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OVERVIEW: Human factors can affect the availability of systems (see Figure 1) and this can in turn affect profitability and safety. It is important to integrate human factors into the design of facilities and equipment and into the arrangements for operating and maintaining plants. The key steps in human factors integration are described in this Safety information bulletin.

Integrating human factors into design and major modifications of plant

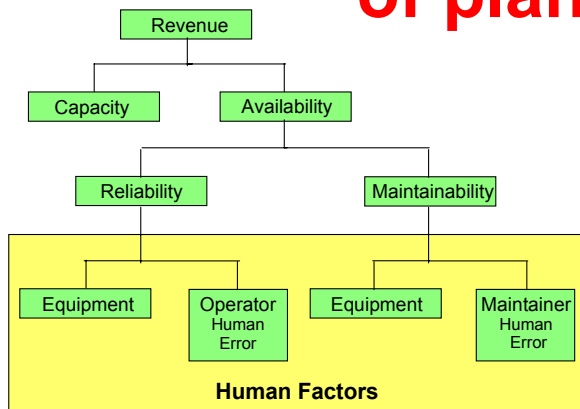


Figure 1 - Impact of human factors on availability

Management commitment and awareness raising

Project managers need to commit to including human factors in their project. They and the project team will then benefit from human factors training with the aim of raising their awareness and appreciation of human factors issues.

Project design specifications

Large projects that are novel in scope or that do not have a set of standard human factors specifications to reference should develop specifications for design. Typical specifications include guidance on workplaces, valves, stairs and ladders, signs and labels, controls and displays, and user computer interfaces. Smaller projects may only need one specification covering those areas that concern them.

The key purpose of human factors in safety and reliability terms is to reduce human error. This is achieved by applying human factors principles to the design, operation and maintenance of the workplace and the equipment used. The most effective human factors interventions are those that are integrated within the lifecycle of a project rather than being an afterthought.

Human factors plan

A human factors plan will help to ensure that appropriate and timely activities are carried out during the course of the project. The plan should describe:

- the work to be done
- who is responsible (including vendors and contractors) and how they are organised
- deliverables from each activity
- the relationship of each activity to the project schedule.

Front end engineering and plant philosophies

Human factors specialists should have access to and comment on proposed engineering philosophy documents. They can help by commenting in particular on philosophies for:

- control systems
- safety systems
- staffing
- emergencies.

During the Front end engineering design (FEED) project phase, a human factors specialist should perform or guide a high-level task analysis. The purpose of this is to identify any problems in the design of human-machine interfaces used in maintenance or operations activities and to ensure that these are addressed in the detailed design phase. As part of this activity, it is useful to review any human factors lessons learned from similar facilities and to obtain input from experienced operations personnel.

Detailed engineering phase

In this phase, the following ten human factors tasks are useful:

1. Provide key personnel with human factors awareness training (managers, engineers, contractors etc). This should describe human factors principles and their implications on the design, operation and maintenance of the facility. It should also introduce the human factors activities to be performed and any input required from engineers and designers.
2. Design specifications that take into account human factors principles should be passed to designers for their information and afterwards to vendors of equipment. Additional human factors standards, guidelines, and checklists should also be provided as required.
3. Set up a human factors action tracking database to facilitate tracking of work to be carried out and verifying that issues are resolved.

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Detailed engineering phase (*continued*)

4. Conduct specific human factors studies such as:
 - Function allocation, task analyses and job descriptions – determine which tasks are to be performed by the system and which by operators; ensure human tasks are feasible; feed information into competency profiling
 - HAZOPs for key areas – human factors specialist to provide input to and review results of HAZOPs to identify opportunities for human error with a view to controlling them
 - Valve criticality analysis (VCA) – identify valves with a critical function (against agreed criticality criteria) then design and locate valves to facilitate operation and maintenance
 - Emergency egress, escape and evacuation studies – review the human factors requirements for escape routes, muster stations, temporary refuges, survival crafts/lifeboats, fast rescue crafts (FRCs), communications alarms, lighting etc
 - Material handling studies – define requirements for manual/mechanical handling
 - Crane operator and operation studies – determine laydown areas based on crane operator viewing angles
 - Control room design and evaluation – physical design and review of control room tasks including abnormal situations
 - HAZOPs of critical operations – human factors specialist to identify errors that could arise from poorly-written procedures
 - Competency profiles – specify minimum performance requirements as a basis for selection and training.
5. Specify human factors requirements to vendors – provide guidelines and checklists to equipment vendors.
6. Human factors review of vendor packages – check for compliance with human factors requirements, specifications and standards; improve where necessary.
7. Design reviews – review of, for example, CAD-based designs at various stages of completion.
8. Inputs to selection and training – propose required characteristics of jobholders – physical attributes and qualifications, training, aptitudes etc. Involve human resources specialists.
9. Input to operations and maintenance documentation – review to ensure that documents contain the right amount and type of information, are accessible and generally conform to human factors design principles.
10. Human factors input to signs and labelling – ensure that signs and labels are consistent and generally conform to human factors principles.

Construction phase

During construction and fabrication of the facilities or equipment, it is important that attention to human factors issues is sustained and that specific problems that can arise in this phase are recognised. The human factors specialist can input to:

1. Human factors awareness training - provide human factors awareness training to construction staff (especially on-site inspectors) focusing on: human factors principles; work conducted to date and possible problems in construction.
2. Human factors inspections – human factors specialist should visit fabrication yards and construction sites to check implementation of human factors requirements.
3. 'Field run' or 'field installed' equipment – as above, human factors specialist to ensure human factors principles are followed during equipment installation.

Installation, start-up and operate phases

Installation and start-up phases – human factors specialist can:

- Review and resolve human factors problems
- Verify procedures.

Operate phase – human factors specialist can:

- Assess operational and maintenance issues and other human factors problems and concerns arising
- Get feedback on system operability and maintainability
- Monitor accident/incident reports to identify human factors design deficiencies
- Develop a lessons learned file or database
- Review problems and make improvements.

References and further information

Hendrikse, J. et al, *Effectively including human factors in the design of new facilities*, presented at 2nd International workshop on human factors in offshore operations (HFOW 2002), Houston, Texas, 8-10 April 2002. See RRS Engineering website: <http://www.rseng.com>.

IP *Human factors briefing notes resource pack*, No. 16 *Human factors integration*, Energy Institute, ISBN 0 85293 400 9. See Energy Institute website: <http://www.energyinst.org.uk/humanfactors/bn>.

ASTM *Standard practice for human engineering design for marine systems, equipment and facilities*, ASTM F 1166-95a – 2000, W. Conshohocken, PA. See ASTM website: <http://www.astm.org/>.

HSE *Human factors integration: implementation in the onshore and offshore industries*, RR001, HSE Books (2002), ISBN 0 7176 2529 X. See HSE website: <http://www.hse.gov.uk/research/rrhtm/index.htm>.

HSE *Human factors assessment model validation study*, RR194, HSE Books (2004), ISBN 0 7176 2809 4. See HSE website: <http://www.hse.gov.uk/research/rrhtm/index.htm>.

HSE *Human factors guidance for selecting appropriate maintenance strategies for safety in the offshore oil and gas industries*, RR213, HSE Books (2004). See HSE website: <http://www.hse.gov.uk/research/rrhtm/index.htm>.