

# Using stakeholder input to develop multi-institutional graduate education programs in food defense

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# Need

- There is a need for an inter-disciplinary, evidence-based food safety and defense information/curriculum for both graduate students and “professionals” that work in the general area of food protection and defense

# Risk Reduction: Inherent vs. Intentional

- Inherent (for probable)
  - Focus on what hazards are likely to occur
  - HACCP
  - GMP's, SOP's, Sanitation
  - Supplier approval, ingredient specifications, audits
  - Training
- Intentional (for improbable)
  - Is a new approach needed? Dual use?
  - Points of vulnerability, prevention, intervention, response, recovery, threat detection, **crisis management**, media interactions, industry communication, public health communication?

# Food Industry Wants

- Develop an approach that can help us prepare better for food defense
- Find a balance...

**PREVENTION**

**FOOD SAFETY** 

food defense

**RESPONSE**

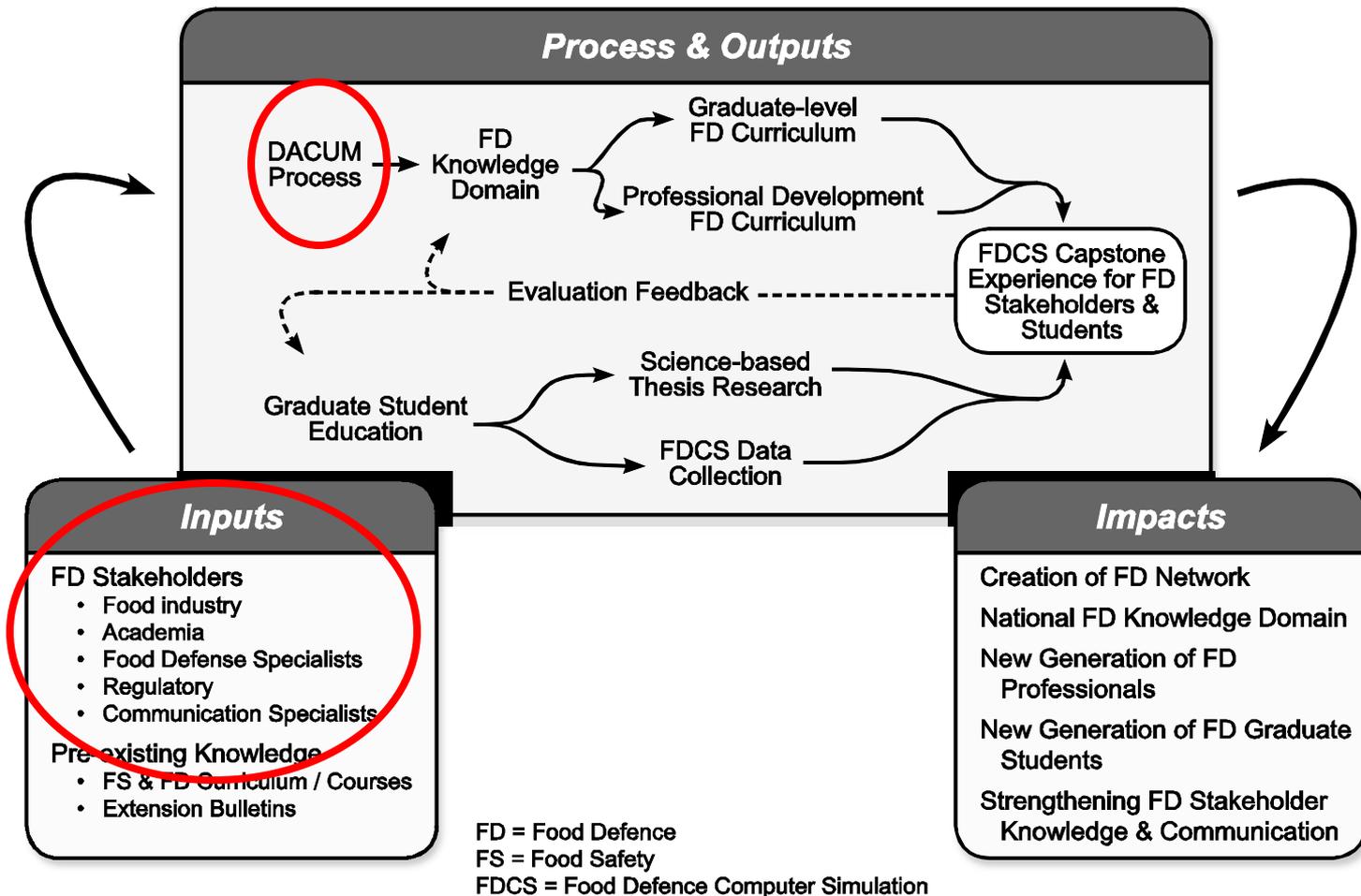
**FOOD DEFENSE**

food safety

# Our Journey...

- OBJECTIVE 1: Development of *National Food Defense Knowledge Domain* using stakeholder input
- OBJECTIVE 2: Development and organization of an applied national educational food safety and food defense *curriculum at the graduate level*
- OBJECTIVE 3: Development and coordination of a food safety and food defense *outreach program for key stakeholders* involved in food safety and food defense
- OBJECTIVE 4: Development of a *capstone experience*, involving food defense stakeholders and graduate students, to complement learning concepts from the educational curriculum

