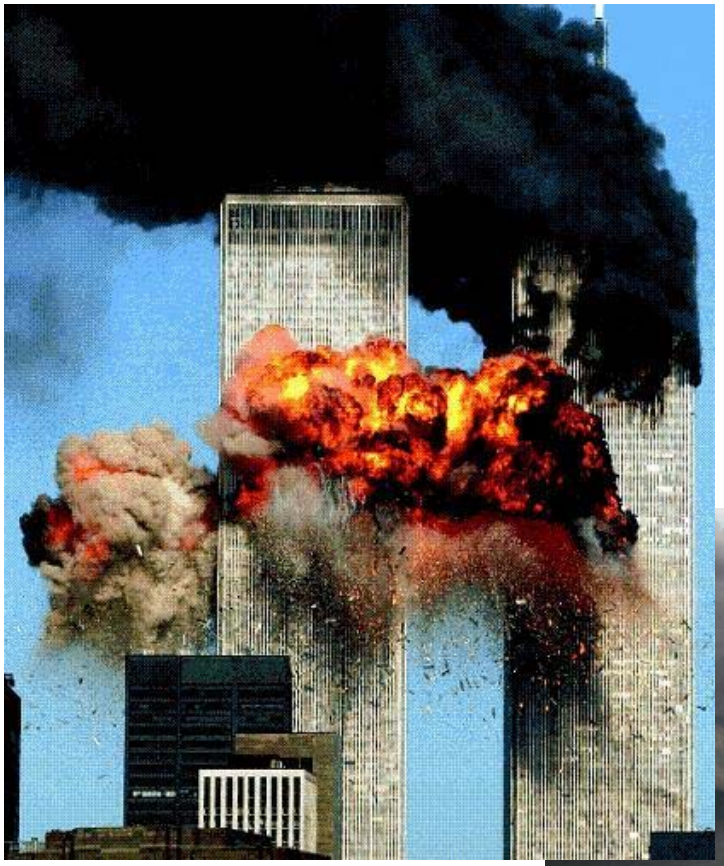
An End-End Quantitative Approach for Estimating Bioterrorism Risk in the Department of Homeland Security

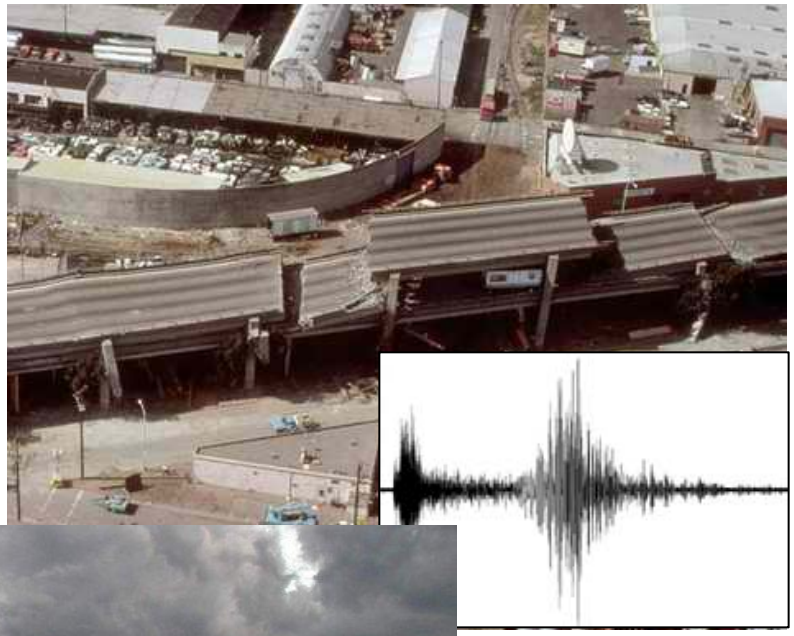
University Programs Summit
20 March 2008

Steve Bennett, Ph.D.
Chemical and Biological Division
Threat Characterization and Attribution Section
Science & Technology Directorate
U.S. Department of Homeland Security

Homeland Security

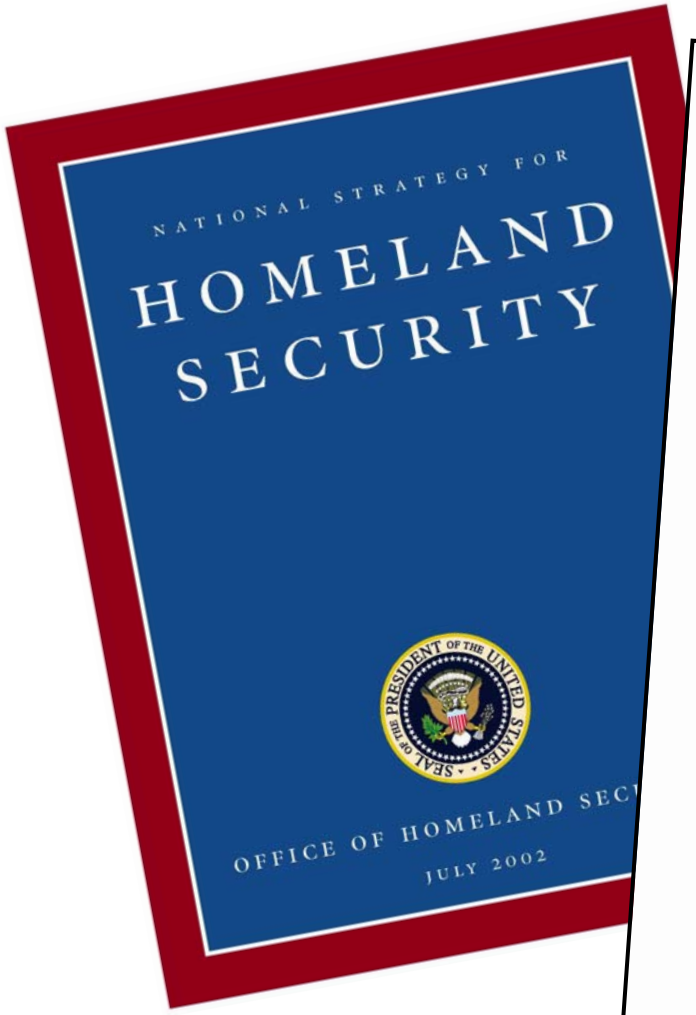
Why Risk Assessment?

