



## Human Factors and automation: Perceived challenges to safety

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Performance



## Human Factors and automation: Perceived challenges to **health & safety**

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# Structure



- HSL / HSE Background
- Regulatory context
- Safety concerns with automation
- It's not all bad news!
- HSL further interest



# Introduction: HSL



- A division of the Health & Safety Executive (HSE)
  - Regulatory context
- Support proactive (e.g. policy, research) and reactive (e.g. investigations) work
- Direct commercial support to industry





# Introduction: Human Factors team

- One of the largest HF teams in Europe
  - Cross discipline
- Example topics across most sectors:
  - Human Reliability
  - Fatigue
  - Safety culture
  - Leadership
  - Stress and wellbeing
  - Design: workplace, equipment, and interfaces
  - MSK
  - Procedure development
  - Behaviour change
  - Competence systems
- Internal support to investigations (inc. prosecutions), research, guidance, inspection, Safety Reports (hazardous installations), and policy.
- International support on regulation



# GB statistics

## Your view

- Fatalities
- Health related deaths



# Fatalities & injuries (GB)



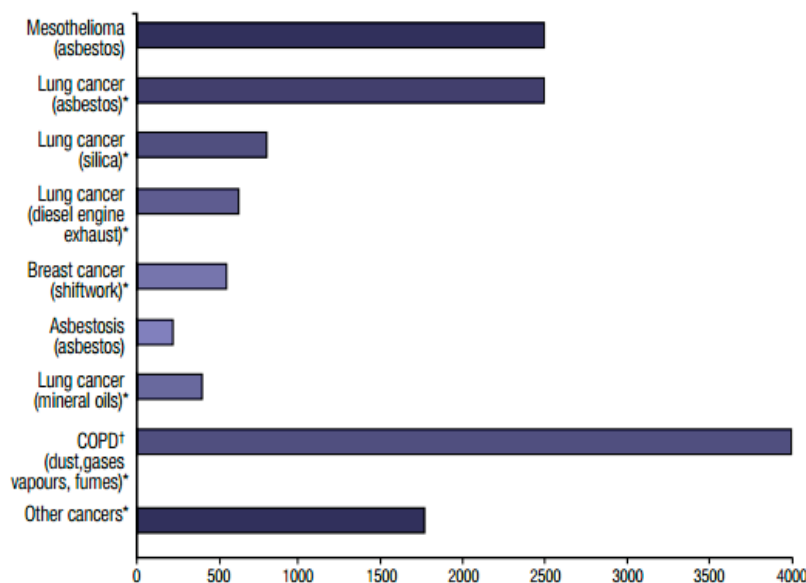
- 144 fatalities
- 76,000 serious injuries/events (hospital, 7+ days from work, fire or explosion)



# Health aspect (GB)



**Estimated current annual deaths due to work-related diseases (with causal agents in brackets)**



Additional data:

- Stress, Depression & Anxiety
- MSK

\* Figures are estimated based on epidemiological data and are subject to considerable uncertainty.  
† Research is underway to identify more specific causal agents for COPD.



## The regulatory context (GB)

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- Goal setting
- ALARP
- High level requirements for compliance
  - The Supply of Machinery (Safety) Regulations
  - Provision and Use of Work Equipment Regulations
- Detail within Standards (keeping pace/future proof?)

...Ultimate aim that people remain healthy and safe when working with or around automation



## Why automate?

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- Safety a consideration, but not always the primary goal
- Reliability (systematic performance / consistency / quality)
  - Both complex and monotonous tasks
  - Perception that people are the problem, therefore better without them!
- Operation in hostile environments
- Increased capability (beyond humans)
  - Speed / volume / weight
- Cost (e.g. employment)



## Key considerations on safety: why concern now?



- Level and amount of automation becoming increasingly advanced
  - Potential for R&D to move rapidly to industry
  - Is it tried and tested?
- Types of automation
  - Processes, machinery, robots, cobots, autonomous vehicles, environment (e.g. lighting)
- Public interest and concern
  - Ethics



## Background



- Is it always the right decision?:
  - Allocation of Function (AoF)

IAEA guidance (Ref 3) states that **'the assignment of tasks between man and machine may be the most critical activity in the design of new process plant and major retrofits.** It warrants a design approach that is commensurate in quality with high levels of plant safety and production performance sought from nuclear plant.' ONR supports this view.