# Our Vision...



# Who are the End Users?

## The “Food Defense Professional”

- Students (graduate and undergraduate)
- Food industry – farm to fork
- Regulatory – federal, state, local
- First responders
- Academia
- Healthcare
- Other key stakeholders

# Stakeholder Input

- What is a “food defense professional?”
- What should they know??
  
- What should we teach?
  - What we know best?
  - What we were taught?
  - What we enjoy teaching?
  - What we have experience with?
  - What the textbook happens to include?
  - What the student/worker needs for successful employment?

What  
**IS**  
taught



What  
**SHOULD BE**  
taught



Academia

← **DACUM** →



Real World

# DACUM

- An Acronym for Developing A CurriculUM.
- Originated at The Ohio State University



- A research-based process to recruit, gather, and integrate **stakeholder input** to maximize educational curriculum development

# DACUM Operates on Three Premises

1. Any occupation can be described in terms of skills required to perform specific tasks.
2. Expert practitioners can describe their occupation better than anyone else.
3. All tasks, in order to be performed correctly, require certain knowledge, skills, tools and worker behaviors.

# Steps in a DACUM Process

1. Select an occupation to be described.
2. Select a panel of experts in that occupation
3. Select a skilled facilitator to work with the panel.
4. Facilitator and panel develop a DACUM chart in a 2-3 day workshop.
5. Verify the contents of the DACUM chart by other experts not on the panel.
6. Translate and apply the DACUM chart to instructional strategies, materials and evaluation instruments.

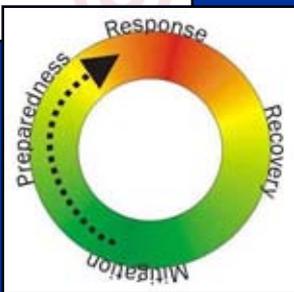
# The DACUM Workshop

- 3-day process led by a trained facilitator (Dr. Cynthia Woodley, PTI)
- Panel of 13 food safety & defense experts



# DACUM Chart

- The DACUM workshop produces a matrix that describes the occupation in terms of **DUTIES** (general areas of competence), and **TASKS**, as well as associated **knowledge domains**.
- The contents of the chart represent the consensus of the expert panelists.



