



Food Safety, Food Security and Sustainability

Do we have a enough safe and
nutritious food
for our population?

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Food Safety, Food Security and Sustainability

- Today our production-to-consumption food system is very complex, and in the USA the food is largely safe, tasty, nutritious, abundant, diverse, convenient, and less costly and more readily accessible than ever before, **but it does not mean it can not be better.**
- Scientific and technological advancements must be accelerated and applied in developed and developing nations alike, if we are to feed a growing world population.
- By 2050 food production must increase by 70% higher than it is today to feed the anticipated 9 Billion people (FAO 2009)

Food Security Gaps

- As much as half of the food grown and harvested in underdeveloped and developing countries never gets consumed, partly because proper handling, processing, packaging, and distribution methods are lacking.
- Starvation and nutritional deficiencies in vitamins, minerals, protein, and calories are still prevalent in all regions of the world, including the United States.
- Hence, science-based improvements in agricultural production, food science and technology, and food distribution systems are critically important to reduce this gap.

Definitions

What is Food ...?

*U.S. Department of Health and Human Services
Public Health Service
Food and Drug Administration
2013 Food Code

"Food" means a raw, cooked, or processed edible substance, ice, beverage, or ingredient used or intended for use or for sale in whole or in part for human consumption, or chewing gum.

What is Food Security?

(1) the Access to enough food for an active, healthy life; at minimum, includes

- ready availability of nutritionally adequate and safe food and

(2) an ensured ability to acquire acceptable foods in socially acceptable ways (e.g., without resorting to emergency food supplies, scavenging, stealing, or other coping strategies)

What is Food Security? (FAO,1996)

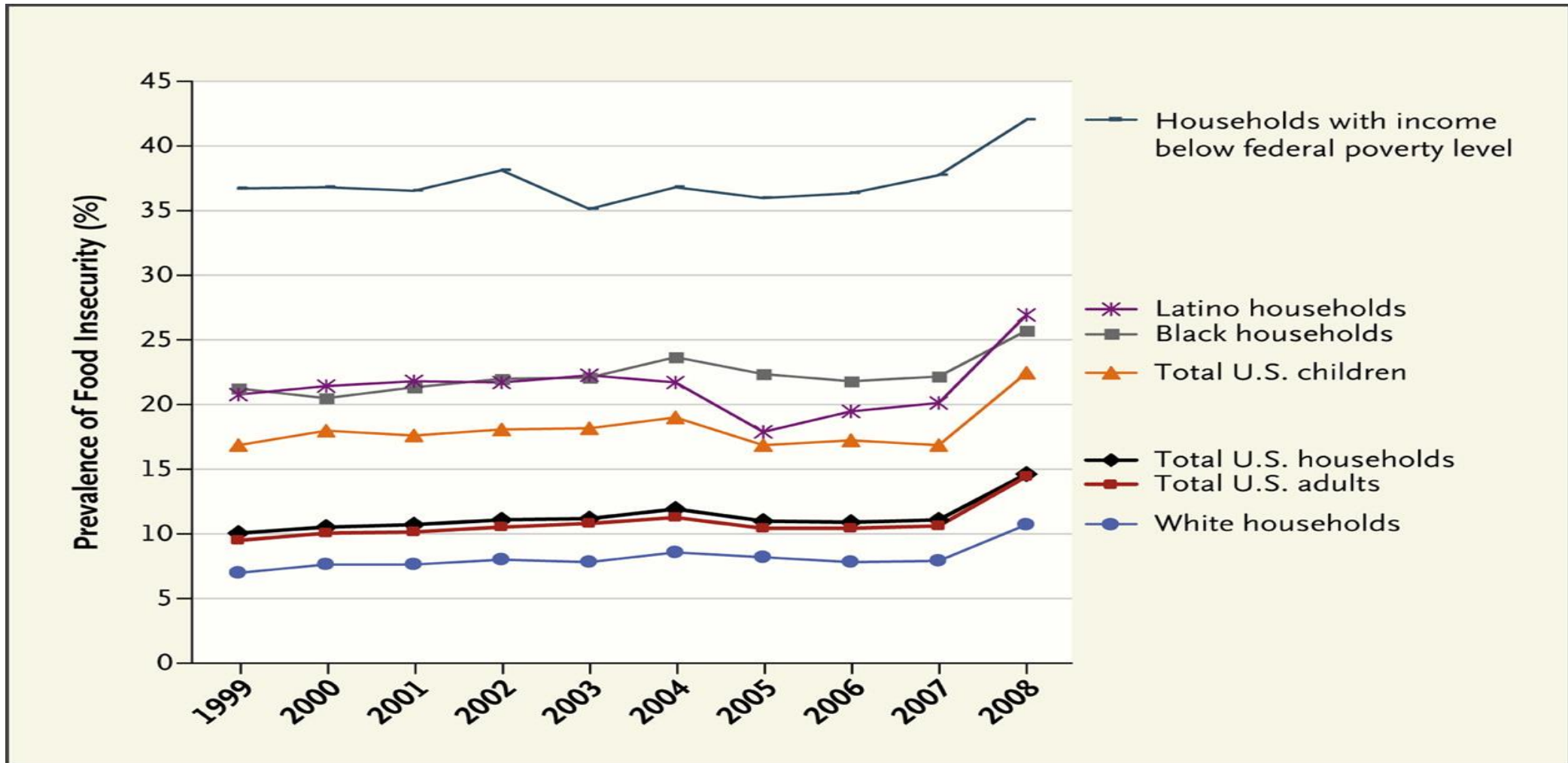
“When all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life”.

- The concept of food security is defined as including both physical and economic access to food that meets people's dietary needs as well as their food preferences.

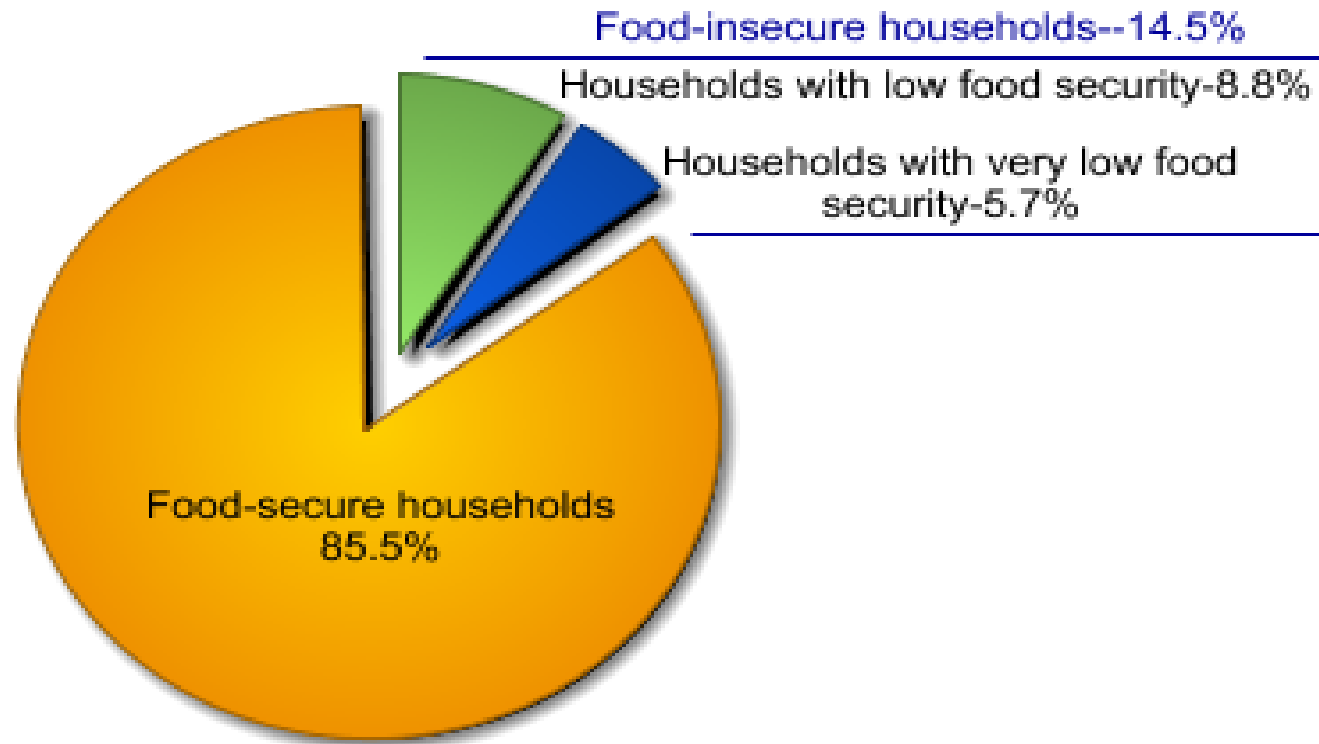
Other definitions.....

