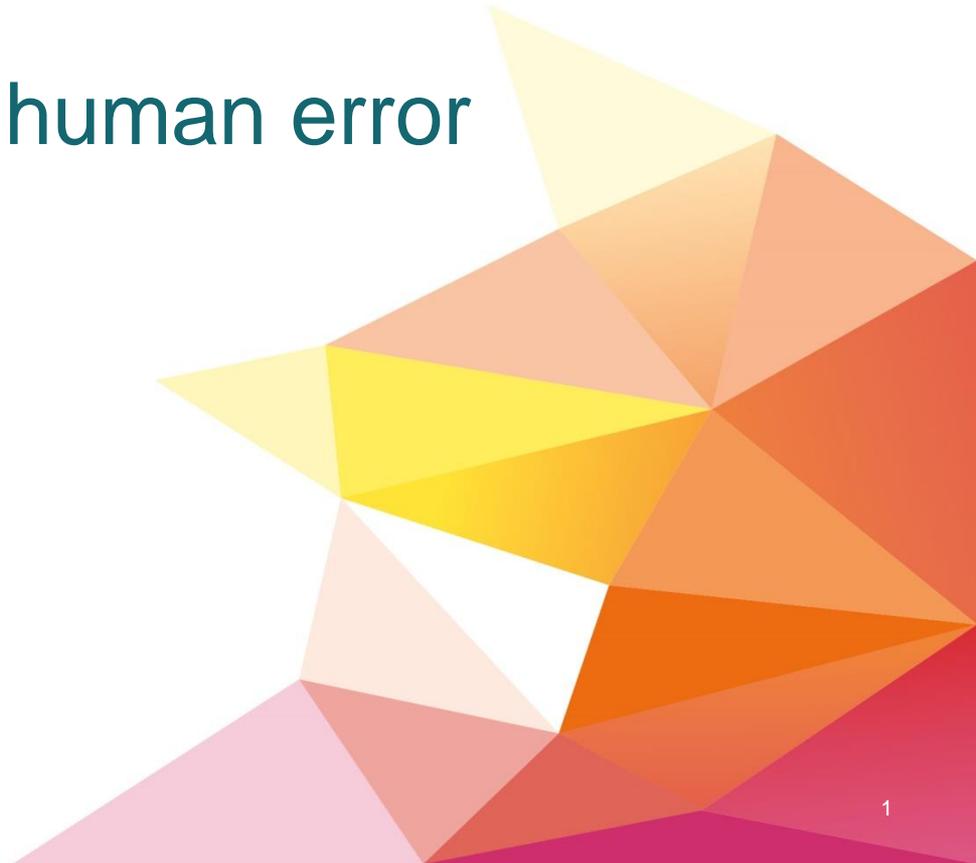


# What we can do about human error

Petroleum Safety Conference

May 2016



# Decision making

All relevant information + Best methods for interpreting information = Perfect decisions

# Situational awareness

**Perception**

**Comprehension**

**Projection**



# Question

Jack is looking at Anne, but Anne is looking at George. Jack is married, but George is not. Is a married person looking at an unmarried person?