Operators are involved in all aspects of operations in various ways and to differing extents, receiving information and making decisions based on this information and by direct and indirect interaction through manual and automatic controls. **In automatic systems, this interaction may be less obvious, for example, setting or adjusting controls or through maintenance activities.**



## Background: Allocating to people?

- The Dutyholder has considered the negative impacts of automation. For example:
  - Long periods of inactivity resulting in boredom.
  - Loss of situation awareness.
- The **AoF has been appropriately informed by task analysis** and the Dutyholder can demonstrate that the AoF is iterated in response to analysis and design changes.
- The Dutyholder has demonstrated that the AoF is **compatible with the operator's physical and psychological capabilities** for all operations; **maintenance examination, testing, operation of the plant.**
- The Dutyholder has considered the role of each team member – **it is important that operators feel that they have retained control over the system.** Similarly they should feel that they are **being productive and fulfilling a useful role.** If these needs are not satisfied then it is likely that the human operator's **overall performance will be degraded.**
- The Dutyholder has considered the need for **oversight of system performance by supervisors.**



## Background: Allocating to machines?

The Dutyholder has provided a demonstration that the allocation of function takes into account all of the factors that influence effective and reliable system performance. Inspectors should apply **particular scrutiny to decisions to assign functions to the operator which require:**

- Rapid of long term processing of large quantities of data.
- High levels of accuracy of information processing.
- High repeatability.
- High levels of reliability.
- Reliance upon recovery in short timescales.
  - Often an assumption on human role!
- Completion in hostile environments.



# Background: How critical?

- Is it process safety or personal safety
  - Relevance to public perception (medical vs O&G)
- Is operating space segregated?
  - All of the time (probably not)
  - Occasionally: Based on human decisions / procedures
  - During specified operations



# Challenges with automation

## 1. Humans not fully removed from the system

- Risk management in design & software
  - Advocate hierarchy of controls
- Modifications
  - MoC – generally bad at best!
- Maintenance
  - Work in normally segregated areas
  - Usual failure issues: isolation, errors and latency
  - E.g. incorrect materials used
- Dealing with the unexpected (risk normalisation)
  - Routine or exceptional violations
- Abnormal / Emergencies
  - Awareness and overview to manage
  - Resources / manning





# Challenges with automation

## 2. Interfaces, control and monitoring

### – Operator overview and awareness

Alternative perception, or removal of senses:

- Incident commanders and RPDM
- Pedestal cranes
- Increased use of screens (virtual words)

### – Boredom

*'The devil finds work for idle hands'*

- Use of phones when driving / concentration today?
- Control rooms away from installation (different mind-set?)



# Challenges with automation

## 3. Human nature to 'get the job done'

### – Overrides

- ACS offshore

### – Defeating safety features

### – 'Second guessing'

- Heuristics on how operate
- Transparency needed



# Challenges with automation

Team types:

## 4. Remote working (e.g. CROs)

- Is feedback and situation awareness good enough
- Volume of information to monitor (100 cameras?)
  - Are we *'keeping an eye on things'*
- Trust (Autonomous aircraft? Maintenance workers)

## 5. Multiple teams and communication challenges when in same space (unpredictability)

- Lack of awareness

## 6. Lone working

- Protocol for when things go wrong



# Future considerations

- Increased complexity
  - More autonomy interfacing with each other and people
- Increasingly deskilled workers (boredom)
- Security
- Lack of HF input through lifecycle



## Conclusions

- Automation can be hugely beneficial and enhance health and safety...  
...if done right!
- Our role as HF professionals to continue to educate/support and help achieve this
- Currently appear to be many unknowns...



## Current areas of interest

- HSE approach to research
- Research and IP to support health & safety
  - Existing work
  - Drilling operations
  - BOP activities



# Contact



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# HSL – Dimensions



- 360 staff
- 90 PhDs
- 550 acre site
- 1,100 business customers



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