

Food Safety and Defense: Capabilities and Challenges

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for

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Acknowledgements

The following people have generously provided their time, expertise, experience, patience and slides to make this presentation possible; **Craig Hedberg**, Frank Busta, Shaun Kennedy, Jeff Scholl, Andrew Janine, Sue Harlander, David Acheson, Katherine Swanson, Caroline Smith Dewaal, Julie Ostrowsky, the many co-investigators from the Minnesota Department of Health, local health departments, the CDC, FDA and USDA and Judy Mandy.

Thank you!

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A Preview

- Our current food system
- Foodborne disease as a backdrop for understanding the potential for intentional contamination of our food supply;
 - Previous episodes of intentional contamination/terrorism
 - Potential agents of greatest concern
 - Foodborne disease detection and response
- A framework for prevention

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The Food System

- It is the most complicated system of all industrial or infrastructure-related activities in the world
- A global food supply
- Safety has been a critical issue prior to concerns about intentional harm

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The New Global Food Supply

- US agricultural sector accounts for more than \$1 trillion in economic activity;
- 2004 exports; \$62.3 billion
- Exceeded agricultural imports by \$9.6 billion
- 18% of domestic employment
- 13% of the US gross domestic product

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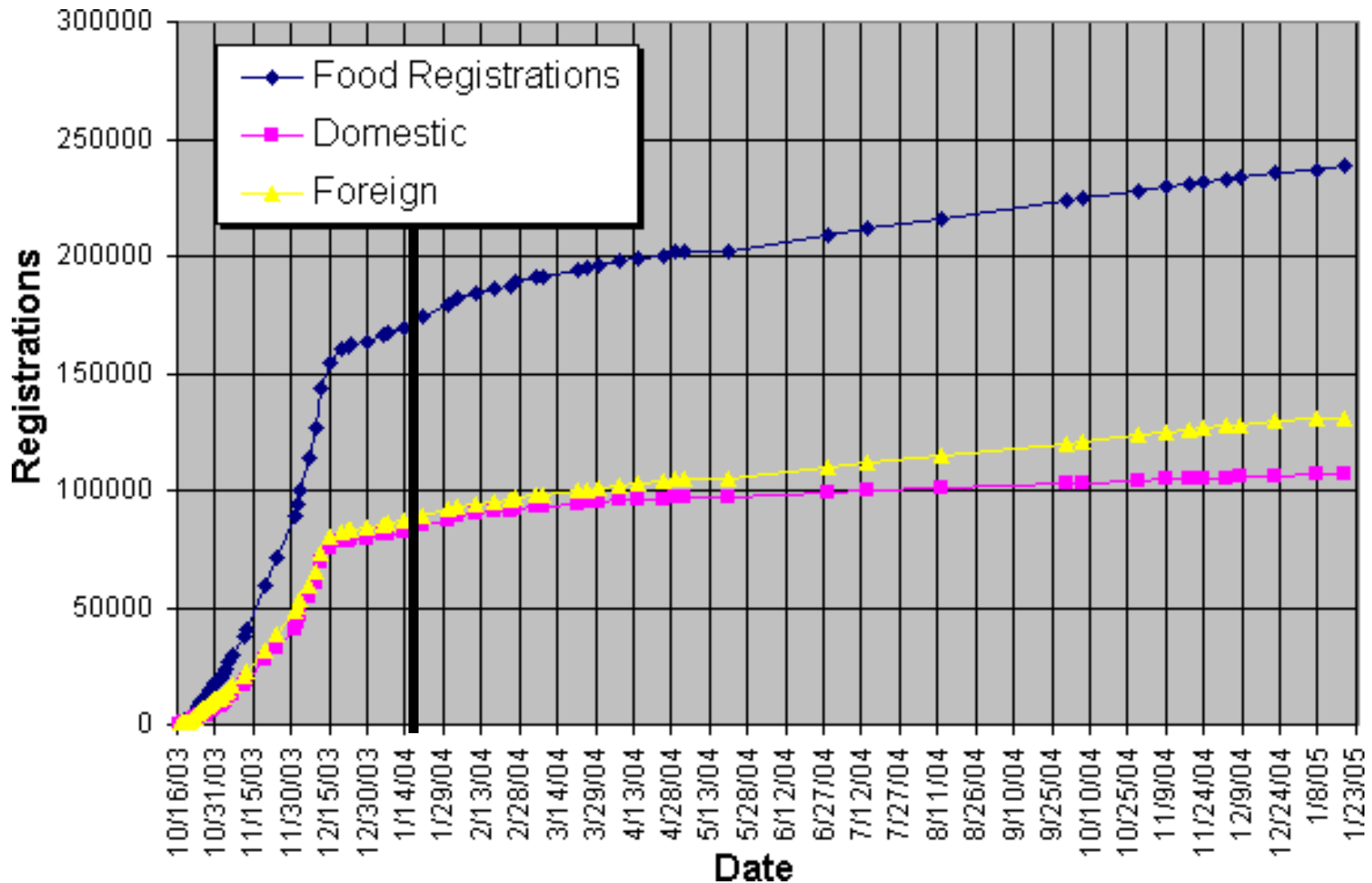
The Problem: Global Food Systems



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Primary Production » Harvest » Transportation » Storage » Processing » Distribution » Handling/Retail-Food Services » Consumer

FDA Food Registrations: Bioterrorism Preparedness and Response Act





Foods From Around The World...

HERBS





Where is this?

