SOPs for Fatigue Management in Aviation Maintenance

Tuesday, November 1st | 1:00 p.m. - 2:00 p.m.

PRESENTED BY:
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Alertness impairments accumulate with sleep debt

Chronic sleep restriction

One week of chronic sleep restriction of 6 hours or less per night equates to 1 full night of total sleep loss.

Two weeks of chronic sleep restriction of 6 hours or less per night equates to 2 full nights of total sleep loss.

This means that even relatively moderate sleep restriction seriously impairs function in healthy adults. Studies show that people are largely unaware of increased deficits and this may be why the impact of sleep restriction is often assumed to be benign.

Sources: Van Dongen, et al. 2003
Time of day effects when sleep is restricted

For test times before 18:00, the build up of alertness impairments were dependent of daily total sleep (time spent in bed).

18:00 test time was not dependent on daily total sleep.

Sources: Mollicone, et al. 2009
Light exposure synchronizes circadian rhythm

- Special receptors in eye (not rods or cones) to sense light intensity patterns
- Light impact largest around WOCL
- Internal clock does not shift (minimal) for short trips
Risk factors for fatigue related accidents

Risks of fatigue-related errors and accidents stem from multiple interrelated and interacting aspects of work, rest, and sleep.

• Duration of work periods within a single day and over time,
• Time of day at which work occurs,
• Variation in the timing of work within and between weeks,
• Duration of sleep obtained on work days and on nonwork days,
• Frequency and duration of days off from work,
• Different vulnerabilities of workers to fatigue from these factors, and
• Volume and intensity of work.

Risk of incidents based on usual daily sleep

On average, how many hours of sleep do you get in a 24-hour period?

6-7h sleep per day – 40% increase in risk
5-6h sleep per day – 79% increase in risk
4-5h sleep per day – 165% increase in risk

Analysis based on the National Health Interview Survey (2004-2008). A total of 74,415 persons reported on average sleep duration.

Sources: Lombardi, et al. 2010
Risk increased by 4% for 9 hour shifts
Risk increased by 13% for 10 hour shifts
Risk increased by 20% for 11 hour shifts
Risk increased by 27.5% for 12 hour shifts

Meta-analysis conducted based on 4 large studies in different countries (Sweden, USA, Germany)

Fatigue stressors
Night work (time of day)
Extended wakefulness
Sleep debt
A plane is safest when it is in the hanger, but that is not what planes are for. We cannot eliminate risk, however, we can manage it.

Mount Everest, Earth’s highest peak at 29,029 ft.

Climbing to the summit is a risky.

Safest route is not to go.
Safety critical events increase when fatigued

184% increase in risk
## Fatigue Countermeasures

<table>
<thead>
<tr>
<th>Counter Measure</th>
<th>Reduction in safety critical events</th>
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</thead>
<tbody>
<tr>
<td>Get an extra 20 minutes of sleep each day</td>
<td>4% decrease</td>
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<tr>
<td>Take a nap before a night shift*</td>
<td>10% decrease</td>
</tr>
<tr>
<td>Take a 20-30 minute nap during night shift*</td>
<td>10% decrease</td>
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</table>

* Remember to give yourself time to fully wake up before returning to work.
25% risk reduction
2 hour nap
Individuals have different vulnerabilities to fatigue stressors

- **Subject 1**
  - Large deficits after 16 h awake

- **Subject 2**
  - Large deficits after 16 h awake with lower daytime deficits (“circadian rescue”)

- **Subject 3**
  - Virtually no deficits except during night time (near circadian minimum)

Sources: Van Dongen, et al. 2001
Fitness for duty test

Psychomotor Vigilance Test (PVT)
- Measures vigilant attention and psychomotor speed
- No learning effects
- Unaffected by aptitude differences

Validated to be sensitive to:
- Sleep deprivation
- Night work
- Medical conditions
- Drug effects

Objective measure of alertness deficits

Sources: Van Dongen, et al. 2003