A: Yes

B: No

C: Cannot be determined



Jack  
Married



Anne  
Married



George  
Unmarried

Jack  
Married



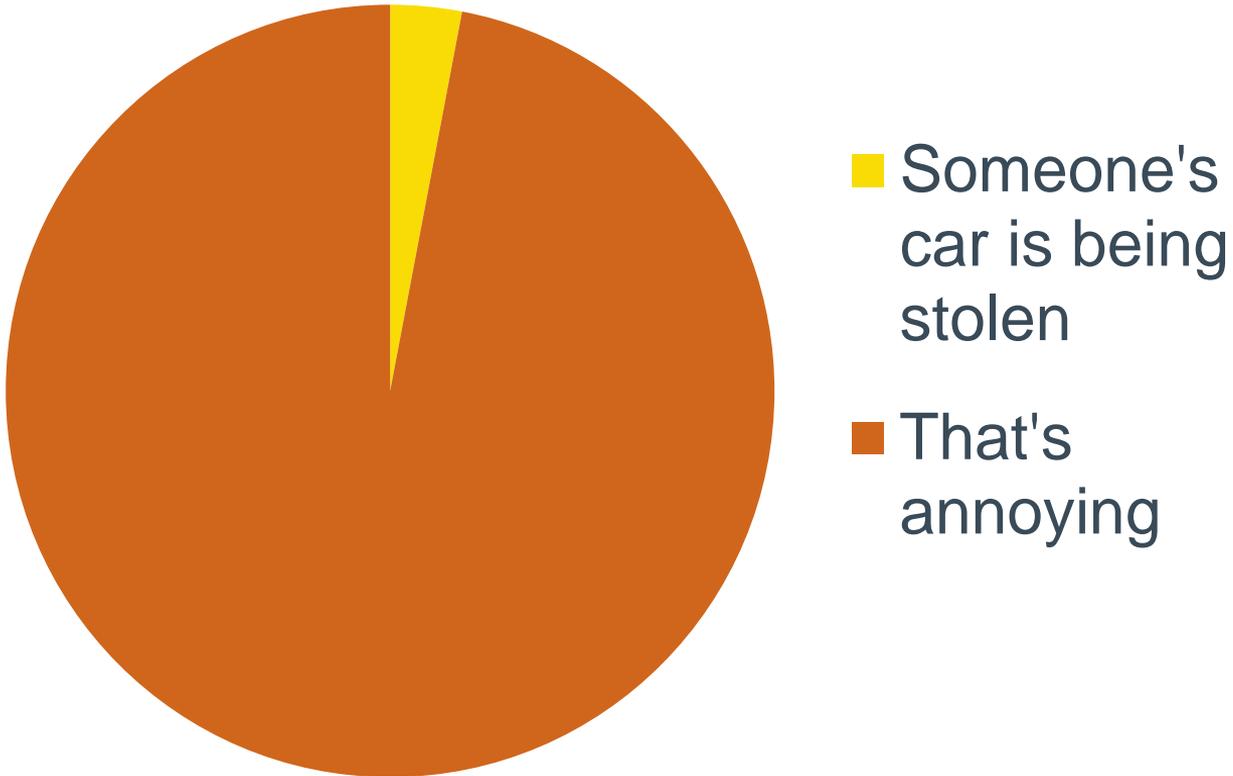
Anne  
Unmarried

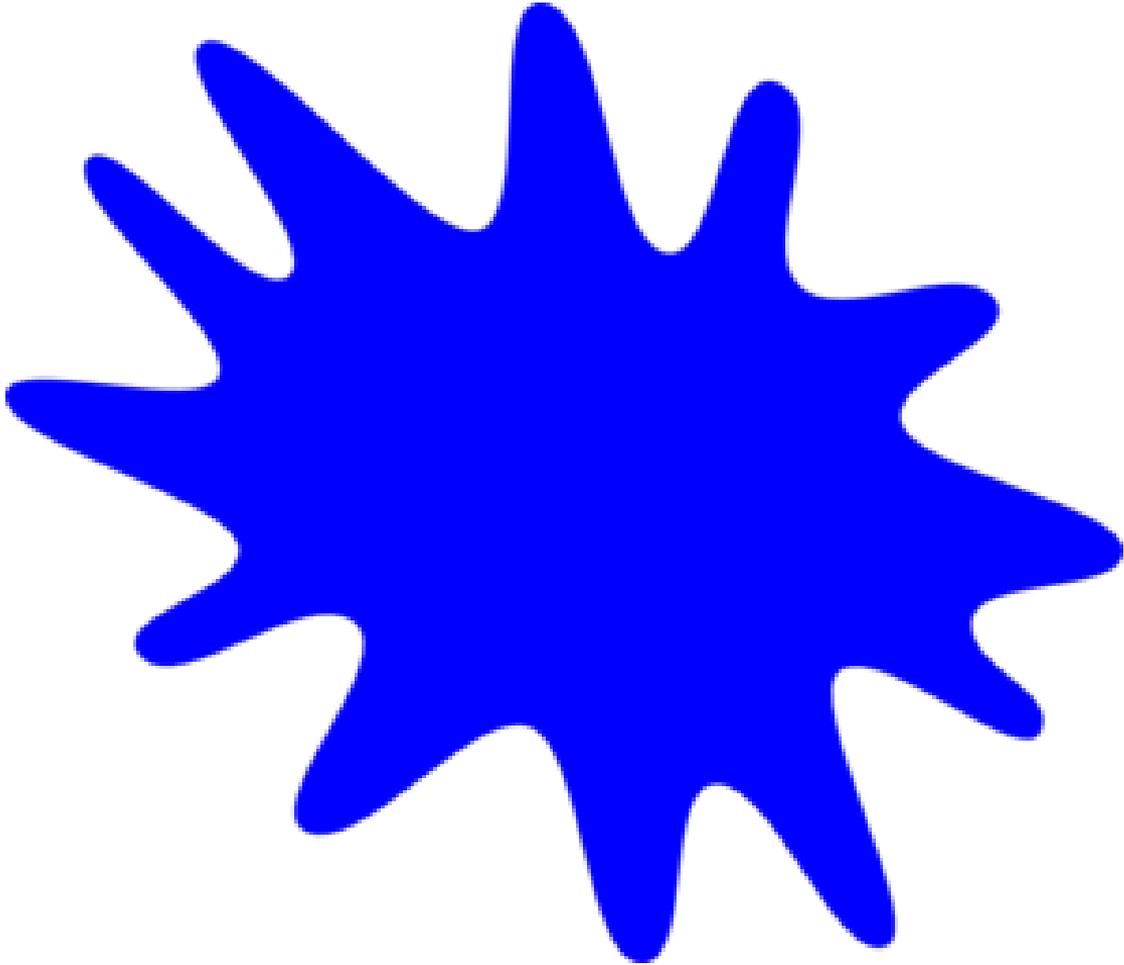


George  
Unmarried

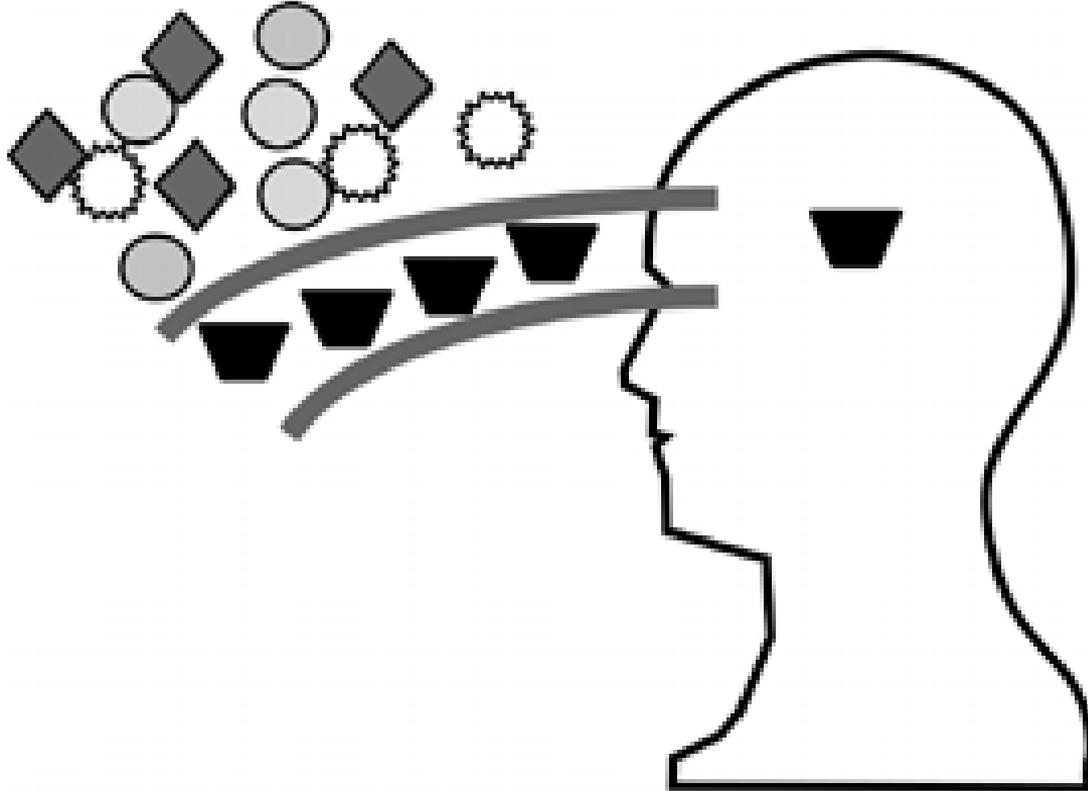
# Cognitive bias

## Thoughts when a car alarm goes off

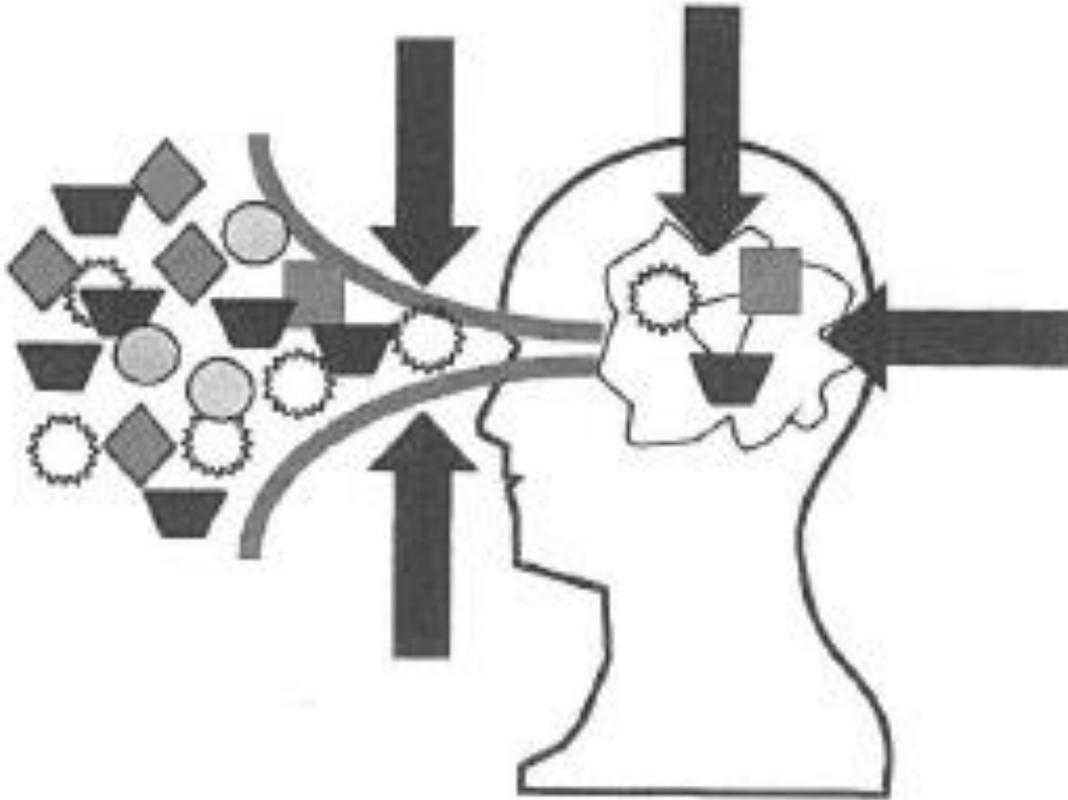




