

Optimal Facility Layout under Toxic Release in Process Facilities: A Stochastic Approach

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Abstract

This paper presents a new approach for the optimal facility siting considering the uncertainty of toxic release in one of the installed facilities. The proposed formulation incorporates the effect of wind speed, wind direction and atmospheric stability to calculate the risk of death via probit functions and Monte Carlo simulation. The overall problem is initially modeled as a disjunctive program where the Cartesian coordinates of each new facility for siting and cost-related variables are the main unknowns to determine. Then, the convex hull approach is used to reformulate the problem as a mixed integer nonlinear program (MINLP). The numerical difficulties are shown in a case study where multiple optimal layouts have been found. In general, the numerical results demonstrate the potential of this approach to improve the process layout design activity.

Keywords: MINLP applications; Disjunctive programming; Plant layout; Toxic release uncertainty; Convex hull