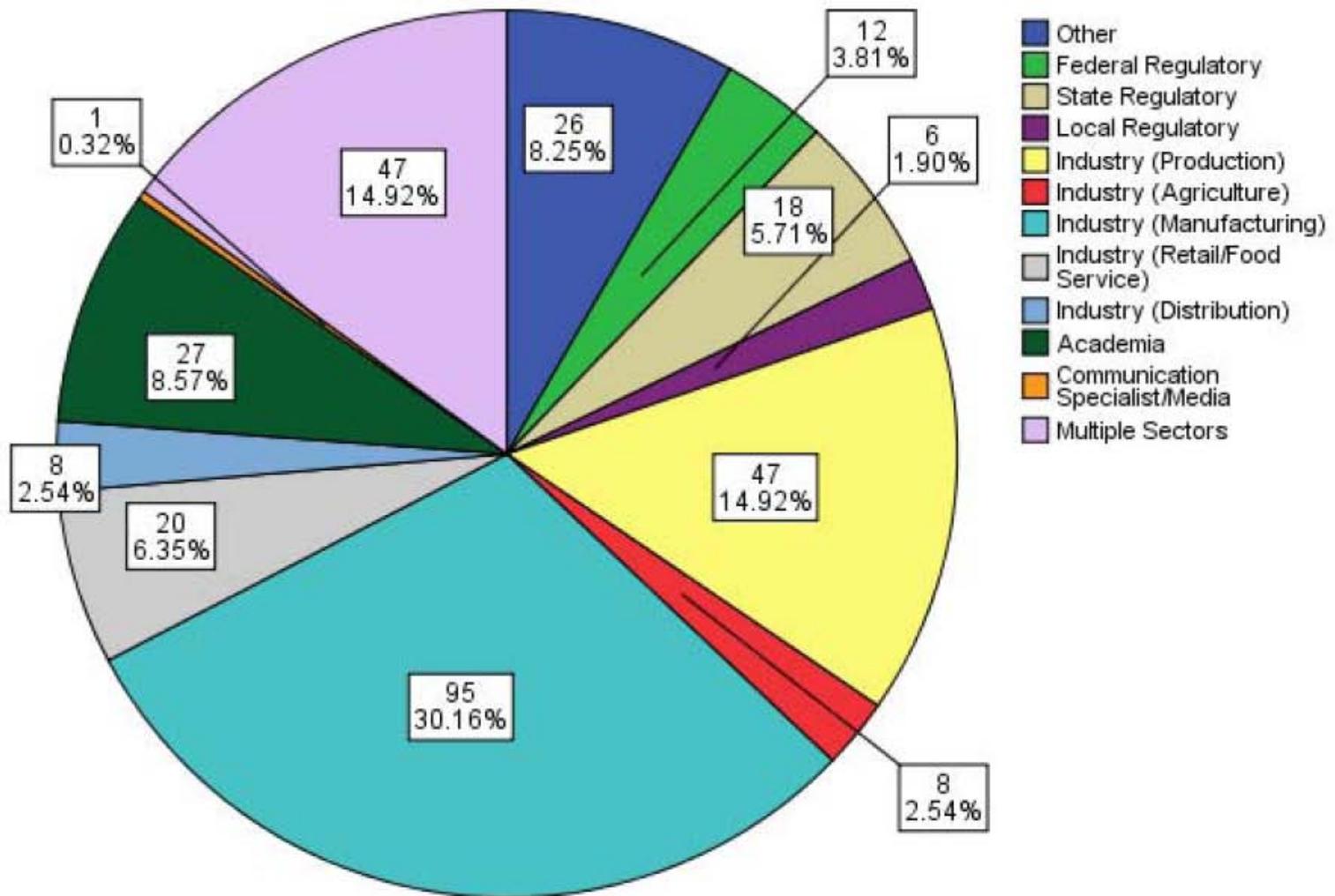
# Key Duties Identified

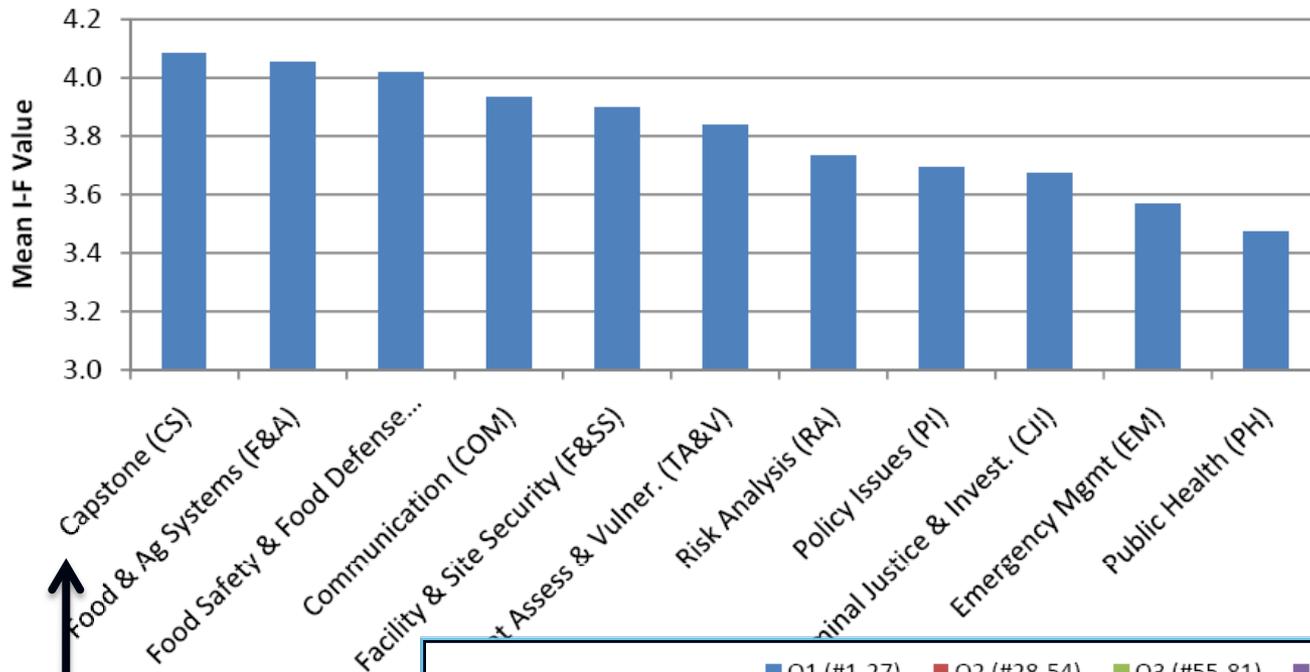
- Preventing,
  - Detecting & diagnosing,
  - Responding to, and
  - Recovering from food system incidents.
- 
- Communication
  - Research & Development

