

4. Global Resources: Human Factors Application in the Oil and Gas Industry

Human Factors Topic	Considerations	Guidance/ Background Reading	Tools/ Techniques and Design Guidance
1. Managing Human Failures	<p>In order to effectively learn from incidents we need to understand why human error occurred and how management systems can be augmented to prevent this and errors of similar causation reoccurring.</p>	<ul style="list-style-type: none"> • Dekker, S. (2012) Just Culture: Balancing Safety and Accountability. 2nd Ed, Ashgate. • Reason, J (1997) Managing the Risks of Organizational Accidents. Ashgate. 	<ul style="list-style-type: none"> • Energy Institute, London, Guidance on Investigating and Analysing Human and Organisational Factors Aspects of Incidents and Accidents, May 2008. http://publishing.energyinst.org/__data/assets/file/0014/25034/Guidance-on-investigating-and-analysing-human-and-organisational-factors-aspects-of-incidents-and-accidents-May-2008.pdf • Centre for Chemical Process Safety (CCPS). Guidelines for Investigating Chemical Process Safety Incidents. 2nd Edition, Wiley.
	<p>It is beneficial to review areas in which human failure has the potential to initiate or fail to control process safety incidents to determine whether there are sufficient controls in place to reduce risks.</p>		<ul style="list-style-type: none"> • United Kingdom Health Safety Executive, Evaluation Report on OTO 1999/092 Human Factors Assessment of Safety Critical Tasks, 2002. http://www.hse.gov.uk/research/rrpdf/rr033.pdf • Energy Institute, London, Guidance on Human Factors Safety Critical Task Analysis, First Edition, March 2011.

<p>2. Procedures</p>	<p>The quality and content of procedures will determine how reliable a person is when following them.</p>	<ul style="list-style-type: none"> • NOPSEMA Information Paper. N-06300-IP1041- Human Factors: Procedures and Instructions. 2013 • Health and Safety Executive (HSE) Human Factors Briefing Note No. 4, Procedures. http://www.hse.gov.uk/humanfactors/topics/04procedures.pdf 	<ul style="list-style-type: none"> • Abnormal Situation Management (ASM) Consortium, Effective Procedural Practices, June 11, 2010 • United Kingdom Health Safety Executive, Procedures Audit Tool (Style/Layout/Language), Version 1.1, December 2009. http://www.hse.gov.uk/humanfactors/topics/procedures-audit-tool.pdf
<p>3. Training and Competence</p>	<p>Training should relate directly to job roles and should cover the most important / safety critical aspects of the work. Assessment methods should be appropriate to the type of competence which is being tested. Selection methods should relate directly to the tasks that are to be conducted in that job role.</p>	<ul style="list-style-type: none"> • NOPSEMA Information Paper. N-06300-IP1038- Human Factors: Competency Assurance, 2012. • Fletcher, S (2000) Competence Based Assessment Techniques. Kogan Page. 	<ul style="list-style-type: none"> • American Petroleum Institute (API), Guidance Document for the Qualification of Liquid Pipeline Personnel, API 1161, August 2000. • Health and Safety Executive (HSE) Research Report 086 Competence assessment for the hazardous industries. Prepared by Greenstreet Berman Ltd for the Health and Safety Executive 2003. • Health and Safety Executive (HSE) Research Report 086 Competence assessment for the hazardous industries. Prepared by Greenstreet Berman Ltd for the Health and Safety Executive 2003.

<p>4. Workload, Staffing Levels and Supervision</p>	<p>Workload, staffing and supervision are additional elements which can assist in the control of error potential. Jobs may have the possibility of chronic or situational underload or overload. Measuring workload can lead to improvements in task allocation and allocation of function (i.e. what to automate in the system). Workload measurement can assist in the determination of appropriate staffing for a control facility considering abnormal and emergency conditions.</p> <p>Effective supervision can provide a check and additional assistance for abnormal and emergency situations.</p>	<ul style="list-style-type: none"> • NOPSEMA Information Paper. N-06300-IP1040- Human Factors: Personnel Resourcing, 2013. • Energy Institute (2004). Safe Staffing Arrangements - User Guide for CRR348/2001 Methodology. • Health and Safety Executive (HSE) Research Report 292. Different types of supervision and the impact on safety in the chemical and allied industries. Assessment Methodology and User Guide. Prepared by Entec UK Ltd. for the Health and Safety Executive. 	<ul style="list-style-type: none"> • Health and Safety Executive (HSE) Contract Research Report 348/2001. Method to assess the safety of staffing arrangements for process operations in the chemical and allied industries. • ISO 10075 Parts 1-3 Ergonomic principles related to mental workload. • Rubio, S at al. 2004. Evaluation of Subjective Mental Workload: A comparison of SWAT, NASA-TLX, and Workload Profile Methods. Applied Psychology: An International Review, 2004, 53 (1), 61-86.
<p>5. Change Management</p>	<p>Organizational change may also affect operations. Changes in workload, staffing and operating conditions can be assessed in terms of the impact they may have on operational effectiveness.</p>	<ul style="list-style-type: none"> • NOPSEMA Information Paper. N-06300-IP1039- Human Factors: Change Management. 2013 • Health and Safety Executive (HSE) Information Sheet: Organizational Change and Major Accident Hazards. No CHIS7: http://www.hse.gov.uk/pubns/chis7.pdf 	

