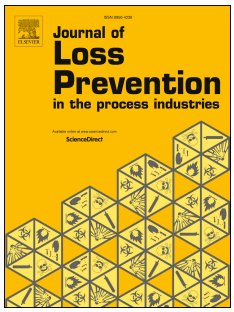
Accepted Manuscript



Exploring inherent process safety indicators and approaches for their estimation: A systematic review

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PII: S0950-4230(17)31125-7

DOI: 10.1016/j.jlp.2018.01.013

Reference: JLPP 3651

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

Received Date: 24 December 2017

Revised Date: 25 January 2018

Accepted Date: 26 January 2018

Please cite this article as: Jafari, M.J., Mohammadi, H., Reniers, G., Pouyakian, M., Nourai, F., Torabi, S.A., Rafiei Miandashti, M., Exploring inherent process safety indicators and approaches for their estimation: A systematic review, *Journal of Loss Prevention in the Process Industries* (2018), doi: 10.1016/j.jlp.2018.01.013.

Exploring inherent process safety indicators and approaches for their estimation: a systematic review

Abstract

The index-based approach is one of the most popular ways to measure the inherent safety degree of a chemical route or process during the early design stages. One of the main shortcomings of current indices is the limited set of aspects which are considered and are influencing inherent safety. In addition, the minimal knowledge of process designers regarding inherent safety hazards can exacerbate this problem. In this study, we identify the inherent safety indicators (within the period 1990-2017) used to measure the inherent safety degree of a process, and describe existing approaches to estimate these indicators. Bibliographic sites, including the Web of Science, ScienceDirect, Springer, ACS publications and Online Library, were searched based on various search strategies. A total of 62 resources were selected, and 35 indicators were found that were classified into six categories: (i) the 'chemical and physical properties of a chemical substance (11 indicators); (ii) the 'process conditions' (5 indicators); (iii) the 'equipment' (5 indicators); (iv) the 'reaction/decomposition properties' (3 indicators); (v) the 'activities and operations characteristics' (4 indicators); and (vi) the 'consequences' (7 indicators). We also found six estimation approaches, including the relative rating, an advanced mathematical approach (statistical, numerical descriptive and fuzziness), the risk-based, graphical, equational (or formula) based approach and the hybrid approach. This study can provide a quick guide for non-experienced researchers being enthusiast to work on inherent safety measurements using an index-based approach.

Key words: inherent safety, measurement, index-based, indicators, process