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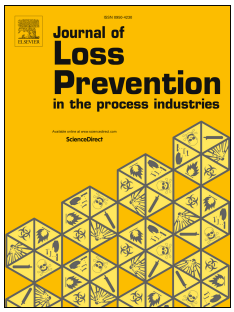

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A quality function deployment-based framework for the risk management of hazardous material transportation process

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Abstract

The risk management of hazardous materials (HazMats) transportation is a systematic process consisting of risk identification, evaluation, and control. A quality function deployment-based framework under fuzzy environment is proposed to effectively regulate the risks and manage the safety of HazMats transportation process. The framework includes three components. A 4D identification system, namely, "H (human) – M (material) – E (environment) – M (management)," for risk factors is constructed in the first stage, and the basic importance rating of each factor is calculated in the second stage. Subsequently, the corresponding risk control measures are proposed, and the correlation between risk factors and control measures are identified. Finally, the improved priority of each risk control measure, which is the benchmark for limited enterprise resource allocation and risk management policy development, is calculated in the third stage. In particular, this study utilizes fuzzy linguistic terms that are then transformed into triangular fuzzy numbers as evaluation tool for facilitating the expression of experts and decreasing information loss by considering the uncertainty and ambiguity of risk evaluation process. In addition, a new comprehensive weighting model is constructed to determine the influence of experts under group decision-making environment. The proposed framework is applied to explain the process of the risk management and loss prevention of a HazMats transportation company in China. Results not only provide certain acceptable recommendations to safety management of HazMat transportation process but also verify the feasibility and validity of the proposed approach.

Keywords: hazardous materials transportation; quality function deployment; risk evaluation; fuzzy group decision-making; safety management

1. Introduction

The production and transportation volume of hazardous materials (HazMats) in social economic activities show a corresponding increasing trend with the rapid development in modern manufacturing and logistics industries. The actual survey data show that approximately 6, 000 kinds of HazMats exist, and more than 2, 000 kinds of commonly used HazMats are transported on roads in China. The US Department of Transportation (US DOT) defines HazMats as any

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