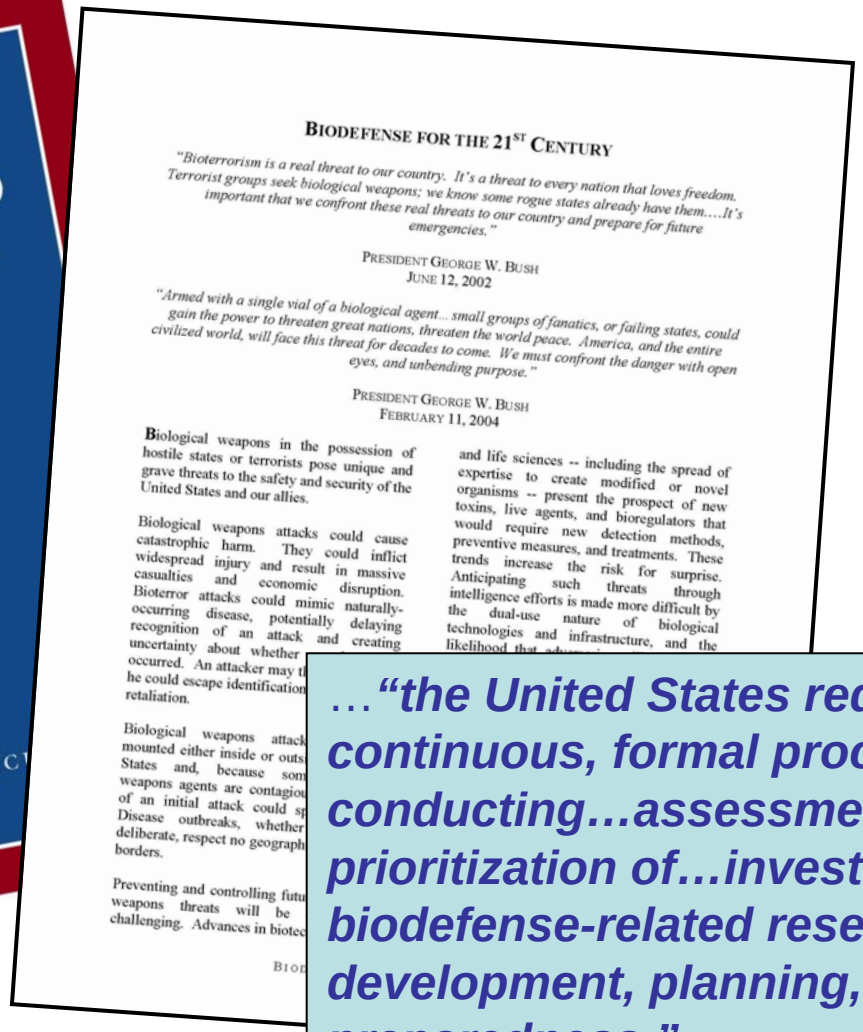




Homeland Security

Bioterrorism Risk Assessment Requirements in the Department of Homeland Security





BIODEFENSE FOR THE 21ST CENTURY

"Bioterrorism is a real threat to our country. It's a threat to every nation that loves freedom. Terrorist groups seek biological weapons; we know some rogue states already have them….It's important that we confront these real threats to our country and prepare for future emergencies."

PRESIDENT GEORGE W. BUSH
JUNE 12, 2002

"Armed with a single vial of a biological agent... small groups of fanatics, or failing states, could gain the power to threaten great nations, threaten the world peace. America, and the entire civilized world, will face this threat for decades to come. We must confront the danger with open eyes, and unbending purpose."

PRESIDENT GEORGE W. BUSH
FEBRUARY 11, 2004

Biological weapons in the possession of hostile states or terrorists pose unique and grave threats to the safety and security of the United States and our allies.

Biological weapons attacks could cause catastrophic harm. They could inflict widespread injury and result in massive casualties and economic disruption. Bioterror attacks could mimic naturally-occurring disease, potentially delaying recognition of an attack and creating uncertainty about whether
occurred. An attacker may t
he could escape identification
retaliation.

Biological weapons attack
mounted either inside or outs
States and, because som
weapons agents are contagiou
of an initial attack could sp
Disease outbreaks, whether
deliberate, respect no geograph
borders.

Preventing and controlling futu
weapons threats will be
challenging. Advances in biotec

and life sciences -- including the spread of expertise to create modified or novel organisms -- present the prospect of new toxins, live agents, and bioregulators that would require new detection methods, preventive measures, and treatments. These trends increase the risk for surprise. Anticipating such threats through intelligence efforts is made more difficult by the dual-use nature of biological technologies and infrastructure, and the likelihood that

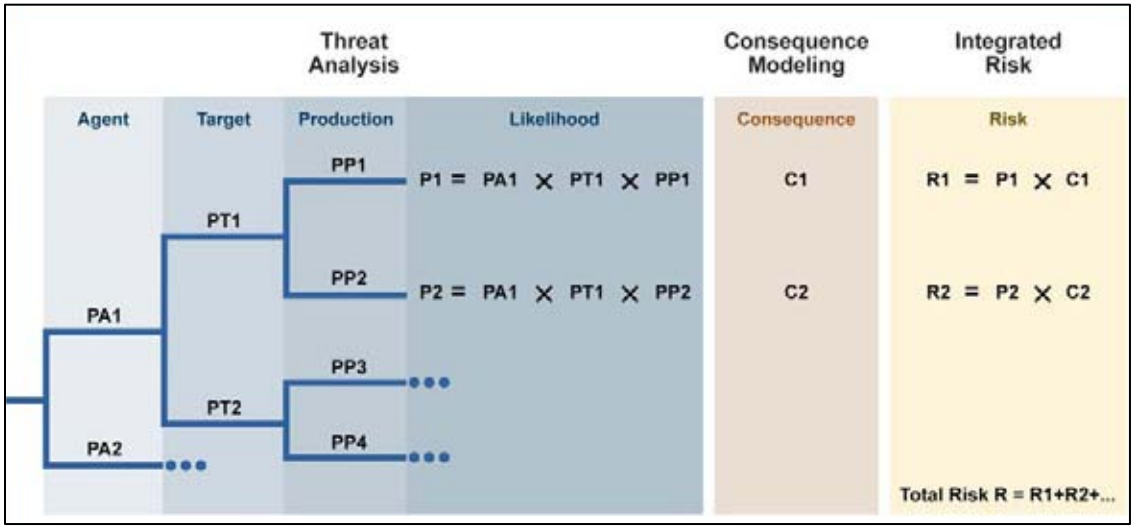
…***"the United States requires a continuous, formal process for conducting…assessments to guide prioritization of…investments in biodefense-related research, development, planning, and preparedness."***

