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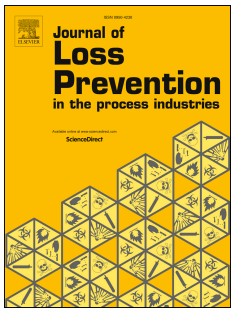

Safety of atmospheric industrial tanks: Fragility, resilience and recovery functions

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PII: S0950-4230(17)30531-4

DOI: 10.1016/j.jlp.2017.06.007

Reference: JLPP 3535

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

Received Date: 2 April 2017

Revised Date: 29 May 2017

Accepted Date: 8 June 2017

Please cite this article as: Mebarki, A., Safety of atmospheric industrial tanks: Fragility, resilience and recovery functions, *Journal of Loss Prevention in the Process Industries* (2017), doi: 10.1016/j.jlp.2017.06.007.

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ACCEPTED MANUSCRIPT

Safety of atmospheric industrial tanks: fragility, resilience and recovery functions

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ABSTRACT:

Resilience of industrial plants is addressed in the case of cylindrical metal tanks. They are considered as demonstrators in order to write explicitly and analytically their bearing ~~carrying~~ capacity drops, their recovery functions by plastic adaptation and their resilience. For illustrative purposes, their behavior and the damages are investigated in the case of lateral loading that corresponds to tsunamis, floods or blasts effects.

These key parameters are addressed in order to study the effects of internal interaction between the components of the system, i.e. along the critical cross-sections, and also the interaction at the frontiers, i.e. the influence of the limit conditions.

For the case studies, the sub-domain for resilience is then studied and represented in the operation space "Hazard – Damage – Resilience". It is shown that the ~~inner~~ internal interaction and outer interactions have great influence on the resilience and capacity for recovery.

Furthermore, conventional basins of attraction and attractors concepts are also adopted in order to provide illustrative representation of the capacity to return or not to resilient state for given values of the damages, for each of the limit conditions, i.e. depending on the inner/outer interactions.

Keywords: Damages; Industrial risk; Metal tank; Recovery function; Reliability; Resilience

1. Introduction

Nowadays, there is a clear trend towards resilience-driven design and analysis not only in engineering sciences, but also in other disciplines to support decision-making processes ~~in each discipline as decision support~~. Numerous projects at national, regional and international levels are devoting more and more resources ~~importance~~ to quantitative resilience when it comes to study risks, vulnerability and post-disaster recovery not only at the physical systems level but also at wider scales: urban, regional, national and international.

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