# Attention tunneling / confirmation bias



# Stressors



# Demons of Situational Awareness

- Attention tunneling
- Requisite memory trap
- Workload, anxiety, fatigue and other stressors
- Misplaced salience
- Complexity creep
- Errant mental models

# What we can do...

All relevant information + Best methods for interpreting information = Perfect decisions

## Situational Awareness

- Workplace design
- Accessibility
- Human machine interface design
- Alarm management
- Comprehensive communications

- HMI design
- Task design
- Procedures
- Competence management
- Training
- Fatigue and shiftwork
- Culture and climate
- Supervision
- Teamwork

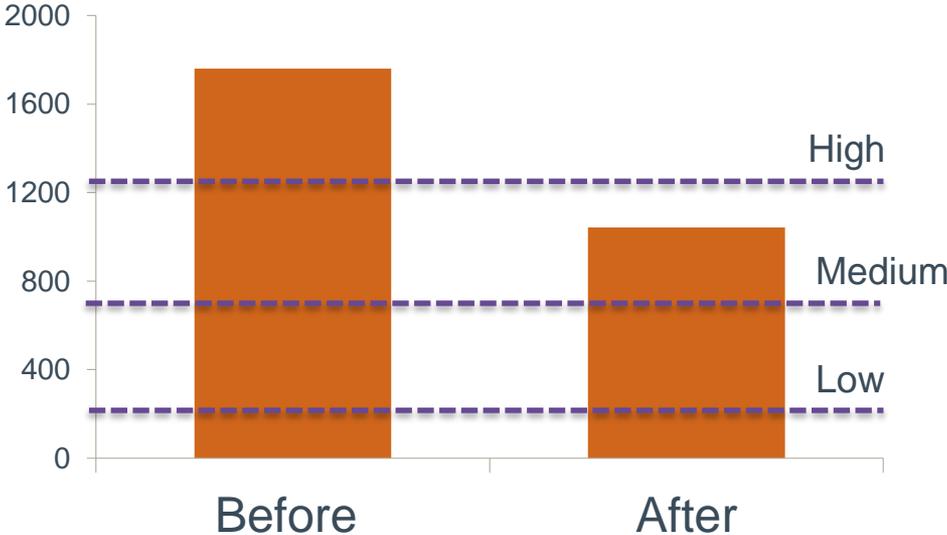
# What we can do...

