Human Factors in design

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Overview

- Human centred design
- Risk reduction through design
- Human factors integration
- End user involvement
- Documentation.

“Human Centred Design”

- Human centred approach
  - HF is not a separate activity
  - Considered throughout the design process
- Human interaction with technical components
- Human activities supporting the technical system
- Systematic processes for identifying, tracking and resolving human factors issues
- Ensuring a balanced development of technology and human capabilities.
Risk Reduction Strategy

- Remove the possibility of error
- Always the first consideration
- Mindful of risk transfer and impacts on operability
- Reduce the likelihood of error
- Make the system error tolerant
  - Predict errors during design
  - Feedback to personnel – make errors visible
  - Automatic protection

Minimising risks

- Operations
  - Simple process – few operator interventions
  - Robust engineering – not possible to exceed design
  - Reliable protection – no reliance on people to respond to hazardous events
- Maintenance
  - Over capacity
  - Simple isolations
  - Equipment redundancy
  - Logical layout and labelling.

Minimising risks

- Use of proven design
- Simple & logical layout
- 3D model to ensure good access and egress
- Comprehensive tagging and labelling
- Minimal number of overrides required
- Sensible use of automation & remote monitoring
- Good working conditions.
Design

- Automation – beware of the ironies
- Redundancy – potential for confusion
- Error tolerant – can result in work arounds
- Automatic protection – beware of over-reliance.

Equipment controls

- Are controls are consistent on different items of equipment?
- Do they comply with normal conventions?
- Are they properly labelled?
- Is specific training required?
- Are there good instructions on how to use the equipment?

Allocation of Function During Design

- People are good at
  - Detecting small visual or acoustic signals
  - Perceiving patterns
  - Improvising and using procedures flexibly
  - Recalling historical information when needed
  - Exercising judgement
- Machines are good at
  - Responding quickly to control signals
  - Applying forces smoothly and precisely
  - Storing information briefly
  - Handling highly complex situations.
Things to be aware of

- Confusing equipment controls
- Illogical or inconsistent layout
- Poor labelling
- Illegible, missing or hand written
- Complex tasks
- Possible short-cuts
- People working when fatigued or stressed
- Distractions and poor working conditions
- Reliance on communication.

Human factors in the design process

- Input to HAZID and HAZOP
- Support QRA (Quantified Risk Assessment)
- Task and error analysis
- Evaluation of design
  - Layout logic
  - Tagging and naming
  - Access to valves, instruments and controls
  - Material handling studies.

Human factors integration plans

- Identify issues to be addressed during design
- Human factors work packages
- Roles and responsibilities
- Integration with other project activities
- Deliverables
- Human factors issues log with close-out
- Final report
Focus on human factors ‘hot spots’

- Handling bulk quantities of hazardous materials
- Work in confined spaces
- Start-up and shutdown
- Design projects

End user involvement

- Operations staff involved in conceptual, FEED and detailed design
- Pre-operations plan and team
- Involving all operating staff before start-up for
  - Production & maintenance procedure development
  - Training requirement definition & material development
  - Equipment acceptance testing
  - Commissioning, sign-off & handover

Requirement

- The safety report should also show how human factors have been taken into account in the design of equipment and systems
- Usability,
- Tolerance of errors - Detectability and recovery
Documentation
- Operations, maintenance and emergency procedures
- Training and competence system
- Human factors basis of design
- ALARP demonstration.