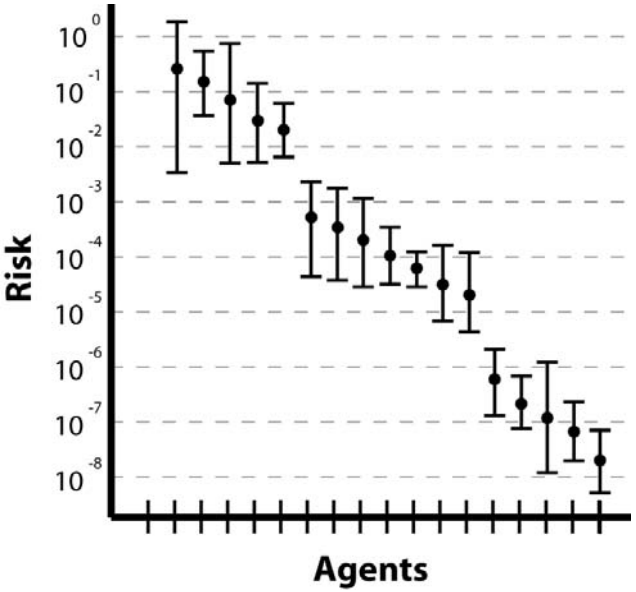
DHS Bioterrorism Risk Assessment (BTRA) Scope

- Potential bioterrorism agents
  - 38 Human pathogens
  - 5 Livestock pathogens
- Millions of enumerated scenarios
  - Aerosol (indoor and outdoor)
  - Food and water contamination
  - Human vector
  - Transportation
- Intelligence-community elicited probabilities
- Physically-based consequence modeling
  - Fatalities, illnesses, economic impacts (direct and indirect)

Homeland Security

Bioterrorism Risk Assessment (BTRA)