“Saying that most accidents are due to human error is akin to saying that most falls are due to gravity”

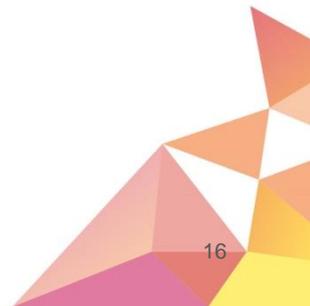
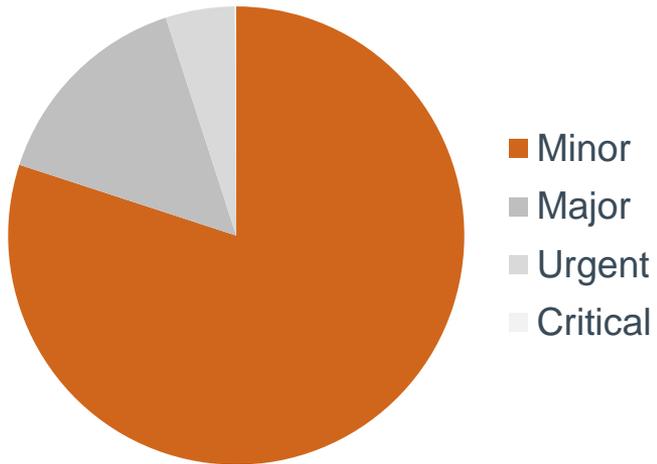
-Trevor Kletz

# Rationalized and prioritized alarms

### Impact of Alarm Rationalization



### Priority distribution



# Fatigue and shiftwork

Average hours of sleep over 48 hour period

12 on 12 off

14.6

Short change

8.4

# Summary

- Should we address human error?
- Why?
- Why do we make decision making errors?
- What can we do about it?

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## What we can do about human error

### Abstract

“Saying that most accidents are due to human error is akin to saying that most falls are due to gravity”. Simply identifying *human error* as a root cause is not helpful. In doing so we fail to provide sufficient information to effectively mitigate human errors. There are different types of human error and each has a different set of effective mitigation. It is therefore imperative that during investigative and predictive human error analysis, specific error types are ascertained.

During this presentation we'll discuss how and when errors occur within human operations; the underlying conditions that impact successful decision-making and operations; and how we can establish conditions to maximize human reliability.

- People make errors
- Why are human errors a problem?
- Why do people make errors?
- What can we do about it?

### Speaker notes

#### Introduction

Personal story about mistaking blue paint on my son's torso for a serious bruise. Subsequent hospital visit and unveiling of this error.

Human errors do happen all the time. Human error is a problem. But there is good news, because if we can understand why human error happens we can do something about it.

In the personal story the consequences were minimal.

In other examples the consequences are more serious. Loss of assets. Environmental releases. And there are countless examples where human error has led to a fatality and in many case multiple fatalities.

Should we try to prevent every human error? Of course not, in many instances errors are of no real consequence. Many positive discoveries were made serendipitously: For example: x-rays, pacemakers, artificial sweetener, fireworks, cornflakes, the slinky. Trying to eliminate human error in its entirety doesn't have value. However, there are many examples of major incidents in which human error has been a significant contributing factor: Texas City, Macondo, Lac Megantic, Challenger, Flixborough to name just a few.

Therefore, we do need to pay attention to human error, but let's focus our efforts in areas where we will get most value. We can target safety critical tasks.

#### Decision making

A fundamental truth of decision theory is that if we have all of the information and employ the best methods for interpreting that information we will get perfect decisions every time.

But life is not like this. We rarely have all of the information and there are elements that obstruct us employing the best interpretation methods.

This equation is synonymous with what we refer to in Human Factors as Situational awareness.

### **Situational Awareness (SA)**

SA comprises three parts: Perception (knowing where everything is and its status); Comprehension (understanding what the position and status of equipment means – what is happening now); and Projection (what will happen as a result). We need to look after our situational awareness by providing all the relevant information and only the relevant information (Perception) and applying the best methods for interpreting it (Comprehension and Projection).