- Food insecurity - Limited or uncertain ability to acquire acceptable foods in socially acceptable ways (Anderson, 1990).
- Food insufficiency - An inadequate amount of food intake due to a lack of resources (Briefel and Woteki, 1992).
- Hunger - The uneasy or painful sensation caused by a lack of food; the recurrent and involuntary lack of food (NRC, 2006).

Prevalence of Food Insecurity in the United States, 1999–2008.



U.S. households by food security status, 2012



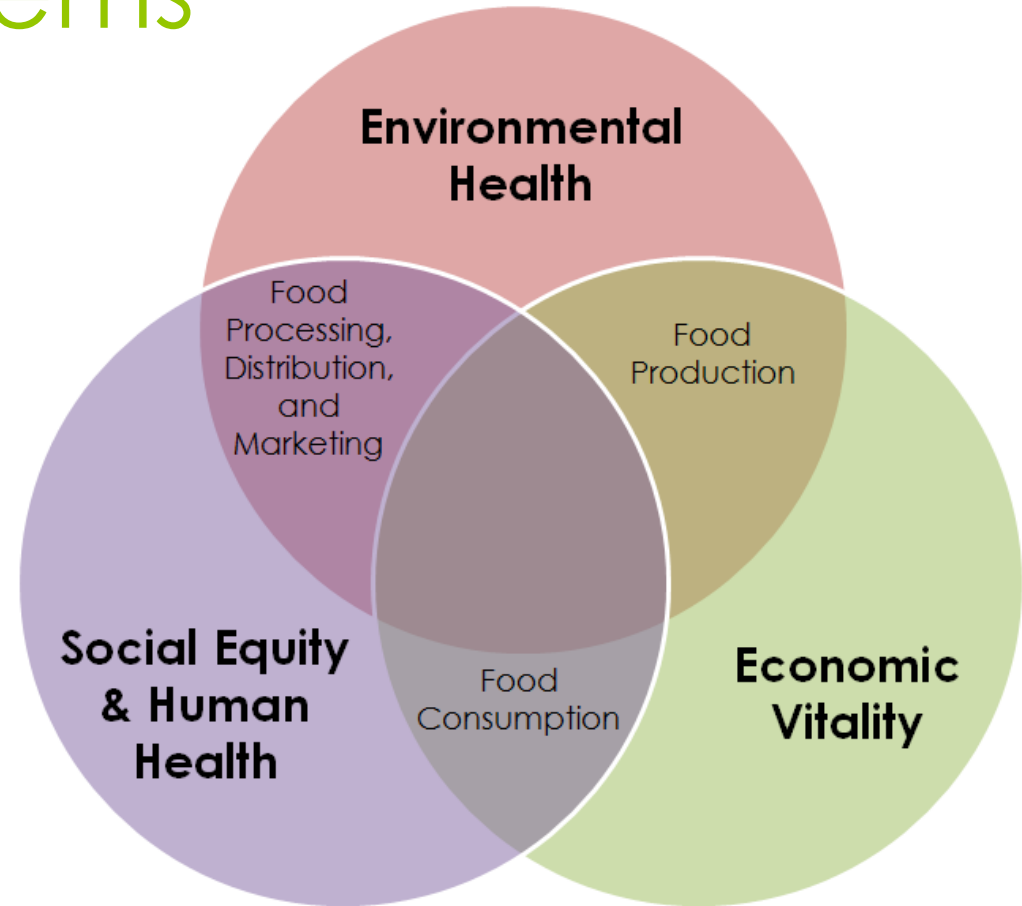
Source: Calculated by ERS using data from the December 2012 Current Population Survey Food Security Supplement.

Food security is built on three pillars:

- Food availability: sufficient quantities of food available on a consistent basis.
- Food access: having sufficient resources to obtain appropriate food for a nutritious diet.
- Food use: appropriate use based on knowledge of basic nutrition and care, as well as adequate water and sanitation.
- Food security is a complex sustainable development issue, linked to health through malnutrition, but also to sustainable economic development, environment, and trade.

Sustainable Food Systems

- A healthy, sustainable food system is one that focuses on Environmental Health, Economic Vitality, and Human Health & Social Equity.



What is Food Safety?

Protection of the food supply from natural or non intentional contamination.

A suitable product which when consumed orally either by a human or an animal does not cause health risk to consumer.

What is Foodborne Illness (FBI)?

Foodborne illnesses are defined as diseases, usually either infectious or toxic in nature, caused by agents that enter the body through the ingestion of food. Every person is at risk of foodborne illness.

What is Food Defense?

- Food Defense is the effort to protect the food supply against intentional contamination due to sabotage, terrorism, counterfeiting, or other illegal, intentionally harmful means.
- Potential contaminants include biological, chemical, physical, and radiological hazards that are generally not found in food or their production environment.

Food Safety vs. Food Defense

- Food defense differs from food safety, which is the effort to prevent unintentional contamination of food products by agents reasonably likely to occur in the food supply (e.g., *E. coli*, *Salmonella*, *Listeria*).

Before 9/11....

- Food analysis in industry were focused on both ingredient and finished product quality and safety, but not considering food defense
 - HACCP plans mainly in Biological concerns
- Government testing were focused on both safety of ingredient and finished for the whole population and for susceptible subpopulations: Children, elderly and diseased people or immune compromise.
 - Heavy metals, pesticides, etc
- University – methods development serving both and academic curiosity

U.S. Bioterrorism Act

- The U.S. Bioterrorism Act of 2002 is playing a major role in food safety in the US.
 - With the FDA having authority over 85 percent of the U.S. food supply, the Bioterrorism Act has more impact on the nations' food supply industry than all other regulations combined. While some exemptions do exist, the law is intended to be broadly applied to all companies that manufacture, process, pack, hold, transport, distribute, or receive food products.
- It is estimated that the U.S. Bioterrorism Act covers more than 475,000 U.S. and foreign facilities.
- Under this act, there are several regulations which govern not only fresh produce companies but all food producers...

What is Food Fraud....?

