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Flow Control of Hazardous Contaminants to Protect Evacuees in Civil Infrastructure Emergency Scenarios SARA RIMER, University of Michigan — The threat of accidental or deliberate toxic chemicals released into public spaces is a significant concern to public safety, and the real-time detection and mitigation of such hazardous contaminants has the potential to minimize harm and save lives. Furthermore, the safe evacuation of occupants during such a catastrophe is of utmost importance. This research develops a comprehensive means to address such scenarios, through both the sensing and control of contaminants, and the modeling of and potential communication to occupants as they evacuate. A computational fluid dynamics model is developed of a simplified public space characterized by a long conduit (e.g. airport terminal) with unidirectional ambient flow that is capable of detecting and mitigating the hazardous contaminant (via boundary ports) over several time horizons using model predictive control optimization. An agent-based model is developed to simulate agents (i.e. building occupants) as they evacuate a public space. The agent-based evacuation model is coupled with the computational flow control model such that agents must interact with a dynamic, threatening environment. Results demonstrate how flow control can be achieved via feedback sensing of location of occupants with desire to minimize contaminant exposure.

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