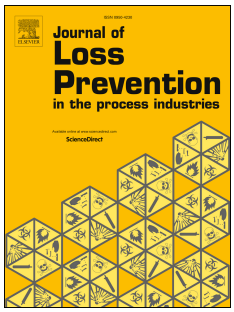
Accepted Manuscript



Risk assessment of process system considering dependencies

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PII: S0950-4230(18)30347-4

DOI: 10.1016/j.jlp.2018.06.014

Reference: JLPP 3725

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

Received Date: 6 April 2018

Revised Date: 21 June 2018

Accepted Date: 21 June 2018

Please cite this article as: Guo, C., Khan, F., Imtiaz, S., Risk assessment of process system considering dependencies, *Journal of Loss Prevention in the Process Industries* (2018), doi: 10.1016/j.jlp.2018.06.014.

Risk assessment of process system considering dependencies

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Abstract

Risk assessment is conducted in process systems to identify potential accident scenarios and estimate their likelihood and associated consequences. The bow-tie (BT) technique is most frequently used to conduct the risk assessment. It is a simple, comprehensive and straightforward technique; however, it considers independence among the causation factors (initiating events) of an accident scenario and the safety barriers in place to minimize the impact of the accident scenario. This is a serious limitation and can lead to erroneous results. This paper presents a simple yet robust approach to revise the Bow-tie technique considering interdependence. It employs copula functions to model the joint probability distributions of causations in the BT model of the accident scenario. This paper also analyzes the impact of dependence on two common logic gates used to represent the potential accident scenario. The probability of a potential accident scenario in a hexane distillation unit using both the traditional BT technique and the revised approach is compared. Results confirm that the revised approach is reliable and robust.

Key words: Risk assessment; Bow-tie model; Dependence; Copula function, operational risk

1. Introduction

In chemical process industries, it is very likely for accident scenarios to occur. If safety and protection systems fail to function, these scenarios will likely escalate into catastrophic events. Therefore, it is essential to analyze the risks of existing process systems to increase awareness of accident probabilities and their possible consequences.