Collective term used to encompass the deliberate and intentional substitution, addition, tampering, or misrepresentation of food, food ingredients, or food packaging; or false or misleading statements made about a product, for economic gain.

What is Economically Motivated Adulteration (EMA)...?

- “the fraudulent, intentional substitution or addition of a substance in a product for the purpose of increasing the apparent value of the product or reducing the cost of its production.”

Examples of food fraud

- Olive oil
 - Various types of olive oil
- Wine
 - False variety
 - Addition of Ethylene glycol - (mouthfill)
- Fruit juices
 - % of real juice
- Honey
 - Comes from X Country and goes thru different ports and then reaches USA
 - All honey that comes from X Country is analyzed for pesticides, not necessarily other countries honey is analyzed with that scrutiny
- Melamine
 - Milk and pet food
 - It was safe for human consumption but not for children

Safety vs. Defense vs EMA

Safety

- No intentional
- On going
- Real threat

Defense

- Intentional
- Sporadic
- Plausible, danger unknown

EMA

- Intentional
- Continue
- Unknown threat

Agencies Involved in Food Protection/ Safety/Defense

- In the U.S., as many as 15 different federal agencies are responsible for keeping our food safe. But the lion's share of responsibility goes to the **United States Department of Agriculture (USDA)** and the **Food and Drug Administration (FDA)**.

Agencies related to Food Safety

- The USDA oversees the safety of meat, poultry and certain egg products. Its Food Safety and Inspection Service (FSIS) is required to inspect all cattle, sheep, swine and other animals during slaughtering and processing. At least **one federal inspector is required to be on the line during all hours a processing plant is operation.**
- The FDA is responsible for virtually all other foods, including milk, seafood, and fruits and vegetables. Part of the Department of Health and Human Services, the agency also ensures the **safety of imported food products.**

History of food safety

- **1842** - Agriculture Division established
- **1861** - Isaac Newton, 1st superintendent of Agriculture Division
- **1862 - President** Abraham Lincoln appointed a chief chemist to serve in the new Department of Agriculture. This appointment marked the beginning of the Bureau of Chemistry, the predecessor of the Food and Drug Administration.
- **1880** - Peter Collier, chief chemist, U.S. Department of Agriculture, recommended the passage of a national food and drug law, following his own food adulteration investigations. The bill was defeated.
- **1883** - Harvey W. Wiley became chief chemist. There was an increasing concerns, both by scientists and consumers over the use of untested chemicals as food preservative.

History of food safety

- **1906** The Pure Food and Drug Act and the **Federal Meat Inspection Act (FMIA)** became law on the same day in 1906.
- FMIA prohibited the sale of adulterated or misbranded meat and meat products for food, and ensured that meat and meat products were slaughtered and processed under sanitary conditions.
- **1906** Pure Food and Drugs Act is passed by Congress, prohibiting interstate commerce of misbranded and adulterated foods, drinks, and drugs. This law was spurred by shocking disclosures of the use of poisonous preservatives and dyes in foods, documented in the press and featured in Upton Sinclair's novel *The Jungle*.
- **1907** First Certified Color Regulations issued at the request of manufacturers and consumers, listing seven colors found suitable for use in foods.

History of food safety

- **1938** - Federal Food, Drug and Cosmetic (FDC) Act passed by Congress (replaced 1906 Act).
- **1939** - First Food Standards issued for canned tomatoes, tomato puree, and tomato paste.
- **1949** - For the first time, FDA publishes guidance for industry, "Procedures for the Appraisal of the Toxicity of Chemicals in Food" (which came to be known as the "black book").



History of food safety

- **1957 - PPIA Poultry Products Inspection Act**, which ensured, just like the FMIA did for meat products, that poultry products shipped in interstate commerce are continuously inspected: prior to slaughter, after slaughter, before processing and, if the poultry was imported, at the point of entry into the United States. The law also required that plant facilities be sanitary and that product labels be accurate and truthful.
- **1958 - Humane Methods of Slaughter Act (HMSA)** was signed into law. It required that the government only purchase livestock that had been slaughtered humanely, but did not directly require it of industry. Twenty years later, the HMSA of 1978 amended the FMIA by requiring that all meat inspected by FSIS for use as human food be produced from livestock slaughtered by humane methods.



Egg Inspection

- **1970 Egg Products Inspection Act (EPIA)**, which provides for the mandatory continuous inspection of the processing of liquid, frozen, and dried egg products. For the next 25 years, ARS' Poultry Division inspected egg products to ensure they were wholesome, otherwise not adulterated, and properly labeled and packaged to protect the health and welfare of consumers.
- 1995** - FSIS became responsible for the inspection of pasteurized liquid, frozen, or dried egg products. FDA assumed responsibility for shell egg safety.

History of food safety

- **Meat & Poultry Inspection's Changing Home**

In **1971**, ARS was reorganized, and in 1972, all of the meat and poultry inspection functions of ARS.

- Consumer and Marketing Service were transferred to the newly created [Animal and Plant Health Service](#) (APHIS).

- In **1977**, the Food Safety and Quality Service (FSQS) was created to perform meat and poultry grading, as well as inspection activities, instead of APHIS. In 1981, FSQS was reorganized and renamed the Food Safety and Inspection Service (FSIS).

History of food safety

1958 FDA publishes first list of nearly 200 Substances Generally Recognized as Safe (GRAS)

1969 FDA begins administering sanitation programs for milk, shellfish, food service, and interstate travel facilities

1973 Low-acid food processing regulations issued following botulism outbreaks from canned foods

1980 Infant Formula Act establishes special FDA controls to ensure safety and proper nutritional content

1990 Nutrition Labeling and Education Act requires all packaged foods to bear nutrition labeling and all health claims for foods to be consistent with terms defined by the U.S. Department of Health and Human Services

1993 FDA Food Code published as a model for state and local agencies that regulate foodservice, vending and retail food stores.

1994 Dietary Supplement Health and Education Act establishes specific labeling requirements and authorizes FDA to issue good manufacturing regulations for dietary supplements



HACCP Systems

- In 1993, an outbreak of *E. coli* O157:H7 occurred in the Pacific Northwest, causing 400 illnesses and four deaths. The public demanded change for safer ground beef products.
- On July 25, 1996, FSIS issued its landmark rule, **Pathogen Reduction/HACCP Systems**. The rule focuses on the prevention and reduction of microbial pathogens on raw products that can cause illness.

HACCP Systems

1995 Seafood HACCP (Hazard Analysis Critical Control Point) regulations to ensure the safe and sanitary processing of fish and fishery products, including imported seafood.

1998 Juice HACCP rule provides procedures for the safe and sanitary processing and importing of juice and requires warning label on unpasteurized juices

2002 Public Health Security and Bioterrorism Preparedness and Response Act provided new authority in areas including record keeping, registration of facilities, prior notice for imports, and administrative detention

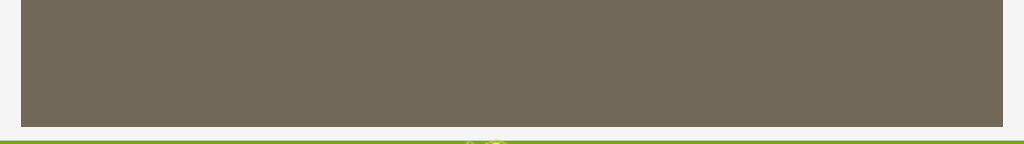
2006 Food Allergen Labeling and Consumer Protection Act goes into effect requiring all ingredients derived from 8 allergenic foods be described on the label

2009 FDA Egg Safety (final) Rule issued – establishes requirements for control of Salmonella Enteritidis in eggs from production through distribution

2011 FDA Food Safety Modernization Act (FSMA), the most sweeping reform of our food safety laws in more than 70 years, was signed into law by President Obama on January 4, 2011. It aims to ensure the U.S. food supply is safe by shifting the focus from responding to contamination to preventing it.