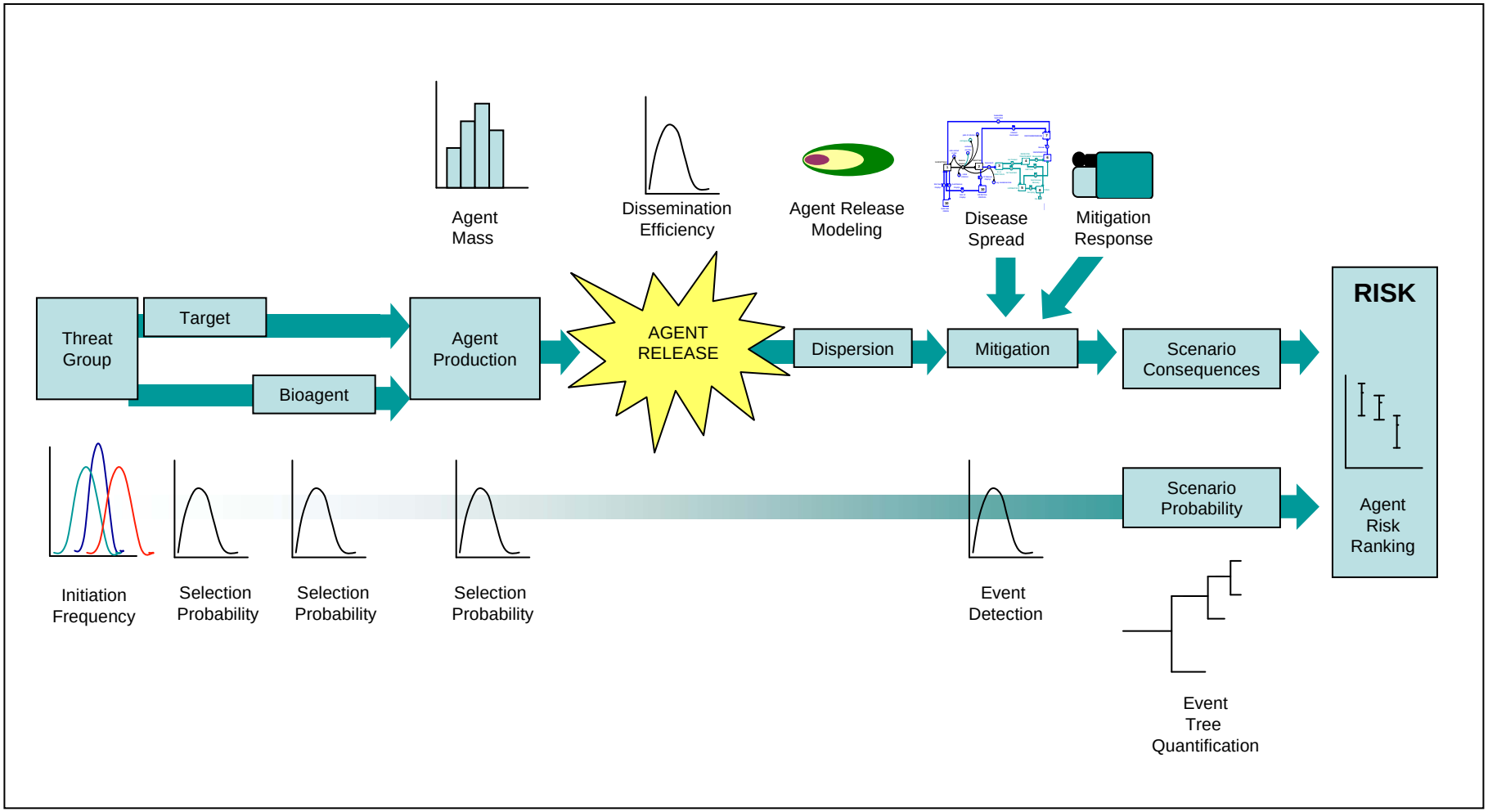




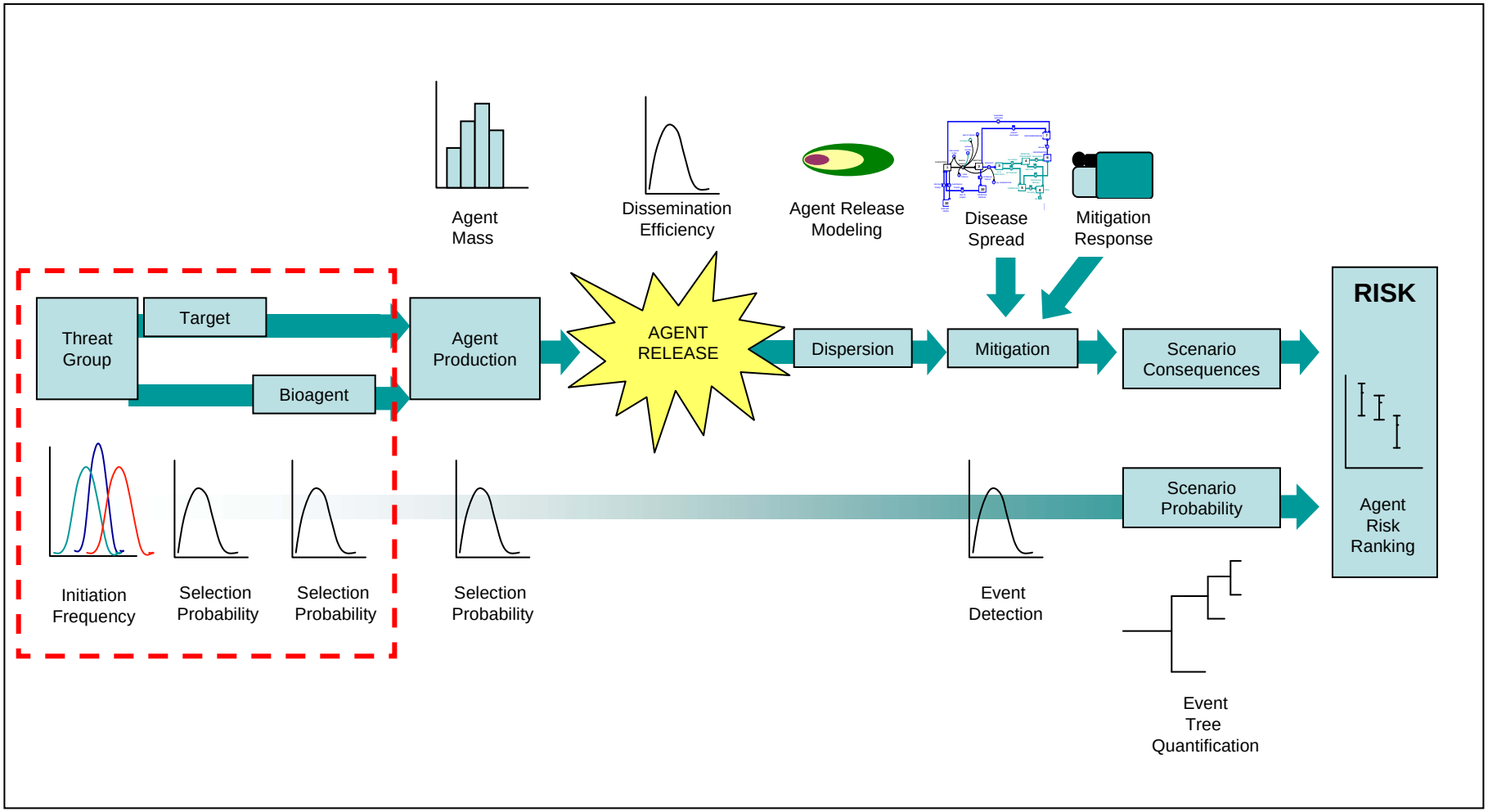
- Required by HSPD-10; first assessment delivered to HSC in January, 2006. Updated assessments are due every two years.
- 2008 update scheduled for delivery 21 March 2008 – many significant expansions and improvements.

Homeland Security

