National Study Center for Preparedness and Catastrophic Event Response

Development of EMCAPS
Electronic Mass Casualty Assessment and Planning Scenarios

James J. Scheulen
Johns Hopkins Medicine
Emergency Medicine
PACER
EMCAPS Concept

- Johns Hopkins Office of Critical Event Preparedness and Response (CEPAR)
  - Prepare the Johns Hopkins Enterprise
  - Connect with local, regional and national agencies
  - Health system preparedness in the nation
CEPAR
Planning and Operations

Assess Vulnerabilities

Drills and Exercises

Planning

Research

Communications

Policy

PACER
National Center for the Study of PREPAREDNESS AND CATASTROPHIC EVENT RESPONSE
EMCAPS
Development

- Development of Surge Capacity
- Hazard Vulnerability Analysis
- Capability Based Planning
- The Scenario: An bomb is exploded at the stadium...
  - Unrealistic projections
  - My Eyes Glaze Over effect
EMCAPS Development

• Develop a simple planning tool
• Act as simulation or exercise front end
• Scale the National Planning Scenarios
  – Can be used for specific communities
  – Can be scaled for different events and locales
  – Useful for EMS, state and local government and healthcare preparedness personnel
EMCAPS Development

• Assumptions and Calculations based upon DHS scenarios
  – Augmented by further research
  – Augmented by previously developed predictive models
  – Expert panel review of input and output variables
    • Weapons of mass destruction
    • Agent model transport and delivery
    • Medical management
Electronic Mass Casualty Assessment & Planning Scenarios

EMCAPS

Electronic Mass Casualty Assessment & Planning Scenarios (EMCAPS)

Version 1.0
September 2006

This tool is intended to allow plausible scenarios to be reasonably modeled to help planners better understand and assess preparedness and response capabilities needs. It is not intended to precisely model the physical behavior of WMD threat agents or the outcomes of specific threat conditions.

Click Here for more information about the objectives.

Start
Electronic Mass Casualty Assessment & Planning Scenarios

EMCAPS

Electronic Mass Casualty Assessment And Planning Scenarios

RADIOLOGICAL
- RDD - Dirty Bomb

BIOLOGICAL
- Inhalational Anthrax
- Pneumonic Plague
- Food Contamination
  GI Anthrax
- Pandemic Influenza
  CDC FluSurge Model

CHEMICAL
- Blister Agent - Mustard Gas
- Toxic Gas - Chlorine
- Nerve Agent - Sarin

EXPLOSIVE
- IED - Truck Bomb

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National Center for the Study of
Preparedness and Catastrophic Event Response
EMCAPS

- Strong focus on EASE of OPERATION and PRACTICAL application
Conclusion

- EMCAPS provides a practical planning tool that enables planners at all levels to perform directed, capability based planning using scenarios that are scaled specifically for their community.
Electronic Mass Casualty Assessment and Planning Scenarios (EMCAPS): Development and Application of Computer Modeling to Selected National Planning Scenarios for High-Consequence Events

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Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not represent the policy or position of the Department of Homeland Security.

INTRODUCTION

As part of comprehensive disaster preparedness planning, regional planners and health care system administrators must routinely assess their response capabilities, including surge capacity and overall system resources required for accommodating the influx of casualties after an event. The incorporation of surge capacity and overall system resources required for analyzing the impact of disasters has been shown to be essential in the development of effective and efficient emergency response plans. The study of potential scenarios that could result in high-consequence events and their potential impacts on systems such as hospitals, public health agencies, and emergency medical services is critical in understanding the potential effects of these events on community health and well-being.

Advance and directed planning taking into consideration adverse effects of potential events is essential for emergency managers at all levels as a means of effective and efficient decision-making during events. To assist emergency planners, the Department of Homeland Security released a set of 13 National Planning Scenarios for use in federal, state, and local homeland security preparedness and response activities. Each scenario is described in terms of background, critical assumptions, and various objectives such as medical, financial, logistical. The scenarios are intended to be used as a basis for exercises or as planning tools to help emergency planners better understand the nature and scope of natural and terrorist-induced hazards in their area and to guide prioritization of preparedness expenditures. However, practical...
Thank you!

National Center for the Study of Preparedness and Catastrophic Event Response

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EMCAPS

Electronic Mass Casualty Assessment And Planning Scenarios

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  - Pneumonic Plague
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  - Blister Agent - Mustard Gas
  - Toxic Gas - Chlorine
  - Nerve Agent - Sarin

- **EXPLOSIVE**
  - IED - Truck Bomb

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**Scenario Overview:** A bomb is attached to a tanker carrying compressed chlorine. The entire contents of the tank escape into the atmosphere and the plume spreads to the surrounding area. The plume spreading and the effect on the population are calculated according to the input variables below.