# Validation of DACUM Chart

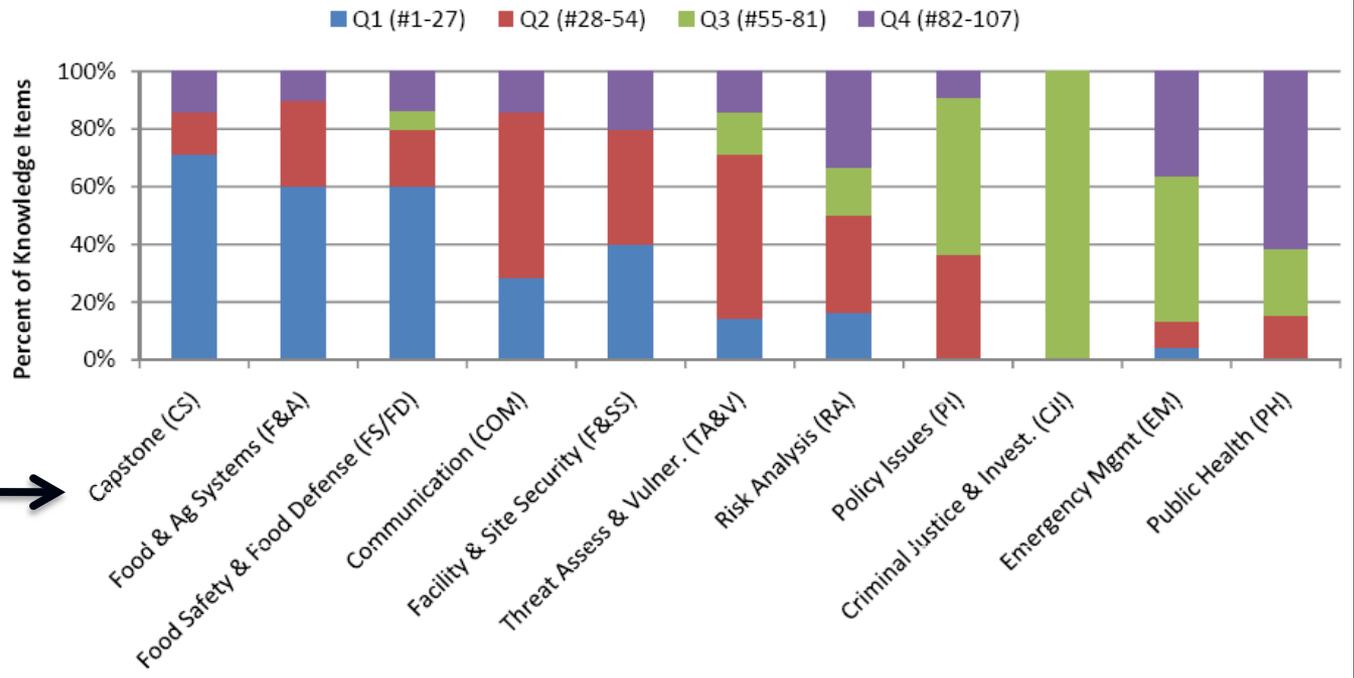
- Within these duties and tasks, more than 100 knowledge areas were identified.
- The relevance of these knowledge areas was validated using an online survey instrument.
- More than 300 survey participants rated the knowledge domains with respect to importance and frequency of use.

# Survey participants by sector





**Capstone**  
*(more later)*



# How to Use DACUM Information

The results of the DACUM process can be used for:

- curriculum development,
- training materials development,
- training needs assessment,
- career counseling,
- job descriptions, and
- competency test development.

# The case for collaborative, multi-institutional graduate education initiatives in food defense

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- “...no one entity has the financial capacity, the experience or the knowledge base to completely address the potential threats facing the nation’s food supply.”