<p>6. Safety Critical Communications (Shift Handover)</p>	<p>The effectiveness of communications between shifts is important. For guidance on how to make these communications more effective please the referenced documentation.</p>		<ul style="list-style-type: none"> • Lardner, R., United Kingdom Health Safety Executive, Safe Communication at Shift Handover: Setting and Implementing Standards, 1999. Available on HSE website: http://www.hse.gov.uk/humanfactors/topics/standards.pdf • Structured approach to shift handover improves situation awareness. White Paper. http://www.asmconsortium.net/Documents/2011_HUG_Engen_ThompsonWhite%20Paperfinal.pdf
<p>7. Human Factors Engineering in Workspaces</p>	<p>In the design phases of projects there is an opportunity to design out potential for human error and injury to humans by applying industry specific standards.</p>	<ul style="list-style-type: none"> • Oil and Gas Producers Association Publication 454 (2011) Human Factors Engineering in Projects: http://www.ogp.org.uk/pubs/454.pdf 	<ul style="list-style-type: none"> • ABS (April 2003) Guidance notes for the application of ergonomics to marine systems • ABS (May 2002) Guide for crew habitability on offshore installations • ASTM F1166 Standard practice for human engineering design for marine systems, facilities and equipment • NORSOK S-002 Working Environment • FABIG Technical Note 9. Human Factors Guide for the Protection of Onshore Plants and Offshore Structures against Fires and Explosions. The Fire and Blast Information Group, London. • ISO 15534 Ergonomic Design for the Safety of Machinery • ISO 9355 Ergonomic Requirements for the Design of Displays and Control Actuators

<p>7a. Design of Control Rooms</p>	<p>Design of control rooms can affect operator performance. There are standards which can be applied in design to maximize operator performance.</p>		<ul style="list-style-type: none"> • ISO 11064 Ergonomic Design of Control Centres. Parts 1-7. (Note: Covers design principles, control room arrangements and layout, workstations, displays, controls, interactions, temperature, lighting, acoustics, ventilation, and evaluation). • American Petroleum Institute (API), Recommended Practice for Developing a Pipeline Supervisory Control Centre, API RP 1113, February 2000.
<p>7b. Design of Control Room Workstations</p>	<p>Design of workstations can affect the possibility of developing musculoskeletal disorders. This can be designed out by applying HF requirements in the design phase.</p>		<ul style="list-style-type: none"> • ANSI/HFES_100-2007. Human Factors Engineering of Computer Workstations. • ISO 11064 Part 4 Ergonomic Design of Control Centres - Layout and dimensions of workstations.
<p>7c. HCI Design</p>	<p>Design of software systems can greatly affect an operator's ability to complete tasks efficiently and effectively. Software systems should be designed around the users tasks and with knowledge of human perception and attention systems. The following documents provide good practice for achieving those aims.</p>		<ul style="list-style-type: none"> • Abnormal Situation Management (ASM) Consortium, Effective Console Operator HMI Design, Second Edition, October 10, 2013 • Engineering Equipment and Materials Users' Association (EEMUA), Process Plant Control Desks Utilizing Human-Computer Interface, Publication 201: 2002 • British and European Standards (BS EN), Ergonomics of Human-System Interaction, BSI BS EN ISO 9241 • American Petroleum Institute (API), Recommended Practice for Pipeline SCADA Displays, API RP 1165, First Edition, January 2007, Reaffirmed July 2012