**USA? PERU?
MEXICO? CHILE?**



National Restaurant Association 2005 Restaurant Industry Facts

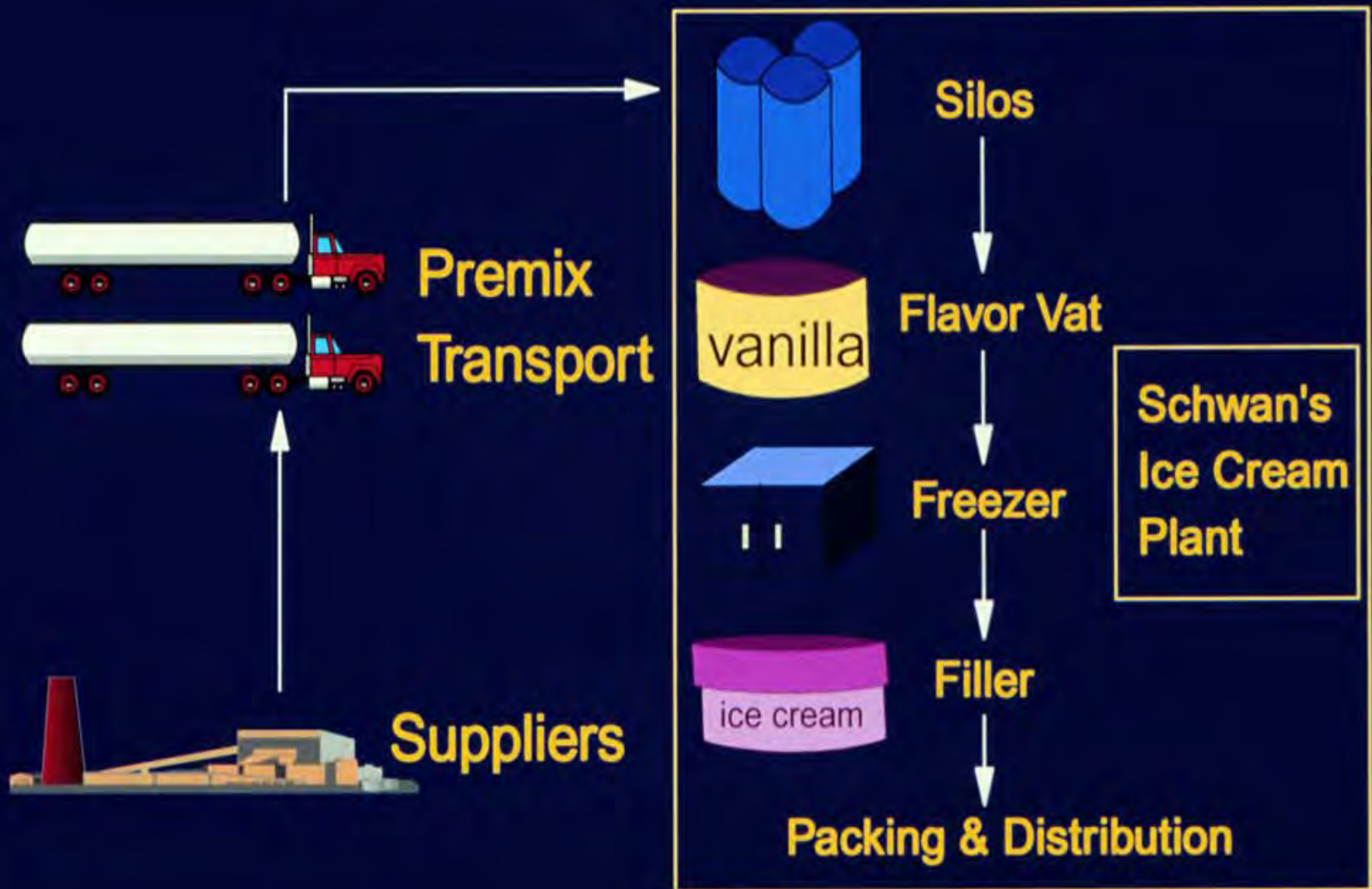
- Sales \$476 billion
- Locations 900,000
- Employees 12.2 million
- Restaurant share of the food dollar 47%

