



# Being Awake is Not Enough

## Being Awake is Not Enough





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## Fatigue is...

- A decreased capacity to perform mental or physical work due to inadequate restorative sleep
- Fatigue accumulates
- Direct effect on physical, mental and emotional health
- Nothing more important than Sleep!

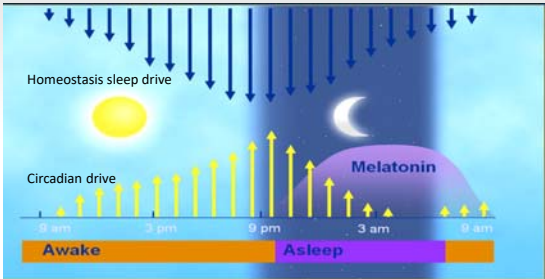



## Drowsiness Is...


- A state of sleepiness accompanied by lack of energy
- Drowsiness fluctuates
- The more fatigue, the more drowsy episodes you will have
- Immediate effect on cognitive performance, errors, stress tolerance, vigilance, etc.

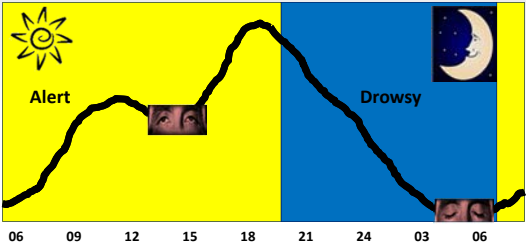
## Sleep Wake Cycle




The diagram illustrates the sleep-wake cycle with a 24-hour timeline. It shows 'Homeostasis sleep drive' (blue arrows) increasing during the day and decreasing at night. 'Circadian drive' (yellow arrows) peaks during the day and is lowest at night. 'Melatonin' levels (purple area) are low during the day and high at night. The cycle is divided into 'Awake' (orange) and 'Asleep' (purple) periods.



## Master Clock and Body Temperature




The graph shows body temperature fluctuating over a 24-hour period. The temperature is higher during the day (yellow background) and lower at night (blue background). The 'Alert' state is associated with higher temperatures, and the 'Drowsy' state is associated with lower temperatures. The x-axis is labeled with times: 06, 09, 12, 15, 18, 21, 24, 03, 06.



## Adjusting the Body Clock

- 1 day to adapt for every hour of shift change
- Referred to as "entrainment"





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## The Reality of our Species




- Can never “fully” adapt to night shift
- Any night shift adaptation gained doesn't last
- The more consecutive night shifts in a rotating schedule, the harder to synchronize

## Light and Melatonin




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

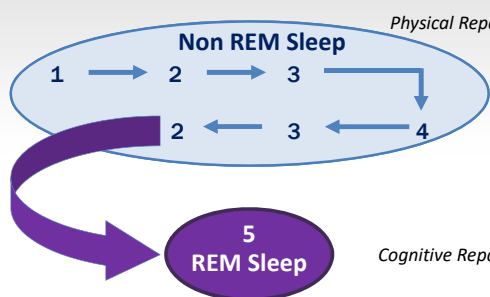
## The Role of Sleep



## Five Stages of Sleep

Awake  (Beta/Alpha)

