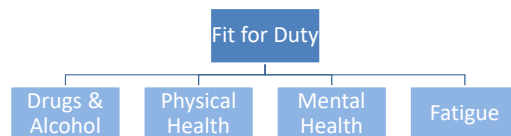


Fatigue: The Invisible Hazard



Where Fatigue Fits in OHSMS

D&A, fatigue, physical and mental health are all “fit for duty” concepts that must be managed



Performance is tied to each fit for duty element!



Fatigue and Municipalities

Emergency Services

- Police, Fire, EMS, Dispatch

Public Works

- Sewers, Drainage, Utilities

Transportation

- Transit/Bus Operations,
Road Construction/
Maintenance, Snow Removal



The Challenges

Municipalities face

- limited resources
- constant scrutiny by public taxpayers and governing bodies
- the need to show a return on investment with H&S initiatives
- lack of metrics to know how big the problem is!



Fatigue is...

- A decreased capacity to perform mental or physical work as a result of inadequate restorative sleep
- Also influenced by time of day (circadian factors) and amount of prior wakefulness
- Fatigue accumulates
- Has a direct long term effect on both physical and mental health



Drowsiness Is...

- A state of sleepiness accompanied by lethargy (lack of energy)
- Drowsiness fluctuates
- The more fatigue you have, the more drowsy episodes you will have
- Has an immediate effect on cognitive performance, errors, stress tolerance



Fatigue: The Invisible Hazard

Shift Work Tolerance

Younger vs. Older



Circadian Rhythms

...our built-in body clocks

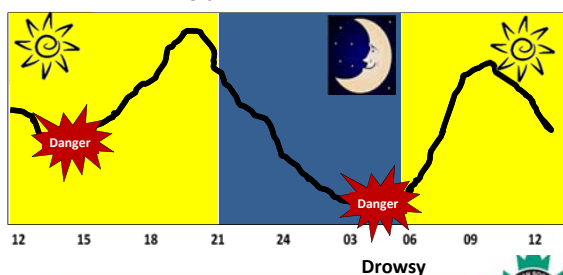
Tell us when to be active, when to rest, when to eat

Controls body temperature, kidney function, hormone secretion, blood pressure, digestion, etc.



Body Temperature Curve

Alert



Melatonin



- Natural sleep hormone synthesized and secreted at night
- Powerful anti-oxidant
- Age reduces melatonin production
- Light at inappropriate times can depress production



Book vs iPad

- 55% less melatonin
- 10 minutes longer to fall asleep
- less REM sleep during the night
- felt sleepier the next day and took "hours longer" to feel alert (book readers had no such effect)
- the next night, the iPad readers' circadian clocks were delayed by more than 90 minutes

Options?

- Stop viewing 3 hours before bed
- Wear sunglasses with orange lenses
- Download F-lux or Twilight app
- Apple iOS 9.3 has built in "Night Shift"



PNAS Journal, Harvard Medical School, Dec 2014

Sleep Factors

A typical day:

- sleep
- work
- family / recreation

Reduced our sleep from 9 hrs to less than 7 hrs

Referred to as "sleep restriction"



Fatigue: The Invisible Hazard

Quantity vs. Quality

- Both are important, for very different reasons
- Most quality sleep comes early on in the sleep process
- Only sleep cures fatigue



Significant Increase in...

- cardiovascular disorders (40% ↑)
- digestive disorders (6-8X)
- rectal and colon cancer
- heart damage and enlargement
- diabetes (50% ↑)
- kidney disease and tubule scarring
- rheumatoid arthritis
- fertility problems for females
- respiratory infections /colds
- clinical depression
- inability to absorb medications (400% variance)



Light Stages of Sleep



Stage 1 NREM

- brain waves slow to “theta” waves
- lasts only a few minutes
- muscles relax, pulse and breathing slow down

Stage 2 NREM

- brain waves slow further
- lasts 15-30 minutes



Deep Stages of Sleep

Stages 3 and 4 NREM

- long, slow delta brainwaves
- most important stage for physical recuperation
- only time when growth hormone is produced



Delta sleep deprived?

- muscular aches, awake feeling unrefreshed and are more prone to viruses and colds



Stages of Sleep

Non REM Sleep



REM Sleep

Important for psychological well-being, cognitive repair and memory consolidation



How much is enough?

Genetically determined

Most require 8 hours

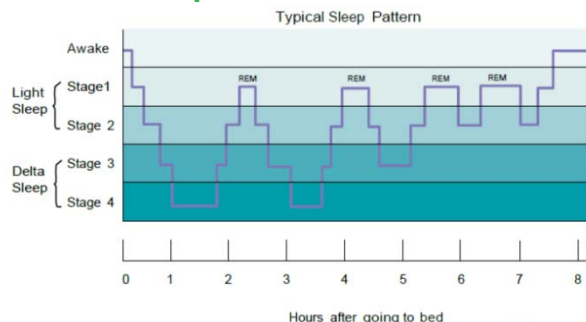
Missing out on 1 hr increases physiological sleepiness the next day

The more fatigued, the more difficulty with complex decision making and interpretation



Fatigue: The Invisible Hazard

Adult Sleep Pattern



Adapted from NASA Ames Fatigue Countermeasure Program

Chronic Sleep Loss

Accelerates aging

Affects hormonal balances

- ↓ sensitivity to insulin
- ↓ leptin, inhibits hunger
- ↑ ghrelin, increasing cravings

Connection to dementias and Alzheimer's disease



Fatigue is Dangerous

Automatic Behaviour Syndrome

- several minutes where a person performs routine duties but is not capable of cognition

Microsleep

- If debt continues to accumulate, brain disengages
- lasts several seconds during which you do not see and may not hear critical cues from the environment



Motor Vehicle Accidents



Fatigue related crashes tend to ...