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10 13 '94

Flow of Ice Cream Product To and Through the Schwan's Plant



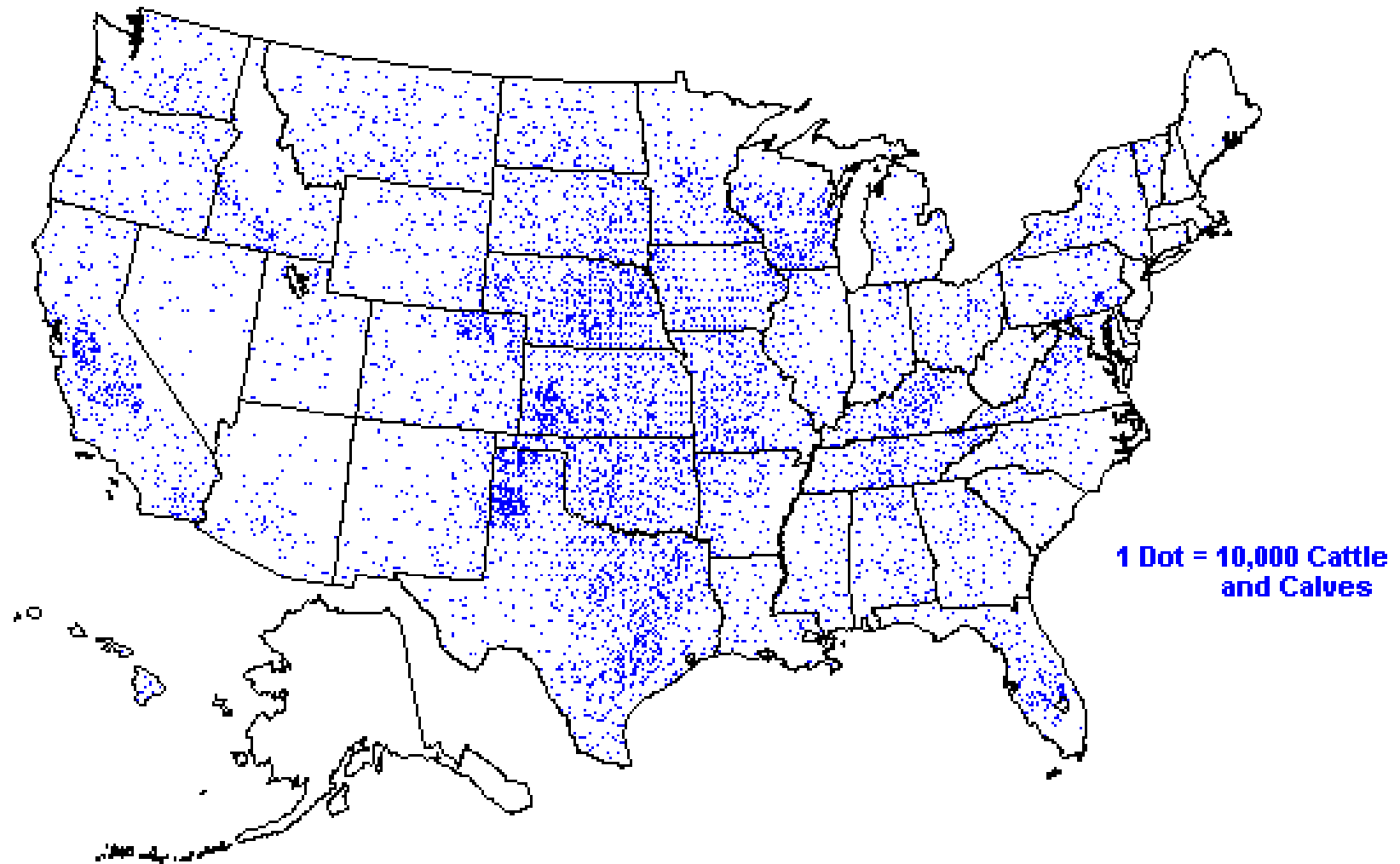
Enumeration of *Salmonella enteritidis* in Positive Schwan's Ice Cream Samples*

Date of Production	Time+	MPN/Gram (95% CI)	MPN per 65 gram Serving
Aug. 25	6:43 p.m.	<0.003(N/A)	<0.2
Aug. 25	10:13 p.m.	0.093(0.079-1.013)	6.0
Aug. 26	7:56 a.m.	0.093(0.079-1.013)	6.0
Sep. 12	11:43 p.m.	<0.003 (N/A)	<0.2

*Microbiologic testing conducted by the Minnesota Department of Agriculture
 +Time finished product was packaged

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Cattle and Calves - Inventory: 1997



United States Total
98,989,244

Intentional Attacks

1984, the Rajneeshee cult sprinkled the bacteria on ten restaurant salad bars.

Doomsday Cult/Type

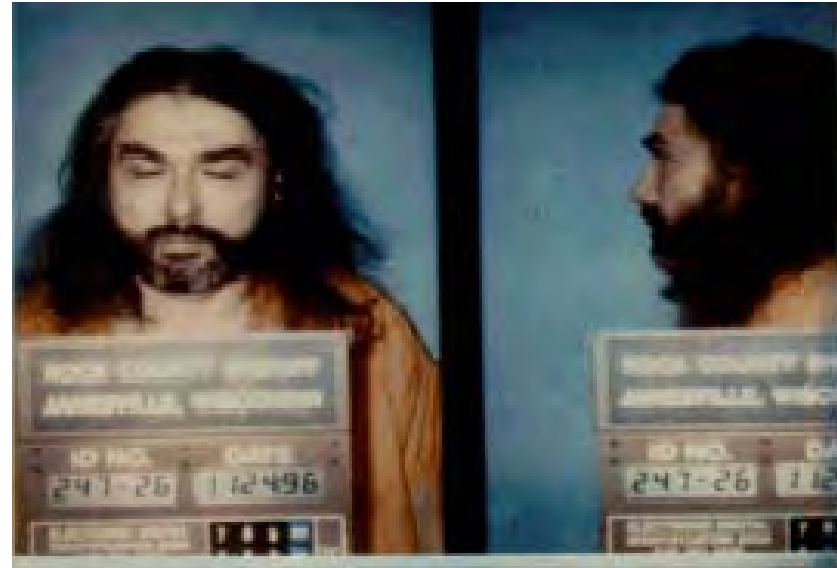


GROUP COMPOUND AND CLANDESTINE LAB

Lone Individuals

In January 1998, Thomas Leahy, Janesville, WI, was sentenced to 6 years in Federal prison for having made deadly agents in his basement “lab.”

Search items later confirmed to be Ricin, *Clostridium botulinum* and weaponized Nicotine Sulfate.



