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Multi-plant emergency response for tackling major accidents in chemical industrial areas

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ABSTRACT

Emergency response planning for major accidents in the chemical industry is essential to protect the public and workers' health and safety, to reduce the environmental impacts, and to accelerate the resumption of normal operations. So far, much attention has been given to developing and implementing emergency planning in single chemical plants. However in chemical industrial areas – also known as chemical clusters – which consist of a number of different plants, less attention has been given to multi-plant emergency response planning. This paper is aimed at developing a multi-plant emergency response decision tool for chemical clusters in case of major accidents so that not only plant emergency levels but also respective response strategies can be determined. This way, a crisis situation within the chemical cluster can be handled in a much faster way than is the case today.

1. Introduction

Chemical and oil & gas facilities have an undeniable influence on the global economy and play a key role in maintaining and creating our modern day life. Due to some factors such as environmental conditions, social motives and legal requirements, most of the chemical plants are located in clusters (Reniers and Soudan, 2010). The integration and linkage between the activities of companies within industrial areas leads them to be near to each other. Hence, a major accident in the cluster may cause more substantial consequences both inside and outside the premises of the establishment than those of a similar accident in a detached single plant.

During a major accident, toxic gas clouds, overpressure waves and heat radiation effects do not delay to claim their toll. Therefore, emergency planning as mitigation measure plays a key role in reducing the risk of accidents by avoiding fatalities and injuries, protecting the environment and accelerating the resumption of normal operations. Many guidelines have been published to assist the work of emergency responders in handling emergency situations in the chemical industry, such as the Centre for Chemical Process Safety (CCPS, 1995), the U.S Federal Emergency Management Agency (FEMA, 1996), the Oil and Chemical Industries Safety Studies Group in France (GESIP, 2001), UK Health and Safety Executive (HSG191, 2009), the European Union "Seveso-III" directive (Council Directive, 2012), and Incident management system for oil and gas industry (OGP, 2014). These guidelines are mainly based on the lessons learned from past disasters and represent the current knowledge and practices on emergency planning within single chemical plants. Moreover, some researchers have made attempts to address the emergency response planning in case of major accidents from a single-plant perspective (Phong, 1989; Ramabrahmam et al., 1996; Kourniotis et al., 2001; Tseng et al., 2008; Lin et al., 2009; Zhong et al., 2010).

However, in chemical industrial areas, considerably less attention has been given to multi-plant emergency response planning. In these industrial areas, other plants and nearby communities may be affected in addition to the company where the major accident takes place. In 1984, the Community Awareness and Emergency Response (CAER) Code of Responsible Care Management Practices was developed by the Canadian Procedures Association to guide the chemical plants in industrial areas to have effective and mutual response planning. The CAER Code determines "what" must be done for compliance but leaves it to individual companies to decide "how" it should be done based on their own judgment about what constitutes an 'appropriate' response (Prakash, 2000; Howard et al., 1999).

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	Plant A	Plant B	Plant C	Plant D
SCEN-01	Level 1	Level 2	Level 2	Level 1
SCEN-02	Level 3	Level 1	Level 3	Level 2
SCEN-03	Level 1	Level 2	Level 0	Level 1
SCEN-04	Level 2	Level 3	Level 2	Level 0
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….				

Fig. 1. Multi-plant emergency response matrix example (based on Reniers and Faes, 2013).

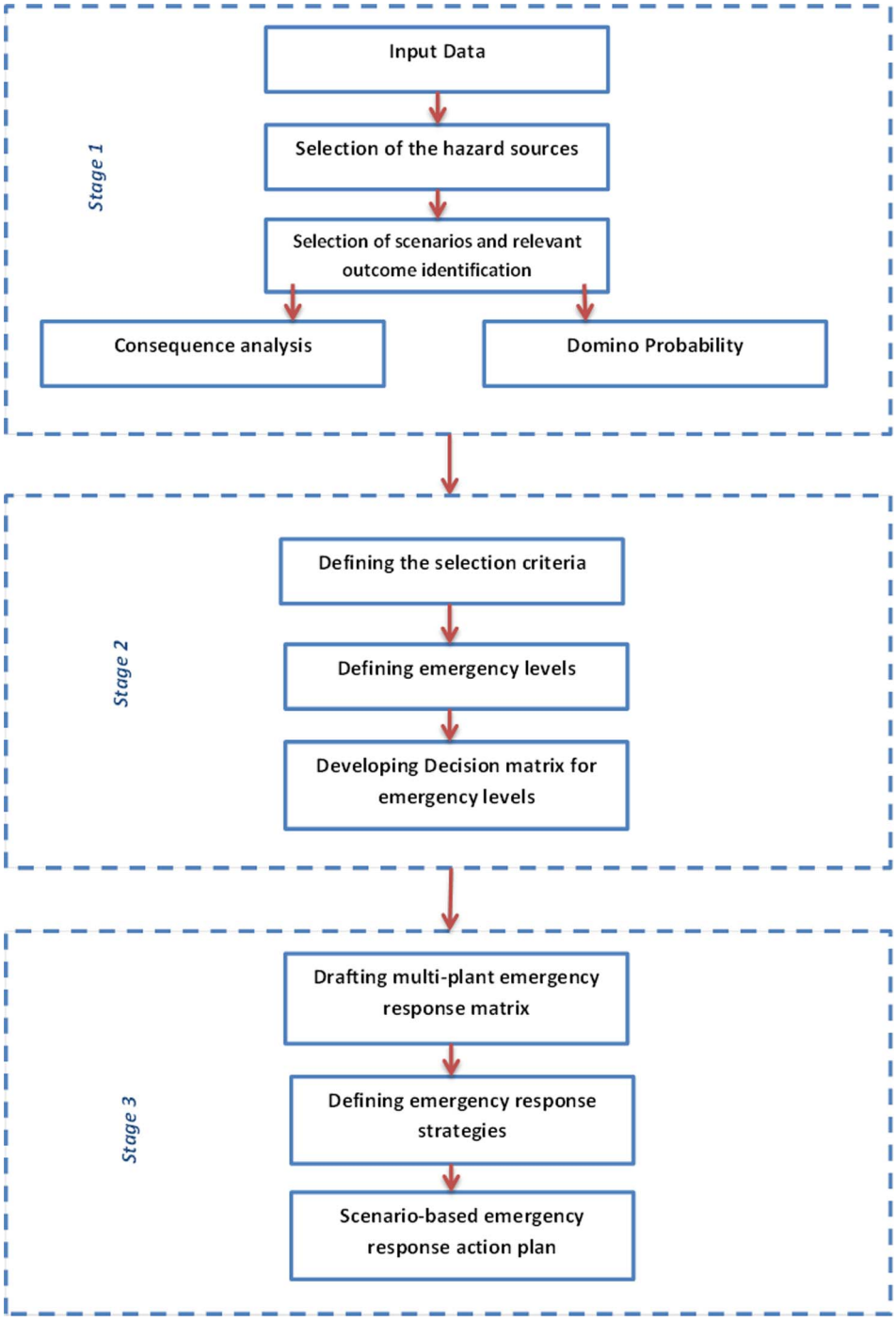

Fig. 2. The developed methodology flow chart.