An Approach to Solve the Facility Layout Problem Based on the Worst-Case Scenario

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Abstract

A new approach to determine the optimal distribution of process facilities is presented in this paper. The formulation considers a set of facilities already installed in a given land and a new set of facilities to be accommodated within the same land. In addition, it is considered that a set of facilities either installed or to be laid out presents the possibility of toxic release. Based on previous analysis, the worst-case scenario implies calm wind and stable atmospheric condition. Since these conditions tend to exist during several days of the year, the proposed model is formulated assuming these deterministic values for wind and atmospheric conditions. The final model is formulated as a disjunctive model that is converted into a mixed-integer non-linear program (MINLP) via the convex-hull method. The model is then solved with local and global optimizers in the GAMS package. Using the current approach based on minimum distances for a particular case study results in a distribution with a very high risk whereas the optimal results using this proposed approach indicate large separations between releasing facilities and the inhabited facilities due to the high toxicity of the released material. More elaboration will be aggregated into the developed model to include prevention and mitigation systems to produce more compact but optimal and safe layouts.

Keywords: Worst-case scenario; Toxic release; MINLP applications; Disjunctive programming; Plant layout