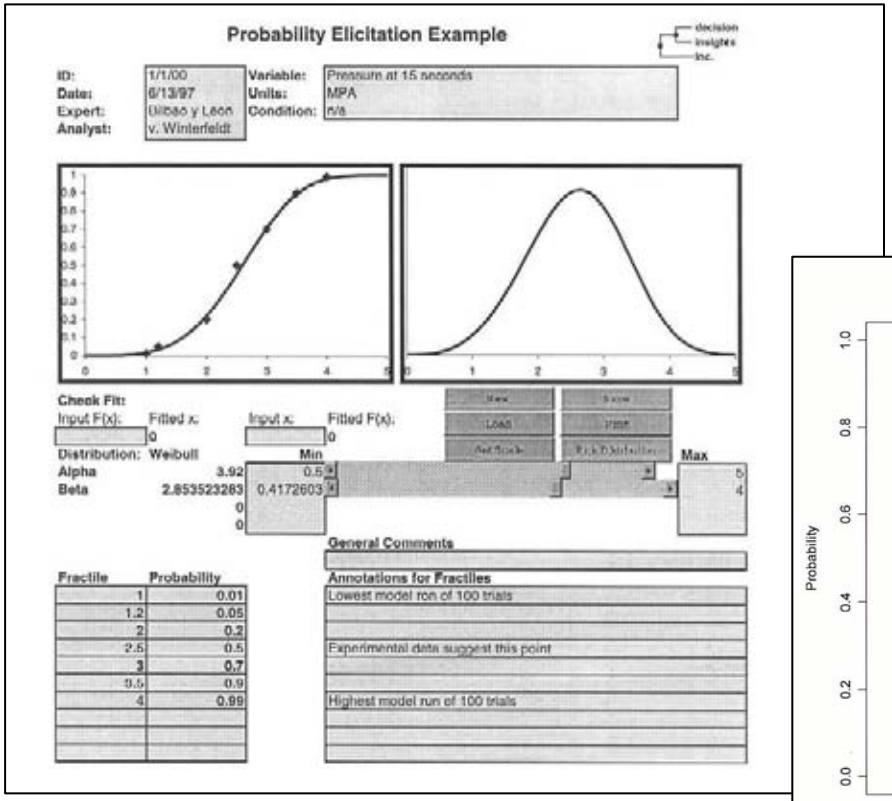
A Quantitative, End-to-End Approach to Estimating Bioterrorism Risk

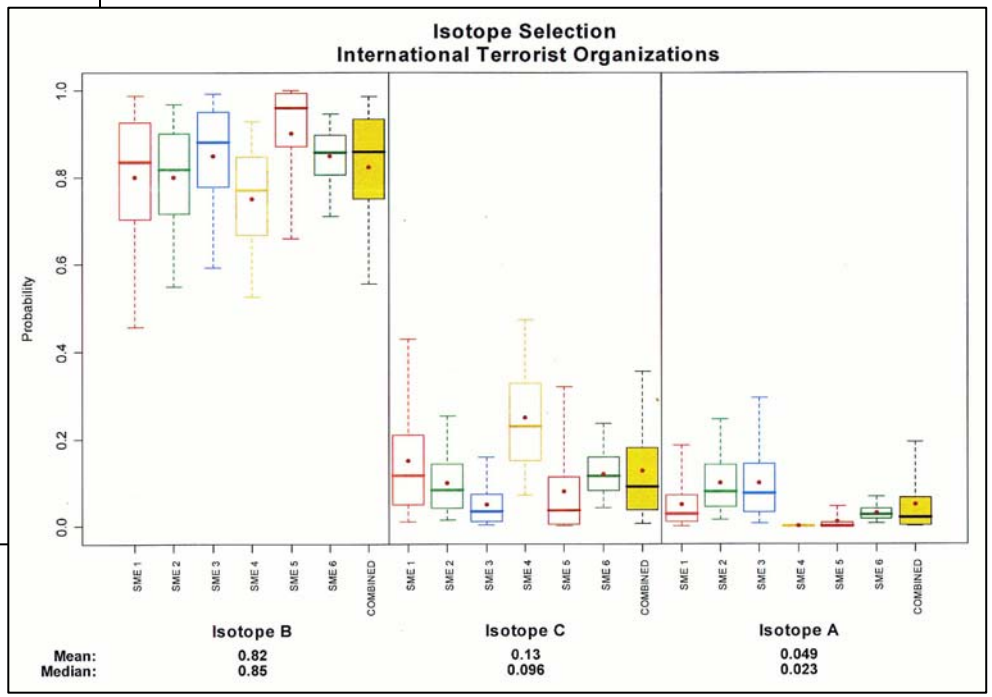


Estimating Bioterrorism Risk: A Multidisciplinary Activity



Bioterrorism Probabilities: Formal elicitation approaches applied to intelligence judgments (CREATE)

