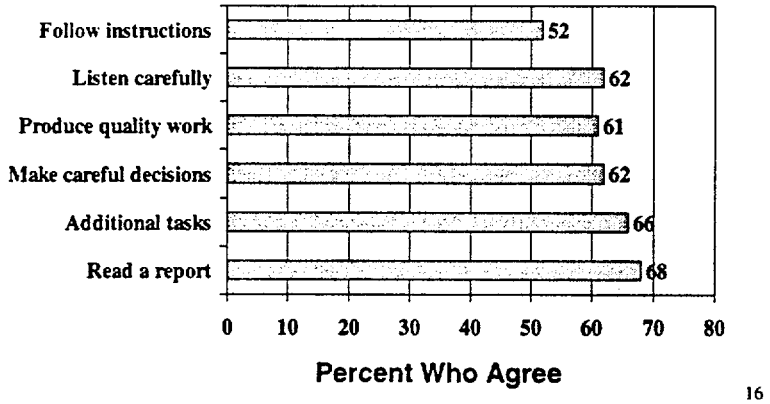
National Sleep Foundation
2002 Sleep in America Poll

Performing Tasks on Days Without Enough Sleep Is Harder



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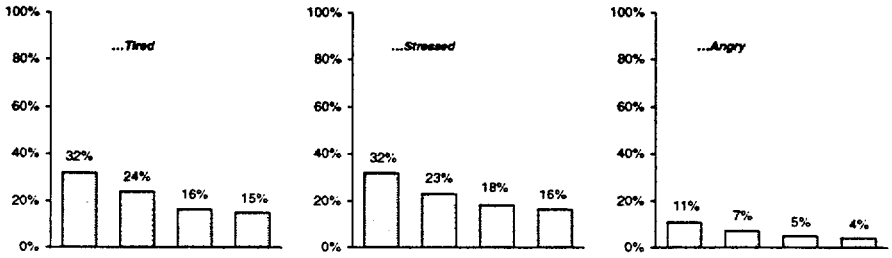
National Sleep Foundation
2002 Sleep in America Poll

Percent of Respondents Reporting They Typically Feel...By Hours Slept on Weekdays

The following graphs show the proportion of respondents reporting how they feel on a typical day compared with the number of hours they sleep on a weekday:

- Those who get less than six hours of sleep on a weekday are *more likely* to be tired, sad, stressed, and/or angry.



Shift work respondents obtained an average of 6.5 hours of sleep on weekdays

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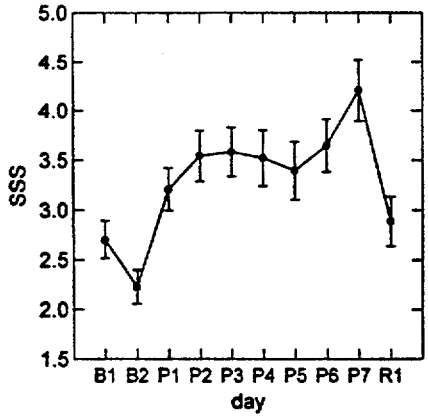
Restricted Sleep – Subjective Sleepiness



Dinges, et al., Cumulative Sleepiness, Mood Disturbance, and Psychomotor Vigilance Performance Decrements During a Week of Sleep Restricted to 4-5 Hours per Night. Sleep, 1997

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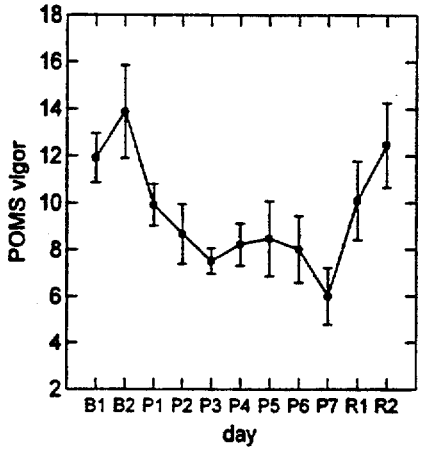
Restricted Sleep - Mood



