

Development of Screening Methodology for Natural Hazard Characterization and Vulnerability Assessment of Exposed Industrial Installations (English Presentation)

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INTRODUCTION

Natural hazards have always represented a threat to society. The total number of reported natural disasters has consistently increased over the past century with a proliferation in the number of affected people and economic losses [1,2]. Natural hazard consequences can be aggravated when they impact industrial facilities handling hazardous materials (hazmat). When this happens energy or hazmats can be released into the atmosphere in the form of fires, explosions, and the toxic gases. These technological “secondary effects” caused by natural hazards are known as “Natech” accidents [3]. Some examples include fires at a refinery during the Kocaeli earthquake in Turkey in 1999 [4], chlorine gas release during the summer floods in the Czech Republic in 2002 [5], and multiple fires and explosions at oil refineries following the Great East Japan Earthquake and Tsunami [6]. The consequences of these events demonstrated that a conjoint natural and technological accident represents a complex scenario that requires special risk management and risk governance arrangements [7, 8].

Growing efforts are aiming at proposing alternatives to better assess and manage Natech risks. However, this requires the strengthening of proactive initiatives in order to effectively address Natech risk. In this sense, screening methodologies can serve as a tool to support the initial stages of risk assessment by simplifying the characterization of natural hazards on industrial facilities’ territory. To the best of our knowledge, the availability of such tools in the Natech context is inexistent. Thus, this study proposes a simplified

screening methodology for natural hazard characterization and vulnerability assessment of exposed industrial installations.

NATURAL HAZARD CHARACTERIZATION

Natural hazards must be characterized in order to determine their ability to cause harm, overwhelm the capacity of industrial and public emergency-response systems [3], and their potential to affect business continuity. Bearing this in mind and aiming to contribute on properly dealing with the above-mentioned effects, a large body of research and tools have been proposed; along with data collection on historical natural events impacts. Despite these advancements, simplified mechanisms for natural phenomena identification and characterization are still needed in the context of Natech risk assessment, given the complexity of these scenarios. In this sense, screening methodologies can serve as a suitable option.

Screening methodologies have been used as a tool for rapid identification of hazards and to facilitate the decision-making process. These tools have been applied in a variety of contexts such as health, energy, risk management, and natural hazards impacts implications, to name a few. Examples to the latter case include the Climate and Disaster Risk Screening Tools developed by the World Bank aiming to support the risk assessment of climate change and geophysical disasters into priority sectors, by determining hazard exposure at a national level. This considers institutions’ readiness to address potential impacts. However, the tool does not address chemical spills. Another example is the

Climate Resilience Screening Index (CRSI) proposed by the United States Environmental Protection Agency, useful for characterizing county and community resilience to natural hazards by considering different domains in existing socio-ecological systems' conditions. This tool does consider exposure to technological hazards. However, the former examples are not explicitly focused on industrial installations' vulnerability to natural hazards. We attempt to contribute on filling this gap, by proposing a screening methodology intended for rapid characterization of natural hazards in the territory and determine their potential structural impact on the industrial installation.

A SCREENING METHODOLOGY FOR NATURAL HAZARD CHARACTERIZATION OF EXPOSED INDUSTRIAL INSTALLATIONS

The screening methodology proposed is targeting industrial facilities in areas prone to earthquakes, floods, landslides, storm surge, and tsunamis. These methodologies consider key factors that can help a risk analyst to determine if the facility is located in a hazardous area and if further analyses are required to estimate a level of risk, and if preparedness, mitigation or control measures should be implemented. The methodology suggests the use of hazard maps (when available) or alternative ways to identify the potential occurrence of a natural event in the industrial facility's territory. It then considers if hazmats are handled or stored and if a threshold value is surpassed. If that is the case, Natech risk management is required. In addition, the methodology also suggests the analyst to determine the potential effects of the natural hazard on a) the infrastructure and b) the most vulnerable process equipment. Therefore, the methodology proposed supports the decision maker regarding the need for detailed Natech risk assessment and management. Figure 1 shows an example of the screening methodology for earthquake hazard characterization and vulnerability assessment.

CONCLUSIONS

This study proposes a simplified screening methodology, aiming at supporting the characterization of the natural hazard in territories where industrial facilities are exposed to different kinds of natural hazards. By considering the potential effects of the natural event on the facility's infrastructure it also supports the vulnerability assessment.

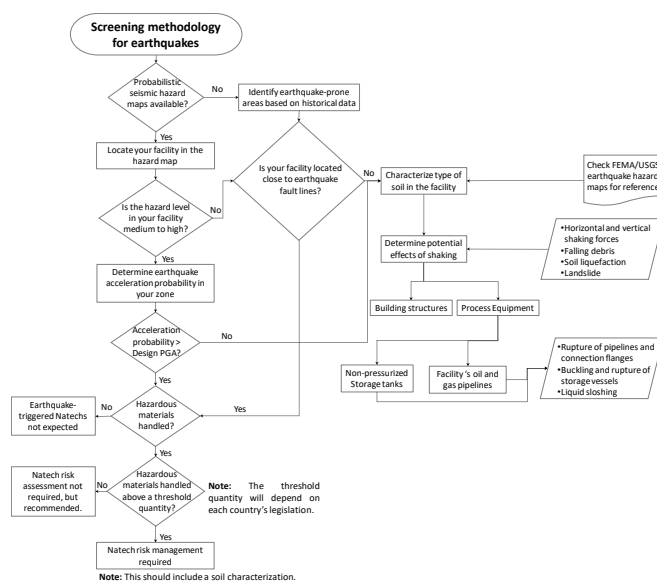


Figure 1. Screening methodology for potential earthquake-trigger Natech scenarios

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