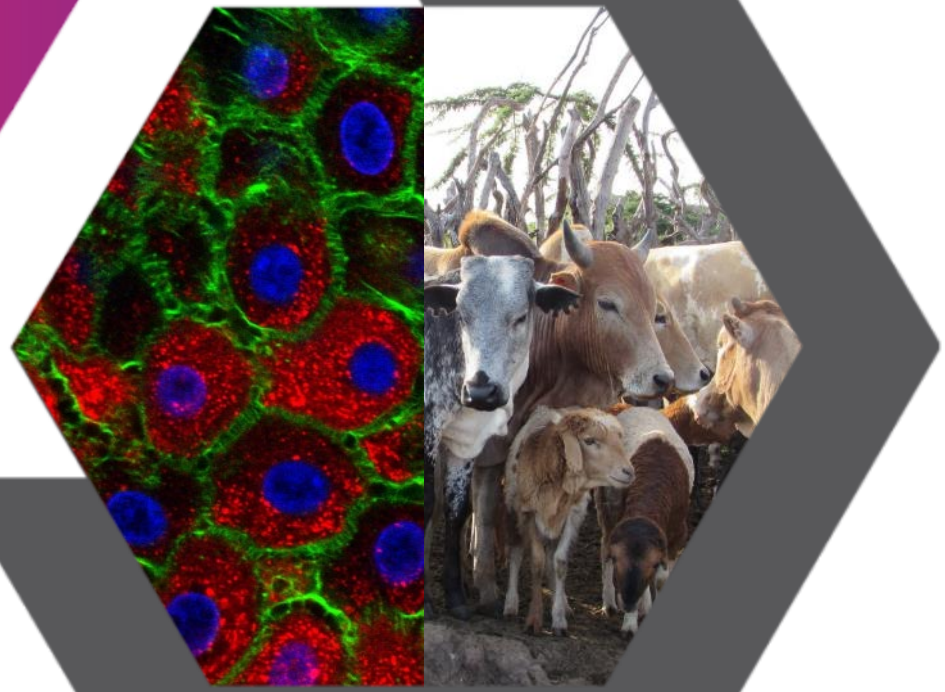

Biosafety Critical Task Analysis as a Means to Mitigate Human Failure in a High-Containment Facility

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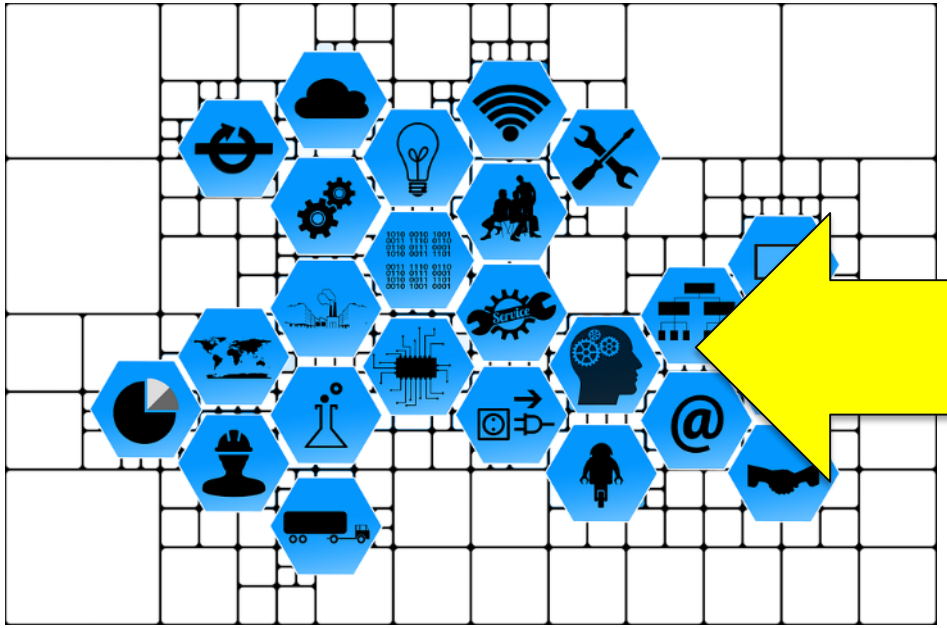
BBSRC bioscience for the future
The Pirbright Institute receives strategic funding from BBSRC.

