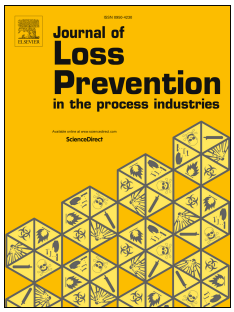
Accepted Manuscript



Monitoring of Down-hole Parameters for Early Kick Detection

Nayeem Ayesha, Ramachandran Venkatesan, Faisal Khan

PII: S0950-4230(15)30076-0

DOI: 10.1016/j.jlp.2015.11.025

Reference: JLPP 3084

To appear in: *Journal of Loss Prevention in the Process Industries*

Received Date: 6 July 2015

Accepted Date: 28 November 2015

Please cite this article as: Ayesha, N., Venkatesan, R., Khan, F., Monitoring of Down-hole Parameters for Early Kick Detection, *Journal of Loss Prevention in the Process Industries* (2016), doi: 10.1016/j.jlp.2015.11.025.

Monitoring of Down-hole Parameters for Early Kick Detection

Ayesha Nayeem, Ramachandran Venkatesan, Faisal Khan*
Faculty of Engineering and Applied Science,
Memorial University of Newfoundland, St. John's, NL, A1B 3X5, Canada

*Correspondance author: Email: fikhan@mun.ca; Phone: + 1 709 864 8939

Abstract

Kick or influx poses a serious risk to the safety of the wellbore. Early detection of fluid influx from formation is crucial to minimize the possibility of a blowout occurrence. There is a high probability of delay in kick detection, when using an exclusively surface-based kick detection system. Down-hole monitoring techniques have a potential to detect a kick at its early stage. Down-hole monitoring would be particularly beneficial when the influx occurs as a result of a lost circulation scenario.

This paper presents am experimental study to investigate the occurrence of a kick based on the mass flow rate, pressure, density, and conductivity of the fluid in the down-hole. Pressure sensors, a Coriolis flow and density meter, and a conductivity sensor are employed to observe deteriorating well conditions in the down-hole. These observations can assess the occurrence of a kick and associated blowout risk. Monitoring of multiple down-hole parameters has the potential to improve the accuracy of interpretation related to kick occurrence, reduce the number of false alarms, and provide a broad picture of down-hole conditions. Moreover, the most sensitive parameters that get affected by the kick are identified. A methodology to detect the kick without false alarms is also reported.

1. Introduction

Oil well drilling is an inherently uncertain process, which is associated with high impact and consequences upon occurrence of an accident. The impacts could be environmental loss, human loss, and monitory loss. Recent experience shows that kick poses the highest risk to the safety of the wellbore. During an underbalanced condition, when a barrier, such as mud or cement, fails to resist the high pressure caused by the formation fluids, it might allow the formation fluid to enter the wellbore. This phenomenon is called kick or influx [1].

When kick occurs, it does not turn into blowout instantaneously. Most often, when influx occurs, it takes some time to evolve into a critical incident such as a blowout. The delay in its detection and controlling process may allow the formation fluids to flow uncontrollably, leading to a blowout incident. The possibility of blowout prevention could be high if the down-hole monitoring is done along with the surface monitoring. This is because, apart from delay, the exclusive surface monitoring has several limitations, including misrepresentation of the down-hole condition due to: mechanical problems, execution issues, wellbore breathing or ballooning,