### **Question (and answer)**

#### **Cognitive bias**

This is a straightforward question which we all the capacity to understand and get right. However, 80% of people get this wrong – why. Our brain takes short cuts. We are miserly with our cognitive reasoning. In this case: we made a lazy assumption that we did not have all the information to determine the answer, although we did.

The short cuts we make are called cognitive biases. We (often subconsciously) calculate that these short cuts are worth the risk. Other examples of cognitive bias include stereotyping and the ‘bandwagon effect’, in which the probability of one person adopting a belief increases based on the number of people who hold that belief. This is a powerful form of groupthink and can result in meetings being unproductive (no dissenting voice – may sometimes be ‘the voice of reason’). Note that this is why when the audience were asked the question (previous slide) that they were asked to close their eyes when responding (by raising a hand).

#### **Car alarm example**

This is another example of cognitive bias. We often don’t like hearing dangerous information or bad news so we bury our head in the sand (Ostrich effect).

#### **Personal story - revisited**

There were many pieces of evidence which pointed to an error (personal story). So how could an error like this be made?

#### **Attention tunneling / confirmation bias**

Sometimes we come to a decision prior to having all the information. Our attention is tunneled toward additional information that supports that decision. Information that contradicts that decision is ignored. This is an example of confirmation bias and attention tunneling.

#### **Stressors**

There are many things that could be considered stressors. Anxiety caused as a result of concerned for a family member for example. Fatigue and high workload are other examples.

### **Demons of situational awareness**

Requisite memory trap - Situational awareness is reliant on short term memory. This memory bank has limited space. Information will be lost unless it is repeated or revisited.

Misplaced salience - People seek out relevant information. However, attention is caught by highly salient (conspicuous) information. Use of color, flashing, text size increases salience. Situational awareness is impacted when non-relevant information is more salient.

Complexity creep - System complexity reaches a point that it is difficult for the operator to form an accurate representation of how the system works.

Errant mental models - Mental models of a system inform the operator of how to interpret significance of new information and develop reasonable projections. An incomplete, incorrect or out of date mental model leads to inaccurate interpretation and projection.

### **What we can do (1)**

We now understand that by preserving and improving our situational awareness we can improve our decision making capability. There are many Human Factors tools that enable us to address those factors that negatively impact situational awareness (demons and biases). However, there is a step missing. We need to identify the key areas to address so that we can generate a targeted approach to implementing remedial measures.

### **What we can do (2)**

“Saying that most accidents are due to human error is akin to saying that most falls are due to gravity”. This means that merely attributing human error as a root cause is not helpful. We need to go further and identify the type of error made and the contributing demons of SA and cognitive biases. This will allow us to apply appropriate mitigation.

This identification can be done either by

1. Reviewing incident and near miss data; establishing trends in error types.
2. Identifying safety critical tasks through Safety Critical Task Analysis and making an informed prediction about what the relevant error types are.

### **Example 1: Alarm rationalization**

The first step when implementing HF into a major offshore design project was to facilitate a meeting with operations and chief design engineers to determine priorities. Operators had previously experienced problems with redundant, nuisance and duplicate alarms as well as alarm cascades. Therefore, we executed an alarm rationalization and prioritization process. This had the impact of reducing the total number of alarms to an acceptable level by eliminating unnecessary alarms, whilst ensuring that necessary information was presented in a prioritized format. This promotes situational awareness by ensuring all relevant information was available whilst avoiding distraction from unnecessary information.

## Example 2: Fatigue and shiftwork

Also through facilitating a review of priorities, it was determined that fatigue was considered an issue to be resolved within a drilling organization. After interviewing 300 drill operators, several conclusions were reached, one of which that operators get more sleep on 12 on / 12 off shift than on a short change program.

As a result of our input the company moved to a 12 on 12 off program and implemented a fatigue management program across their organization which:

- promoted opportunities to sleep
- Encouraged critical operations to be undertaken at the time of day when operators were naturally 'more alert'
- Minimized distractions and noise in accommodation areas.

## Summary

- We need to address human errors, with a focus on safety critical operations.
- Human error is a root cause for major incidents. It is essential, therefore, to address it.
- Decision making errors are caused by a deterioration of our situational awareness by demons of SA and cognitive bias. This in turns means that we don't have all the relevant information, we aren't employing best methods for interpreting that information, or both.
- We have many Human Factors tools with which to promote and improve situational awareness. But first we need to generate a targeted approach which addresses the most critical areas.

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Find out more about what we do and how we do it – [www.atkinglobal.com](http://www.atkinglobal.com)

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