Introduction

- The Pirbright Institute, UK
- Major Hazard Site
- High containment facility licensed to handle pathogens listed under the Specified Animal Pathogens Order (SAPO)
- Human pathogens up to Hazard Group 3

The Problem

Systems



Interrelated collection of plant, equipment and devices

Humans

Employees, visitors, contractors

Human Factors

Examines the **reasons** for human failure, with the aim of classifying the **types** of failure and finding **solutions** to them.

Based on the facts that:

- Human failure is not random
- Different human failures require different solutions

Biosafety Critical Systems

In high containment, human failure could affect some systems in a way that leads to a loss of containment.

Air handling systems

Barrier showers

Barrier equipment

Such systems are termed **Biosafety Critical Systems.**

Biosafety Critical Tasks

Tasks that involve interacting with or working on these systems are termed **Biosafety Critical Tasks**.

For example:

- Changing a HEPA filter
- Crossing the shower barrier
- Laboratory sealability testing
- Autoclave operation / validation
- Operation of effluent treatment plant

The Solution

We developed a **Biosafety Critical Task Analysis** process, based on published guidance* from the UK regulator, that allowed us to:

1. Identify biosafety critical tasks
2. Identify where and how human failure could occur
3. Determine the possible outcome of such failures
4. Decide on measures to prevent failures or mitigate the outcome

*HSE guidance on safety critical task analysis

The Solution

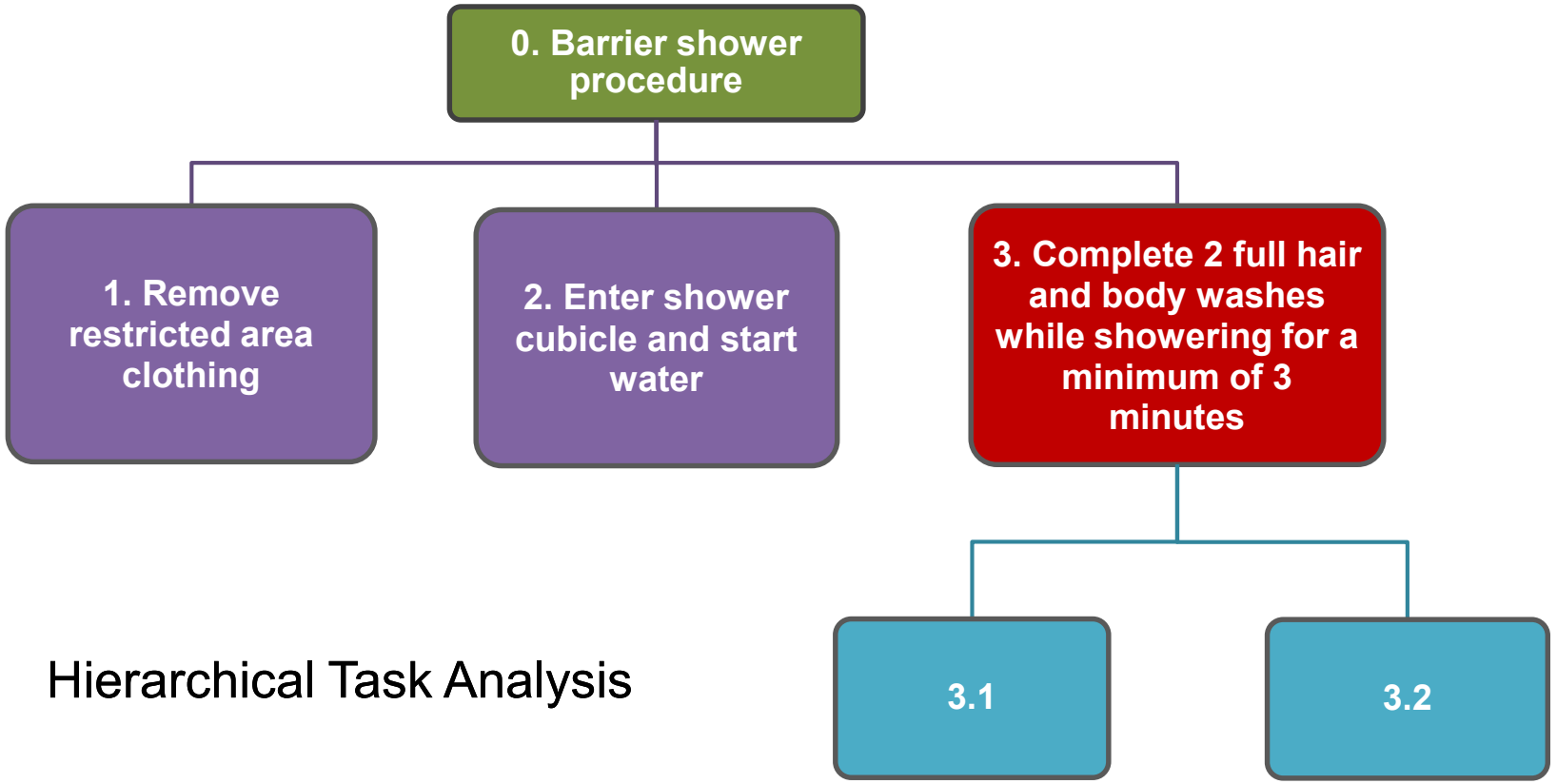
1. Identify biosafety critical tasks and rank in order of criticality

