

A critical component in early offshore installation design

Integrating a well-defined HFE strategy into offshore installation design improves overall HSE and occupational performance, which ultimately can impact the bottom line.

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Lessons learned in the last two decades have resulted in more concentrated efforts to improve human performance and reduce human error through the introduction of Human Factors Engineering (HFE) into the design of offshore installations.

HFE focuses on the critical role of the human element as the root of effective safety standards and practices. Human behavioral and physical capabilities and limitations along with traditional engineering disciplines are integrated to produce human-system interaction that maximizes the best of both. These practices and principles are based on system and environmental safety, competent personnel, and effective performance that allow the human and system to safely achieve required functions and goals. Despite positive experiences and lessons learned from including HFE design practices and principles into offshore design projects, HFE has yet to become a widely accepted and fully integrated component of offshore design projects.

It is time to change the industry's view of HFE. Integrating HFE design practices and principles that reflect human capabilities and limitations can result in installations that are more cost-effective, safer and easier to operate and maintain.

HFE implementation strategy

As a strategy, HFE implementation has evolved. A well-defined approach, where the owners and contractors are responsible, is vital to promoting the effective integration and implementation of HFE design principles throughout the life-cycle phases of an offshore capital project.

Ideally, this approach encapsulates the key HFE activities needed to integrate HFE into an offshore installation design and layout and associated project management systems and considers these activities throughout the asset's life cycle. It should also consider interrelated elements that influence how personnel can safely and efficiently perform assigned tasks, including workspace design and

layout, ambient environmental considerations, and management and organizational issues related to installation operations and maintenance.

The 2014 ABS Guidance Notes on the Implementation of Human Factors Engineering into the Design of Offshore Installations (HFE Guidance Notes) provides a strategy for integrating and implementing HFE in the design process as a way to help improve human performance and personnel efficiency and reduce safety risks associated with working and living on offshore installations.

The HFE Guidance Notes identify the HFE activities that should be executed effectively and efficiently and describes a strategy for integrating HFE into existing project management systems.

The document is a roadmap for a larger effort to promote the application and understanding of HFE principles and criteria in system design and operations with the goal of improving personnel performance and safety while reducing the potential for human error. Although compliance with the HFE Guidance Notes is not required, experience shows that the earlier in the process these principles and recommended practices are adopted and integrated, the greater the impact on business, health and safety performance.

Focusing on safety and productivity

While the application of HFE practices and principles may seem like common sense, they are not. The successful application of HFE requires a practitioner with a background in multidisciplinary fields such as engineering or psychology with emphasis in human factors, human factors engineering, physiology and ergonomics.

HFE professionals work to advance human-centered design and optimize system operations through human factors engineering principles, including human-system interfaces; integration of human physical and cognitive performance limitations; complex systems analysis; human-automation interaction and bias; personnel selection, readiness and training; organizational culture; and other HFE methodologies that eliminate



A proper guardrail design with toe board in the appropriate position can reduce potential injuries by limiting falls on elevated walkways.

or reduce the probability and consequence of human error.

Identifying the potential for human error or injury takes many forms and must be evaluated in terms of

their impact and significance when developing potential solutions. HFE personnel participate in risk and hazard studies, take part in design and layout, help develop training devices and other related training materials,

participate in electronic 3-D modeling walkthroughs involving human-machine issues and conduct periodic visits to construction facilities throughout a project. This allows them to gather data and track issues in an HFE database from which reports can be generated at each design phase.

Applied examples

Effective program planning is essential in achieving an HFE vision, mission and objectives. Although the number and type of tasks in an HFE program depend on the size and complexity of the design project, the following are generally included as part of the HFE program:

- Review/develop early project design documents;
- Identify HFE tasks and prepare HFE implementation plan;
- Select/write the HFE design aids;
- Conduct HFE training for designers;
- Establish an HFE tracking database;
- Carry out a manning assessment;
- Conduct drawing/design reviews;
- Apply HFE to vendor-supplied equipment;
- Prioritize HFE efforts for systems/equipment;
- Incorporate a facility-wide labeling program;
- Prepare/review operations, maintenance and training manuals/materials;
- Participate in special design studies;
- Visit the construction yard and vendor facilities; and
- Prepare progress reports.

Isolating a few of these HFE activities from experience serving major offshore engineering, procurement, construction and installation (EPCI) projects illustrates the value of implementing this practice in installation design.

In one case, offshore personnel from a major Gulf of Mexico production E&P company rated “good labeling” as one of the most important HFE contributions to their project. HFE professionals worked closely with the builder and vendor to develop a program for facility labeling and safety signage and designated appropriate locations for the signs. HFE professionals also participated in site surveys to identify tagging and labeling noncompliance.

Another recommendation in the HFE strategy is to have an HFE drawing and document review procedure within the HFE implementation plan. The plan should contain a master list of drawings that will be reviewed by an HFE professional along with provisions for reviewing drawings and revisions, a process for reviewing change proposals, and guidelines for entering comments in the

HFE tracking database. The value in applying HFE principles lies in improved safety and more streamlined operations. When HFE professionals identified a number of noncompliant elements during a major offshore EPCI project, the issues could be addressed early on so costly rework could be avoided. Noncompliance issues that have been resolved through HFE reviews prior to construction include:

- Improper height and orientation of manually operated valves;
- No access or limited access to critical equipment, valves, hand wheels, etc.;
- Equipment protruding into walkways that could contribute to trips and falls;
- Equipment and structures placed in or along equipment removal routes;
- Controls and display design that are not consistent with HFE requirements;
- Inconsistent orientation and placement of equipment; and
- Stair, ladder, steps and walkway designs not consistent with HFE requirements.

Lessons learned

The lessons learned over the years from incidents and accidents in which human error was the primary cause or contributor—including those related to rare, high-severity offshore accidents such as the Piper Alpha and *Deepwater Horizon* tragedies—have provided a historical context from which HFE professionals have gained experience and gathered data. History has shown the factors leading to the successful implementation of HFE, applicable to major oil and gas design and development projects, include commitment and support from the owner at all levels of the project organization; early and continuous involvement of HFE throughout the project; effective HFE planning and monitoring/oversight; location of HFE discipline to promote interaction with other design disciplines; and interaction between HFE personnel, operators and maintainers. This information has been applied to develop HFE as an overall risk reduction strategy.

While some companies have been slow to recognize HFE as a viable discipline, early adopters have found that applying HFE to their operations has delivered better ergonomics and improved occupational safety. There is now a body of evidence that shows an HFE strategy, implemented early on in the design phase for offshore installations, optimizes human well-being and improves overall system performance. **ESP**