

Risk assessment in gas and oil pipelines based on the fuzzy Bow-tie technique

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Abstract

Introduction: Nowadays, gas and oil account for 60 percent of world energy resources. Transporting crude oil and its products are accomplished through a number of ways among which pipelines are of the utmost significance. Considering the extent of pipelines in installation and residential areas and also high potential for damage, the safety of these pipes and application of risk management principles have undeniable importance. Bow-tie risk assessment method is one of the ways to determine safety level. The tool is a qualitative and semi-quantitative method the data of which are implemented by specialists and experts via conducting surveys.

Material and Method: In the present study, Bow-tie technique was employed having been combined with fuzzy logic in which Likert Scale was applied to quantify the qualitative (verbal) data to reduce the uncertainty of risk evaluation of Amaak No.10 gas pipeline and Bongestan No.12 petroleum pipeline. In this way, factors affecting the pipeline safety were at first, recognized through the checklists. Then, the risk evaluation of pipelines was conducted using the mentioned method.

Result: The results of the study showed that third party damages, initial defects in materials, and constructing pipeline with failure possibility of 0.0484 stood at the highest in terms of importance (equivalent to 12.32%) in destroying oil and gas pipelines. In addition, the toxic impacts and environmental damages with occurrence possibility of 0.00327 were the most striking consequences of gas and oil leakage based on event tree analysis.

Conclusion: Considering the recognized factors leading to destruction of pipelines and their most notable outcomes, instructions on how to control and reduce the potential consequences were suggested, with emphasis on the removal of the most probable causes.

Keywords: Gas and Oil Pipelines Safety, Fuzzy Bow-Tie, Fault Tree, Event Tree, Instructions on Reducing Consequences

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