Experimental Investigations of Gas Kick for Single and Two-Phase Gas-liquid Flow in near Horizontal Wells

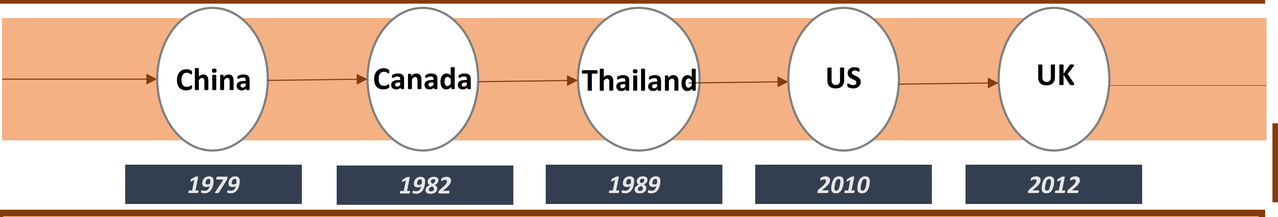
Motasem Abdelrazeq[1*], Ahmad K. Sleiti[1], Mohammad A. Rahman[2], Abinash Barooah[2]
[1]Department of Mechanical and Industrial Engineering, College of Engineering, Qatar University, Doha, Qatar
[2]Texas A&M University, Doha, Qatar
ma1511475@qu.edu.qa , asleiti@qu.edu.qa

Category: Graduate Students

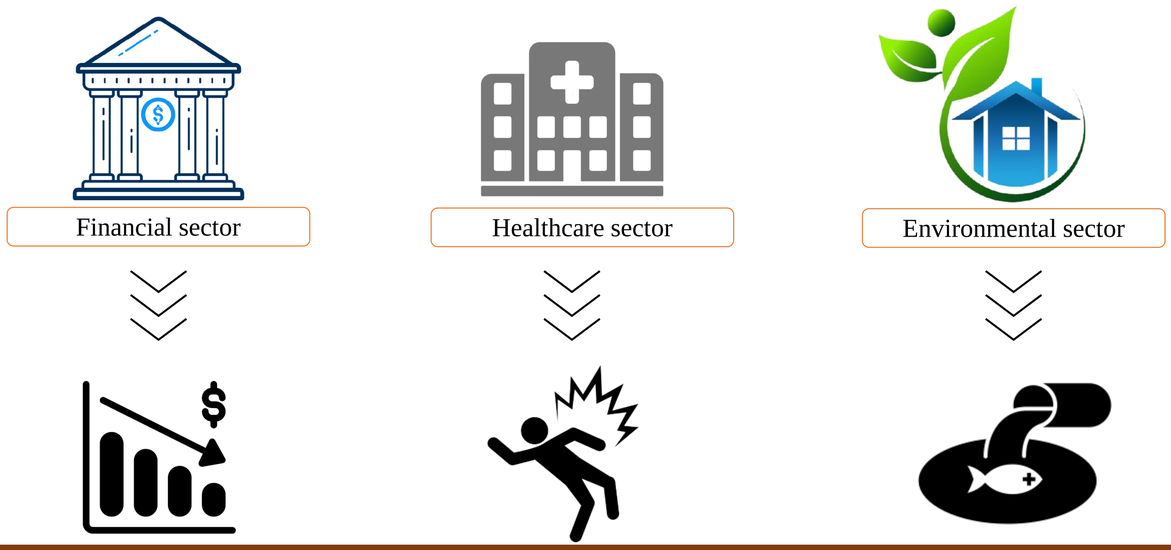
Abstract

Multiphase flow in pipelines or annuli is of great importance and broadly used in several industries and various applications. A multiphase flow is a complex physical phenomenon where more than one phase occurs. In oil and gas exploration process, more attention has been given to the well drilling operation to fulfill the extreme high demand of natural gas. Well drilling operation and technology has transformed to ultra-high pressure and high temperature reservoirs. This transformation has negatively impacted the drilling conditions and the safety of the drilling rig, as a gas kick would become more likely to occur at these extreme conditions. The resulting uncontrolled gas kicks may ignite and explode causing dramatic blowouts associated with very serious consequences, including financial losses, damaging the environment, and loss of personnel's lives. The early detection of a gas kick is therefore essentially needed for timely response with appropriate well control measures.