*Education Group of the National Center for Food Protection and Defense from the Science and Technology Directorate. “Food Defense Education: Post 9/11.” 2007. Available at [www.foodprotectioneducation.org](http://www.foodprotectioneducation.org).*

- Graduate Certificate in Food Safety & Defense



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- Certificate-like program for Food Protection and Defense Professionals

NATIONAL CENTER FOR  
**FOOD PROTECTION AND DEFENSE**  
A HOMELAND SECURITY CENTER OF EXCELLENCE

# AG\*IDEA Program

- Established through 2005 USDA Higher Ed Challenge Grant
- Uses GPIDEA / AGIDEA platform
- Four participating institutions
- Students select one as their home institution, but take classes from all four universities



# NCFPD Program

- **leverage and fuse** outstanding course offerings and/or initiatives from **many institutions** without formal inter-institutional agreements
- accommodate **various course formats** (online, traditional classroom setting, short course, etc.)
- make the program accessible to **students anywhere**
- feature **flexibility** to meet the needs and interests of individual students
- plan for and **embrace change** as the needs of food defense professionals **evolve**

# Leveraging the DACUM Process

Multi-institutional programs can leverage the DACUM process because it is an effective method to develop a comprehensive set of *knowledge domains* and *critical core educational competencies* related to food safety and food defense that can serve as a *foundation for educational curricula.*

# Capstone

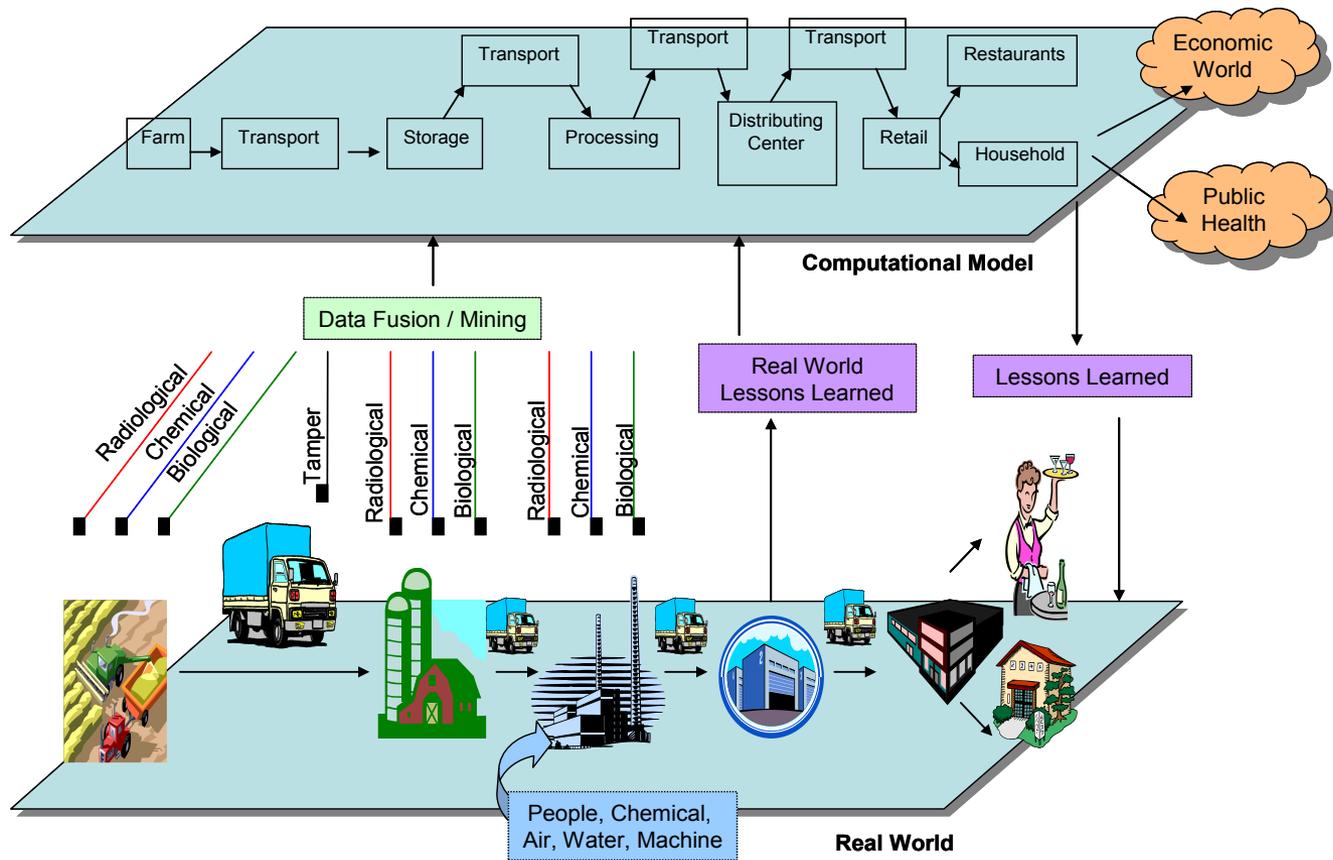


# Capstone Experience



Food Defense Computational Simulation

# Overall Thinking



# General Approach for Simulation

1. Collect economic, public health, and food distribution data
2. Develop computational model to forecast economic and public health information
3. Establish teams representing food industry, government, media, etc.
4. “Play” the simulation
5. Facilitate discussion of decision making rationale and impacts with after action reviews