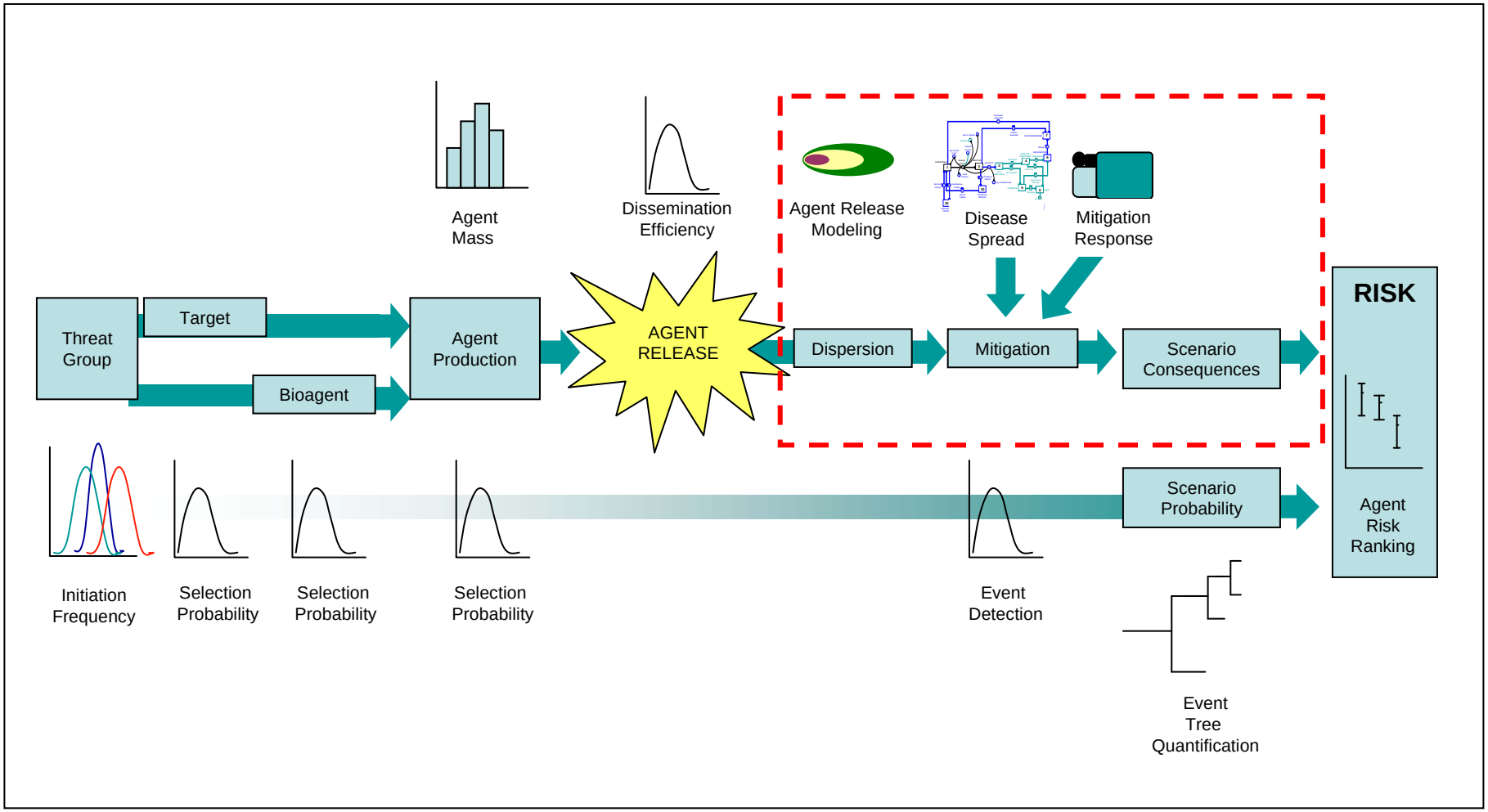




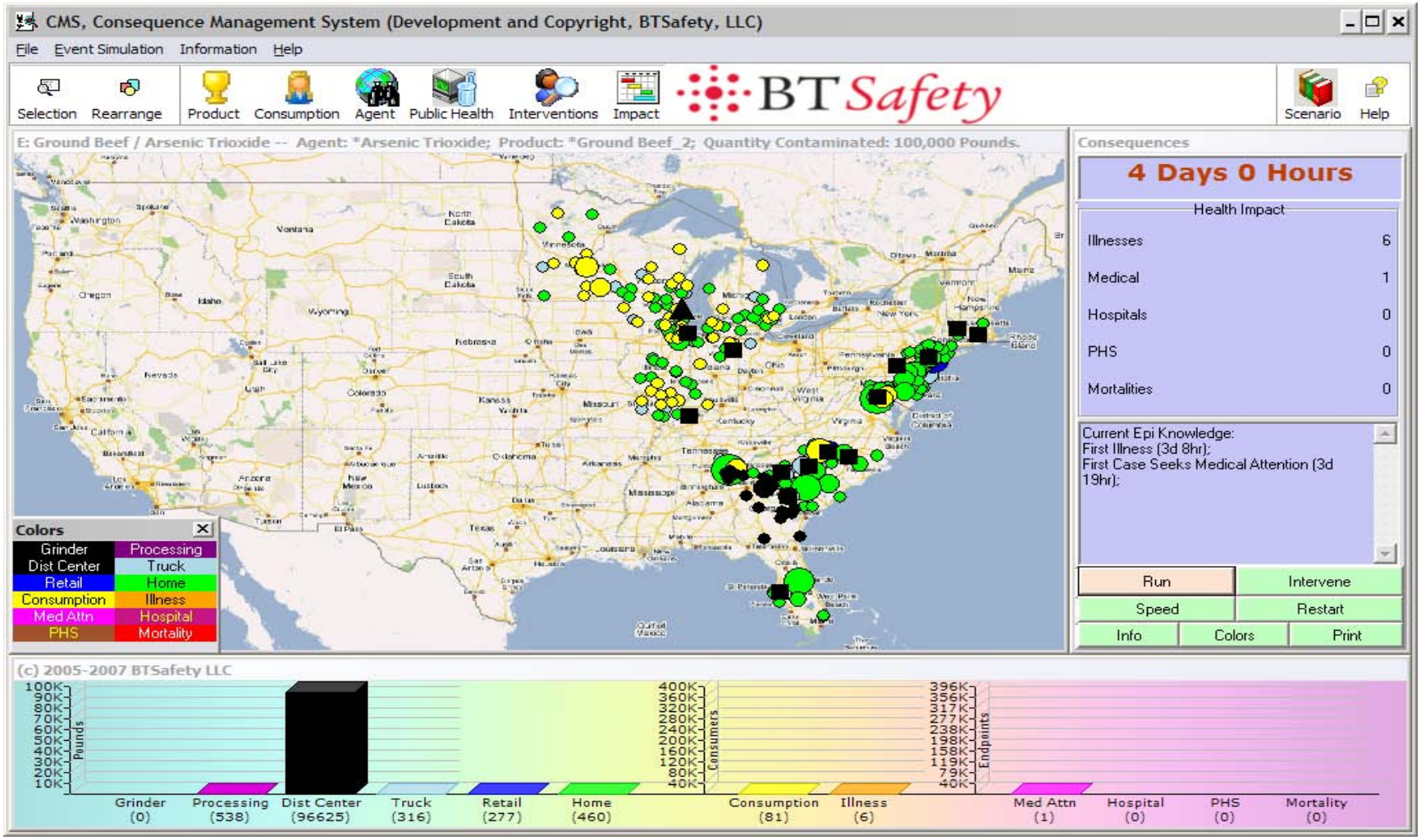
Homeland Security

Data randomly generated – not actual elicitation data

Estimating Bioterrorism Risk: A Multidisciplinary Activity



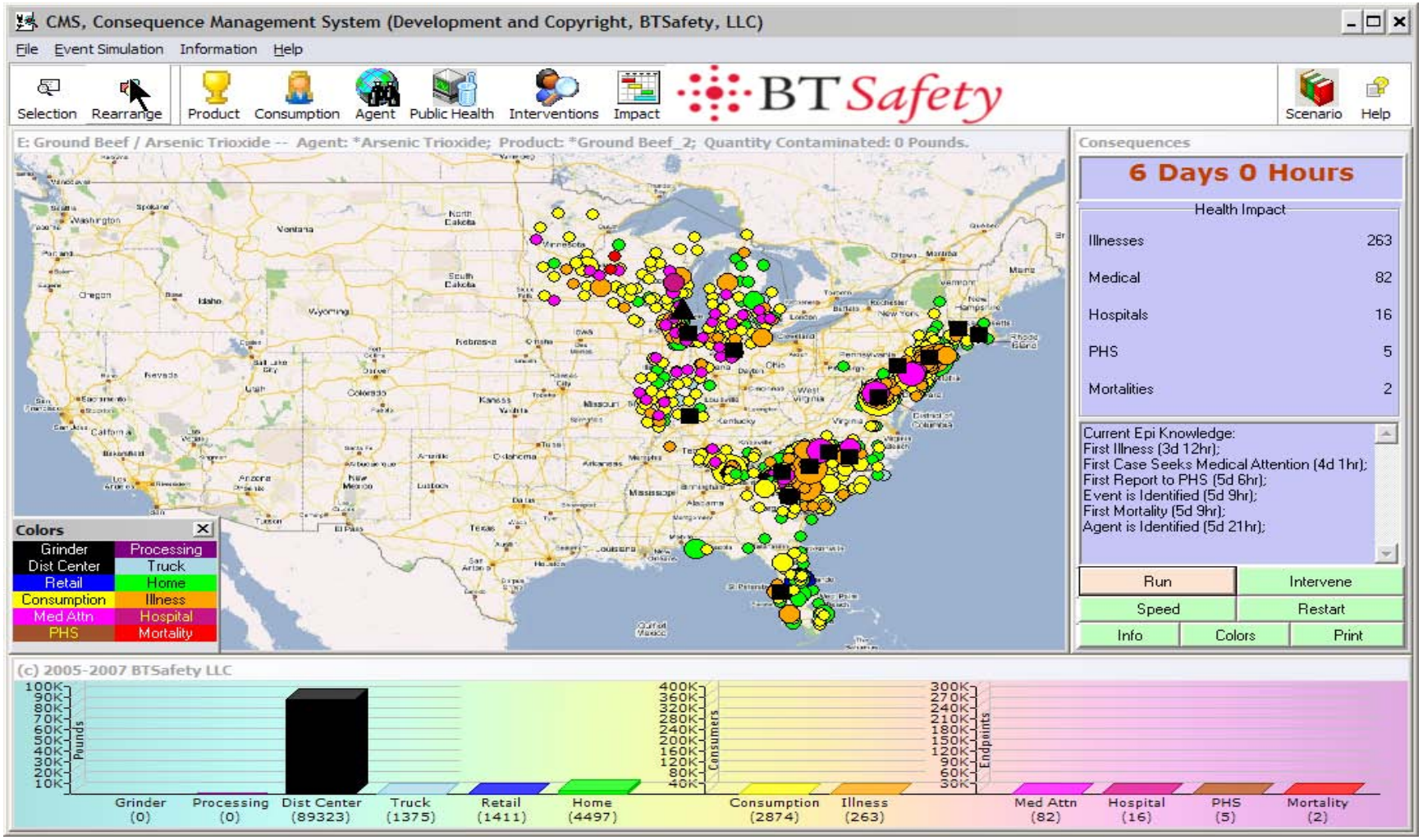
Bioterrorism Consequences: Characterizing Food Contamination (NCFPD)