Complex Food Safety Regulatory System...

- The USDA regulates **chickens** while the FDA regulates **eggs**.
- The USDA regulates **cows** while the FDA regulates **milk**.
- The USDA regulates **pepperoni pizza** while the FDA regulates **cheese pizza**.
- The USDA regulates **catfish**, while the FDA regulates **tuna**.
- **All Food Safety Regulatory System work together to meet the goals of Healthy People 2020**



Healthy People 2020





- A Resource for Promoting Health and Preventing Disease Throughout the Nation



Healthy People 2020

- Healthy People is led by the Department of Health and Human Services (HHS), with an Advisory Committee providing input to the Secretary of HHS. It has been used as strategic management tool by the Federal Government, States, communities, and many other stakeholders. These stakeholders have a direct influence on and provide ongoing input to the Healthy People development and implementation process.

Evolution of Healthy People

Target Year	1990	2000	2010	2020
				
Overarching Goals	<ul style="list-style-type: none"> • Decrease mortality: infants–adults • Increase independence among older adults 	<ul style="list-style-type: none"> • Increase span of healthy life • Reduce health disparities • Achieve access to preventive services for all 	<ul style="list-style-type: none"> • Increase quality and years of healthy life • Eliminate health disparities 	<ul style="list-style-type: none"> • Attain high-quality, longer lives free of preventable disease • Achieve health equity; eliminate disparities • Create social and physical environments that promote good health • Promote quality of life, healthy development, healthy behaviors across life stages
# Topic Areas	15	22	28	39*
# Objectives/Measures	226/NA	312/NA	467/1,000	>580/1300+

* With objectives

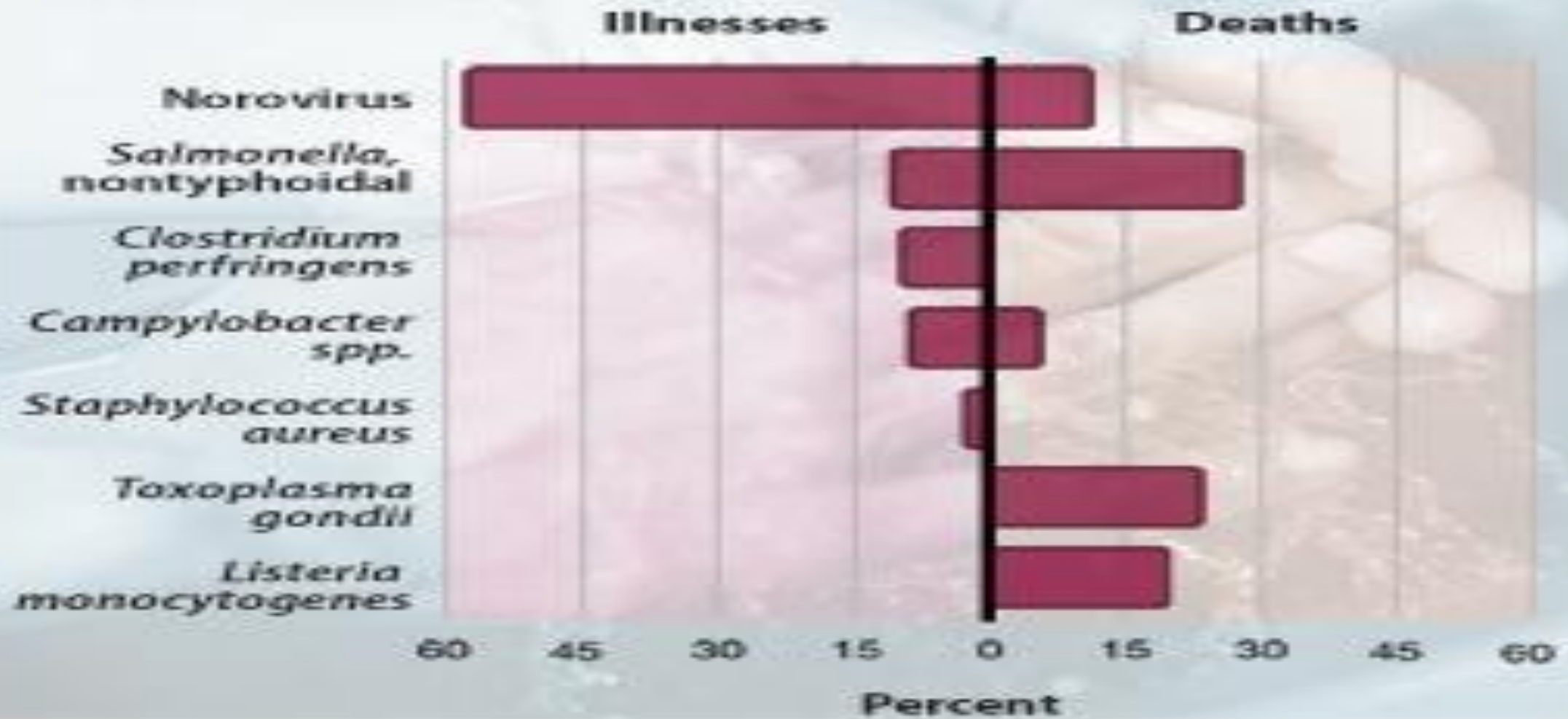
How Safe is our Food?

CDC Estimates

- 48 Million people (1 in 6 Americans) get sick,
- 128,000 are hospitalized, and
- 3,000 die each year from foodborne diseases, according to recent data from the Centers for Disease Control and Prevention.
- This is a significant public health burden that is largely preventable.



Top pathogens contributing to domestically acquired foodborne illnesses and deaths, 2000–2008



Chemicals of concern

Class of Agent	Examples
Biotoxins (plants/animals)	abrin, ricin, colchicine, digitalis, nicotine, saxitoxin, tetrodotoxin
Blister/Vesicants	mustard gases, Lewisites, phosgene oxime
Blood	arsine, CO, cyanides, Na monofluoroacetate
Caustics (Acids)	hydrofluoric acid
Choking/Lung/Pulmonary	NH₃, Br, Cl, MeBr, phosgene, phosphine, sulfuryl fluoride
Incapacitating	BZ, fentanyls & other opioids
Long-acting Anticoagulants	super warfarin
Metals	As, Ba, Hg, thallium
Nerve Agents	sarin, soman, tabun, VX
Organic Solvents	benzene
Riot Control/Tear Gas	bromobenzylcyanide, chloropicrin
Toxic Alcohols	ethylene glycol
Vomiting Agents	adamsite

