Individual risk-based layout optimization for chemical process safety

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Most of chemical processes have compact configurations in spite of hazardousness or vulnerability of the equipment due to cost issue. Without securing the appropriate safety distance, however, such layout could cause heavy damage and casualties if an accident occurs as can be seen from the case of refinery explosion in BP, Texas or LPG station explosion in Bucheon. In this study, we propose an MILP formulation for process layout optimization including the safety consideration to deal with this issue. Among various indices or measures for safety and risk, we adopt individual risk (IR) approach to account the direct risk from the process units to nearby humans. IRs of the equipment can be obtained from the frequency and consequence analysis of the process, and then converted to safety distances to be implemented as additional distance constraints in conventional layout optimization problem, which minimizes the cost of process layout. A case study illustrates the proposed method will be presented. With this approach, both the economic feasibility and the inherent safety of target process can be enhanced.