

**ABSTRACT:**

Minimum fresh water consumption and wastewater generation in a facility can be achieved when all options for water minimization including source elimination, reduction, reuse/recycle, outsourcing, and regeneration have been considered. This work presents the development of a new generic mixed integer linear programming (MILP) model to holistically minimize fresh water consumption and wastewater generation for systems involving multiple contaminants where the various options for water minimization are simultaneously considered in order to ultimately generate a minimum water utilization network. The MILP model proposed in this work can be used to simultaneously generate the minimum water targets and design the minimum water network for global water-using operations for buildings and industry. This work also includes cases where fresh water concentrations for all contaminants are assumed to be either zero or non-zero. The approach has been successfully implemented in case studies involving an urban building (Sultan Ismail Mosque, UTM) and a manufacturing plant (a chlor-alkali plant).