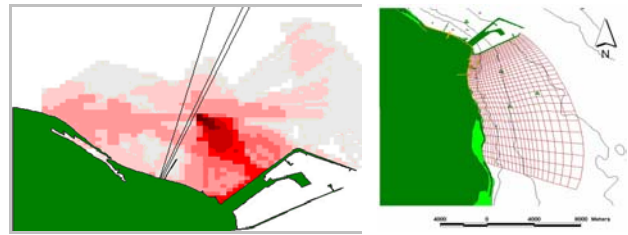


Fate and Transport Modeling Accidental Releases from Natural Gas Pipelines

Ras Laffan Liquefied Natural Gas, Arabian Gulf, Qatar



Situation

At the Ras Laffan Industrial City, located in the north eastern coast of the State of Qatar, three 38" wet gas production pipelines were proposed from the North Field to the Ras Laffan Liquefied Natural Gas Ltd., onshore processing facilities. The objective of this study was to perform predictive spill impact modeling to quantify the impacts of four hypothetical accidental releases of hydrocarbons.

Approach

The accidental spill impact modeling was performed using the hydrodynamic (HDM) and chemical and oil spill (COSIM) modules of GEMSS® (Generalized Environmental Modeling System for Surfacewater), 3-D surface water modeling software developed by ERM. For environmental impact studies, a typical procedure is to apply the spill model in the stochastic mode to predict probability of spill impact on the water surface, sub-surface and shoreline.

The impact of an accidental release from a production pipeline depends upon the size and location of the spill. Trajectory and fate modeling of small- and large-scale releases nearshore and offshore were modeled for four scenarios: (1) a leak in pipeline weld 3 km from shore about 10 cm long and 2.5 cm wide; (2) a slow corrosion leak 3 km from shore - 1.5 cm hole; and (3) a rupture due to navigation incident 25 km from shore - 25 cm long, 4 cm wide; (4) corrosion leak 25 km from shore - 3.75 cm hole. For realism, time was allocated for accident identification and response time.

Results

The results show that the released gas bubble plume reaches the water surface within a few seconds, allowing all the gas to escape to the atmosphere. The liquid fractions are also carried to the surface by the gas bubble plume. The interaction of the gas plume with the water surface causes lateral spreading until the radial velocity becomes zero. After the lateral spreading, dispersion spreading becomes dominant for next few hours of the spill.

During the first few hours of the spill, most of the liquid fractions are lost to the atmosphere by evaporation. The impact probability plumes are very small for all scenarios and are confined to a small area in the vicinity of the release location, with no shoreline impacts.

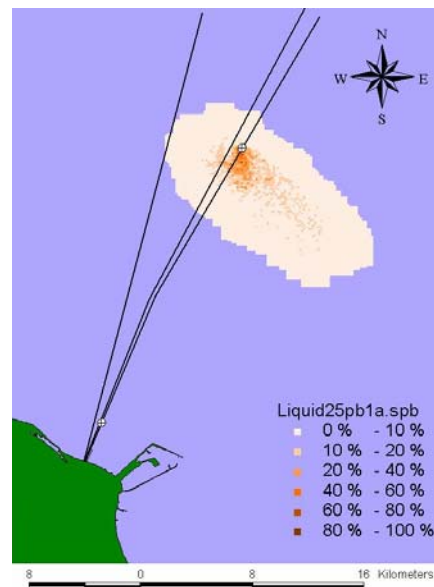


Figure 1 Percent probability of spill impact, Scenario 3