## One Sleep Cycle = 90-120 minutes



**Non REM Sleep** (Physical Repair)

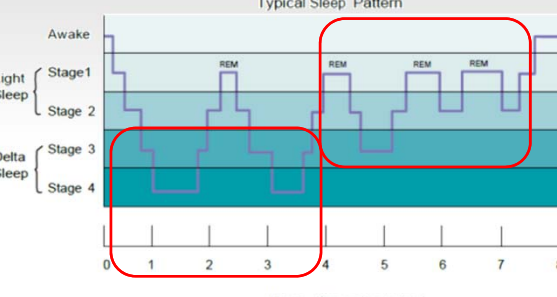
1 → 2 → 3 → 4

2 ← 3 ← 4

**5 REM Sleep** (Cognitive Repair)

## Adult Sleep Pattern

Typical Sleep Pattern



Awake

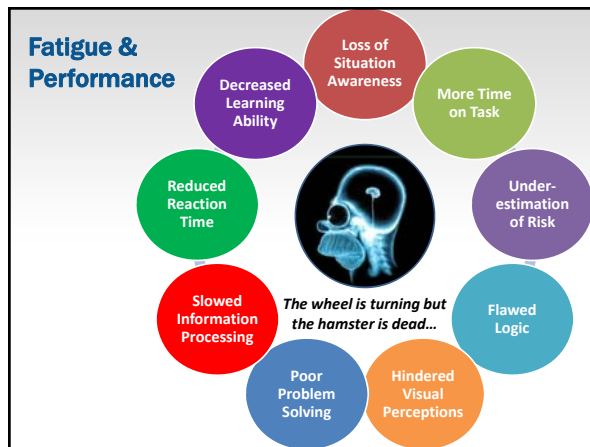
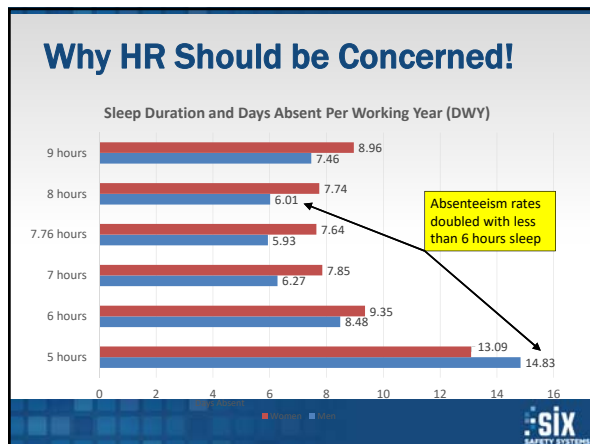
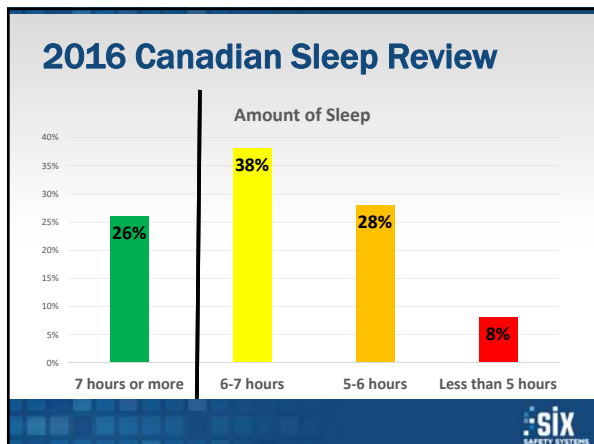
Light Sleep { Stage 1, Stage 2