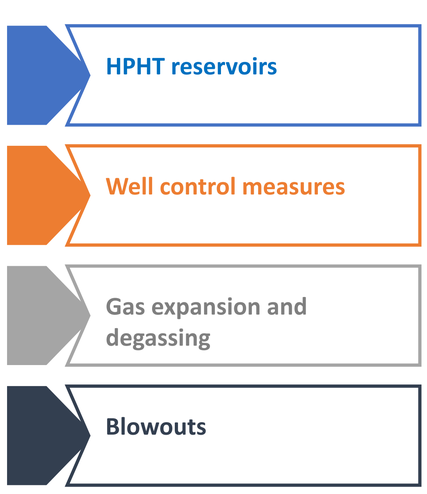
Notable offshore well blowouts



Impacts



Introduction



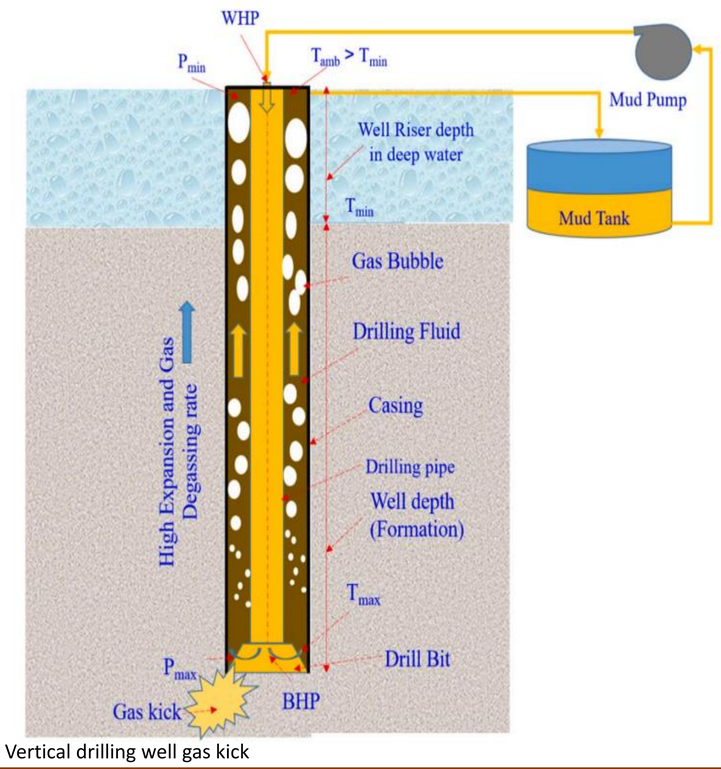
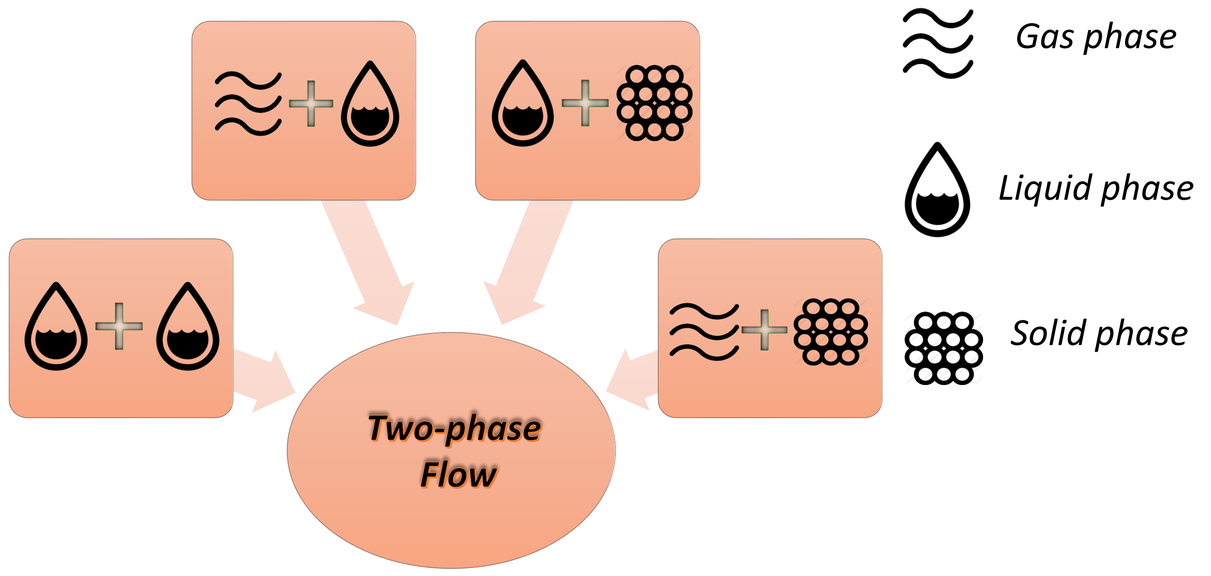


