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Concept Safety Risk Assessment of Floating Technologies

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Abstract

As worldwide energy needs continue to grow, energy reserves moves further away from traditional, established supply chain infrastructures. To recover stranded gas in remote, offshore reservoirs, companies are looking to novel designs to economically develop these recoverable energy supplies.

Three novel floating technologies that have been proposed to bring these energy supplies to the world markets include: Floating LNG (FLNG), Compressed Natural Gas (CNG), and Floating Gas to Liquids (FGTL). While the floating plant designs are often greatly influenced by the limitations of the installation's configuration (optimizing space, volume and weights against economics), these limitations can also contribute to the on-board personnel's safety risks. These compact, congested and remote designs can expose personnel to increased risks from both hydrocarbon (loss of containment events, escalation to fire / explosion or evacuation risks) and non-hydrocarbon risks (helicopter and marine transportation, ship collisions, certain occupational risks).

One method of minimizing personnel risk is to conduct a Concept Risk Assessment (CRA) early in the design selection process. A CRA is a systematic, consistent, and reasonably simple assessment, whose methodology is based on that of more detailed Quantitative Risk Assessments (QRAs), and other detailed hazard risk analyses. The CRA methodology for floating concepts uses a building block approach to calculate risks to hazardous events typically found in an offshore operating environment. Each building block combines release frequencies (based on generic failure data) and fire/explosion consequences (based on hydrocarbon release rates) to calculate an associated risk for each hazardous event. These blocks are then modified by installation's specific factors to estimate the facility risks to personnel. Because the CRA is a screening tool, it estimates comparative risks among individual design concepts.

This CRA methodology was applied to generic FLNG, CNG, and FGTL technology concepts. Comparative risk measures of Personnel Risk Exposure (PRE) and Cumulative Risk Factor (CRF) were calculated for FLNG, CNG, and FGTL components along the value chain, namely, production, shipping and receiving.

Introduction

Three novel floating technologies have been proposed to monetize stranded gas in remote, offshore reservoirs, which include: Floating LNG (FLNG), Compressed Natural Gas (CNG), and Floating Gas to Liquids (FGTL). It is desirable to provide a preliminary screening of key safety risks to personnel for these floating technologies. Accordingly, a comparative safety risk assessment is performed for the various gas value chain components of these technologies (i.e., offshore processing facility, transport shipping vessel, and onshore receiving facility), as the severity of the risks to personnel will vary for each of these value chain components. There are also potential risks to personnel in the upstream value chain components (i.e., wells, subsea production facilities, flowlines and risers), but these would be similar for each of the floating technologies, and thus not considered in this comparative assessment.

The Atkins Concept Risk Assessment (CRA) methodology was used to provide this preliminary screening of safety risks to personnel, as it is particularly well-suited for a high-level comparative assessment of different technology concepts. This methodology has been calibrated against more detailed Quantitative Risk Assessments (QRAs), and enables the risks to