- be more severe
- generally reflect little or no avoidance action
- involve high impact speed
- be single vehicle accidents

Impaired is Impaired



17 hours of wakefulness = .05% BAC
 22 hours of wakefulness = .08% BAC
 24 hours of wakefulness = .10% BAC

Quick Fatigue Calculator

Step 1	Predicted amount of wakefulness: Count the total # of hours you will be awake for at the end of this shift e.g., 2 hrs before shift + 12 hr shift + 2 hrs after = 16hrs awake	16
Step 2	Total amount of sleep in last 48 hours	9
Score	Subtract step 2 from step 1	7

Fatigue: The Invisible Hazard

Score	Control Measure
1 to 5	Self-Monitoring
6 to 12	Supervisor to Actively Monitor
12+	Ongoing Monitoring and Additional Control Measures as Required

Solutions for Sleeping

Buy a good bed
– individual pocket springs



Avoid “down” comforters

Solutions for Sleeping

Sleep as soon as you get home from the night shift
Remove or cover all sources of light



Solutions for Sleeping

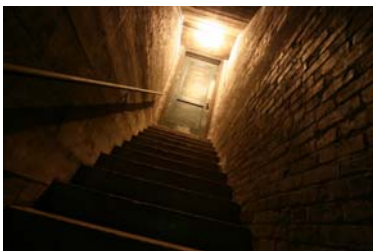
Develop a pre-sleep routine



No pets in bedroom!



Solutions for Sleeping



The Rules of Napping

Avoid random napping
Short naps limited to 40 minutes
Longer naps at least 2 hours
Most effective on first night of a sequence of shifts



Fatigue: The Invisible Hazard

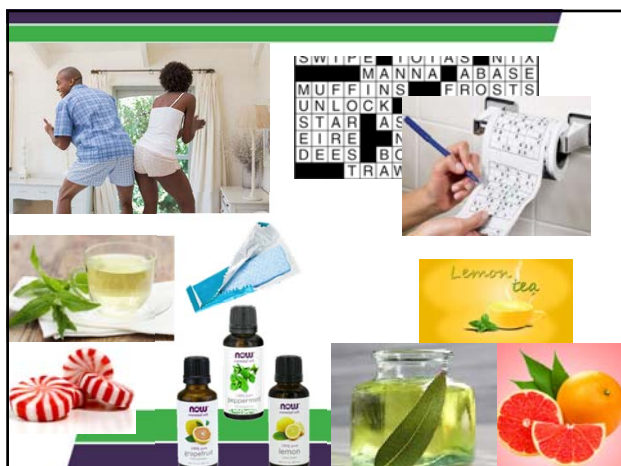
Sleep Medications

20 million sleep aids prescribed in 2015 (Canada)
Growing 2-3X faster than any other class of drug

Sleep Medication	Helps you fall asleep	Helps you stay asleep	Can lead to dependence
Doxepin (Silenor)		✓	
Estazolam	✓	✓	✓
Eszopiclone (Lunesta)	✓	✓	✓
Ramelteon (Rozerem)	✓		
Temazepam (Restoril)	✓	✓	✓
Triazolam (Halcion)	✓		✓
Zaleplon (Sonata)	✓		✓
Zolpidem (Ambien, Intermezzo, Zolpimist)	✓		✓
Zolpidem extended release (Ambien CR)	✓	✓	



Alertness Strategies



Personal Factors Influencing Fatigue

Sleep hygiene

Personality

Diet

Exercise

Alcohol

Medications and recreational drugs



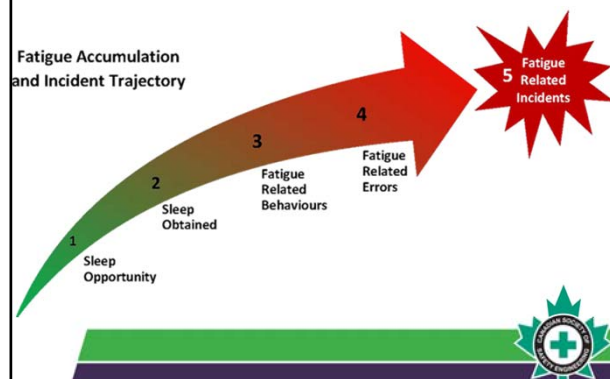
What about the organization?

Oil and Gas Sector:

Fatigue is 4 X more likely to contribute to workplace impairment than drugs or alcohol



Assessing for Fatigue Related Risk



Fatigue: The Invisible Hazard

Fatigue is Multi-faceted



...and therefore requires multiple,
overlapping controls



Thank you for being a great audience!



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