



## Annual Workplace Safety and Health Conference

# Human Factors Engineering

The Key to Human Performance Improvement

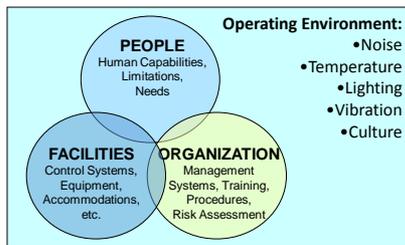
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## What is Human Factors Engineering?



Human Factors Engineering is:  
 The integration and application  
 of scientific knowledge about:

- People
- Facilities
- Organization
- Operating Environment

To improve their interaction with  
 technology and the working  
 environment.

Human Factors Engineering = HFE  
 Also called "Ergonomics"  
 Greek: "ergon" (laws) & "nomos" (work) = "The Laws of Work"

The base sciences of HFE:  
 HFE = P + P + P + S  
 Psychological + Physiological + Physical + Sociolog



## Human Error

**Eighty five percent** of all accidents in the industry occur through **human error** rather than by gear and equipment failure. With that understanding, **engineering for safety must begin with the human being.**

- Source: United States Coast Guard (6/7/98), <http://www.uscg.mil/hq/g-m/moa/docs/sa0998.htm>



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## Why Is Human Factors Engineering Important?

1986 Space Shuttle Challenger Explosion



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# The Challenger Explosion



The Space Shuttle Challenger exploded when joints in the solid rocket booster motor suffered catastrophic failure.

- On several occasions, the O-rings had partially failed, but there had been no leak of fuel.
- O-rings had suffered failures in low winter temperatures.
- Low temperatures were experienced before the launch.
- Manufacturers recommended that NASA should delay the launch.
- NASA challenged the recommendations.
- The manufacturers' managers overruled their engineers and agreed that the launch could go ahead.
- Challenger exploded shortly after lift-off due to a fuel leak caused by O-ring failure.



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# Recent Human Error-Related Catastrophes

**2010 BP Macondo/Deepwater Horizon Drill Ship Explosion, Fire, and Oil Spill**



**2013 – Capsizing of the Jascon 4 off the Coast of Nigeria, Killing 12 of the 13 Crew**



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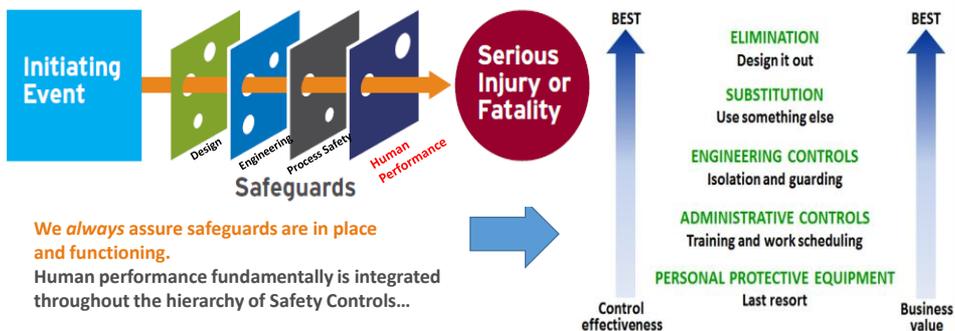
## Barriers That Prevent Accidents

There are three main barriers that prevent accidents – plant and equipment, processes, and people.

1. Human factors affect each barrier in different ways.
2. Some human factors are a particular problem in our industry.
3. If we don't manage human factors, we will weaken the barriers – which could result in an accident.



## Human Performance Is One of the Primary Safeguards in Preventing Incidents and Accidents



*We always assure safeguards are in place and functioning.*  
Human performance fundamentally is integrated throughout the hierarchy of Safety Controls...

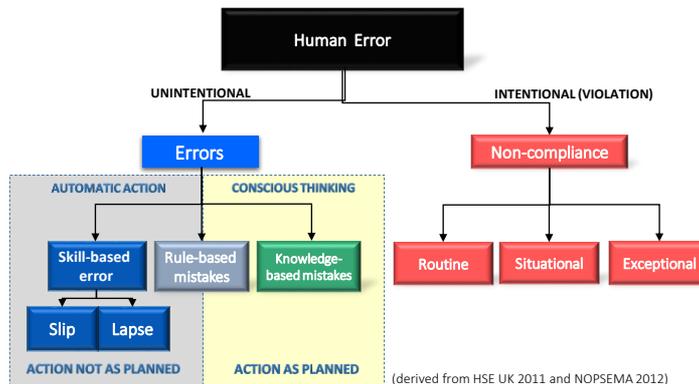


# Human Performance

Human error has been shown to be a factor in nearly every serious incident and fatality. Your focus on improving human performance is critical to achieving an incident-free operation.

