**IMPLEMENTATION OF SYSTEMS THEORETIC EARLY CONCEPT ANALYSIS (STECA) IN LARGE HYDROCARBON FUEL TANKS**

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**ABSTRACT**

Fuel storage depots or tank farms are sites where hydrocarbon fuel storage tank operations occur and usually located in the open side of the plant installation. Tank farms contain large liquid tanks mainly used in oil and gas industry for the storing of both different types of fuels and raw materials in confined areas. Fixed or cone roof, open top floating roof and fixed roof tanks with internal floating roof are constituted the three main types for storing flammable or combustible hydrocarbon fuels, according to the Institution of Chemical Engineers (IChemE).

Significant accidents (e.g. fires and explosions) in tank farms have been reported in the past decades and recently at different geographic locations in the world, for instance, Buncefield disaster in the UK (2005), Caribbean Petroleum Refining accident in Puerto Rico (2009) and Tehran oil refinery accident in Iran (2021), among others. These and other similar accidents indicate not only the large-scale of disaster in the facilities, surroundings and environment, but also emphasize the necessity to avoid or mitigate the risk for similar accidents, by using improved and new risk assessment methods (Argyropoulos et al. 2012, Nivolianitou et al. 2012).

The purpose of this study is to introduce and implement a systematic analysis approach for the early stages of safety processes in large hydrocarbon fuel tanks, known as Systems Theoretic Early Concept Analysis (STECA), the method is based on the STAMP (Systems Theoretic Accident Model and Process) accident causation model (Leveson, 2004). STAMP considers safety as emergent property and therefore every tool based on STAMP, including STECA, considers each system as a whole. The STECA is currently being utilised in the aviation industry (Urano, 2016) and emergency plans (Kafoutis and Dokas, 2021) for the identification of loopholes.

Results are presented and discussed, and it is concluded that the present systematic analysis method helps to identify the missing information that the procedures should have or safeguards that should be established in order to avoid major accidents, to improve safety measures and to assist the analysis in these aspects.

**KEYWORDS:** hazard assessment, process safety, STAMP, STECA, Risk Management

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