Delta Sleep { Stage 3, Stage 4

REM

Hours after going to bed

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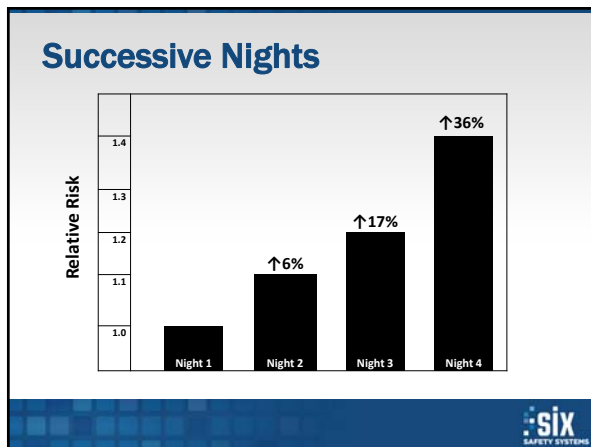
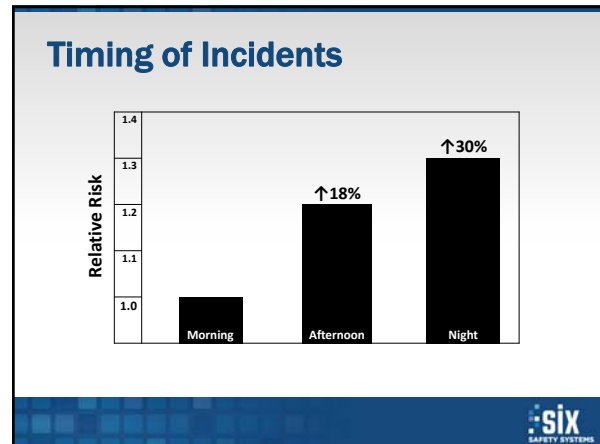
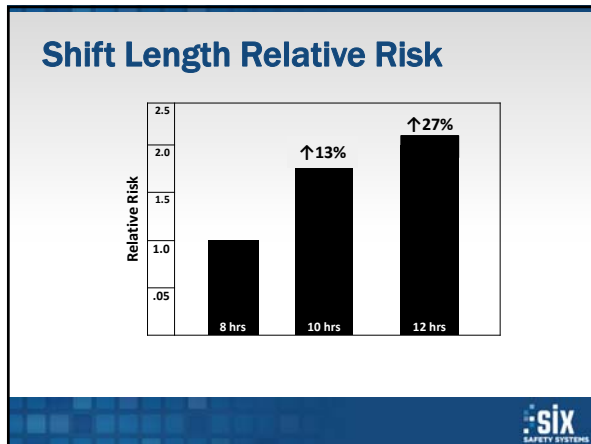
### Fatigue and Cognitive Skills

- Mental tasks longer than 30 min deteriorate if tasks are monotonous or tedious
- More difficulty with complex decision making and interpretation
- Cognitive impairment can last up to 5 years after stopping shift work

### Fatigue and Safety

Hours of Sleep	<5	5-5.9	6-6.9	7-7.9	8-8.9	9-9.9
# of injuries per 100 workers	7.89	5.21	3.62	2.27	2.50	2.22

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### Fatigue and Driving Tasks

- Routine, highly-over-learned task

Hours of Sleep	<4	4-4.9	5-5.9	6-6.9
Risk Level for MVC	11.5	5.4	1.9	1.3

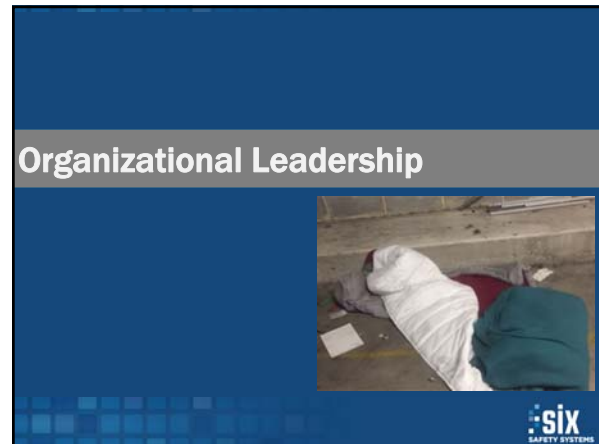
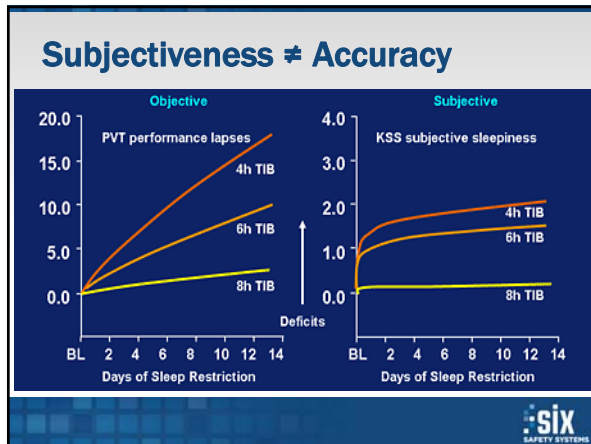
AAA Foundation for Traffic Safety, 2016