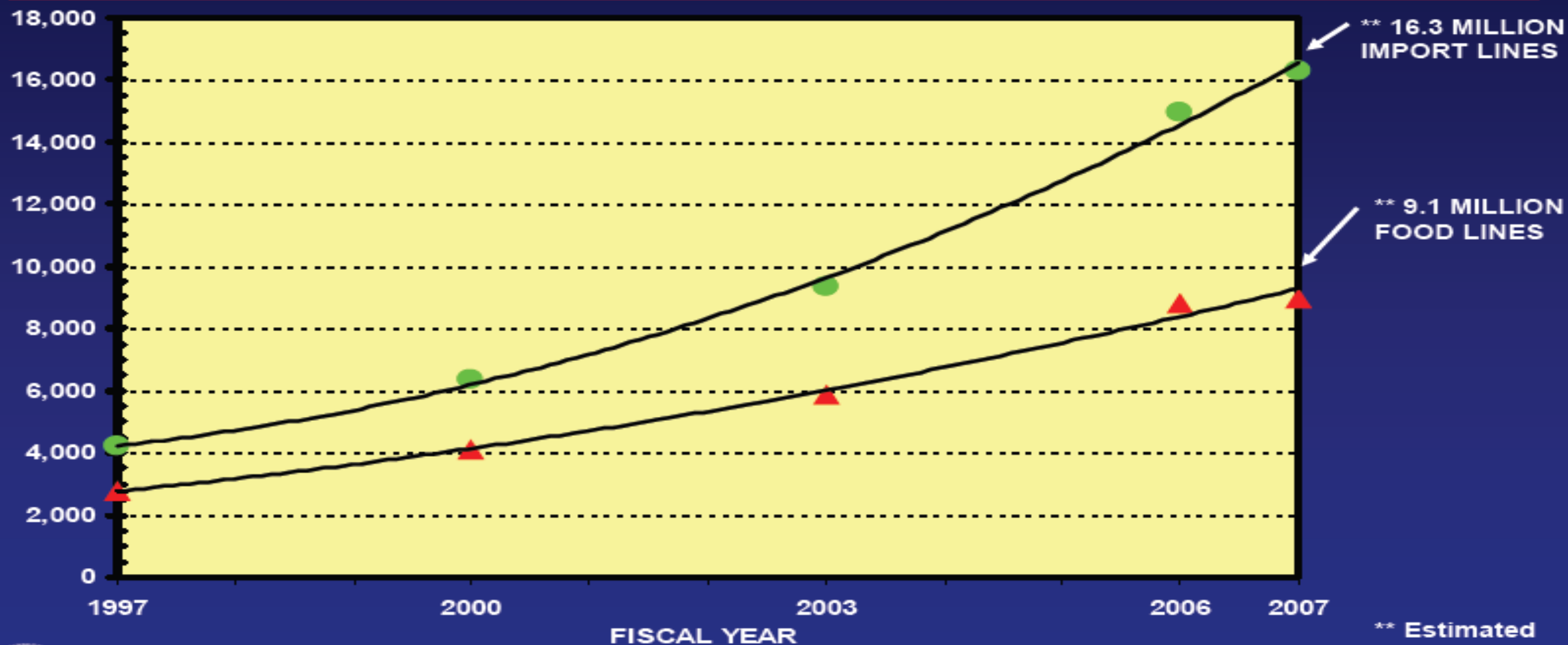
Food Quality <> Food Safety <> Food Fraud <> Food Defense

Food Quality	Food Fraud	Economic Threat
Food Safety	Food Defense	Public Health Threat
Un-Intentional	Intentional	

Source: Adapted from: Spink (2006), The Counterfeit Food and Beverage Threat, Association of Food and Drug Officials (AFDO), Annual Meeting 2006

Changes and Challenges

Global Food Supply



** Estimated



● IMPORT LINES (000) ▲ FOOD LINES (000)
 — Poly. (IMPORT LINES (000)) — Poly. (FOOD LINES (000))



Challenges...

- In the last five years, food imports have doubled, with more than **240,000 establishments in 200 countries and territories** selling products to the United States each year.
- Today, between 10 and 15 percent of all food consumed each year by U.S. households is imported. In some food categories, more of what we consume is imported than produced domestically—**60 percent of fruits and vegetables and 80 percent of seafood**, for example, come from abroad.
- HOWEVER in PR 85% is imported and only 15% is produced locally.

Why Are We Concerned?



2010

- Intentional contamination does happen

US uncovers plot to poison hotels and restaurants at multiple locations

Beijing - The food poisoning of 203 hospital patients in northeast China was an intentional act, police said...



People's Daily

2003

61 Students felled by rat poison in central China

iOLnews

2007



2003

Italy on alert for water poisoner

JOURNAL OF FORENSIC SCIENCES

2010

Arsenic Poisoning Caused by Intentional Contamination of Coffee at a Church Gathering