Previous Intentional Attacks

- Starting in the fall of 2001 and continuing into spring of 2002, bulk milk tanks on dairy farms (14 total) were contaminated with antibiotics. This event may have been a test of the feasibility of an attack using the milk system as a delivery vehicle.
- China 2002 – Business owner poisons hundreds, kills 77, by spiking competitor's baked goods with tetramine-based rat poison
- Michigan 2003 – Contamination of 200 lbs of ground beef with a insecticide containing nicotine by a disgruntled employee in a supermarket results in 111 ill, including 40 children

Major Foodborne Attack Threats

- **Economic disruption:** Target agriculture with animal or crop diseases (e.g., FMD virus in livestock)
- **Mass human casualties:** Target food processing or transportation with Class A agents (e.g., botulinum toxin in tanker truck)
- **Mass anxiety:** Target popular restaurants, food products with “credible” hoax

Characteristics of an Ideal Food/Beverage Vehicle For A Foodborne Bioterrorism Attack

- Opportunities for perpetrator access
- Lack of subsequent adequate heat-treatment
- Large volume and/or maximum mixing
- Product environment for agent growth or toxin chemical preservation
- Rapid distribution to consumers
- Rapid consumption by consumers
- Disproportionate consumption by “high risk populations”

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Agents of Concerns; Food-related Terrorism

- Biological
 - *Clostridium botulinum*
 - *Bacillus anthracis*
 - Enteric bacteria
 - Animal/plant specific agents
- Chemicals
 - “Fast acting”
 - “Slow acting”

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Food Protection and Defense

Food protection and defense is the development of effective measures to prevent, detect and respond to a potential bioterrorist attack of the food system.

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Identifying Food Bioterrorism

“Early detection of disease resulting from covert food terrorism depends on sensitive surveillance systems for communicable disease at the local and national levels, with close cooperation and communication among clinicians, laboratories and public health officials.”

World Health Organization (WHO), Terrorist Threats to Food, 2002.

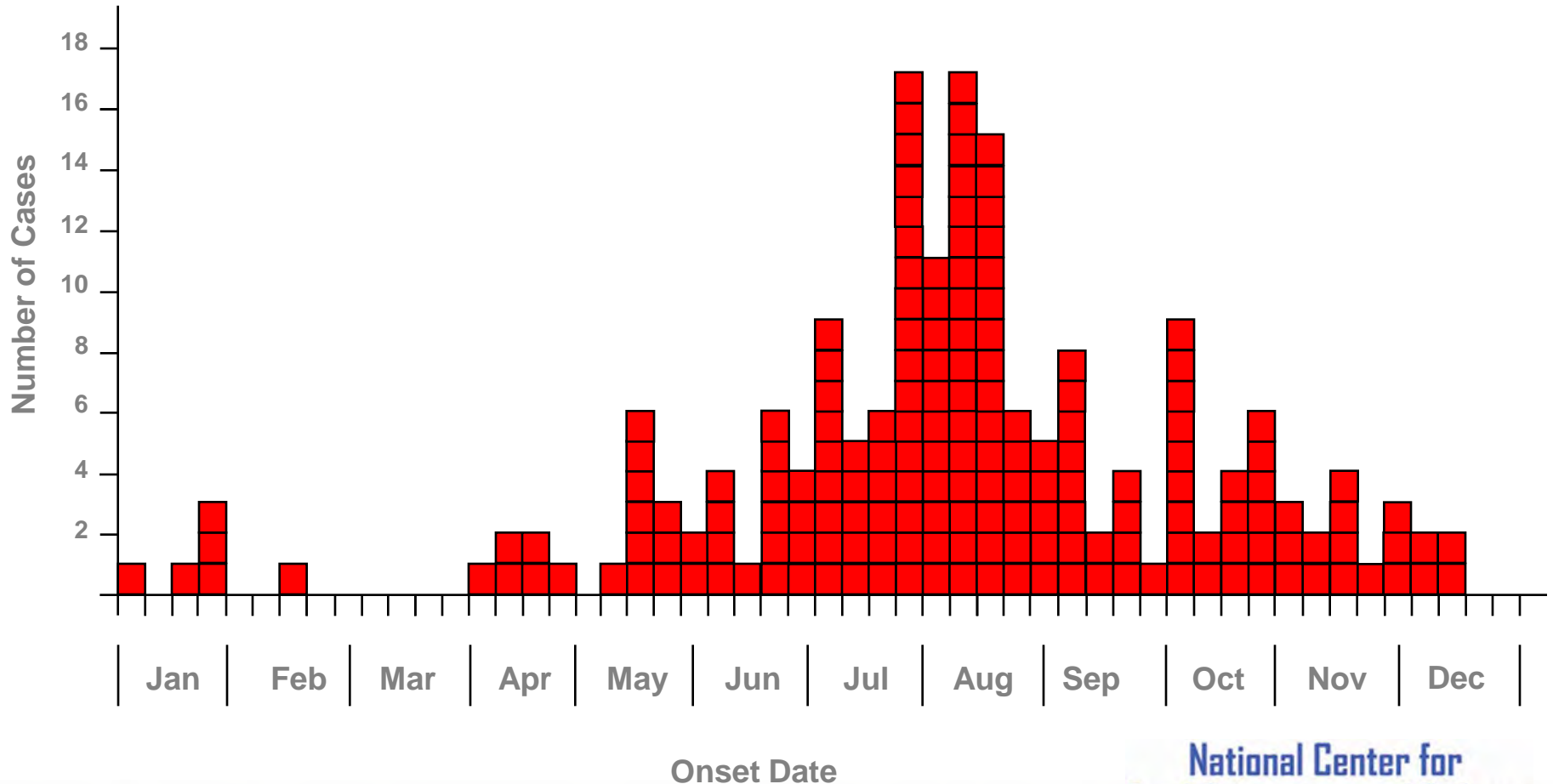
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Foodborne Disease Surveillance and the Public Health Response to Food Terrorism

- Will depend on the type of agent, efficiency of the attack and geographic distribution of cases
- Acute and unusual illnesses clustered by time and location will trigger immediate response
- Typical enteric-related foodborne disease, even if in large numbers of cases, if distributed nationally will be difficult to detect and identify the source in a timely manner

