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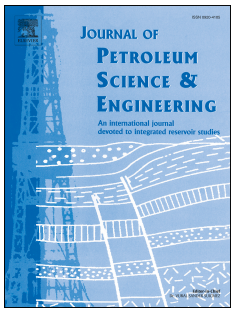

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Estimating Total Discharged Volume in Uncontrolled Oil Wells

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Abstract

This paper presents a practical oil-spill risk assessment method. The basis of this method is constituted by modeling the physical fluid-flow phenomenon from the reservoir to discharge point and accounting for distribution of uncertainties of various independent variables. Our model couples the gas/oil two-phase flow in a wellbore with a reservoir in deepwater settings. Unsteady-state reservoir depletion coupled with changes in flow patterns in the wellbore are implicit in this analytical modeling approach.

We validated the model with various published results related to Gulf of Mexico's Macondo oil spill in a probabilistic frame. Overall, combining the physical model with distributions of uncertain parameters enabled us to depict the risk picture of the uncontrolled wellbore flow events. This approach led to volumetric estimation of the spilled volume. The statistical design of experiments aided in the analysis of the discharged volume range assessed by others in the Macondo case study. The results suggest that good agreement is in hand when compared with the previous deterministic solutions.

1. Introduction

The current regulation in the Gulf of Mexico drilling environment requires that operators report a single value for the worst-case discharge (WCD) based on the highest daily flow rate. We note that the single value of WCD may not necessarily help manage the risk of an uncontrolled well discharge event and the subsequent impact on marine environment. That is simply because a large number of unknowns make any such assessment a daunting task.

Advances in technology have encouraged operators to exploit harshest exploration environments, including ultra-deepwater and HP/HT reservoirs. Despite the implementation of multiple sophisticated safety barriers, well blowout, the most undesirable event, still occurs as Macondo and Montara incidents show. The precipitous decline in oil price over the last few years

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