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REPORT
IN BRIEF

Protecting Building Occupants and Operations From Biological and Chemical Airborne Threats: A Framework for Decision Making

Protecting buildings from biological and chemical airborne threats is a complex matter subject to many variables including the construction, missions, and vulnerabilities of the building to be protected. A systematic process that takes into account the building's vulnerabilities and risks of attacks, its physical limitations, the budget, and options for protection using risk assessment and management approaches is needed to guide decision making and cost-benefit analysis for building protection.

Attacks using airborne biological and chemical threat agents in the last two decades have increased the urgency of protecting buildings, their occupants, and critical operations from those threats. At the request of the Defense Threat Reduction Agency, the National Academies convened a committee to consider existing work on preventing and mitigating the effects of airborne biological and chemical threat agents released within or infiltrated into buildings. The resulting report discusses general principles derived from existing work and the variables that need to be considered in the design and implementation of a protection system for airborne biological and chemical releases, its likely cost, benefit, and risks.



Considerations for designing building protection systems

To design an appropriate building protection system, many factors have to be considered. What are the threat agents to be protected from and how would they be delivered? What are the vulnerabilities to and risks of attacks and how could they be managed? What are the main goals of protection—saving lives only or protecting resources and maintaining continuous operations inside the building as well? What are the limitations posed by the building procurement, design and construction? Are there financial resources available for design, implementation, operation, and maintenance? **Given the complex interactions of these factors, building protection cannot be designed generically. Building protection systems should be designed and implemented on a case-by-case basis for each structure to be protected.**

Goals and Objectives

The goals and objectives of building protection vary depending on the mission and activities of each building. In general, building activities and missions are encompassed within one or a combination of the following broad categories:

- Buildings with storage only;
- Buildings with equipment only;
- Buildings with personnel only; and
- Buildings with critical operations conducted by personnel.

Such factors determine, in part, what needs to be protected and the level of protection that should be sought. The goals and objectives should be defined prior to deploying protection systems.

Components of Building Protection Systems

Components of building protection systems include building design and site selection, heating, ventilating and air-conditioning systems, filtration, detection and identification technologies that can actively monitor the presence of threat agents and identify them, and operational responses such as shelter-in-place and use of personal protective equipment. The protection components for a given building should be selected based on the specific goals and objectives for protecting that building from a variety of biological and chemical threat types. In addition to providing protection, these components must meet the requirements set by building administrators, designers, and security experts on the basis of risk assessment and management analyses.

A well-conceived building protection strategy should include metrics to measure the success of that strategy against building protection objectives. There is no universal set of metrics that can be used to assess protection systems of all buildings because of the uniqueness of each building, its use, and the goals

and objectives of its protection. Because goals and objectives for protection drive the choice of building protection system for each installation, metrics for a building protection system should be based on these same well-understood, clear goals and objectives.

Framework for Decision Making

Establishing a systematic process that weighs different protection options would help DTRA and other agencies to design appropriate protection systems. Prior to implementation of a building protection program, the Department of Defense (DOD) should establish a complete framework for building protection that guides decision making for each building to be protected. The decision-making framework should consider the following steps: (1) defining the objectives of building protection; (2) preparing a threat assessment; (3) establishing a risk assessment; (4) developing a case-by-case plan for building protection; (5) conducting a risk management analysis; and (6) analyzing costs and benefits using appropriate metrics and modeling and simulation tools as needed. The complexity of steps in the framework and the time required for each step will depend upon the program and building protection objectives.

Budgetary Considerations

The costs of a protection system extend beyond costs incurred during the design and implementation phase. A long-term operation and maintenance budget is necessary to maintain the performance objectives of the building protection system. All the monetary costs associated with a protection system within its lifetime should be planned for prior to deploying building protection.

A well-defined strategy for protection, starting at the design phase and continuing through the deployment stage, combined with sound decision making, can lead to the best options for reaching building protection goals now and into the future.

This brief was prepared by the National Research Council based on a report by the Committee on Protecting Occupants of DOD Buildings from Chemical and Biological Release. The report was sponsored by Defense Threat Reduction Agency. For more information, contact the Board on Chemical Sciences and Technology at (202) 334-2156 or visit <http://nationalacademies.org/best>. Copies of *Protecting Building Occupants and Operations from Biological and Chemical Airborne Threats: A Framework for Decision Making* are available from the National Academies Press, 500 Fifth Street, NW, Washington, D.C. 20001; (800) 624-6242; www.nap.edu.