Predicting of Hydrate Deposition in Loading and Offloading Flowlines of Marine CNG Systems

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Abstract : The main aim of this paper is to demonstrate the prediction of the model capability of predicting the nucleation process, the growth rate, and the deposition potential of second phase particles in gas flowlines. The primary objective of the research is to predict the risk hazards involved in the marine transportation of compressed natural gas. However, the proposed model can be equally used for other applications including production and transportation of natural gas in any high-pressure flow-line. The proposed model employs the following three main components to approach the problem: computational fluid dynamics (CFD) technique is used to configure the flow field; the nucleation model is developed and incorporated in the simulation to predict the incipient hydrate particles size and growth rate; and the deposition of the gas/particle flow is proposed using the concept of the particle deposition velocity. These components are integrated in a comprehended model to locate the hydrate deposition in natural gas flowlines. The present research is prepared to foresee the deposition location of solid particles that could occur in a real application in Compressed Natural Gas loading and offloading. A pipeline with 120 m length and different sizes carried a natural gas is taken in the study. The location of particle deposition formed as a result of restriction is determined based on the procedure mentioned earlier and the effect of water content and downstream pressure is studied. The critical flow speed that prevents such particle to accumulate in the certain pipe length is also addressed.
Keywords : hydrate deposition, compressed natural gas, marine transportation, oceanography
Conference Title : ICO 2015 : International Conference on Oceanography
Conference Location : Miami, United States
Conference Dates : March 09-10, 2015