

Human Reliability in the Context of the Offshore Oil & Gas Industry

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Human Factors is an applied discipline which focuses on the relationship between humans, tasks, technologies, organisations and the surrounding environment. Themes such as leadership and culture, perception of risk and decision-making, individual and team capacity, communication of risk, human factors in design, investigation and learning from incidents, collaborative and distributed team working, commercial and contractual environment, workload transition and assurance of safety-critical human activities have been identified as relevant aspects that need to be addressed in exploration and production operations¹, highlighting the importance of human factors' considerations in a wider perspective.

The acknowledgement that the human aspect should be considered for achieving realistic reliability assessments of techno-social systems led to the development of different approaches to tackle this issue, such as Human Reliability Analysis (HRA). HRA can be generally defined as a predictive tool, intended to estimate the probability of human errors and weigh the human factors contribution to the overall risk by using qualitative and/or quantitative methods². HRA is used to examine the extent to which the nature of the task and the performance shaping factors (controls, documentation and operator competence etc.) make error either more or less likely.

72 different techniques to estimate human reliability have been identified in a comprehensive review of Human Reliability Assessment Methods³. Further analysis highlighted 17 of these HRA tools to be of potential use for major hazard directorates in the United Kingdom. Overall, these methods offer some taxonomies to handle possible internal and external factors that could influence human behaviour, having in common three general purposes⁴:

1. Identify human errors that could occur (human error identification);
2. Estimate their likelihood (human error quantification: *this step might be skipped for qualitative approaches*);
3. Improve human reliability by reducing error likelihood and identifying error recovery opportunities (human error reduction).

In the context of the offshore oil and gas industry, some relevant considerations on how to achieve a fair level of regulatory compliance by demonstrating a realistic risk assessment for offshore facilities are discussed below.

- Structured techniques to evaluate Human Factors throughout the installation lifecycle should be identified, implemented and integrated with engineering risk assessments. Processes susceptible to variations associated with human actions should be mapped.
- The team designated to conduct the analysis should be competent and demonstrate a general understanding of the assessed installation, hold qualifications in human factors

¹ Society of Petroleum Engineers. (2013). *Technical Report - The Human Factor: Process Safety and Culture*.

² Moura, R et al. (2015). *Learning from major accidents to improve system design*. Safety Science 84, 37–45.

³ Bell, J., Holroyd, J. (2009). *Review of Human Reliability Assessment Methods*. HSE Books, Suffolk.

⁴ Kirwan, B. (1994) *A Guide to Practical Human Reliability Assessment*, CRC Press.

and adequate training in the use of the HRA methodology. The ability to identify limitations (or special circumstances where the designated team would be unable to adequately assess risks without external consultation) is desirable. Active participation of the workforce is encouraged;

- Calculation of error likelihood should not be used to determine whether an activity should proceed (e.g. error probability must be below “x’ to perform this task). The objective is to evaluate the operator’s contribution to system reliability and predict human error rates to support decision-making.
- The HRA should be reviewed at regular intervals to ensure risk reduction measures remain consistent throughout the facility’s lifecycle;
- The potential use of HRA is beyond the identification, implementation and monitoring of barriers to control risks. HRA can provide decision-makers with information for planning and operational purposes, such as the definition of staffing levels, qualification and support risk communication.

The oil and gas community recognises human factors aspects as an essential element of an adequate safety management system. The European Union Directive 2013/30/EU on safety of offshore oil and gas operations specifies that *in undertaking a thorough assessment of reports on major hazards, the competent authority shall ensure that (...) whether, in determining the necessary measures to achieve acceptable levels of risk, the operator or owner has clearly demonstrated how relevant good practice and judgment based on sound engineering, best management practice, and human and organisational factors principles have been taken into account.* Likewise, many of the International Regulators’ Forum members’ regulations contain specific provisions regarding human factors. Industry has also developed guidelines and tools, in order to help companies to improve risk assessment capabilities, enhance operational efficiency and minimise losses.

There are many resources available to assist licensees to navigate human factors and implement Human Reliability Analysis as part of their Operational Safety Management Systems. Methodology choice will largely depend on asset characteristics and risk profile. The references below provide some insights regarding the subject and shall offer useful (and free) guidance on human factors and HRA.

- **Human Factors Products and Resources, International Association of Oil & Gas Producers (IOGP)**
The IOGP provides one of the most valuable and useful websites in Human Factors. Internal guidelines, links to IRF members’ websites (BSEE, NOPSEMA, HSE and PSA), further resources from other Oil and Gas Industry Associations and other industries and a comprehensive literature review. <https://www.iogp.org/oil-and-gas-safety/human-factors/>
- **Human factors awareness web-based training course, Energy Institute**
The Energy Institute offers a free web-based training course regarding human factors awareness. It has 11 modules, covering ten key human factor topics (training and competence; managing human failure; procedures; staffing arrangements and workload; organisational change; fatigue; maintenance; HF in design; communication, and safety culture). <http://eihoflearning.org/>

- **Human Factors briefing note No. 13 - Human Reliability Analysis, Energy Institute**
A four-page document briefly explaining the main steps of qualitative and quantitative HRA. <https://publishing.energyinst.org/topics/process-safety/leadership/human-factors-briefing-note-no.-13-human-reliability-analysis>
- **Guidance on quantified human reliability analysis (QHRA), Energy Institute**
The Energy Institute offers some detailed guidance on understanding and using quantitative HRA, with practical examples. <https://publishing.energyinst.org/topics/human-and-organisational-factors/guidance-on-quantified-human-reliability-analysis-qhra2>
- **RR679 - Review of human reliability assessment methods, Health and Safety Executive UK**
The report provides a summary of seventy-two HRA tools and methods considered to be of potential use to analysts undertaking HRA in the major hazard sector. <https://www.hse.gov.uk/research/rrpdf/rr679.pdf>

Further Reading

Kirwan, B. (1994) *A Guide to Practical Human Reliability Assessment*, CRC Press.

Stanton, A., Salmon, P., Walker, G., Baber, C. and Jenkins, D. (2005) *Human Factors Methods: A Practical Guide for Engineering and Design*, Ashgate.

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