**Assumptions:**
- 4,320-gallon tank, all contents released through 3-ft hole
- Fairly cloudy, no precipitation
- 50% of people in plume area are indoors
- Effects of chlorine on population determined through evaluation of chlorine gas concentration zones, which were determined using ALOHA plume modeling software (see References)
- First effects on humans at concentration = 10 ppm
- Minimum lethal dose = 430 ppm for 30 min
- Median lethal dose (short-term exposure) = 1,000 ppm

**References**

**Variable** | **Range / Units** | **User Input**
--- | --- | ---
Outdoor Temperature | Selection Guidance | (20, 50, or 85) °F | 30
Wind Speed | Selection Guidance | (3, 9, or 15) mph | 9
Setting | Selection Guidance | Urban or Rural | Urban
Population Density | Selection Guidance | (200 - 450) persons/m² | 8000

**Calculation Methodology & Scaling**
### Reference Population Densities for US Cities and Maryland Jurisdictions

<table>
<thead>
<tr>
<th>City</th>
<th>Population Density (persons/mi²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manhattan</td>
<td>43,582</td>
</tr>
<tr>
<td>New York City</td>
<td>23,686</td>
</tr>
<tr>
<td>San Francisco</td>
<td>15,993</td>
</tr>
<tr>
<td>Chicago</td>
<td>12,639</td>
</tr>
<tr>
<td>Philadelphia</td>
<td>10,958</td>
</tr>
<tr>
<td>Washington, DC</td>
<td>9,480</td>
</tr>
<tr>
<td>Los Angeles</td>
<td>8,145</td>
</tr>
<tr>
<td>Detroit</td>
<td>6,557</td>
</tr>
<tr>
<td>San Jose</td>
<td>5,133</td>
</tr>
<tr>
<td>San Diego</td>
<td>3,910</td>
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<tr>
<td>Dallas</td>
<td>3,523</td>
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<tr>
<td>Houston</td>
<td>3,471</td>
</tr>
<tr>
<td>Columbus, OH</td>
<td>3,469</td>
</tr>
<tr>
<td>San Antonio</td>
<td>2,977</td>
</tr>
<tr>
<td>Phoenix</td>
<td>2,923</td>
</tr>
<tr>
<td>Indianapolis</td>
<td>2,141</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>City</th>
<th>Population Density (persons/mi²)</th>
</tr>
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</tbody>
</table>

**Ok**
Scenario Overview: An Improvised Explosive Device (IED) utilizing an ammonium nitrate/fuel oil (ANFO) mixture is placed in a cargo truck and detonated. Depending upon the size of the explosive that is chosen and the population density, EMCAPS will calculate the resulting casualty population. Buildings and other physical structures are not considered in these calculations; it is assumed that the explosion takes place in a relatively open area (e.g., stadium, parking lot, park, etc.).

Bomb size selection guidance: 1993 World Trade Center in New York City = 2,000-lb ANFO, 1995 Murrah Building in Oklahoma City, OK = 4,000-lb ANFO

References

<table>
<thead>
<tr>
<th>Variable</th>
<th>Range / Units</th>
<th>User Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bomb Size</td>
<td>(500, 1000, 2000, 3000, 4000 or 5000) lbs ANFO</td>
<td>1000</td>
</tr>
<tr>
<td>Population Density</td>
<td>1 person per x ft²</td>
<td>100</td>
</tr>
</tbody>
</table>
EMCAPS Scenario Output

IED - Truck Bomb Scenario

Selected Inputs:

Bomb Size: 1000 lbs ANFO
Population Density: 1 person per 100 ft²

Casualties:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dead</td>
<td>137</td>
</tr>
<tr>
<td>Trauma Injuries</td>
<td>241</td>
</tr>
<tr>
<td>Urgent Care Injuries</td>
<td>1,183</td>
</tr>
<tr>
<td>Injuries Not Requiring Hospitalization</td>
<td>443</td>
</tr>
</tbody>
</table>

Symptoms

- Impact injuries - pulmonary blast
- Pulmonary contusion
- Barotrauma
- Fractures - internal, compound, spinal
- Smoke inhalation
- GI blast injury - edema, hemorrhage, rupture
- Auditory blast injury - partial or total loss of hearing
- Lacerations
- Shrapnel, debris penetrations: glass, metal, etc.
- Burns

Healthcare Considerations

- Triage concerns:
  - Many victims will be unconscious
  - Many victims will have hearing loss - partial or total
  - Psychological distressed but uninjured population (a.k.a. "worried well") reporting to hospitals could be