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EVACUATION ROUTE OPTIMIZATION IN CHEMICAL PLANTS BASED ON THE DEPTH FIRST SEARCH ALGORITHM

Ying Liu[1,2], Zuoling You[1], Fa Wang[1], Yunrui Zhang[1], Bo Zhang[1,3*]

[1]*Department of Safety Science & Engineering, China University of Petroleum (East China), Qingdao 266580, P.R. China*
[2]*Dan F. Smith Department of Chemical Engineering, Lamar University, Beaumont, TX, 77710, USA*
[3]*Centre for offshore Engineering and Safety Technology (COEST), China University of Petroleum (East China), Qingdao 266580, P.R. China*

Abstract

Optimal evacuation routes are crucial to protect workers' safety when accidental leakage of toxic gas occurs in chemical plants. However, the majority of route optimization focuses on the transport field and few on the evacuation routing optimization in chemical plants. This paper proposes a dynamic evacuation routing optimization method for chemical plants under toxic gas release scenarios. From the complete accident scenario set (CASS) built with wind fields and leakage sources, the leakage probability can be quantitatively represented. Based on the computational fluid dynamics (CFD) simulation, the consequences of toxic gas dispersion including the time-dependent concentration under different leakage scenarios can be obtained. Subsequently, considering the time-dependent toxic gas concentration and exposure time, the dynamic cumulative individual risk (CIR) can be calculated by applying the dynamic dose-response model (DDR). Then according to the simplified evacuation topology, the Depth First Search (DFS) algorithm is employed to define all evacuation routes connected with arcs. With the objective of minimizing CIR, an evacuation route optimization model is proposed and solved by MATLAB. Results demonstrate that the proposed method can hopefully minimize the CIR in chemical plants when they are facing toxic gas release and poisoning risks.

Key words: complete accident scenario set; computational fluid dynamics; Depth First Search; dynamic dose-response model; evacuation routing optimization

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* Author to whom all correspondence should be addressed: e-mail: zhangbo@upc.edu.cn; Tel: +86-532-86983500-8707; Fax: +86-532-86983300