Figure 1: Vertical drilling well gas kick

Multiphase flow types



Multiphase flow regimes

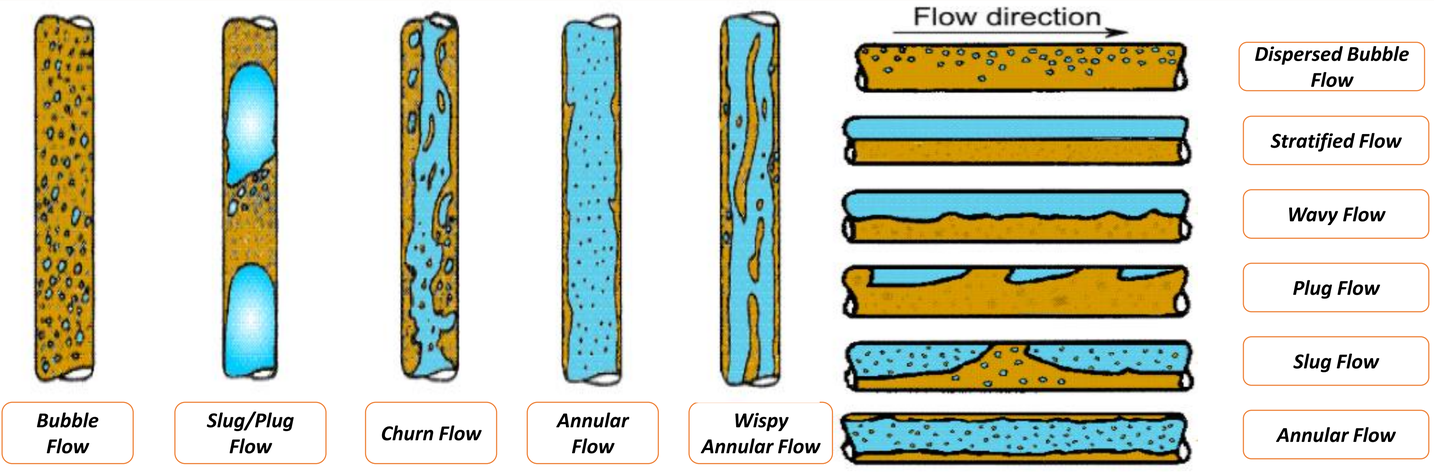


Figure 2: Flow regimes in vertical and horizontal multiphase flow

Experimental setup

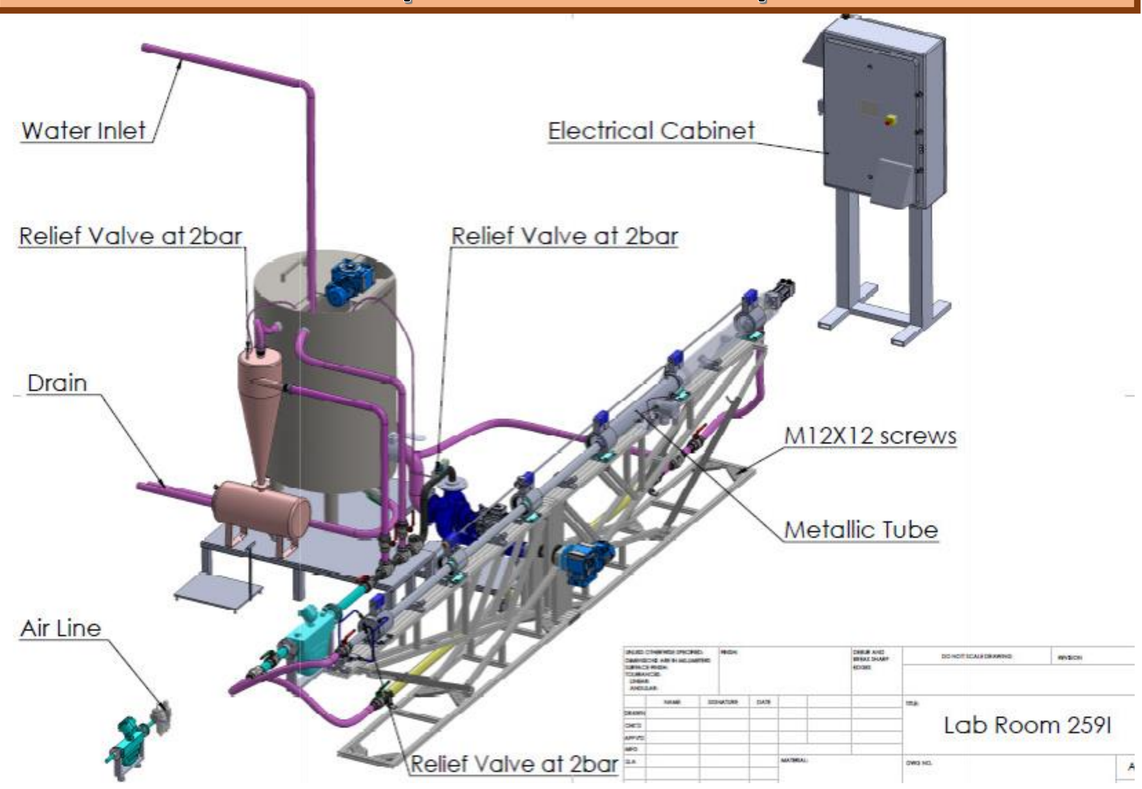


Figure 3: Flow loop system at Texas A&M Qatar

Results

Figure 4: Repeatability test

Figure 5: Experimental Pressure drop vs Reynolds number

Figure 6: Pressure drop at different angles

Figure 7: Pressure drop at different gas flow rate

Acknowledgment

This research was made possible by Graduate Sponsorship Research Award (GSRA) from Qatar National Research Fund (a member of Qatar Foundation) [GSRA7-2-0427-20027]. This publication was also jointly supported by International Research Collaboration Co Fund Grant [IRCC-2019-012], Qatar University and Texas A&M University at Qatar. The findings achieved herein are solely the responsibility of the authors.

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