- ### How deep is the problem?
- 60% admitted to driving while fatigued
  - 15% admitted to falling asleep while driving over the past year
  - 23% say they know someone personally who has crashed due to falling asleep at the wheel
  - 3% of US adults admitted to falling asleep in the past 2 weeks (7 Million drivers)

### Impaired is Impaired

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

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### Myths that Guide Organizations

- Sleep is controllable by workers
- Worried about perceptions
- Still confuse sleeplessness with vitality and high performance

A circular inset image shows a person in green medical scrubs sitting on a light-colored floor, leaning their head against a wall and looking down with a distressed expression.

### Part of the Problem is...

- Employees afraid to admit or talk about it
- Employees never been asked
- Not collecting the right metrics... or any metrics!

### Fatigue Needs a Management System

Set of guiding principles that form the strategic framework

A "systems" approach recognizes that errors are regarded as consequences rather than causes

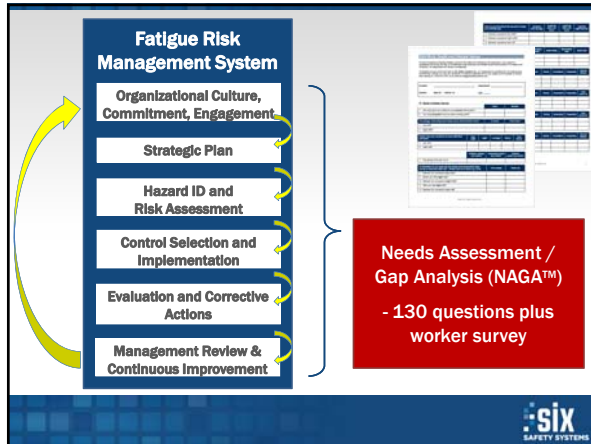
A blue box with white text 'Fatigue Risk Management System' has a red arrow pointing from it towards the text 'A "systems" approach recognizes that errors are regarded as consequences rather than causes'.

### Fatigue Risk Management System

- Based on CSA Z1000, ANSI Z10, ISO 45001
- Strategic framework that clearly identifies,
  - the purpose of the program
  - what it will look like
  - how it will be run (who, what, where, when, why)
  - how it will remain viable

A vertical flowchart with six boxes connected by downward arrows. From top to bottom: 'Organizational Culture, Commitment, Engagement', 'Strategic Plan', 'Hazard ID and Risk Assessment', 'Control Selection and Implementation', 'Evaluation and Corrective Actions', and 'Management Review & Continuous Improvement'. A large yellow curved arrow on the left side points upwards, indicating a feedback loop.

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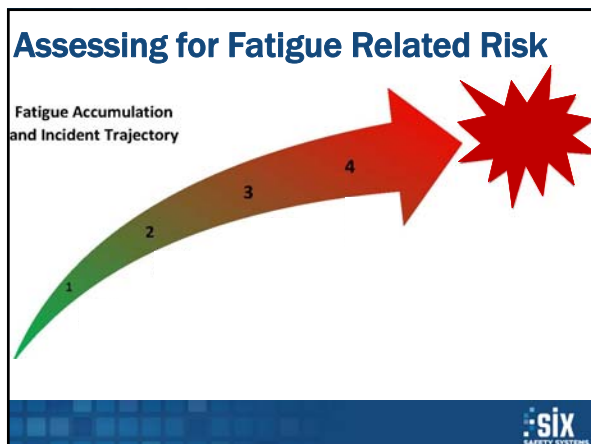


## Sample NAGA Questions

- How does management demonstrate commitment to managing fatigue?
- What is the basis for the current shift schedule selection?
- Has there been an evaluation of OT?
- Have workers and family been trained?
- What tools have been given to supervisors to identify and manage fatigue?
- Is commuting distance accounted for in rosters?

