

Chemical Security Analysis Center Homeland Explosive Consequence Assessment Tool (HEXCAT)



Homeland
Security

Science and Technology

COMBATTING TERRORIST USE OF EXPLOSIVES IN THE UNITED STATES

The Homeland Security Presidential Directive-19 *Combating Terrorist Use of Explosives in the United States* requires "prevention and detection of, protection against, and response to terrorist use of explosives in the United States". The Department of Homeland Security (DHS) Science and Technology Directorate Chemical Security Analysis Center (CSAC) is completing development of the Homeland Explosive Consequence Assessment Tool (HEXCAT). This tool, developed for desktop computers, will rapidly analyze the human health consequences from an explosion, the current medical ability to respond, and various mitigation and response strategies to an explosion where the device is placed inside a structure or outside in a populated area.

HEXCAT considers the following information in its calculation of life-threatening, severe, and mild injuries:

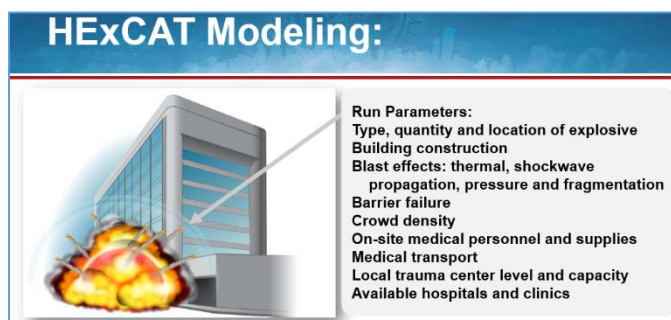
- Target scenarios – buildings, transportation hubs, parades, open air festivals, stadiums, municipal centers, or other public spaces
- Device characteristics – material, mass, enhancements, and placement to calculate thermal, pressure, and fragmentation effects
- On-site and in-hospital medical capability, material supplies and equipment, medical personnel, transportation, and accessible facilities

HANDLING REAL-WORLD UNKNOWN AND MEDICAL MITIGATION

Unknowns are considered by using probabilistic analysis. Thousands of scenarios are modeled based on random sampling from default distributions for key parameters such as building types, materials of construction, population density, device location, and device characteristics. This allows the user to capture the range of the expected outcome with minimal user input needed, allowing planners to determine which scenarios result in fewer casualties and which result in more.

The output can be graphically displayed, or downloaded as a spreadsheet, to show fatalities, injuries, number saved, resources consumed, and the dependence on key variables.

Medical mitigation is considered through a fully integrated stock-and-flow medical mitigation model, which calculates the ability to respond and considers material and personnel resource limitations and time delays from the point of injury throughout the delivery of care.



HEXCAT Model Parameters

HEXCAT CAPABILITIES

- Scenario-based explosive hazard consequences
- Flexible and fast analysis tool; millisecond run time per simulation
- Probabilistic approach; Monte Carlo sampling from key parameter distributions
- Embedded statistics and drag-and-drop graphics
- Evaluation of the sensitivity of key variables to focus follow-up studies on impactful parameters

HEXCAT allows users to specify ranges of explosives, placements, building types, bomb construction, locations, crowd density, and medical capabilities. Planners can evaluate a large range of "what-if" scenarios and visually assess the effects. Prevention, detection, mitigation, and response planning can be focused on potential worst-case scenarios.

FUTURE PLANS

- Integrate HEXCAT into DHS Countermeasure Assessment Planning Tool (CAPT) Web available on the Homeland Secure Data Network (HSDN), a DHS secure website
- Add advanced analytics and time-resolved output for single simulations to explore details of an outlier
- Develop an Unclassified/For Official Use Only version of HEXCAT

