Xiaohui Wang, J Pet Environ Biotechnol 2018, Volume 9
DOI: 10.4172/2157-7463-C2-042

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New risk assessment method of gas influx based on fifteen example wells

Gas cut risk assessment is the premise of well control schemes; the evaluation method used is the key technology in the risk assessment process, which directly affects the final effect of well control. In this paper, a gas invasion risk assessment system based on analytic hierarchy process (AHP) and hidden Markov model (HMM) is studied and the feasibility of the system is verified using fifteen actual wells. Firstly, this research starts from the interval judgment matrix and approximates the interval judgment matrix to the general digital judgment matrix. Then it forms an AHP with automatic correction judgment matrix and obtains the approximate weight of each element. Thus, a gas trapping evaluation system based on HMM was established. Real-time dynamic risk assessment was carried out with HMM and its results were compared with the results of AHP. The experimental results show that the method of general digital judgment matrix can be used to solve the problem that the traditional AHP method often results in inconsistency in the measurement of multi-factor weight and improves the accuracy and trust worthiness of the evaluation results. Through the collection of real-time data in the drilling process, the HMM method is used to calculate the risk situation of each node and the monitoring signal data is updated in real time; then the original data is provided for the implementation evaluation system based on the HMM method. Combined with the AHP evaluation results, the degree of the risk can be described more accurately, thus having higher assessment accuracy. The real-time risk assessment method based on HMM and AHP proposed in this research can solve the above problems effectively, thus reducing the harm of gas invasion and save the drilling cost.

Recent Publications

1. Yin H, Liu P and Li Q (2015) A new approach to risk control of gas kick in high-pressure sour gas wells. Journal of Natural Gas Science & Engineering 26:142–148.
2. Chen P and Ma T (2014) Research status of early monitoring technology for deep water drilling overflow. J. Acta Petrolei Sinica 35(3):602–612.
3. Hauge E, Aamo O M and Godhavn J M (2013) A novel model-based scheme for kick and loss mitigation during drilling. Journal of Process Control 23(4):463–472.
4. Mcconnell D R, Zhang Z and Boswell R (2012) Review of progress in evaluating gas hydrate drilling hazards. Marine and Petroleum Geology 34(1):209–223.
5. Alhuthali A H, Datta Gupta A and Yuen B (2010) Optimizing smart well controls under geologic uncertainty. Journal of Petroleum Science & Engineering 73(1–2):107–121.

Biography

Xiaohui Wang has her expertise in evaluation and passion in improving the risk assessment in deep water drilling. Her open and contextual evaluation model based on hidden Markov model creates new pathways for improving accuracy of gas cut evaluation. She has built this model after years of experience in research, evaluation and administration in educational institutions.

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