# Data Collection

- Information type (examples)
  - *Economic data* (retail prices, market share, recall effects, cost of testing)
  - *Public health data* (biological and chemical agent characteristics, foodborne illness statistics, etiological agent testing, infective dose, morbidity/mortality rates, intervention strategies)
  - *Ingredient and food distribution data* (processing plant locations, production information, product information, distribution networks)
- Accessing information
  - Literature searches, company financial statements, personal communication with members of the food industry

# Simulation “Teams”

- Human Players - Make Decisions
  - Ingredient Suppliers (4-5 teams)
  - Food Processors (4-5 teams)
  - Food Retailers (4-5 teams)
  - Food Transportation/Distribution (4-5 teams)
- Human Players – Provide Information
  - Government (State/Local, USDA, FDA, CDC, FBI)
  - Other first responders (i.e. emergency management)
  - Media
  - Consumers (hotlines, complaints)
- Computer Players – Data collection/output
  - Food Distribution

# Simulation Setting



# Simulation Setting

## Financial Report

### COMPANY

Texowa

### TYPE

Processor

### SALES

Cost : 3,015,168

Units : 5412

Dollars : 7414,440

### TOTAL

Cost : 1,207,014

Units : 16225

Dollars : 22228,25



## Options Panel

### Actions

- > Test LotIds
- > Hold LotIds
- > Recall LotIds
- > Release LotIds
- > Proceed

### History

### Display

## Node Information

COMPANY	TYPE	LOCATION	LEGEND
Kroger	Kroger	Kroger	<ul style="list-style-type: none"> <li><span style="color: orange;">●</span> BULK</li> <li><span style="color: red;">●</span> PROCESSING</li> <li><span style="color: purple;">●</span> DISTRIBUTION</li> <li><span style="color: blue;">●</span> RETAIL</li> </ul>
<b>SALES COST</b>	<b>SALES UNITS</b>	<b>SALES DOLLARS</b>	
\$100	\$100	\$100	
<b>TOTAL COST</b>	<b>TOTAL UNITS</b>	<b>TOTAL DOLLARS</b>	
\$100	\$100	\$100	
<b>INVENTORY</b>			
			<b>TERRORIST LEVEL</b> <ul style="list-style-type: none"> <li><span style="color: red;">■</span> Severe</li> <li><span style="color: orange;">■</span> High</li> <li><span style="color: yellow;">■</span> Elevated</li> <li><span style="color: blue;">■</span> Guarded</li> <li><span style="color: green;">■</span> Low</li> </ul>