Homeland Security

BTSafety Building Technologies for Safety LLC

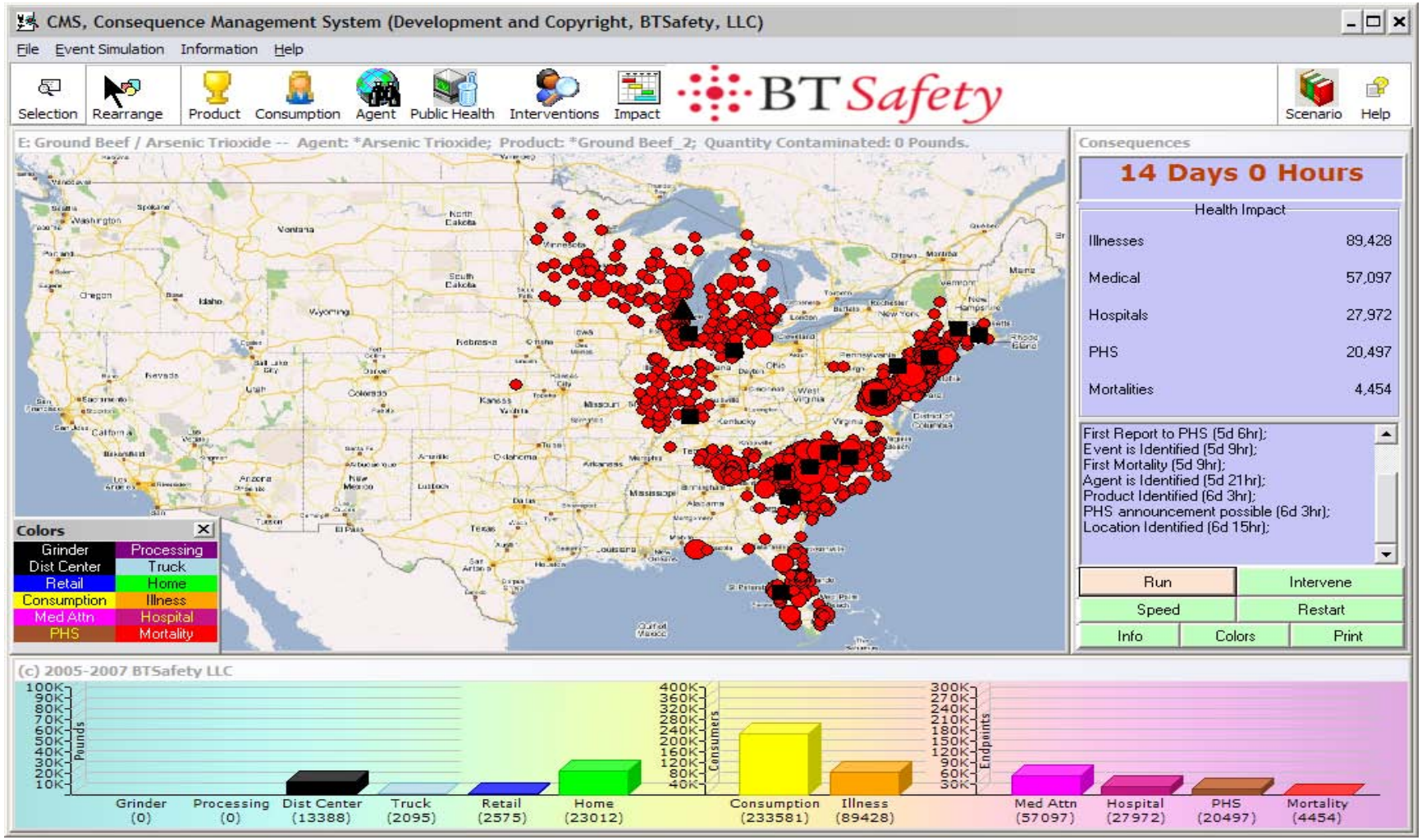
Bioterrorism Consequences: Characterizing Food Contamination (NCFPD, BTsafety)



Homeland Security

BTSafety Building Technologies for Safety LLC

Bioterrorism Consequences: Characterizing Food Contamination (NCFPD, BTsafety)

