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An integrated holistic approach to health and safety in confined spaces

Lucia Botti, Vincenzo Duraccio, Maria Grazia Gnoni, Cristina Mora

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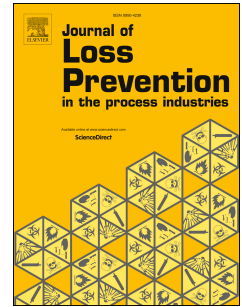
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Abstract

Confined space work is a high-risk activity, posing a significant hazard for both workers and rescuers involved in the emergency response. Risks due to working in confined spaces can be extremely dangerous. The leading cause of accidents and fatalities in confined spaces is atmospheric condition. Further common causes are fire, explosion, ignition of flammable contaminants, spontaneous combustion and contact with temperature extremes. Although confined space work is a high-risk activity, few studies have been oriented aiming to define structured procedures or comprehensive tools to identify and manage the risks of work in confined space. An organized and reliable methodology to assess and control risks associated with working in confined spaces in the process industry is missing. The aim of this paper is to propose a structured procedure for analyzing and managing risks in confined spaces in the process industry. After a first literature review on the topic and an historical analysis on accidents in confined spaces, the authors conceptualize a framework to prevent and manage the risks from working in confined spaces. The tool collects the concepts and requirements from the fragmented regulations on safe work in confined spaces, aiming to support both the assessment and the risk management. Two test cases show the application of the proposed framework showing an ex-post analysis carried out on a real accident occurred during a task execution in a confined space and an ex-ante assessment for risk prevention.

Keywords: Confined space; risk assessment; risk management; safety procedure; industrial safety; job hazard analysis.

1 Introduction

Every year, confined space work causes fatal accidents and injuries, despite the in force regulatory and standards on such activity. Confined spaces are defined as limited or restricted areas not designed for continuous occupancy where employees enter and perform a specific task. Examples of confined spaces include, but are not limited to tanks, vessels, silos and pipelines. The high risk of confined space work can lead to extremely dangerous situations. Several publications, reports and recent news describe the impact of such risks on workers' safety and health, showing high accident rates and multiple-fatality incidents (Burllet-Vienney, Chinniah, Bahloul, & Roberge, 2015a; NIOSH, 1994; OSHA, 2017; Sahli & Armstrong, 1992; Wilson & Madison, 2008). Common causes of accident in confined spaces are fire, explosion, spontaneous combustion and contact with high temperature extremes (Botti, Ferrari, & Mora, 2017a; Riaz, Arslan, Kiani, & Azhar, 2014). As an example, in case

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