Current Day : 3

MAP

# Simulation Setting

## Financial Report

### COMPANY

Texowa

### TYPE

Processor

### SALES

Cost : 3,015,166

Units : 5412

Dollars : 7414,440

### TOTAL

Cost : 1,207,014

Units : 16225

Dollars : 22228,25

## Options Panel

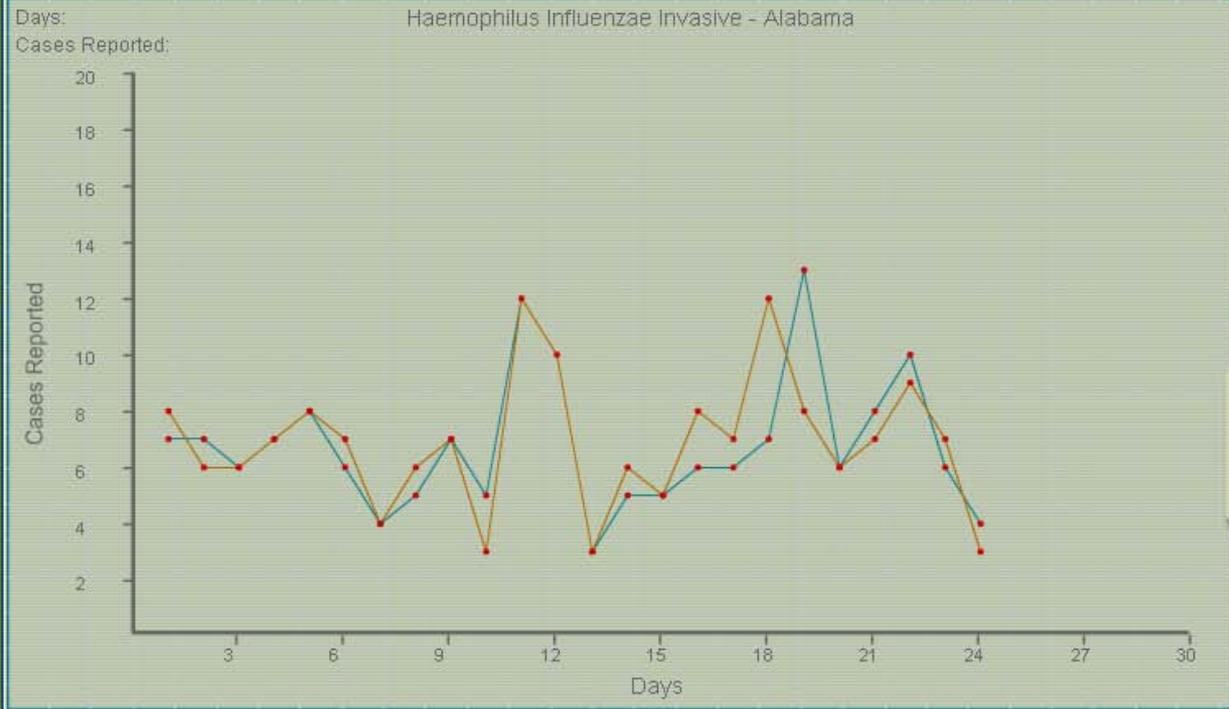
### Actions

### History

### Display

> Show Map

> Show Graph



Choose an agent :

- Haemophilus influenzae Invasive
- Staphylococcus aureus
- Salmonellosis
- Botulism
- Shigellosis
- Legionellosis
- Hepatitis A
- Giardiasis
- Bacillus anthracis
- Cryptosporidiosis

Choose a state :

Alabama

- 2004
- 2005

Submit Graph

Current Day : 3

GRAPH

# Simulation Setting

## Financial Report

### COMPANY

Texowa

### TYPE

Processor

### SALES

Cost : 3,015,168

Units : 5412

Dollars : 7414,440

### TOTAL

Cost : 1,207,014

Units : 16225

Dollars : 22228,25

Game  
Master  
message

## Options Panel

### Actions

> Test LotIds

> Hold LotIds

> Recall LotIds

> Release LotIds

> Proceed

History

Display



## Node Information

### COMPANY

Kroger

### TYPE

Kroger

### LOCATION

Kroger

### LEGEND

● BULK

● PROCESSING

● DISTRIBUTION

● RETAIL

### SALES COST

\$100

### SALES UNITS

\$100

### SALES DOLLARS

\$100

### TOTAL COST

\$100

### TOTAL UNITS

\$100

### TOTAL DOLLARS

\$100

### INVENTORY

--

### TERRORIST LEVEL

■ Severe

■ High

■ Elevated

■ Guarded

■ Low

Current Day : 3

MAP

# Simulation Setting



The interface is divided into several functional areas:

- Financial Report (Left Panel):**
  - COMPANY:** Texowa
  - TYPE:** Processor
  - SALES:**
    - Cost : 3,015,168
    - Units : 5412
    - Dollars : 7414,440
  - TOTAL:**
    - Cost : 1,207,014
    - Units : 16225
    - Dollars : 22228,25
- Options Panel (Bottom Left):**
  - Actions:**
    - Test LotIds
    - Hold LotIds
    - Recall LotIds
    - Release LotIds
    - Proceed
  - History**
  - Display**
- Main Simulation Area (Center):**
  - Day:** 0, 1, 2, 3
  - Company:** DSM-Roche, Tate and Lyle, Texowa, Wild Flavors
  - Product:** Annatto, Ascorbic Acid, Citric Acid, Natural And, Rangeland, Rangeland, Salt, Sugar, Vitamin B12
  - Lot ID:** 0000
  - Shift:** Shift0
  - MAP** button
- Search Options (Bottom Right):**
  - New Search
  - Show All
  - Show Selected
  - Continue
- Status Bar (Bottom):** Current Day : 3 TEST

