

Risk assessment and consequence modeling of BLEVE explosion wave phenomenon of LPG spherical tank in a refinery

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Abstract

Introduction: Although human industrial activities are as a part of efforts to achieve greater prosperity, the risks related to these activities are also expanding. Hazard identification and risk assessment in the oil and gas industries are essential to reduce the frequency and severity of accidents and minimize damage to people and property before their occurrence. The aim of this study was to evaluate the liquefied and pressurized petroleum gas spherical tanks in a refinery and assessing the risks of Boiling Liquid Expanding Vapor Explosion (BLEVE) phenomenon.

Material and Method: In this study, the risks of BLEVE phenomenon were assessed, using the Bowtie method. The consequences of explosion wave phenomenon and the resulting wave quantity and its impacts on the neighboring machineries and equipment were analyzed. PHAST software version 6.54 has been used for modeling the BLEVE phenomenon.

Result: In this evaluation, generally five causes and two consequences were identified for BLEVE phenomenon. In order to reduce its consequences, forty-three controlling measures were introduced to prevent the BLEVE phenomenon and the impacts of 31 control measures were identified. According to the conducted analysis, it was found that the spherical tank blast wave caused by LPG can lead to explosion of close located tanks which can create a chain of explosions.

Conclusion: The results of modeling and risk assessment can be used to identify the BLEVE phenomenon causes and its effects on nearby people and equipment. Based on these results, preventive controlling measures can be implemented and also be determined by adopting proper design and layout, margin of safety for personnel, equipment and accessories.

Key words: Risk Assessment, Modeling, Spherical Tank, BLEVE, Bowtie

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