2006

350 Iraqi Policeman Suffer Food Poisoning

THE INDEPENDENT

2002

'Al-Qa'ida' attempt to poison Rome's water supply foiled

AP Associated Press

2003

Grocery store worker accused of poisoning beef

Telegraph.co.uk 2003

Milk alert as poison terrorist strikes

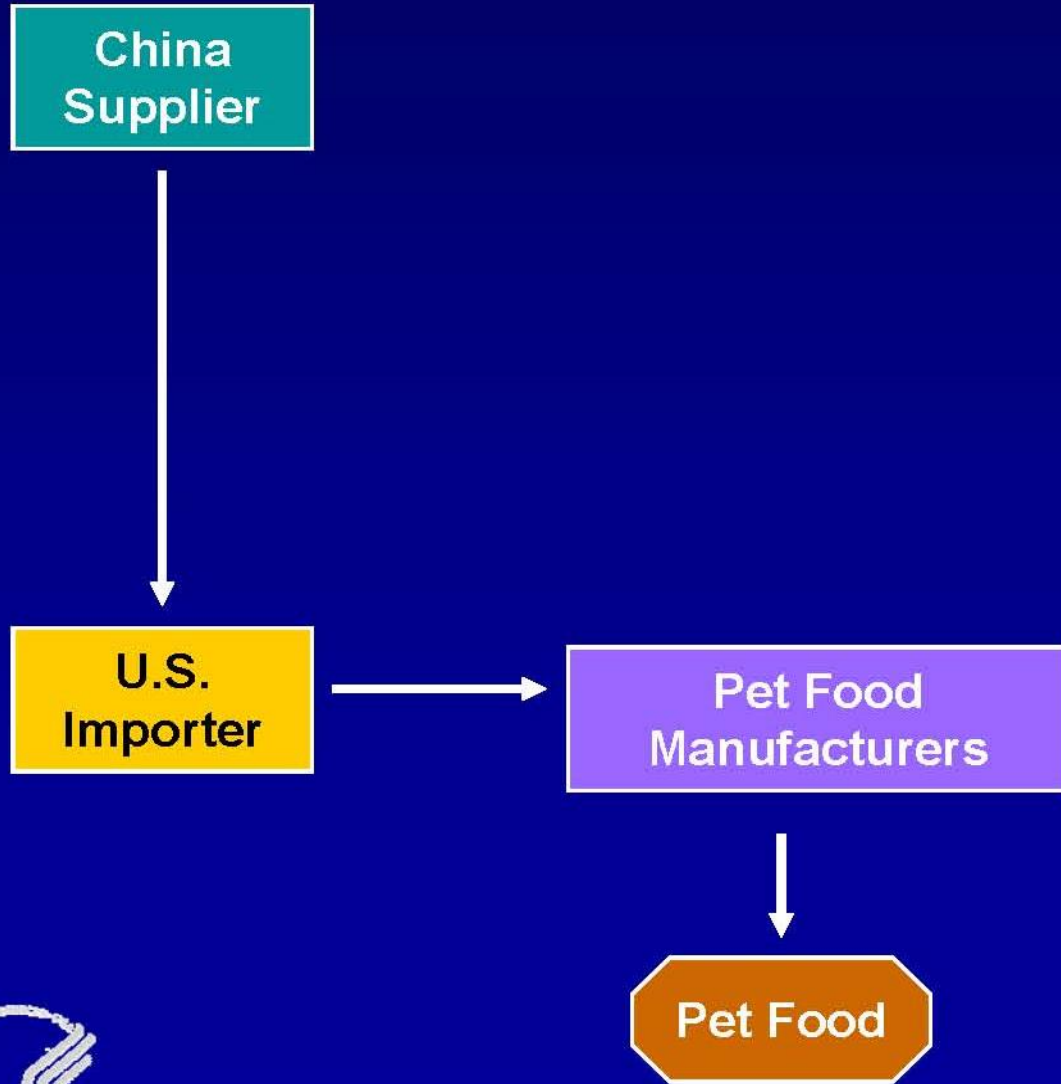


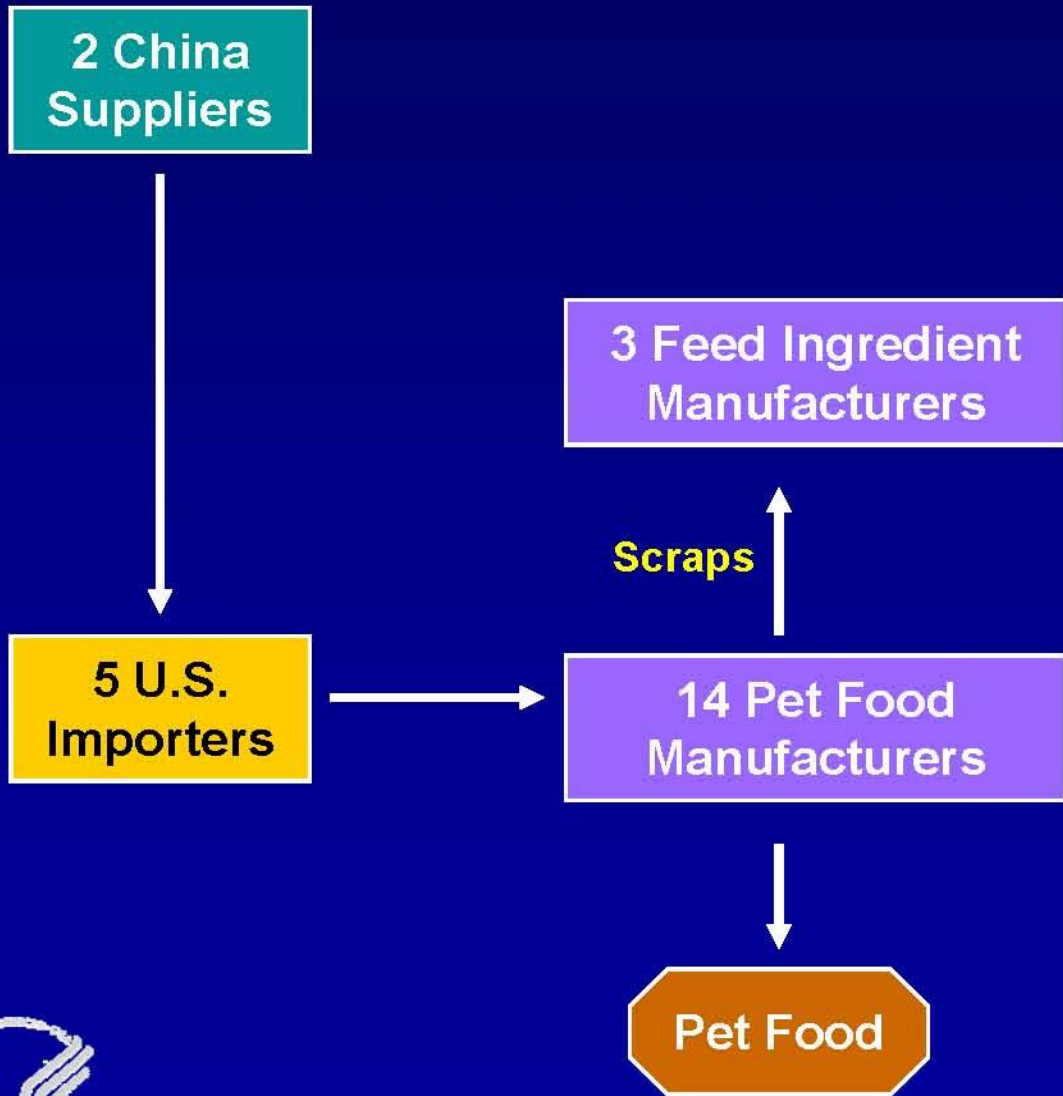
Cases of EMA, turns out to be a health issue