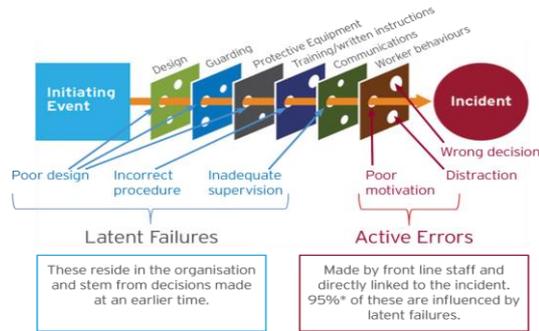


## What Is Human Error? How Do Humans Fail?



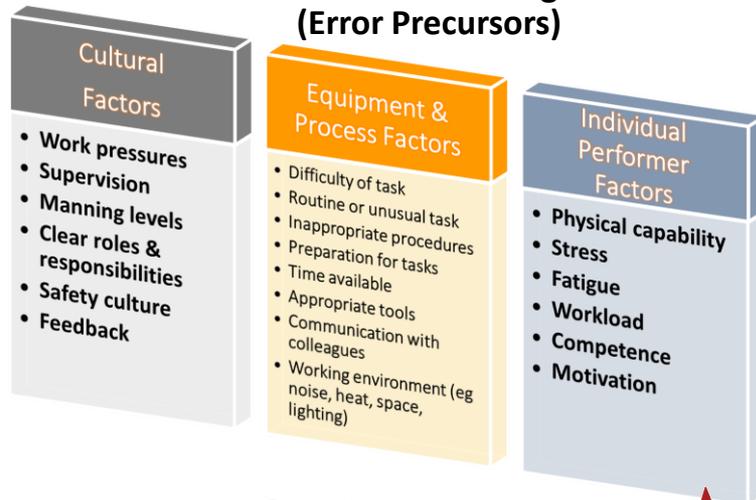
## Human error can occur at every barrier in a chain of events that lead to an incident.

- Front-line staff may have made mistakes, but the reasons were due to buried failures further back in the chain of events.



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## Performance-Influencing Factors (Error Precursors)



Identify and control PIFs

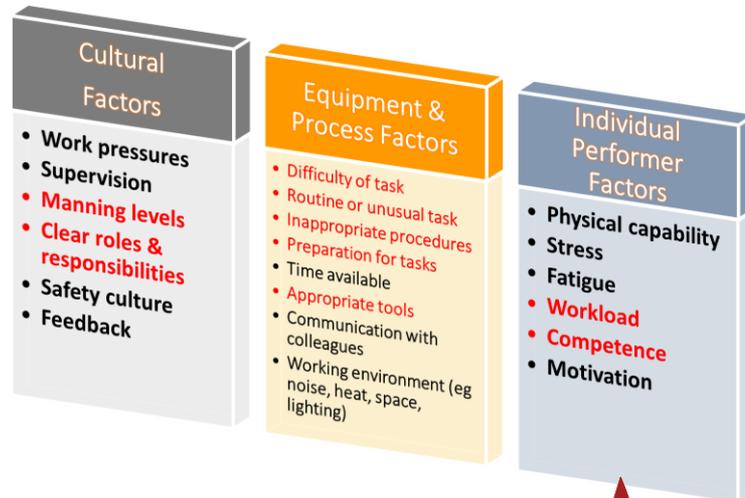


Potential human errors can be predicted, managed, and prevented



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## Procedures Can Shape Performance-Influencing Factors



PIFs highlighted in **RED** can be shaped directly by procedures



## Human Performance Principles

1. People are **fallible**, and even the best people make mistakes.
2. Error-likely situations are **predictable**, manageable, and **preventable**.
3. Individual behavior is influenced by **organizational values** and processes.
4. People achieve **high levels of performance** largely because of the **encouragement and reinforcement** received from leaders, peers, and subordinates.
5. Events can be avoided through an **understanding of the reasons mistakes occur** and application of the lessons learned from past events (or errors).