## Company X Scorecard

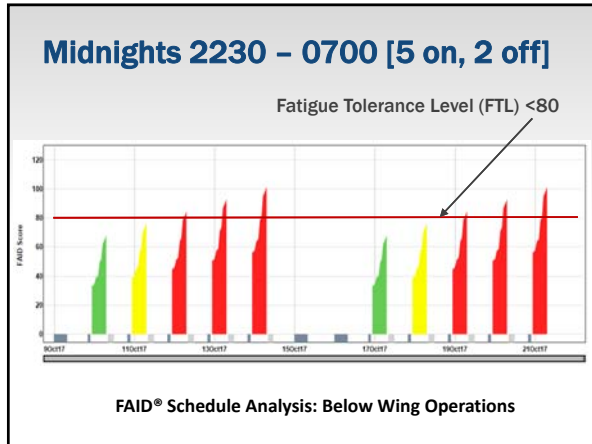
Category	Points Available	Points Awarded
Organizational Culture, Commitment and Engagement	52	18%
Strategic Plan	38	
Hazard ID and Risk Assessment	26	
Implementation of Risk Controls	92	
Evaluation & Corrective Action	30	
Management Review & Continuous Improvement	22	
<b>Overall Score</b>	<b>260</b>	



## Paramedics Die in Plunge off Cliff (2010)

- Ambulance plunged 33 metres into Kennedy Lake, BC
- Started shift at 2AM, less than 5 hours after completing last shift. Crash occurred at 5:30AM
- Concerns expressed about short turnaround but agreed to work

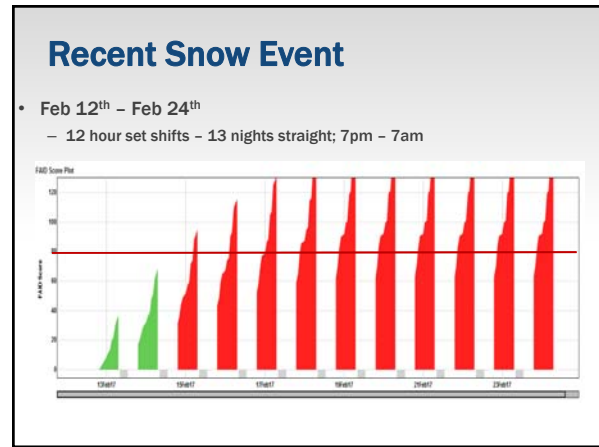
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Start	End	FAID Condition Green	FAID Condition Yellow	FAID Condition Red	Peak FAID Score
9 Oct 17 22:30	10 Oct 17 07:00	8hr 30min			68
10 Oct 17 22:30	11 Oct 17 07:00	6hr 27min	2hr 3min		77
11 Oct 17 22:30	12 Oct 17 07:00	5hr 48min	1hr 5min	1hr 36min	85
12 Oct 17 22:30	13 Oct 17 07:00	4hr 24min	1hr 35min	2hr 31min	93
13 Oct 17 22:30	14 Oct 17 07:00	3hr 52min	1hr 20min	3hr 19min	102
16 Oct 17 22:30	17 Oct 17 07:00	8hr 30min			68
17 Oct 17 22:30	18 Oct 17 07:00	6hr 27min	2hr 3min		77
18 Oct 17 22:30	19 Oct 17 07:00	5hr 48min	1hr 5min	1hr 36min	85
19 Oct 17 22:30	20 Oct 17 07:00	4hr 24min	1hr 35min	2hr 31min	93
20 Oct 17 22:30	21 Oct 17 07:00	3hr 52min	1hr 20min	3hr 19min	102

Compliance Hours		Total Hours Worked	FAID Condition Green Hours	FAID Condition Yellow Hours	FAID Condition Red Hours
#	85	58	12	15	
%	100%	68.3%	14.2%	17.5%	