# Simulation Setting

## Financial Report

### COMPANY

Texowa

### TYPE

Processor

### SALES

Cost : 3.015168

Units : 5412

Dollars : 7414.440

### TOTAL

Cost : 1.207014

Units : 16225

Dollars : 22228.25

## Options Panel

### Actions

> Test LotIds

> Hold LotIds

> Recall LotIds

> Release LotIds

> Proceed

### History

### Display

<input type="checkbox"/>	Virus	E Bola virus	7	1000	80
<input type="checkbox"/>	Bacteria	Salmonella spp	5	35	91
<input type="checkbox"/>	Bacteria	Salmonella Typi	5	100	87
<input type="checkbox"/>	Toxin	Vibrio cholerae (toxin)	5	50	90
<input type="checkbox"/>	Bacteria	Vibrio cholerae (bacteria)	5	35	90
<input checked="" type="checkbox"/>	Bacteria	E. coli O157:H7	4	30	95
<input checked="" type="checkbox"/>	Bacteria	Shigella spp	5	50	91
<input checked="" type="checkbox"/>	Toxin	Shigella dysenteriae Type 1	5	70	87
<input type="checkbox"/>	Bacteria	Listeria monocytogenes	6	30	96
<input type="checkbox"/>	Bacteria	Staphylococcus aureus (bacteria)	4	20	93
<input type="checkbox"/>	Toxin	SA toxin	4	110	94
<input type="checkbox"/>	Bacteria	Coxiella burnetti	4	40	95
<input type="checkbox"/>	Toxin	Ricinus communis toxin (Ricin)	2	100	95
<input type="checkbox"/>	Bacteria	Clostridium perfringens	3	35	90
<input type="checkbox"/>	Toxin	Clostridium perfringens (Epsilon toxin)	6	42	96
<input type="checkbox"/>	Parasite	Cryptosporidium parvum	4	40	90
<input checked="" type="checkbox"/>	Chemical	Arsenic	10	70	95
<input checked="" type="checkbox"/>	Chemical	Cyanide	4	75	95
<input type="checkbox"/>	Chemical	Mercury	2	50	95
<input type="checkbox"/>	Toxin	Abrin	2	100	95
<input type="checkbox"/>	Chemical	Sarin	4	75	95
<input type="checkbox"/>	Chemical Toxin	Strychnine toxin	4	70	92
<input type="checkbox"/>	Chemical Toxin	Ochratoxin	5	50	92
<input checked="" type="checkbox"/>	Chemical	Lead	10	36	95
<input type="checkbox"/>	Chemical	Vomit toxins	5	50	92
<input type="checkbox"/>	Bacteria	Bacillus cereus	4	25	90
<input type="checkbox"/>	Toxin	B. cereus diarrheal enterotoxin	4	110	93
<input type="checkbox"/>	Bacteria	Campylobacter	5	41	89
<input type="checkbox"/>	Chemical	Paraquat	2	65	95
<input type="checkbox"/>	Virus	Norwalk virus	7	1000	80

> Submit

Current Day : 3

TEST

# Simulation Setting

## Financial Report

### COMPANY

Texowa

### TYPE

Processor

### SALES

Cost : 3,015,168

Units : 5412

Dollars : 7414,440

### TOTAL

Cost : 1,207,014

Units : 16225

Dollars : 2228,25

Action	Cost	Agent	LotId	Results
Test	\$410	Bacillus anthracis	3-Texowa-Rangeland Crispy Bran With Raisins-0000-0-Arkansa	PENDING
Test	\$5850	Bacillus anthracis (toxin)	3-Texowa-Rangeland Crispy Bran With Raisins-0000-0-Arkansa	PENDING
Test	\$3000	C. botulinum Toxin	3-Texowa-Rangeland Crispy Bran With Raisins-0000-0-Arkansa	PENDING
Test	\$700	Shigella dysenteriae Type 1	3-Texowa-Rangeland Crispy Bran With Raisins-0000-0-Arkansa	PENDING
Test	\$500	Shigella spp	3-Texowa-Rangeland Crispy Bran With Raisins-0000-0-Arkansa	PENDING
Test	\$300	E. coli O157:H7	3-Texowa-Rangeland Crispy Bran With Raisins-0000-0-Arkansa	PENDING
Test	\$750	cyanide	3-Texowa-Rangeland Crispy Bran With Raisins-0000-0-Arkansa	PENDING
Test	\$700	arsenic	3-Texowa-Rangeland Crispy Bran With Raisins-0000-0-Arkansa	PENDING
Test	\$360	Lead	3-Texowa-Rangeland Crispy Bran With Raisins-0000-0-Arkansa	PENDING

## Options Panel

### Actions

### History

Choose Day:

3

Show History

### Display

Current Day : 3

HISTORY

# Lessons Learned

## ■ ***Communication***

- Communication up and down the food flow chain is critical and challenging
- Media plays an important source of information

## ■ ***Approach differs from food safety***

- Response, prevention, control, and thought process is different for inherent vs. intentionally added contaminants.
- Computer models to help decision making capabilities can be useful for food safety and food defense risks

## ■ ***Human resource screening***

- Procedures should be put in place for new hires including in-depth background checks, character evaluations, and performance surveys
- Policies for dealing with disgruntled employees should be updated to include their threat to bioterrorism as well

# Project Funding

- **Primary Funding** | USDA-CSREES  
National Integrated Food Safety Initiative  
Grant
- **Additional Support** | National Center for  
Food Protection and Defense

# Our Next Program

- 2-day program (15 1-hour modules) | September 22-23, 2009
- 1-day simulation activity | September 24, 2009
- For more information | Contact Richard Linton at: [linton@purdue.edu](mailto:linton@purdue.edu)

**THANK YOU!**

Questions...