SAND2012-6935P

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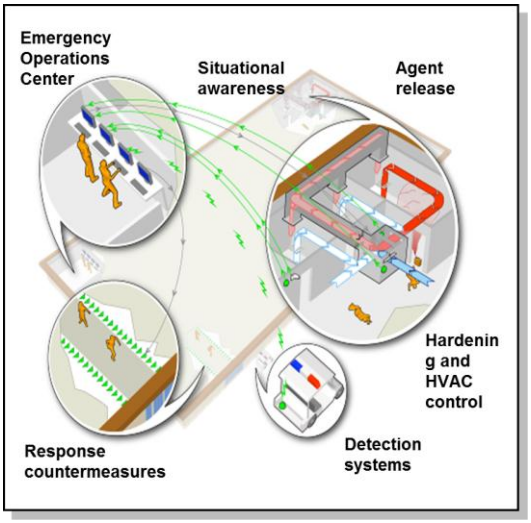
Sandia National Laboratories

Hazards Assessment & Consequence Management Decision Analysis Capability

Sandia's HazDAC Tool



HazDAC provides probabilistic, end-to-end analysis and decision support, including:

- Defining the threat;
- Analyzing attack prevention or hardening measures;
- Evaluating the effectiveness of countermeasures;
- Developing system requirements;
- Deploying optimized detection system architectures;
- Providing modeling and decision support following an attack.

To enable these capabilities, HazDAC is a modular, Java-based, system-of-systems tool that integrates multiple modeling components and datasets into a single analysis center. Some of the HazDAC modules include:

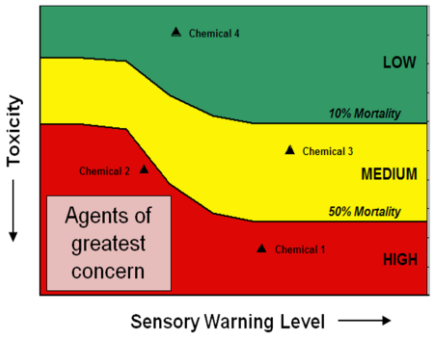
- *Domain data* uses real geometries and actual schedules
  - Actual building geometries, HVAC schedules, and vehicle gate schedules
  - Metropolitan Statistical Area definitions from the Census Bureau
  - The Oak Ridge LandScan population database
- *Attack module* uses Monte Carlo methods to survey the entire space of threat possibilities
  - Aerosol release model
  - Library of building flow states
  - A database of meteorological data from the National Oceanic and Atmospheric Administration (NOAA)
- *Dispersion module* links indoor and outdoor dispersion codes
  - The Hazard Prediction and Assessment Capability (HPAC)
  - An indoor contaminant transport and diffusion model, CONTAM
  - HYSPLIT atmospheric transport and dispersion model
  - Infiltration and exfiltration capability

- *Health effects module* includes a dynamic population for detect-to-warn and static population for detect-to-treat
  - An agent-based, population movement model;
  - Static population & exposure
  - Agent affects model
- *Response module* includes ConOps, sensor siting, multiple metrics and reachback analysis
  - Countermeasure and response options model
  - The Sensor Placement Optimization Toolkit (SPOT)
  - Sensor Inversion Analysis

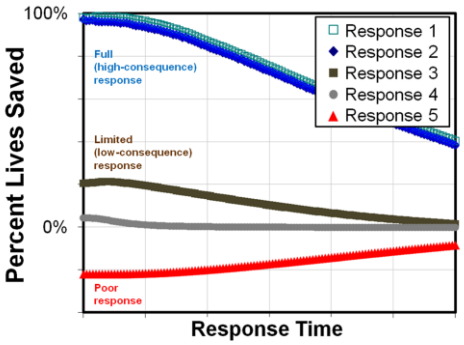
Many studies have used HazDAC to answer a variety of analysis questions

- DHS S&T World Trade Center Complex Indoor Detection Analysis and Optimization Study
  - Generate Design Basis Threat (DBT) scenario library to include chemical, biological, and radiological threat scenarios
  - Compute consequences across all scenarios with and without detection
  - Optimization of detector locations for networks of varying sizes.
- DHS S&T Bio-Detection System Requirements Studies
  - What are the engineering parameter (e.g. flow rate, sensitivity) requirements for optimal cost-benefit performance? Where should detectors be placed for best performance?
  - What metrics are appropriate for measuring performance?
  - Studies supported: Viable Bio-particle Capture System, Bio-Detector Performance Tradeoff Analysis, Risk-Based Indoor-Outdoor Bio-Detector Requirements Analysis, Next-Generation Threat Study, BioWatch BAND
- DHS BioWatch Indoor Reachback Center (BIRC)
  - Optimization of detector locations
  - Simulation and modeling to support exercises and training of locals
  - Post-event analysis to support key response decisions
- DHS CSAC analyses
  - What targets are most at-risk and which agents pose the greatest threat?
  - What countermeasures and responses can be taken to mitigate threat?

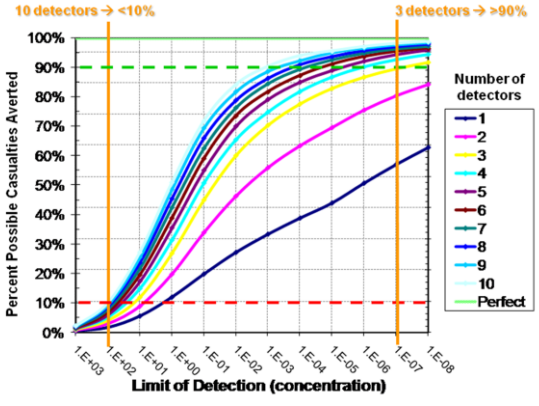
Examples of HazDAC output:



Threat Assessment



Countermeasure Evaluation



System Requirements

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