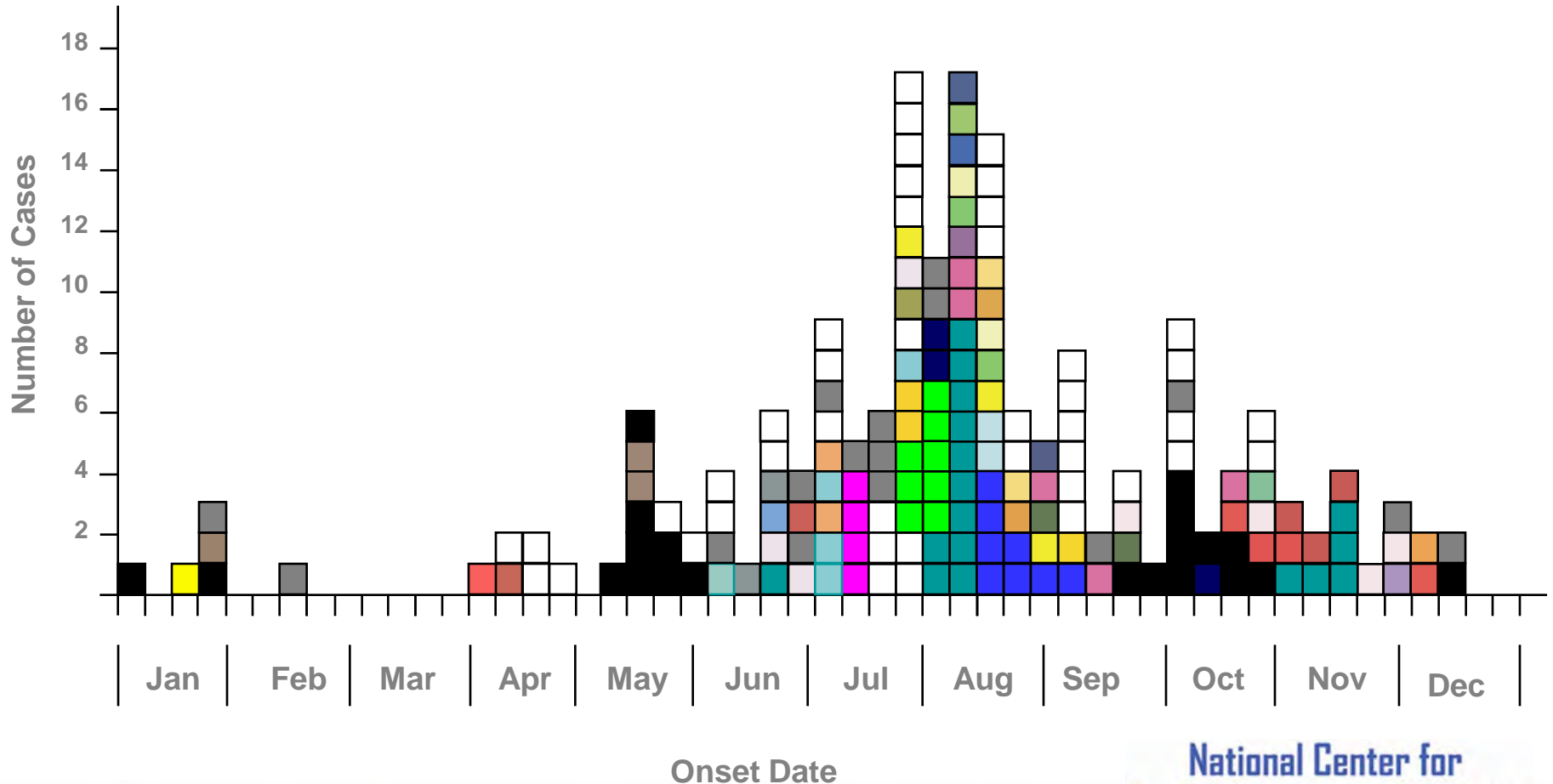
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Escherichia coli O157:H7 Cases, by Onset Date, Minnesota, 1995