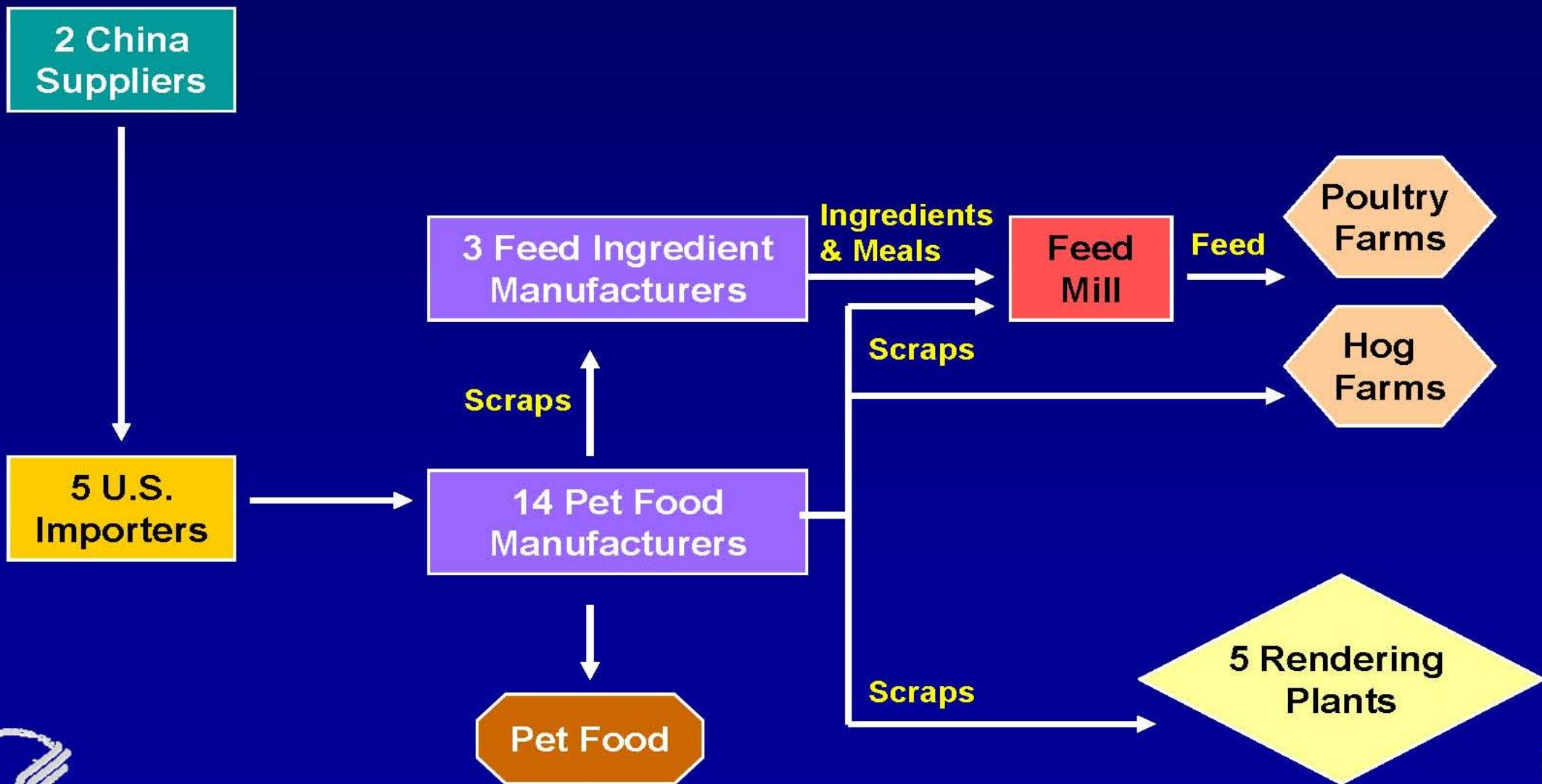
Melamine Contamination

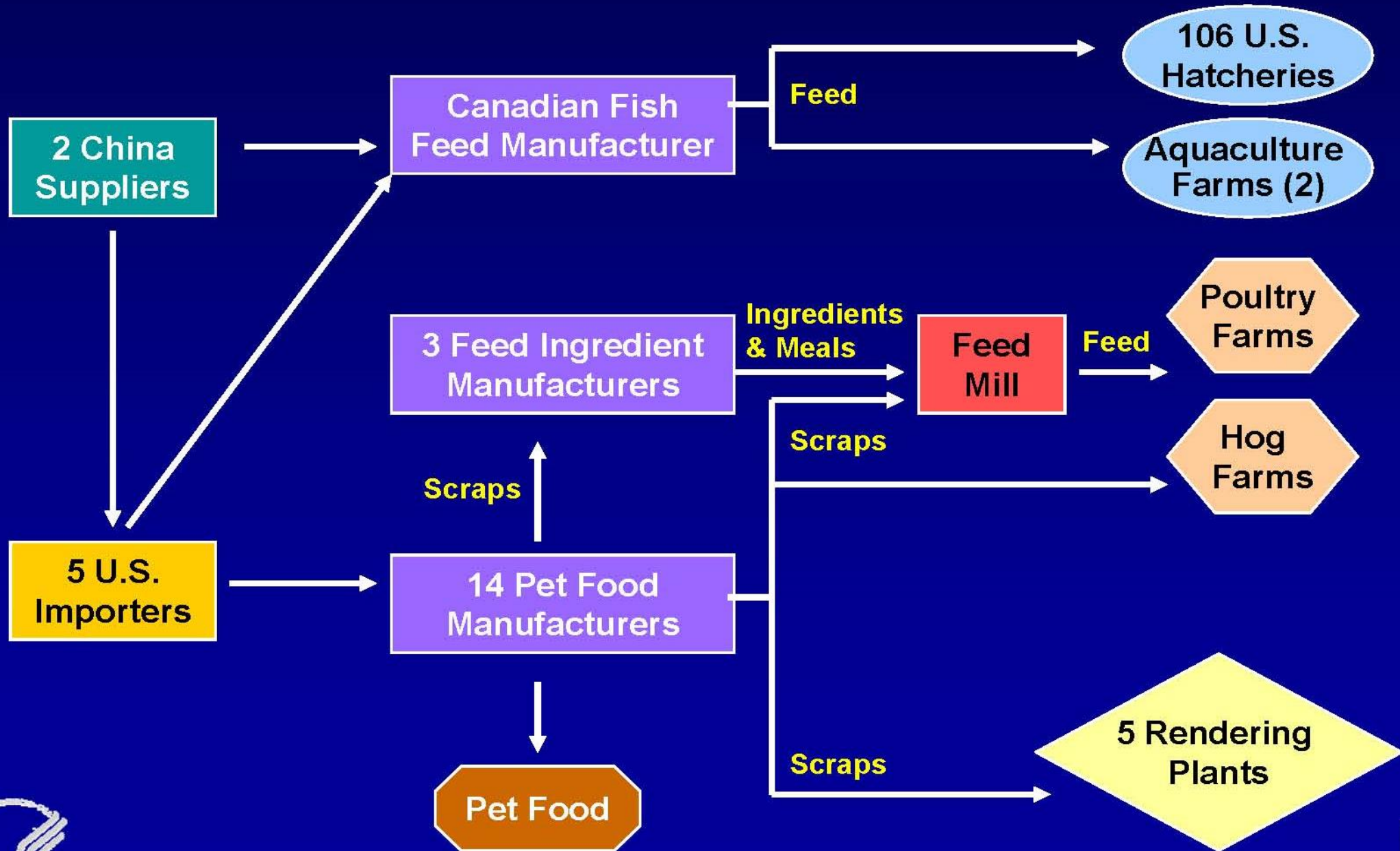
What happened....

