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# An Improved Predictive Tool for Liquid Loading in a Gas Well

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## Abstract

As the search for natural gas becomes increasingly high due to its high demand worldwide, the oil and gas industry is faced with the challenge of liquid loading in gas or condensate wells. It is imperative to properly design and predict the operational parameters necessary for handling flow assurance challenges due to simultaneous flow of gas with liquid. The model of Guo et al is the most recent systematic approach for predicting liquid loading in gas well. However, it did not account for the accumulation and kinetic terms in the momentum energy equation used to estimate bottom-hole pressure in a gas/oil/water/solid four phase flowing well. The two neglected terms in Guo et al formulation have significant effects on the gas well operational parameters such as the minimum gas flow rate for preventing liquid loading.

This paper presents an improved model that describes a systematic approach for estimating liquid loading in a gas well without neglecting any term in the fundamental momentum equation. The results obtained showed that at the early production time where initial transience at the onset of flow is experienced, the critical gas flow rate obtained from the new model is lower than that predicted from Guo et al model due to inclusion of accumulation term while at the later production time, the critical gas flow rate obtained becomes higher than that predicted from Guo et al model and increases as the transient period elapses. Results further show that at some point during production, the minimum energy required to lift liquids out of the wellbore is more than that required at the earlier stage of production. The new model is reasonable, reliable and better when compare with Turner et al and Guo et al models. It is useful for operators to refine their procedures and better manage the risk of liquid loading during natural gas production.

## Introduction

Liquid loading is refers to as the inability of a gas well to remove liquids which are produced along with gas from a wellbore. This phenomenon is activated when the produced gas has lost its capacity to carry up the co-produced fluids up the wellbore (Coleman et al, 1999). A typical gas well produces natural gas and most often it carries either liquid or condensate in the form of mist. The associated liquids accumulate in the production well; hence a