Dinges, et al., Cumulative Sleepiness, Mood Disturbance, and Psychomotor Vigilance Performance Decrements During a Week of Sleep Restricted to 4-5 Hours per Night. Sleep, 1997

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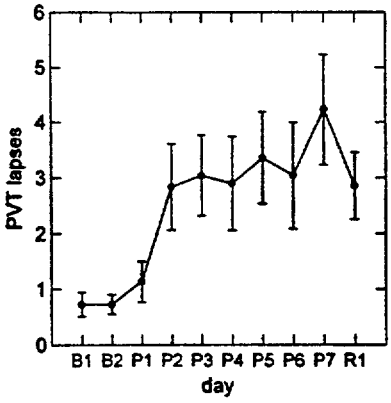
Restricted Sleep – Psychomotor Performance



Dinges, et al., Cumulative Sleepiness, Mood Disturbance, and Psychomotor Vigilance Performance Decrements During a Week of Sleep Restricted to 4-5 Hours per Night. Sleep, 1997

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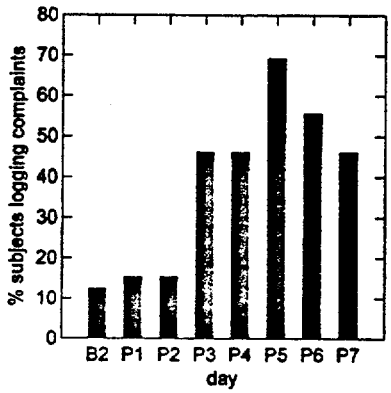
Restricted Sleep - Complaints



Dinges, et al., Cumulative Sleepiness, Mood Disturbance, and Psychomotor Vigilance Performance Decrements During a Week of Sleep Restricted to 4-5 Hours per Night. Sleep, 1997

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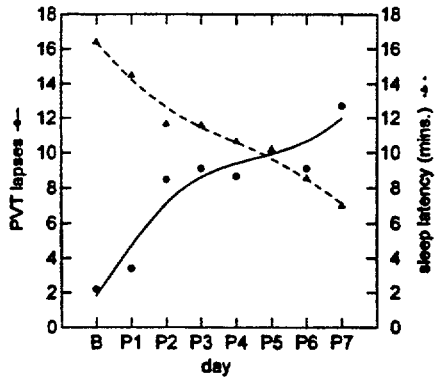
Restricted Sleep – Sleep Latency



Dinges, et al., Cumulative Sleepiness, Mood Disturbance, and Psychomotor Vigilance Performance Decrements During a Week of Sleep Restricted to 4-5 Hours per Night. Sleep, 1997

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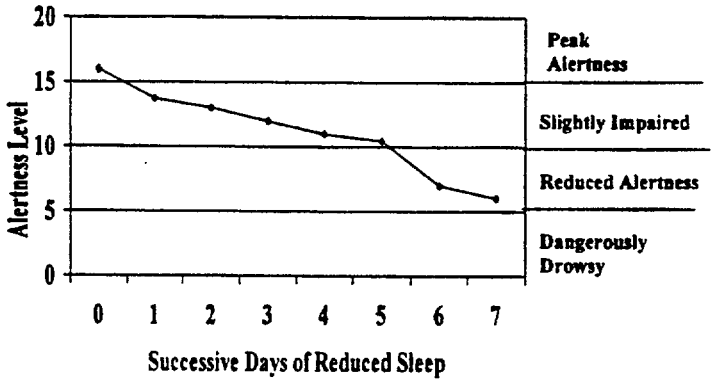
AFFECTS OF SLEEP DEPRIVATION



Moore-Ede, M. – The 24-Hour Society

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Harrison and Horne, 2000
Sleep Deprivation and Decision Making: A Review

Sleep Deprivation can cause:

- reduced concerned over negative consequences when faced with potential high reward (monetary)
- irritability, impatience, childish humor, lack of regard for social conventions, inappropriate interpersonal behavior
- degraded communication by reducing verbal spontaneity and word retrieval
- less willingness to volunteer factual details
- less empathy for colleagues ignorance of vital information,
- impaired transmission of ideas where decision maker needs to receive and distribute emergency information
- increased perseveration
- deterioration of ability to adopt alternative strategies

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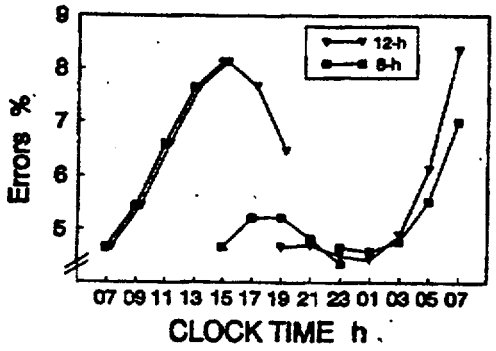
NIOSH Control Room Operator Study



Notes

- Percentage of errors in grammatical reasoning task as a function of clock time
- Continuous process control room operators data
- In general, error rate increased as a function of time on shift
- No differences were observed between the 7 month and 3.5 year test phases on the 12-hour shift

Reference:

Rosa, R. R. (1991). Performance, alertness, and sleep after 3-5 years of 12 h shifts: a follow-up study. Work & Stress, 5, 113 (Figure 2).

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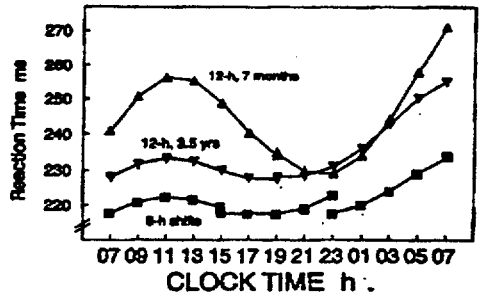
NIOSH Control Room Operator Study



Notes

- Auditory reaction time as a function of clock time
- Continuous process control room operators data
- Reaction time was slower on 12-hour shifts compare to 8-hour shifts
- Slowest overall after 7 month of 12-hour shifts

Reference:

Rosa, R. R. (1991). Performance, alertness, and sleep after 3-5 years of 12 h shifts: a follow-up study. Work & Stress, 5, 113 (Figure 3).

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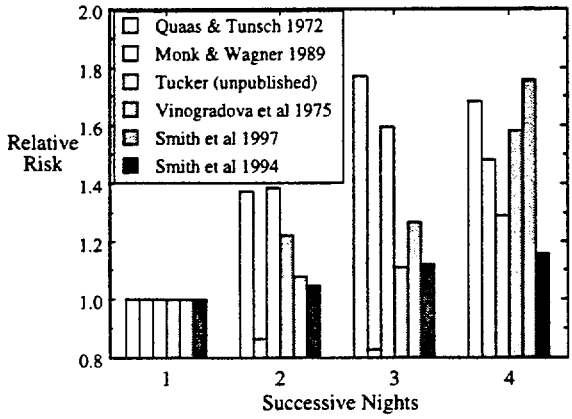
Effect of Successive Night Shifts on Relative Risk



Folkard, S. and Hill (2001) Personal Communication

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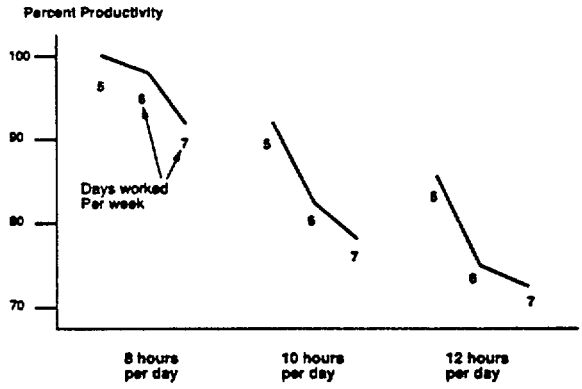
Productivity as a Function of Days on Shift and Shift Length



