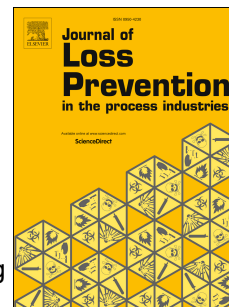


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A system dynamics model for risk perception of lay people in communication regarding risk of chemical incident

Mingguang Zhang^{a*}, Xuedong Wang^a, M. Sam Mannan^b, Chengjiang Qian^a, Jiyang Wang^a

^a*Jiangsu Key Laboratory of Hazardous Chemicals Safety and Control, College of Safety Science and Engineering, Nanjing Tech University, Nanjing, 210009, China*

^b*Mary Kay O'Connor Process Safety Center, Artie McFerrin Department of Chemical Engineering, Texas A&M University System, College Station, Texas 77843-3122, USA*

Abstract: Risk perception plays an important role in risk communication and chemical incident prevention when engaging with different groups of people. Risk perception of lay people emphasizes the individual experience of intuitive judgment and subjective cognition. To study the mechanism of this process on chemical incidents, three causality feedback loops were achieved by analyzing previous studies on this mental process; meanwhile, system dynamics models were constructed. Detailed causal trees of the key state variables (risk perception, risk perspective, risk response, and risk communication) were illustrated and applied to a quantitative simulation using Vensim software. The simulation results reflect the dynamic process of risk perception of lay people, and specific curves of the key state variables were explained to support the rationality of the models. A sensitivity analysis among the state variables and some auxiliary variables were implemented to identify their internal relationships. The proposed methodology quantifies the diversification of psychological activities of risk perception through the simulated data and images, and offers a tool to optimize risk management and the emergency rescue of lay people at risk of a chemical incident.

Keyword: system dynamics model; risk perception; risk communication; chemical incident; lay people

1. Introduction

During the past three decades, chemical industry parks have been developing dramatically throughout China. Although densely distributed facilities and hazardous substances have promoted the productivity of the chemical industry, frequent chemical incidents in these areas have caused numerous losses of lives and property, even severe social panic (Abdolhamidzadeh and Abbasi et al., 2011; Huang and Ban et al., 2013; Sharma et al., 2015). On April 6, 2015, a P-Xylene (PX) project suddenly exploded in the Fujian Gulei Port Chemical Economic Development Zone, which was the second explosion at the same facility in less than 2 years (Zhu, 2015). Such incidents have sharply influenced the public perception of chemical risk. During risk prevention and emergency response, different groups of people (i.e., lay people, experts, and enterprise managers) will communicate to achieve a final decision, through which barriers will occur owing to the gap among their different risk perceptions (Mertz and Slovic et al., 1998; Zhou, 2016).

Risk perception is a mental process based on a risk assessment, which emphasizes the influence of experience from individual intuitive judgment and subjective feeling on human cognition to analyze, control, and manage risk (Renn, 2004; Veland, 2013). The key factor of risk perception is people's ability to deal with risk based on their own cultural background (Kouabenan, 2009). An investigation was carried out in different populations to explore the deviation mechanism of the risk perception gap (Ropeik, 2012). A theoretical framework for risk perception was summarized using a psychometric paradigm and social cognition models (Meng, et al., 2010). The psychological cognitive process can be simply summarized as the input, processing, and output of risk information. Fig.1 shows how people pass through the process of inner psychological activities (Mo, 2005).

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