Considerations	Rating		
	Low (1)	Medium (2)	High (3)
Hazard group of pathogen	1		
Additional hazards present		2	
Reliance on human performance		2	
Reliance on equipment performance			3
Complexity of task		2	

Criticality Score	**10**

The Solution

2. Identify steps in the task (task analysis)



Hierarchical Task Analysis

The Solution

3. Identify the potential for human failure in each step and the factors that make these more likely

Errors

I did not mean to do that!

- Skill–based failures:
  - Slips
  - Lapses
- Mistakes:
  - Rule-based
  - Knowledge-based

Violations

I didn't have a choice!

- Routine
- Situational
- Exceptional

Human Failure Analysis (1)

Task Step Description	Failure Narrative	Failure Type	Performance Influencing (Human) Factors
Complete 2 full hair and body washes while showering for a minimum of 3 minutes	Individual exits without showering correctly	Lapse	• Distraction • Forgetfulness • Shower door not interlocked to water supply
		Rule-based mistake	• Poor training • Inadequate competency assessment
		Routine violation	• Complacency • Poor supervision
		Situational violation	• Time pressure • Illness
		Exceptional violation	• Fire evacuation • Bomb threat • Medical emergency • Flood

Human Failure Analysis (2)

Consequences if Not Recovered	Existing Controls & Recovery Mechanisms	Additional Controls Required
Biological contamination on the person's hair and/or body could be taken out of the restricted area	Access control linked to training and competency assessment	?
	Alarm sounds if water flow stopped before 3 minutes have elapsed	
	Access privileges can be revoked	

The Outcome

4. Prevent the failure or manage recovery:

    - Modify hardware, controls, physical conditions

and/or

    - Redesign the task, improve management

In order to:

    - **Prevent** human failure

and/or

    - Identify and **recover** from human failure

The Outcome

Where possible, **automate** the process and remove the ability for the human to make a decision – e.g. fully automatic showers

Shower doors could be **interlocked** with water supply to prevent personnel exiting without showering / exiting before 3 minutes have elapsed

Procedures can easily be improved, e.g. putting a process in place to assess the competency of new and existing users

HSE References

1. *Reducing Error and Influencing Behaviour, HSG48*. https://www.hse.gov.uk/pUbns/priced/hsg48.pdf
2. *Understanding the Task*. http://www.hse.gov.uk/humanfactors/resources/understanding-the-task.pdf
3. *A Human Factors Roadmap for the Management of Major Accident Hazards*. http://www.hse.gov.uk/humanfactors/resources/hf-roadmap.pdf

Thank You.