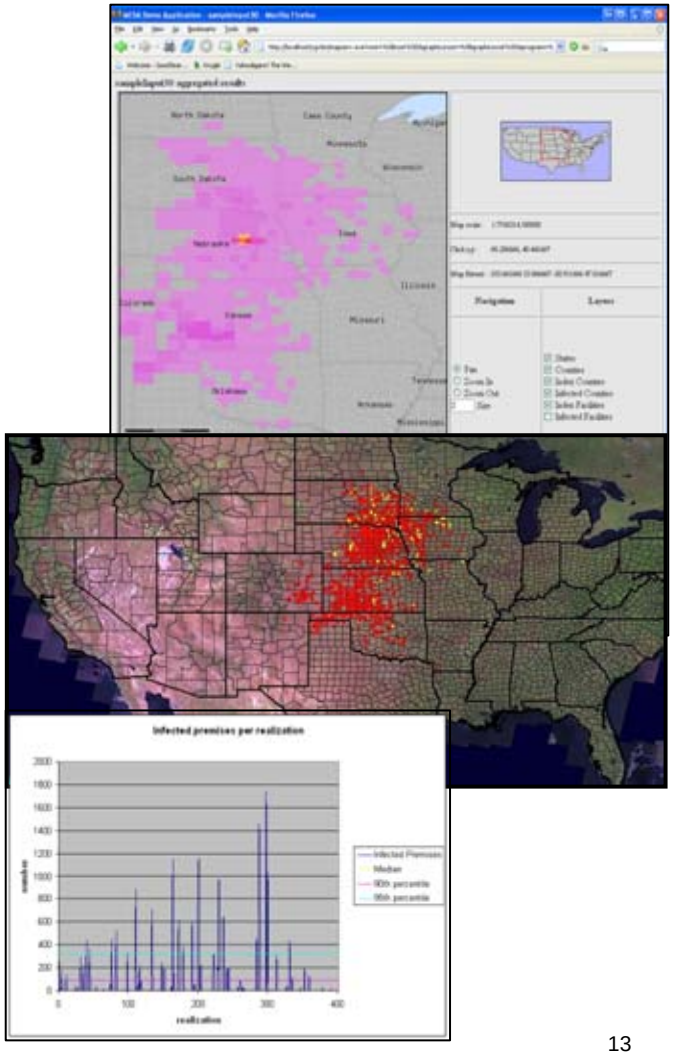


Homeland Security

BTSafety Building Technologies for Safety LLC

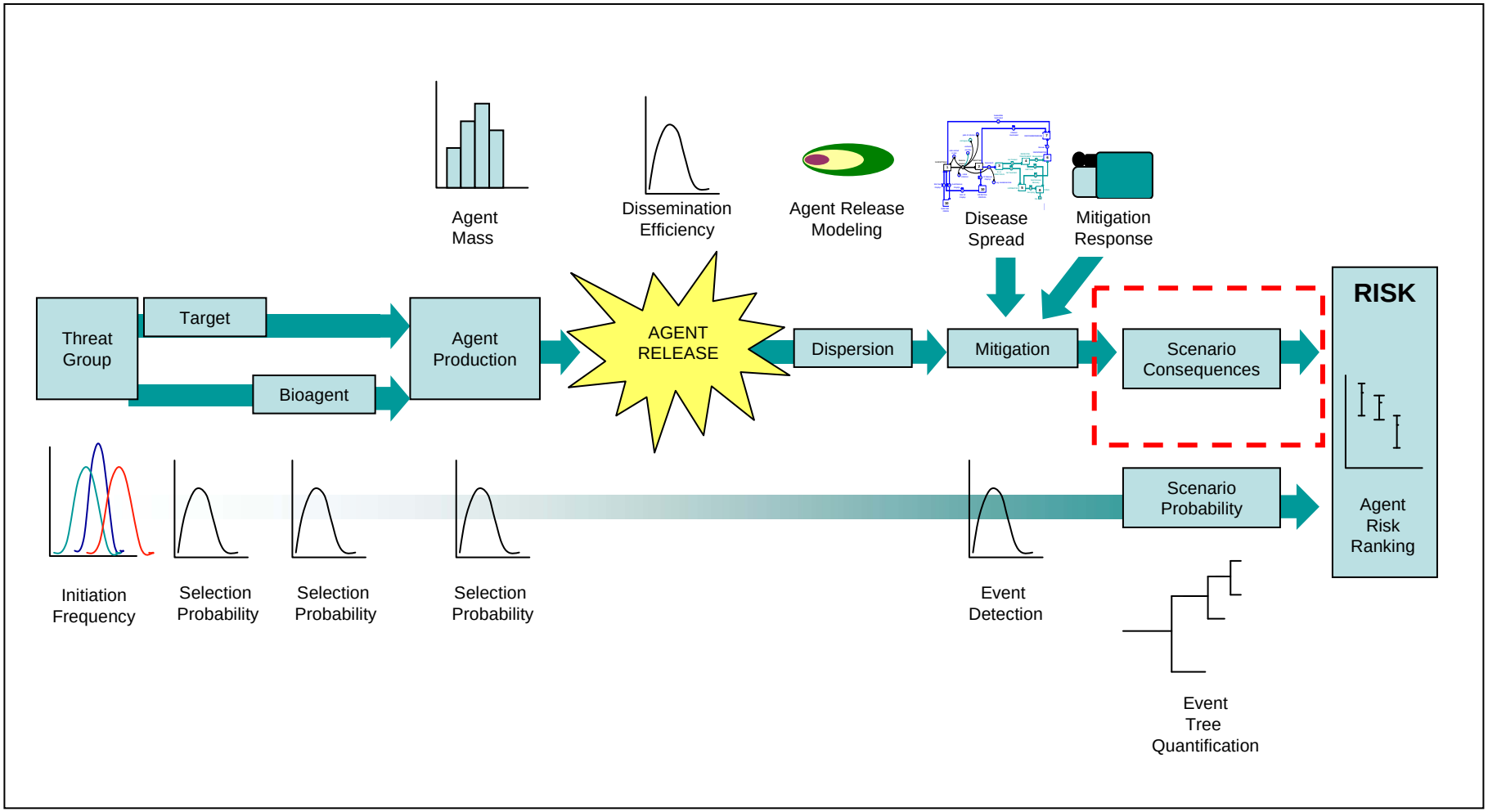
Bioterrorism Consequences: Characterizing foreign animal disease outbreak epidemiology

- MESA has many unique features…
- First (only) US nationwide epidemiological model to simulate foreign animal disease transmission
- Ability to track response resources (vaccines, diagnostic capacity, personnel, costs, etc.)
- Country can be divided into regions; each region can accurately reflect its own attributes for contact rates and response measures
- U.S. Govt. code which is versioned, documented, and available for operational use

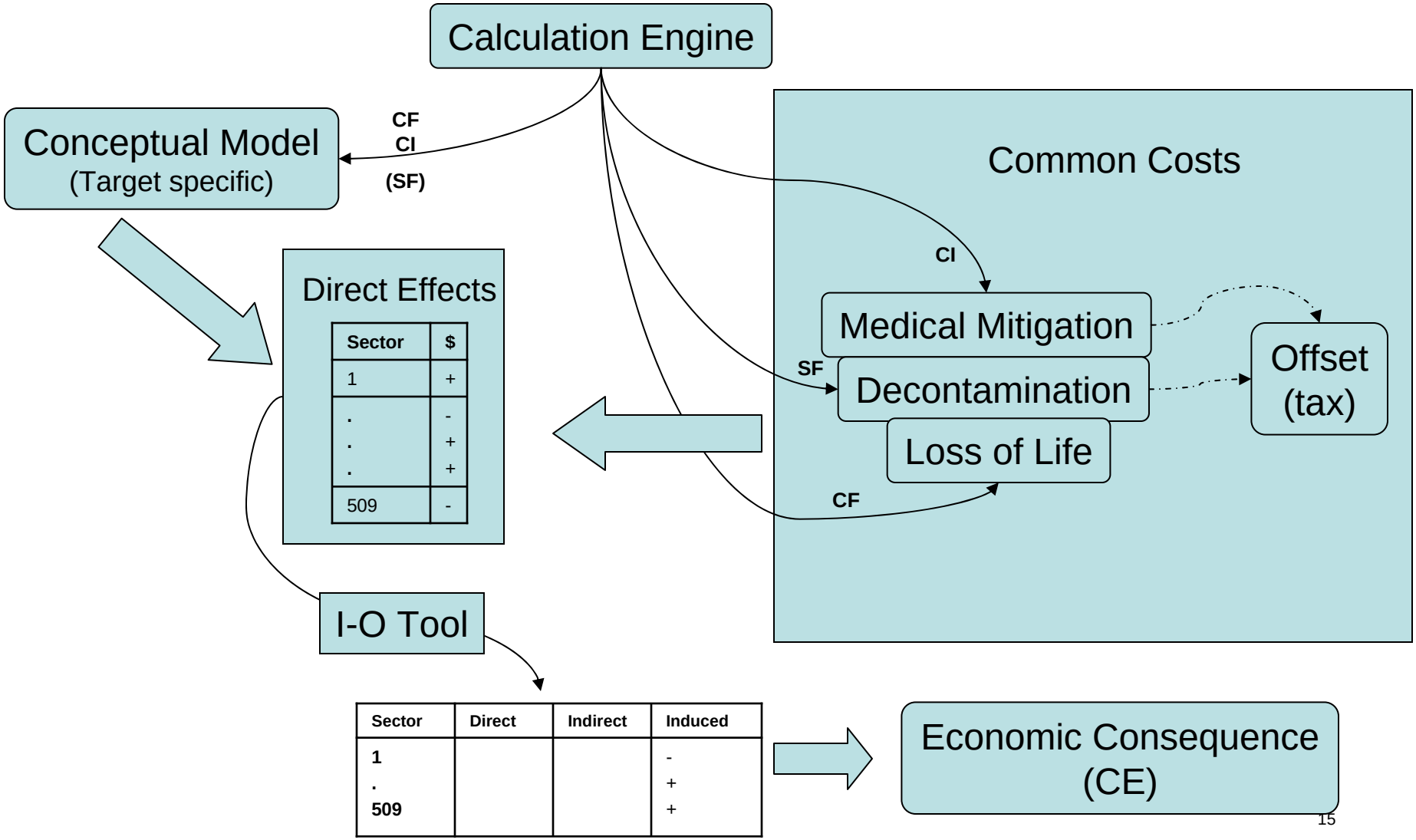


Homeland Security

Estimating Bioterrorism Risk: A Multidisciplinary Activity



Bioterrorism Consequences: Capturing Direct, Indirect, and Induced Economic Costs (CREATE)



Homeland Security