

PROTECTION - SCIENCE AND TECHNOLOGY ADVANCES FOR CHEMICAL AND BIOLOGICAL PROTECTION

Effect Of Envelope Tightening On Collective Biological Protection Of Buildings

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The DoD has a large number of buildings that could be potential targets of an external release of aerosolized contaminants. These contaminants could potentially enter the building through the air intake structure, through cracks or leaks in the building envelope, or through doors and windows. Many Federal buildings are currently implementing methods to reduce building leakage for the purpose of energy efficiency, with some buildings targeting leakage rates of less than 0.25 cubic feet per minute per square foot (CFM/sf) at the common blower door test pressure difference of 75 Pascal (Pa). These improvements are expected to also be beneficial for reducing the extent of particulate and gases infiltration that may be driven by pressure gradients between the building exterior and building interior due to wind load, temperature differential driven 'stack' effects and unbalanced mechanical supply and exhaust ventilation systems.

The objective of this research is to assess the effects of building envelope tightening on infiltration and the resulting implications for occupant exposure risk. A generic scenario that considers the release of micron-sized particles in an external plume upwind of a building will be modeled and discussed. The effects of building envelope tightening and indoor air pressure levels will be considered. The sensitivity of building occupant exposure to the envelope tightness will be assessed. Cases to be presented will include hypothetical scenarios with completely sealed buildings (with the exception of the air intake) and scenarios with varying leakage rates, interior pressures, and exterior environmental conditions. The relative importance of building leakage versus intake transmission with standard air filtration systems will be discussed alongside cost and energy tradeoffs.

The results of this research will inform DoD building managers about the importance of building envelope tightening as part of a holistic approach to collective protection from biological and other airborne threats.

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