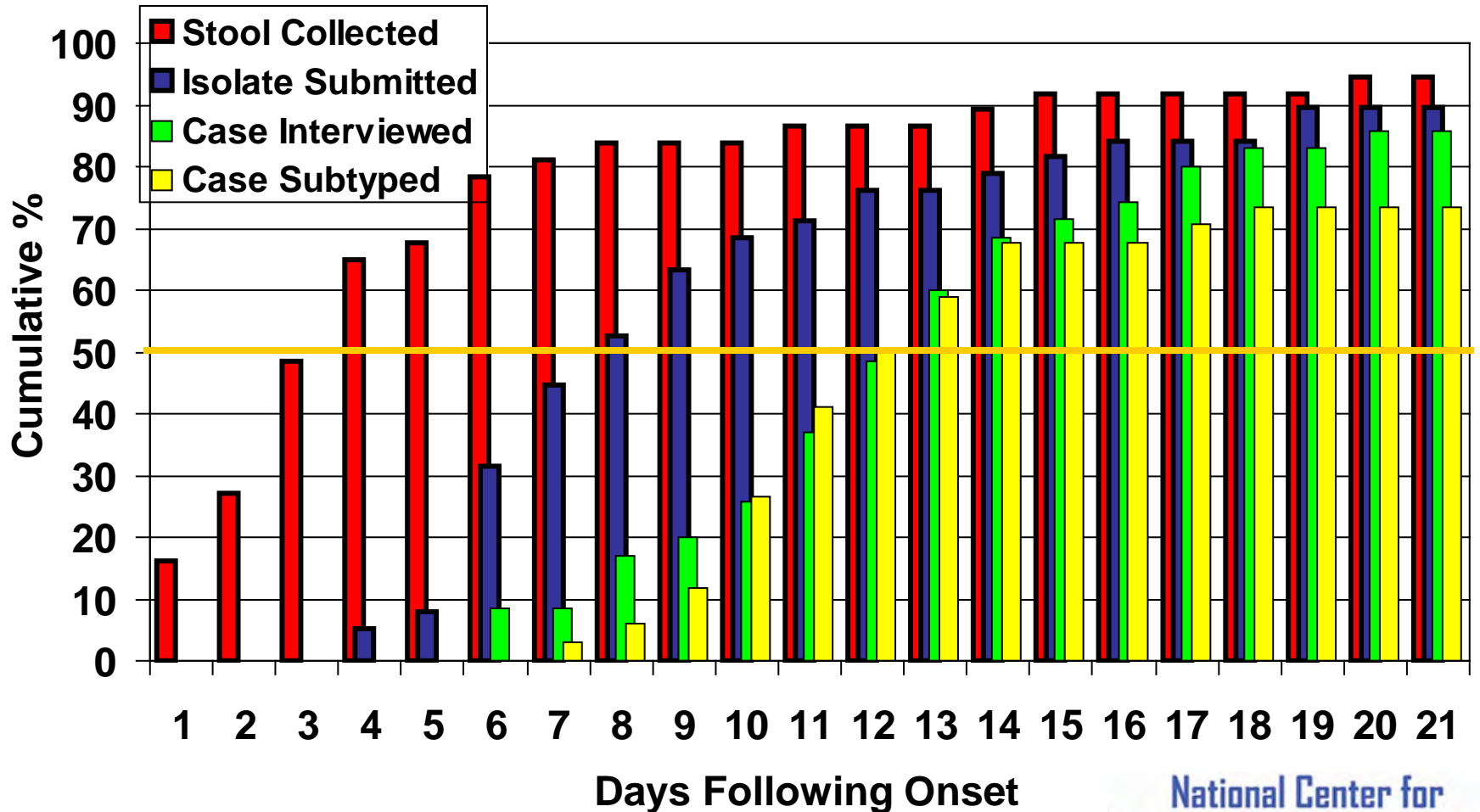
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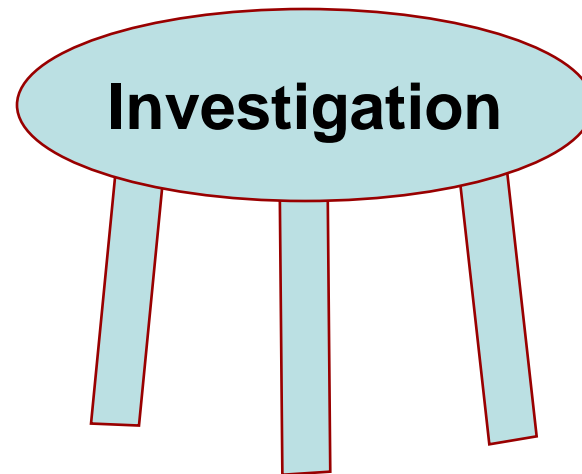
Enteric Disease Timelines, E. coli O157:H7, Medium State, 2002



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Outbreak Investigations: Traditional View of Collaboration

- Close collaboration
 - Epidemiologists
 - Public Health laboratories
 - Environmental health specialists



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Outbreak Investigations: Dynamic View of Collaboration

- Outbreak investigations need to be conducted *rapidly* if they are going to help identify contaminated products and remove them from the marketplace.



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A Framework for Food Protection and Defense

- What Best Serves the Public Good?
- Who Determines Acceptable Risk?
- Food safety versus food protection and defense (i.e. food biosecurity)

HACCP for Food Safety:

Control of Hazards Reasonably Likely to Occur

	Exposure Likelihood			
	Low	Medium	High	
Impact	Severe			
	Moderate			
	Mild			

Food Protection and Defense: Control of Severe Impact with Low Likelihood

	Exposure Likelihood			
	Low	Medium	High	
Impact	Severe			
	Moderate			
	Mild			

Food Protection and Defense

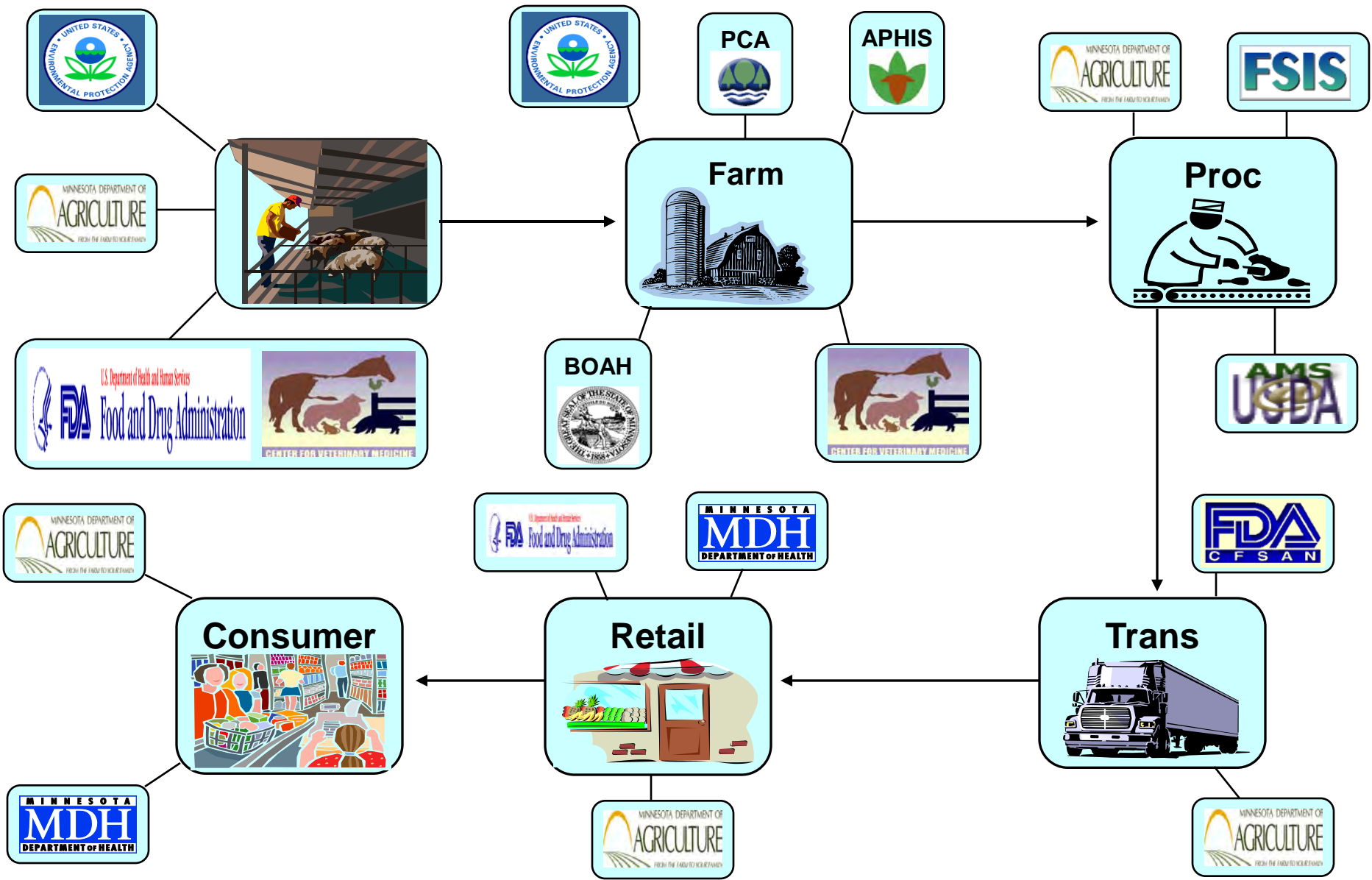
- Because food protection and defense systems target hazards that are unlikely to occur, these investments are *unlikely* to yield measurable benefits.
- How should these viewed?
 - As public goods warranting public support?
 - Regulated as a condition for doing business?
 - Treated as a cost of doing business like insurance?

The Challenges of Food Protection and Defense

- What is the tolerable risk?
 - Zero risk is unachievable
 - Promoting “zero risk” creates a false sense of assurance and reduces overall food protection
- Who pays? Public vs. private good
- How do we implement food protection and defense most effectively and efficiently?
 - Mandate (regulation) vs. incentive

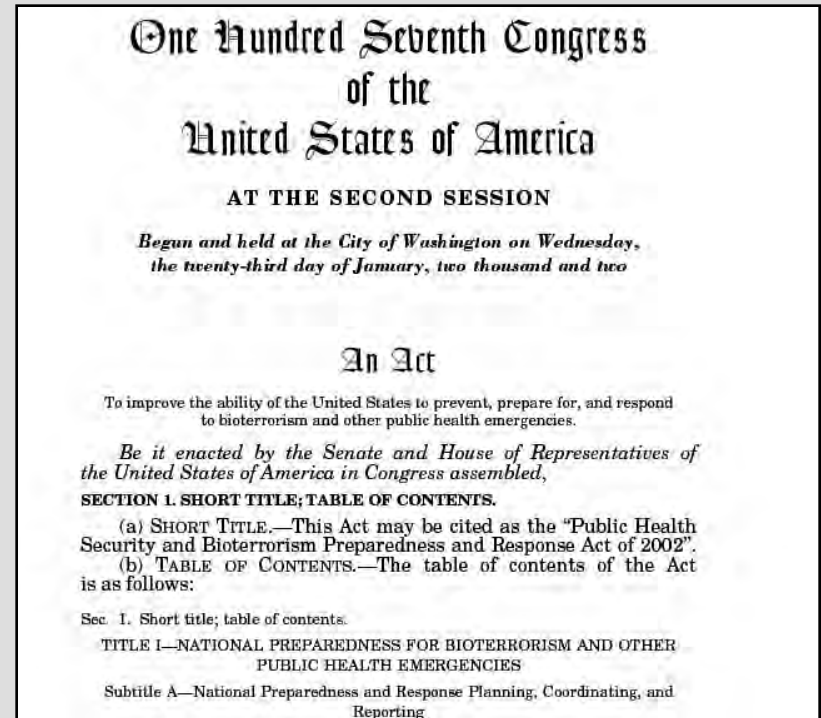
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Effective response requires collaboration

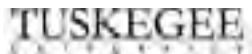


Federal Government Actions

- All involved government agencies and departments have addressed to some extent food defense
- Presidential Directives 7, 9, and 10
- Title Three of the Bioterrorism Act of 2002
- DHS, HHS, and USDA all have taken steps to further secure the food supply, e.g., Food Security Preventive Measures Guidance
- DHS established the National Center for Food Protection and Defense (U of MN) and the National Center for Foreign Animal and Zoonotic Disease Defense (Texas A&M)



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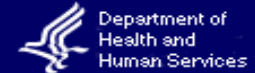


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Collaborating Federal Agencies



U.S. Food and Drug Administration



CENTER FOR FOOD SAFETY AND APPLIED NUTRITION



United States Department of Agriculture



CENTERS FOR DISEASE CONTROL AND PREVENTION



Agricultural Research Service

the in-house research arm of the U.S. Department of Agriculture



United States Department of Agriculture
Food Safety and Inspection Service



Cooperative State
Research, Education, and Extension Service



ERS ECONOMIC RESEARCH SERVICE
United States Department of Agriculture

The Economics of Food, Farming, Natural Resources, and Rural America



aphis.usda.gov

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CARVER

Considers seven factors that affect the desirability of a target:

- **C**riticality – Public health and economic impacts to achieve the attacker's intent
- **A**ccessibility – Physical access to the target
- **R**ecuperability – Ability of the system to recover from the attack
- **V**ulnerability – Ease of accomplishing the attack
- **E**ffect – Amount of direct loss from an attack
- **R**ecognizability – Ease of identifying a target
- **S**hock – Combined physical, public health, psychological, and economic effects of an attack

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CARVER – Overview

- Breaks a food system into its smallest pieces (nodes) in the farm to table continuum
- Identifies “critical nodes” that are the most likely targets for terrorist attack, by applying the analysis to each node
- Leads to the identification of countermeasures to reduce the risk at those nodes

Terrorist Profile

- **Who** is the threat (person/organization)?
- What are their **capabilities**?
- What is their **intent** (goals)?
- What is their prior **history** (past terrorist activities)?

CARVER

- **Criticality:** A target is critical when its attack would have significant health, psychological, or economic impact.
- One must ask: Does it achieve the goals of the terrorist profile?

CARVER

- **Accessibility:** A target is accessible when an attacker, including an insider, can reach the target with sufficient resources to achieve the desired effect.
- Includes the ability to gather intelligence, conduct reconnaissance, conduct the attack, and leave the target undetected.
- One must ask: What are the barriers to an attack?

CARVER

- **Recuperability:** Measured in the time it will take to overcome, bypass or repair the damage to the target, including the physical, psychological and economic impacts.

CARVER

- **Vulnerability:** A target is vulnerable if a terrorist has the means and expertise to successfully attack it and if the attack will result in the desired effect.
- One must ask: Are there existing interventions that could reduce the likelihood of the attack?

CARVER

- **Effect:** The percentage of infrastructure (daily productivity) damaged by the attack.

CARVER

- **Recognizability:** The degree to which a target can be identified by an attacker under varying conditions without confusion with other potential targets.
- Factors that influence recognizability:
 - Size of the target
 - Complexity of the target
 - Existence of distinguishing characteristics

+ Shock

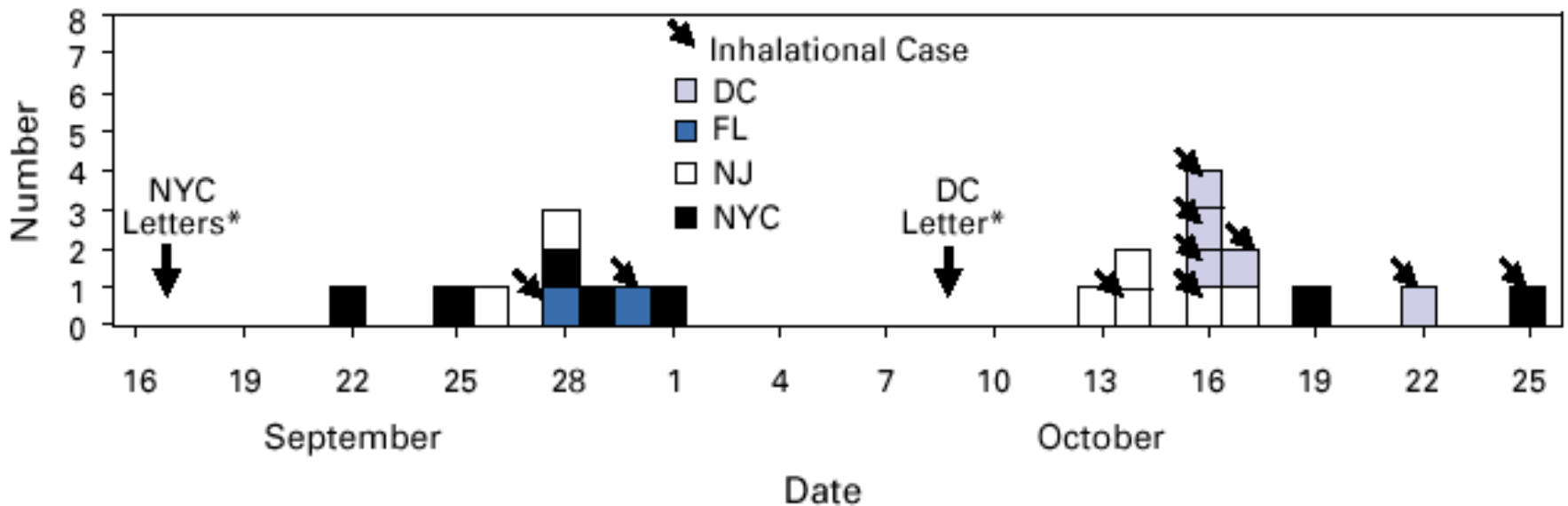
- The psychological effect of an attack on a society or community.
- Factors that effect shock include:
 - Symbolism of the target
 - The historical significance of the attack (has it happen before?)
 - The magnitude of the attack (public health and economic impact)

CARVER and Industry

- Work with “higher-risk” industries to train them in CARVER.
 - Already worked with dairy, bottled water, liquid egg
 - On-going work with several others
- Goal is to develop a tool that will allow industry to conduct their own “CARVER-type” analysis.

Employees Handling Contaminated Products May Not Be The Intended Targets, But May Be The First and Most Visible Sign of a Problem.

FIGURE 1. Number of bioterrorism-related anthrax cases, by date of onset and work location — District of Columbia (DC), Florida (FL), New Jersey (NJ), and New York City (NYC), September 16–October 25, 2001



* Postmarked date of known contaminated letters.



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