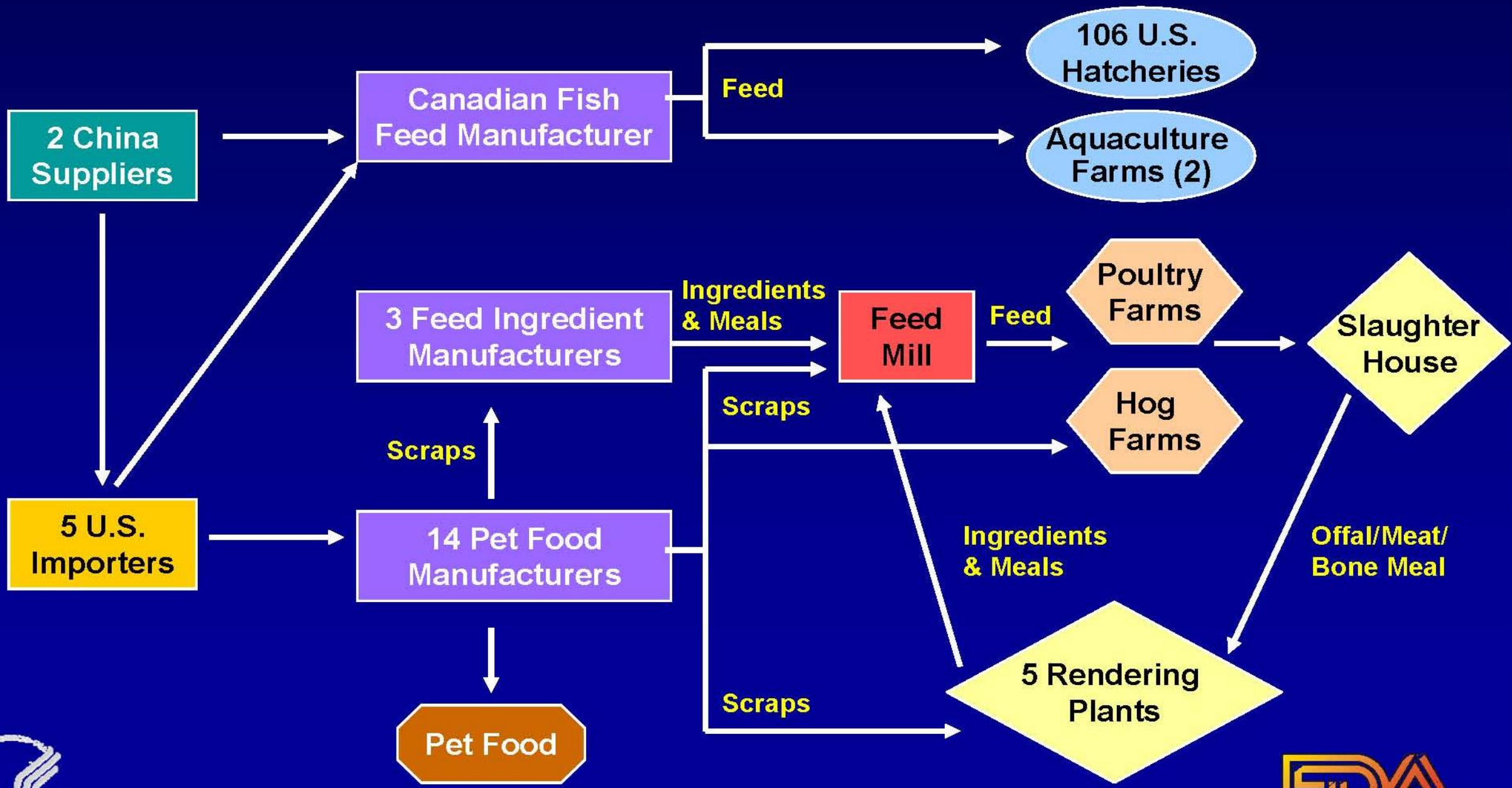
Pets dying











Milk adulteration with melamine

Milk
contaminated by
suppliers

More than 30 brands of
global and local firms
were affected
\$10 billions

More than 60 countries
recalled milk
ingredients from CHINA

Impact to health
290,000 persons were
affected 51,900
hospitalized



GLOBAL
FOOD
SAFETY
CONFERENCE
BARCELONA
2013

Ensure the Safety of the Food Supply from Farm to Table

- Agencies will focus on building a prevention-oriented, science- and risk-based food safety system.
- Preventive controls are in place, from production (or farm) through consumption (or table).
- The goal is to identify potential threats to the food supply and to counteract them before they harm American consumers.

Ensure the Safety of the Food Supply from Farm to Table

- To ensure the safety of the food supply, FDA has aligned its priorities to three long-term objectives:
 - 1) establishing standards for science-based preventive controls throughout the farm to table continuum;
 - 2) achieving high rates of compliance with preventive control standards, both domestically and internationally; and
 - 3) ensuring adequate scientific capacity to support risk-based public health decision making.

Trends and Challenges

Agencies are working to ensure that the nation's food supply is safe, sanitary, wholesome, and accurately and properly labeled and in doing so has seen a number of recent trends and challenges:

- Increased globalization and complexity of the food supply chain;
- Declining resources \$\$\$ for food safety activities;
- Continually evolving technologies around and threats to the food supply; and,
- Emerging food safety hazards.

Trends and Challenges

- FDA is in the process of final Implementation of the Food Safety Modernization Act (2011), a proposed rule that will establish science-based minimum standards for the safe production and harvesting of fruits and vegetables and will address soil amendments, worker health and hygiene, packaging, temperature controls, water, and other issues.
- Food facilities will be required to implement a written preventive control plan, provide for the monitoring of the performance of those controls, and specify the corrective actions the facility will take when necessary.



FOOD PROTECTION

- ▶ **PREVENTION:** *Build safety in from the start*
- ▶ **INTERVENTION:** *Risk based inspections and testing*
- ▶ **RESPONSE:** *Rapid reaction, effective communication*

**FOOD
SAFETY**



**FOOD
DEFENSE**

Food Safety Consumer Information



Food security perspectives from different disciplines.....

- Economist: Availability and poverty
- Agronomists: Food production
- Health specialists: Health indicators of food insecurity
- Sociologist: Social, Economic and Cultural factors
- Environmental: Effect on climate changes and sustainability of food
- Food Scientist: Food preservation and use of new technology

Integrated Plan Provides Three Elements of Protection

PREVENT Foodborne Contamination

- Promote Increased Corporate Responsibility to Prevent Foodborne Illnesses
- Identify Food Vulnerabilities and Assess Risks
- Expand the Understanding and Use of Effective Mitigation Measures

INTERVENE at Critical Points in the Food Supply Chain

- Focus Inspections and Sampling Based on Risk
- Enhance Risk-Based Surveillance
- Improve the Detection of Food System “Signals” that Indicate Contamination

RESPOND Rapidly to Minimize Harm

- Improve Immediate Response
- Improve Risk Communications to the Public, Industry and Other Stakeholders

Food Safety and Security is

- a global issue and a global challenge ...
- a local issue and a local challenge.....
- Is also an academic Institution challenge.....

Academic Institutions should:

1. Attract talented students at their earlier educational stages together with highly motivated science teachers, and involve them in educational and research training in agriculture and the protection of natural resources.
2. Promote participation of students and mentor teachers in summer internships, short courses, hand-on workshops, motivational career lecturing.
3. Provide students with internship opportunities within Government sponsored programs to enhance their experiential learning experiences.
4. Promoting faculty and graduate student development by programming a series of short courses and webinars.
5. Enhancing curriculum development related to agriculture and the protection of natural resources by sharing webinars, videoconferences and on-line resources.

USDA Strategic Goals

1. Assist rural communities to create prosperity so they are self-sustaining, re-populating, and economically thriving;
2. Ensure our national forests and private working lands are conserved, restored, and made more resilient to climate change, while enhancing our water resources;
3. Help America promote agricultural production and biotechnology exports as America works to increase food security; and
4. Ensure that all of America's children have access to safe, nutritious, and balanced meals.

FDA Goals

- Strengthen FDA for today and tomorrow
- Improve patient and consumer safety
- Increase access to new medical and food products
- Improve the quality and safety of manufactured products and the supply chain

Summary

The world is not merely facing a challenge of sustainably producing enough food to feed a world whose population will exceed 9 billion by 2050, but also confronting the continuous challenge of ensuring that nutritious and safe food reaches needy families, so that every child can have a safe and healthy childhood. Combating this urgent crisis requires a global collaborative effort. According to experts, by 2050 agricultural production will need to increase by 70% to meet increased demand for food, diet changes and additional demand for industrial uses for plants. To help meet this goal, USDA has developed a Global Food Security strategy, focused on research, development, education and extension. As part of USDA's Office of the Chief Scientist series of white papers on USDA's research portfolio, this plan aligns USDA's food security research with the goals of President Obama's Global Food Security Initiative, Feed the Future.

Today's challenge...

The challenge of Food Security and Food Safety is an interdisciplinary effort. I invite you to work together and direct our teaching, research and outreach efforts toward answering the following questions:

- What must be done to increase the food production and decrease losses in order to feed the increasing population without increasing the net use of land and water?
- How can increase production and reduce import products?
- How can we organize and integrated Agriculture Production System to be able to increase local food production and reduce importation?
- How can we promote the interdisciplinary effort: Government, Academia and Industry to help improve our Food Supply?

*“Knowing is not enough; we must apply.
Willing is not enough; we must do.”*

—Goethe

FOOD PROTECTION/FOOD SAFETY/
FOOD SECURITY/SUSTAINABILITY

Lets work together!!!!

- <http://www.who.int/trade/glossary/story028/en/>
- <http://www.foodsecuritynews.com/What-is-food-security.htm>