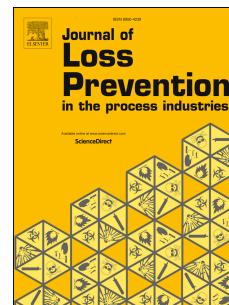# Accepted Manuscript

Quantitative assessment of resilience safety culture using principal components analysis and numerical taxonomy: A case study in a petrochemical plant

Gh.A. Shirali, M. Shekari, K.A. Angali

Please cite this article as: Shirali, G.A., Shekari, M., Angali, K.A., Quantitative assessment of resilience safety culture using principal components analysis and numerical taxonomy: A case study in a petrochemical plant, *Journal of Loss Prevention in the Process Industries* (2016), doi: 10.1016/j.jlp.2016.01.007.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Quantitative assessment of resilience safety culture using principal components analysis and numerical taxonomy: A case study in a petrochemical plant

Gh.A. Shirali[a,] , M. Shekari[a] , K.A. Angali[b]

[a] *Department of Occupational Health Engineering, School of Public Health, Ahvaz Jundishapur University of Medical Sciences, P.O. Box: 61355-131, Iran.* Tel: +98 6133738269; fax: +98 6133738282. Shirali@ajums.ac.ir
[b] Department of Biostatistics and Epidemiology, School of Public Health, Ahvaz Jundishapur University of Medical Sciences.

Abstract:

Over the last decades, some major accidents have occurred in highly reliable industries such as petrochemical plants. Probably, sophisticated safety management systems and a high level safety culture have contributed to decreasing the number of usual accidents, but these classical approaches may not have been sufficient to prevent the occurrence of extraordinary incidents and accidents. Consequently, there is a need for new approaches like resilience engineering to promote the safety of these systems. In this light, and to use safety culture more efficiently in ultra-safe systems, a new concept as "resilience safety culture" has been proposed. However, due to the paucity of studies and their qualitative nature, there is now more interest in using numerical methods to quantitatively evaluate the resilience safety culture of a system. This research, however, aimed at a quantitative assessment of resilience safety culture of a petrochemical plant using a questionnaire and was based on the two approaches of principal components analysis (PCA) and numerical taxonomy (NT). Accordingly, a questionnaire including 59 questions about several aspects of the safety culture and resilience engineering was designed and distributed to 354 randomly selected employees of 12 units in a petrochemical plant. The results of exploratory factor analysis of the data extracted thirteen factors which represent the resilience safety culture. The analysis also led to the determination of the score of resilience safety culture and its weakness in the petrochemical units. Implementing the proposed approach would enable the policy makers and managers in petrochemical industries to identify current weaknesses and challenges regarding the resilience safety culture in their system.

Keywords: safety culture, resilience safety culture, resilience engineering, PCA, NT