<http://www.hss.doe.gov/csa/csp/hpc/index.html>



## Human Performance Objectives

- Understand human capability and limitations and design to influence behavior and performance
- Improve operational performance through improvement of the worker experience
- Explain how human behavior at all levels of an organization can cause accidents
- Enhance the effectiveness and efficiency of operations



## To Err Is Human

“...there is a belief amongst many engineers and managers that human error is both inevitable and unpredictable. However, human error is inevitable only if people are placed in situations that emphasize human weaknesses and that do not support human strengths.”

(Martin Anderson, IChemE Safety and Loss Prevention Subject Group Newsletter, Spring 1999)



# Human Performance Assessment Questions

## Individual Factors:

1. Are you feeling stressed, distracted, or worried due to work or personal issues?
2. Are you excessively fatigued or do you have many things distracting you from the task at hand?



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## Task Demands

1. Are the procedures and instructions for the task unclear?
2. Does the task require high concentration or multitasking?
3. Does the task require more time than allowed?
4. Are you capable of performing the task but feel that you require more guidance?



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## Organizational Factors

1. Do you feel insecure about your ability to use Stop-Work Authority?
2. Are you unclear about your roles and responsibilities?
3. Are you uncomfortable communicating with your peers and supervisors?
4. Do you feel pressured to take shortcuts?



## Work Environment

1. Is the environment (temperature, ventilation, room for movement, egress, lighting or noise level) different from what was expected or planned for?
2. Are you in an environment prone to unanticipated distractions?
3. Are you working in unpredictable or constantly changing conditions?
4. Are labels, signs or displays inadequate?



## Assess the Situation and Take Action

If you can answer “yes” to any of the assessment questions on the facing page, it may affect incident-free job performance.

Preventive actions you or your supervisor can take to reduce the risks to working safely include:

- Get help.
- Get clarification.
- Get focused.
- Defer the work.



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## Getting into the Human Engineering Mind Set: Next Steps...

Pick a problem you want to fix

Pick some simple steps to make a start

### Actions for Everyone

Challenge procedures that are difficult to follow:

- Report any human factors concerns
- Take the time to consider how my actions and decisions can affect others now and in the future
- Report plant and equipment that is difficult to operate, maintain, inspect, and test safely



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## ... Continued

### Actions for Management

I use the case studies to identify human factors topics under my control and deal with them

- Ensure human factors topics are discussed during work planning, preparation, and execution
- Incorporate human factors into my incident investigations
- Take the time to listen and give feedback to my team on human factors topics

### Actions of Managing Directors

Appoint a Human Factors Champion

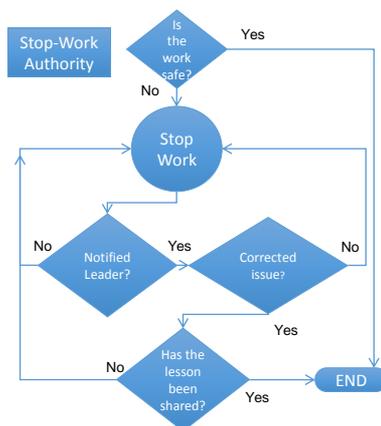
- Make a simple plan to tackle human factors issues
- Take the time to listen to the workforce
- Give feedback to the workforce

**Engage Human Factors SMEs for Support and Direction**



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## Designing HP into Procedures: Flowchart Example



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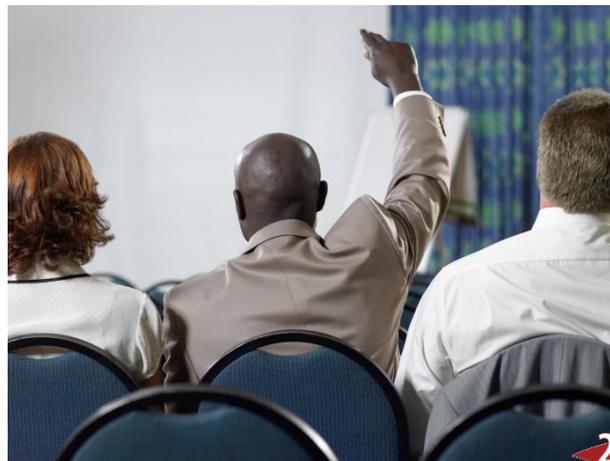
## Integrating Human Performance into Procedures

Safety Dimension LLC can integrate Human Performance Principles to assist with the integration, development, and review of procedures.



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Questions ??????



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