<p>7d. Alarm Management</p>	<p>In order for an operator to respond to each alarm that is presented to them in a reliable manner, alarms must be trusted by the operator. This means that alarms should be important (no nuisance alarms) and be prioritized in a manner which assists the operator in determining the level of severity of the alarm. The pace of alarm pop-up should also be appropriate to the capabilities of humans. The following documents provide guidance for achieving these aims.</p>	<ul style="list-style-type: none"> • Health and Safety Executive (HSE) Human Factors Briefing Note No 9. Alarm Handling: http://www.hse.gov.uk/humanfactors/topics/09alarms.pdf • Health and Safety Executive (HSE) Information Sheet: Better Alarm Handling. Chemicals Sheet No 6: http://www.hse.gov.uk/pubns/chis6.pdf 	<ul style="list-style-type: none"> • Engineering Equipment and Materials Users' Association (EEMUA), Alarm Systems – A Guide to Design, Management, and Procurement, EEMUA 191, 2007 • American Petroleum Institute (API), Recommended Practice for Pipeline SCADA Alarm Management, API RP 1167, First Edition, December 2010 • ANSI/ISA 18.2.2009 – Management of Alarms Systems for Process Industries • AGA Gas Control Committee 'Alarm Management for control room operations in the natural gas industry.' Oct 13 2009 • Abnormal Situation Management (ASM) Consortium. Effective Alarm Management Practices. 2009
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<p>8. Fatigue and Shiftwork</p>	<p>Fatigue management is often best managed in a system of controls with layers of defence against potential for fatigue.</p> <p>Enform's fatigue guidance provides guidance on how to implement a fatigue risk management system and how to develop appropriate defences to control fatigue potential and mitigate effects.</p>	<ul style="list-style-type: none"> • Enform. Guide to Safe Work, Fatigue Management. An Employer's Guide to Designing and Implementing a Fatigue Management Program. [note that Version 3 in development] • Dawson, D., McCulloch, K., (2005) Managing Fatigue: It's About Sleep. Sleep Medicine Reviews (2005) 9, 365-380. http://bulletproofpeople.com.au/wp-content/uploads/2013/09/Dawson_McCulloch-Managing-Fatigue-Its-About-Sleep.pdf • Energy Institute, London, Improving Alertness Through Effective Fatigue Management, September 2006 • International Association of Oil and Gas Producers (OGP)/ International Petroleum Industry Environmental Conservation Association (IPIECA), Managing Fatigue in the Workplace, A Guide for Oil and Gas Industry Supervisors and Occupational Health Practitioners, OGP 392. http://www.ogp.org.uk/pubs/392.pdf • United States Department of Transportation, Pipeline and Hazardous Materials Safety Administration (PHMSA), Control Room Management: Fatigue Mitigation. http://primis.phmsa.dot.gov/crm/fm.htm • American Petroleum Institute (API), Fatigue Risk Management Systems for Personnel in the Refining and Petrochemical Industries, API RP 755, April 2010 	<ul style="list-style-type: none"> • United Kingdom Health Safety Executive, Fatigue and Risk Index Calculator, Version 2.2, User Guidance. http://www.hse.gov.uk/research/rrpdf/rr446g.pdf • Appendices 1- 4 of International Association of Oil and Gas Producers (OGP)/ International Petroleum Industry Environmental Conservation Association (IPIECA), Managing Fatigue in the Workplace, A Guide for Oil and Gas Industry Supervisors and Occupational Health Practitioners, OGP 392. http://www.ogp.org.uk/pubs/392.pdf
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<p>9. Organizational Culture/ Safety Culture</p>	<p>The culture of the organization will affect an operator's decision making and actions. A pervasive and persuasive just and positive safety culture provides an opportunity to further prevent incidents.</p>	<ul style="list-style-type: none"> • National Energy Board (NEB), Advancing Safety in the Oil and Gas Industry – Draft Safety Culture Framework, October 31, 2013. http://www.neb-one.gc.ca/clf-nsi/rsftyndthnvrnmnt/sfty/sftyctr/sftyctr-eng.pdf. • Heart and Minds. Energy Institute: http://www.eimicrosites.org/heartsandminds/ • Dekker, S. (2012) Just Culture: Balancing Safety and Accountability. 2nd Ed, Ashgate. • Cooper, D (2007) Improving Safety Culture: a practical guide. Wiley. • PRISM (2005) Safety Culture Application Guide for the European Process Industries. http://www.epsc.org/content.aspx?Page=PRISM+page 	<ul style="list-style-type: none"> • Heart and Minds. Energy Institute: http://www.eimicrosites.org/heartsandminds/tools.php • United Kingdom Health and Safety Executive, OTO 00049 Safety Culture Maturity Model, 2001. http://www.hse.gov.uk/research/otopdf/2000/oto00049.pdf • Health and Safety Executive (HSE) (1997) Health and Safety Climate Survey Tool, HSE Books ISBN 0 7176 1462 X – see www.hse.gov.uk/pubns/misc097.pdf • Oil and Gas Producers Association Publication 435 (2010) A guide to selecting appropriate tools to improve HSE Culture.
<p>10. Maintenance, Inspection and Testing</p>	<p>As MIT tasks are generally physically demanding there is potential for occupation injury. As they can also involve override of safety systems they are the tasks in which failure can often have the most severe consequences. It is therefore important to ensure sufficient defenses against human error potential.</p>	<ul style="list-style-type: none"> • Health and Safety Executive (HSE) Human Factors Briefing Note No. 6, Maintenance Error. http://www.hse.gov.uk/humanfactors/topics/06maintenance.pdf 	<ul style="list-style-type: none"> • Managing Maintenance Error: A Practical Guide, James Reason and Alan Hobbs (2003) ISBN: 978-0-7546-1591-0.