Fence line monitoring system optimization for minimizing the spatio-temporal risk toward community using gas sensors

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The risk of a chemical plant is getting increased as the number of plants that are close to communities increases. If toxic gas is leaked and dispersed toward communities, it leads catastrophic damage. To minimize the risk toward people, A monitoring system is essential. For it, a fence line monitoring system and sensor placement optimization are necessary. In this study, we designed optimal sensor placement for a fence line monitoring system to minimize the risk of leak scenario toward communities. The risk is defined as the function of the frequency, exposure level, exposed area, exposed population, and vulnerability of each area. Computational fluid dynamics(CFD) simulator is used to generate the leak scenario data. The mixed-integer linear programming formulation is proposed. The object is to minimize the sum of residual risk through all scenarios by placing sensors on the fence line. In the case study, We divided the area into numerous elements and calculated the risk of each element. Sensor placement was conducted using data calculated in the previous step, and then we observe the performance of the fence line system by increasing the number of sensors.