**SAFETY OPTIMIZATION OF THE SPATIAL CONFIGURATION OF BUILDINGS IN REFINERIES**

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**ABSTRACT**The purpose of this study was the development of a methodology for dynamic optimization of the spatial configuration of the building infrastructure in oil refineries applying quantitative risk assessment (QRA) principles. The developed method focused on fatal effects from possible accidents in production and storage units according to API 752. In brief, QRA is used as a bridge to quantify the risk and apply API 752 standards as guide towards plant design optimization when retrofitting is at hand. The assessment methodology includes the classification of the buildings of interest according to API 752, the identification of accident scenarios that may affect these buildings, the identification of the relevant equipment, the consequences and risk assessment of the selected scenarios, the individual and social risk assessment within the buildings, the selection of the appropriate assumptions for the risk assessment and the identification of security enhancement measures. This enhancement is of outmost importance due to its impact on the budget that is required for the implementation of the measures. We have applied this integrative approach to study the safety optimization in a typical large-scale European refinery by re-designing the spatial configuration of the administrative and worker buildings on site. The examined scenarios considered catastrophic rupture of the unit or the escape of the vessel’s content in 10 minutes and applied in all columns, vessels, and containers with a capacity of more than 5 m3 in the refinery. For pressurized storage tanks, in addition to the above, scenarios for leakages and failures of the connected pipelines have been examined. Furthermore, liquid content pipelines were examined for pool fire accidents while NG-LPG-Propane pipes were simulated for catastrophic failures and a hole equal to 20% of pipes diameter, as the Bevi Risk Assessment Manual (RIVM, Netherlands) suggests. Overall, our dynamic optimization methodology for plant and process safety by design has been found efficient as a means to ensure inherent safety in plant retrofits or new designs by integrating traditional quantitative risk assessment at the process level with optimization algorithms fed with acceptable risk criteria and spatial optimization of buildings in complex plant configurations such as large-scale oil refineries.

**Keywords**: QRA, PLL, risk assessment, spatial configuration, social and individual risk