### Compliance by Hours

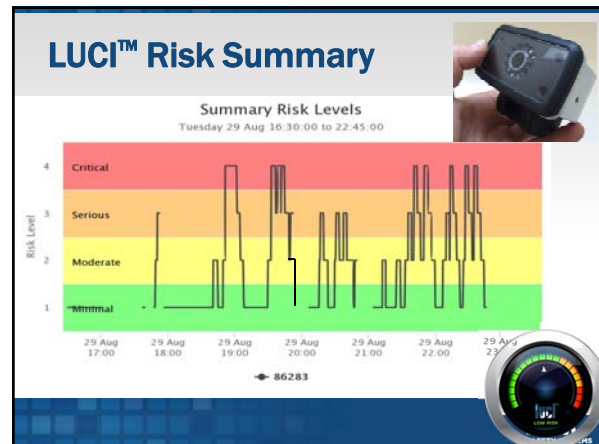
Start	End	FAID Condition Green	FAID Condition Yellow	FAID Condition Red	Peak FAID Score
12 Feb 17 19:00	13 Feb 17 07:00	12hr 0min			37
13 Feb 17 19:00	14 Feb 17 07:00	12hr 0min			69
14 Feb 17 19:00	15 Feb 17 07:00	7hr 50min	1hr 33min	2hr 36min	95
15 Feb 17 19:00	16 Feb 17 07:00	5hr 22min	1hr 55min	4hr 43min	116
16 Feb 17 19:00	17 Feb 17 07:00	1hr 59min	3hr 5min	6hr 55min	133
17 Feb 17 19:00	18 Feb 17 07:00	1hr 22min	54min	9hr 44min	141
18 Feb 17 19:00	19 Feb 17 07:00	1hr 4min	45min	10hr 11min	145
19 Feb 17 19:00	20 Feb 17 07:00	60min	45min	10hr 15min	146
20 Feb 17 19:00	21 Feb 17 07:00	60min	45min	10hr 15min	145
21 Feb 17 19:00	22 Feb 17 07:00	60min	45min	10hr 15min	145
22 Feb 17 19:00	23 Feb 17 07:00	60min	45min	10hr 15min	145
23 Feb 17 19:00	24 Feb 17 07:00	60min	45min	10hr 15min	145

9 shifts = FTL above 100

7 shifts = FTL above 140


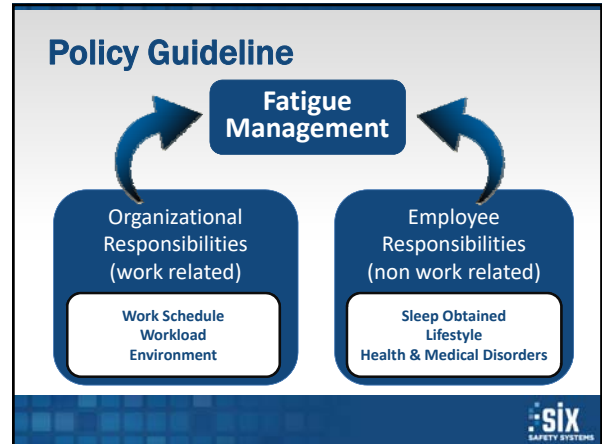
Compliance Hours		Total Hours Worked	FAID Condition Green Hours	FAID Condition Yellow Hours	FAID Condition Red Hours
#	144	47	12	85.4	
%	100%	32.4%	8.3%	60.3%	




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### Company X Scorecard - 2017

Category	Points Available	Oct 2014	May 2017
Organizational Culture, Commitment and Engagement	52	15	40
Strategic Plan	38	10	26
Hazard ID and Risk Assessment	26	15	19
Implementation of Risk Controls	92	6	61
Evaluation & Corrective Action	30	0	17
Management Review & Continuous Improvement	22	0	11
<b>Overall Score</b>	<b>260</b>	<b>46</b>	<b>174</b>
		<b>(18%)</b>	<b>(67%)</b>

- ### Summary
- Fatigue affects us all
  - We are incapable of accurately assessing our own level of fatigue impairment
  - Organizations must identify, measure and manage fatigue as a performance factor
  - Regulations are coming!
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### Thank you!

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