A novel risk assessment method using dynamic simulation of fire and egress scenarios on off-shore platforms

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Risk assessment is an important part in the permitting process of off-shore platforms. The conventional approach is to develop static event trees for events following a loss of containment. The volume and spread of the hydrocarbons are assessed making up various ignition scenarios and their impact on people are evaluated. The prediction of the impact and consequences in terms of serious injuries and fatalities is based on deterministic assignments by simplified engineering models to the characteristics of the system, physical and environmental phenomena and workers responses or averaged/expected values of those.

A novel risk assessment approach is based on simulation of the dynamic interactions between concurrent phenomena following loss of containment, specifically:

- The physical processes (outflow, dispersion, ignition, heat radiation, explosion)
- Detection, alarming and emergency shutdown
- Escape and evacuation
- Impact on persons, escalation and impairment of safety functions

The simulation model runs repeatedly loss of containment scenarios to evaluate the associated stochastic events in time with random delays, durations, instances of occurrences and others. The output data sets are collected over all the simulated scenarios and are further processed to predict risk indicators as the Individual Fatality Risk (IR), the Potential Loss of Life (PLL), the Fatal Accident Rate (FAR, at platform and workplace level), and the group risk (distribution of number of simultaneous fatalities).

This way of tackling the problem allows capturing a great deal of specific characteristics of different platforms, dynamic change of people responses and other characteristics. Scenarios with severe consequences can be ‘played back’ to learn from them and can be animated, which except for the learning effect provides a new way of validation. This also makes the simulation models a good communication tool between system analysts and domain experts.

The approach as a whole and the computer model are the tools improving risk assessment by providing an overall framework to describe and simulate the interactions between concurrent chains of events under the hazardous scenarios and produce probabilistic risk measures.