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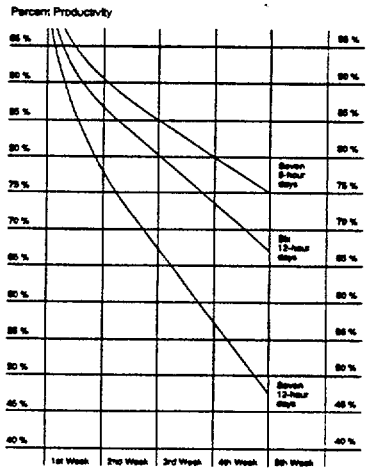
Productivity as a Function of Successive Extended Work Weeks



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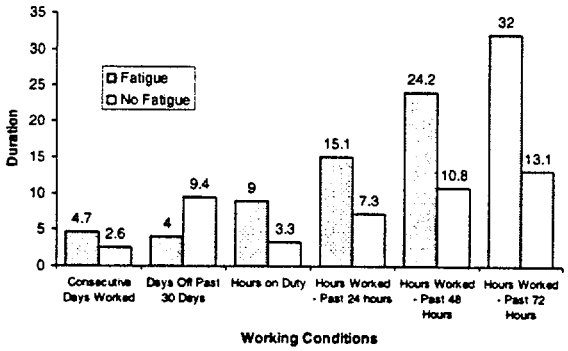
Maritime Industry Fatigue Study



Reference:

Adapted from: Raby, M. & Lee, J. D. (2001) Fatigue and workload in the maritime industry. In P. A. Hancock & P. A. Desmond (Eds.), Stress, workload, and fatigue (pp. 513-528). NJ: Erlbaum, p. 573 (Figure 3.8.3).

Notes

- Comparison of working conditions found to significantly ($p<0.001$) contribute to fatigue-related critical vessels accidents
- Data display is average working condition duration for fatigue related accidents compared to accidents in which fatigue was not a contributing factor
- For example, the average number of hours on duty prior to the accident was 9 hours for fatigue-related accidents and 3.3 hours for non-fatigue related accidents
- The working environment in which these accidents occurred is similar to nuclear power plant control rooms

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NASA Proposed Guidelines for Commercial Aviation (Dinges, et.al.)

- **Duty and Rest Scheduling**
  - –Off-Duty Period
    - •Minimum of 10 hours per 24-hour period
    - •Minimum of 36 continuous hours, to include 2 consecutive nights of recovery sleep, in a 7-day period
    - •Minimum of 48 continuous hours in a 7-day period following flight duty period in a circadian low
  - –Duty Period (includes work, administration, and flight)
    - •Maximum of 14 hours per 24-hour period
  - – Flight Duty Period (specifically pre-flight and flight)
    - •Maximum of 10 hours per 24-hour period for the standard schedule
    - •Maximum of 12 hours for an extended schedule with following additional restrictions:
      - –Additional landing restrictions
      - –Maximum cumulative hours restrictions (4 hour per week)
      - –Compensatory off-duty time

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UCS Proposal

Thresholds

- 14 hrs. in 24 hrs.
- 56 hrs. in 7 days

Deviations

- Generic
- Plant-Specific Risk Assessment
- Case-Specific Risk Assessment
- Acceptance of Self-Declaration
- Annual Reporting
  - •Workers Covered
  - •Number of Deviations

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"Straw Man" Concept

Basic work schedule assumptions

- 8-hr. days, 40 hour week
- 12-hr. days, nominal 40 hour week

Thresholds

- Off-Duty
  - 10 hrs. in 24 hrs.
  - 48 continuous hrs. after five 12-hr days work or seven 8-hr days
- On-Duty
  - 14 hrs. in 24 hrs.
  - 70 hrs. in 7 days

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