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Adapted Fuzzy Fault Tree Analysis for Oil Storage Tanks Fire

Younes Halloul[1], **Samia Chiban**[1] and **Adel Awad**[2]
[1]Higher Institute of Environmental Research (HIER), Tishreen University, Lattakia, Syria
[2]Tishreen University, Syria

In this paper, various potential causes of the crude oil tank fire and explosion (COTFE) are identified with fault tree qualitative analysis technique. Syrian company for oil transport (SCOT) is selected as a case study. The fault tree for SCOT yields 154 minimum cut sets (MCSs) for just 30 basic events (BEs) leading to fire accidents. The occurrence probability of COTFE is determined according to adapted fuzzy set theory to summarize the communal evaluation of five experts in SCOT for BEs occurrence probability. The proposed method is called the extended average method and it excludes the singular opinion, if it exists, that does not fall in a domain determined by the other experts' opinions after presenting these opinions as trapezoidal fuzzy numbers. This method is compared with aggregation method used by Wang et al. 2013. It gave the probability of occurrence for COTFE in Hunan oil depot in China as 4.514*10-2. This result is very close to the probability value of 4.648*10-2 found in Wang et al. 2013. In SCOT, the value of fire probability was found 3.25*10-2 and this value is lower than the average value of COTFE worldwide (4.3*10-2) reported in Shi et al. 2014. According to the Fussell-Vesely importance measure, BEs are arranged basing on their contribution in COTFE. The MCSs are also arranged respecting their importance in fire accidents. In the end, fuzzy analysis of fault tree of COFTE gives valuable information that assist in setting priorities in improving safety procedures.

Recent Publications

1. Chettouh S, Hamzi R and Benaroua K (2016) Examination of fire and related accidents in Skikda oil refinery for the period 2002-2013. Journal of Loss Prevention in the Process Industries. 41:186-193.
2. Dongyin W and Zhen C (2016) Quantitative risk assessment of fire accidents of large-scale oil tanks triggered by lightning. Engineering Failure Analysis. 63:172-181.
3. Shi L Shuai J and Xu K (2014) Fuzzy fault tree assessment based on improved AHP for fire and explosion accidents for steel oil storage tanks. Journal of Hazardous Materials. 278C:529-538.
4. Wang D, Zhang P and Chen (2013) Fuzzy fault tree analysis for fire and explosion of crude oil tanks. Journal of Loss Prevention in the Process Industries. 26(6):1-9.
5. Wang H et al. (2017) A novel method of fuzzy fault tree analysis combined with VB program to identify and assess the risk of coal dust explosions. PLoS ONE. 12(8):e0182453.
6. Oyedeji E.A ,Alake A.S ,Abuhulimen B.A(2016) – Gas leak Detection systems in pipelines

Biography

Younes Halloul obtained his Bsc in Petroleum Engineering from Al Baath university-Syria in 2012. He is currently studying the master of environmental systems engineering at the HIER at Tishreen University. In the same time, He is a shift manager in operation department at the Syrian Company of Oil Transport SCOT since 2014. He has almost finished his master thesis about fuzzy fault tree analysis of crude oil tanks fire and explosions as cleared in the abstract. The subject of master thesis falls in inter-disciplinary field: Petroleum engineering, Safety, Environmental science and fuzzy logic.

younes.halloul1989@gmail.com