FOOD DEFENSE PREPAREDNESS IN SMALL AND VERY SMALL MEAT AND POULTRY ESTABLISHMENTS

by

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A FIELD EXPERIENCE REPORT

MASTER OF PUBLIC HEALTH

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2008

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Abstract

Since the attacks of September 11, 2001, a heightened awareness to the threat of terrorism, particularly directed towards components of critical infrastructure, has permeated the nation. In May 2002, the United States Department of Agriculture Food Safety and Inspection Service issued general guidelines to assist meat and poultry establishments in strengthening their food defense efforts. The guidelines are voluntary; therefore, the extent of the industry's implementation of these protective measures is mostly unknown. Furthermore, some have expressed concern that small and very small establishments may not be adequately prepared for an incident of intentional contamination of their products due to limited resources and other factors. A web-based survey was developed to gain insight into the opinions of establishments of varying size and geographic location within the United States on the importance of different food defense areas. The survey was circulated through four industry trade organizations: the North American Meat Processors Association, the American Association of Meat Processors, the American Meat Institute, and the Kansas Meat Processors Association. Members of these organizations represent various processing sectors and facility sizes. Employees (n=121) with knowledge of food defense preparedness activities of individual plants responded to the survey which was comprised of multiple choice, ranking, and yes or no questions. Questions ranged from demographic (e.g., size of establishment, geographic location) to ranking the likelihood of an intentional contamination event occurring in the U.S. Preliminary results showed that the majority of respondents represented federally inspected establishments (86%), establishments that were small in size (52%), and establishments that had some type of a food defense plan (74%). Fifty-one percent of respondents responded an intentional contamination event in the U.S. was somewhat likely; however, 66% of respondents indicated such an event was not likely to occur in their particular establishment. Additional data from this survey will be used to better understand the needs of small and very small processing establishments and to help guide development and delivery of effective food defense planning materials in the future.

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Acknowledgements

First, I would like to extend my gratitude to my committee:

-Dr. Abbey Nutsch for being so patient and encouraging me to write better and who's knowledge of survey research helped me shape this project.

-Dr. Randall Phebus for encouraging me to actually enter the MPH program.

-Drs. James Marsden and J. Stan Bailey for agreeing to be on my committee and giving valuable feedback as the survey began to take shape.

-Dr. Dr. Marty Vanier of the National Agricultural Biosecurity Center for allowing me to intern with the NABC.

Without this group, I would still be taking one class a semester and not have a goal. I wish to acknowledge the work that Dr. John Boyer, Yoonsung Jung and Edwin Num did with regard to running the data through statistical testing and re-educating me on the meaning of the various statistical tests.

I also wish to acknowledge my colleagues within the U.S. Department of Agriculture Food Safety Inspection Service, Lawrence District Office, for giving me the latitude to be able to complete this project.

I extend many thanks to Dr. Don Lenhert and Mr. Earl Lenhert for generously allowing me to continue my equine therapy and indulge my lifelong passion of riding at High Horse Stables.

I would also like to thank those who helped with coloring maps, John, aka, doorgunnerjgs and Tim, aka Zikan, from www.2old2play.com, for offering to proof read my paper.

Dr. Chris Ellis for putting off working on her presentation to help me with some of the finer details in what the contents of a graph need to be, going over my first set of edits, and just being a friend.

My family gets the greatest thanks and appreciation: my parents, Ralph and Joyce for always encouraging me to learn; my stepson for being understanding when my voice became sharp and reading one of my many revisions; and finally, my loving husband, Tim, for continually encouraging me, being my rock, and providing a shoulder. Thank you all.

Keep on Go!

CHAPTER 1-Introduction

The United States (U.S.) was taken by surprise when the World Trade Center was destroyed by a terrorist group on September 11, 2001. In the following days the nation's vulnerability to outside attack became very apparent. This vulnerability was emphasized during Operation Enduring Freedom when Al-Qaeda "left behind many clues to their aspirations in hundreds of pages of U.S. agricultural documents that had been translated into Arabic," and that "a significant part of the group's training manual is reportedly devoted to agricultural terrorism-the destruction of crops, livestock and food processing operations." *(34, 48)*

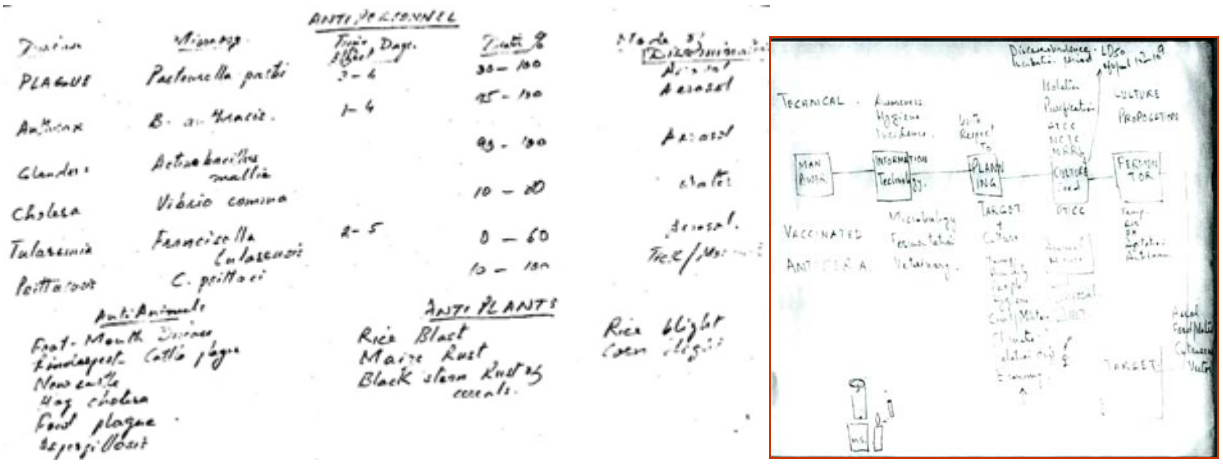

Figure 1 Scan of terrorist documents found in Afghanistan caves referencing biological agents *(29)*.

This information catalyzed the government to assess vulnerabilities to the U.S. agricultural sector and the food manufacturing system, resulting in various awareness initiatives and the issuance of several policy statements and guidelines to these industries to better secure their production or processing facilities and systems. The implementation of food defense actions by the industry appears to be variable, and little formal evaluation of food defense readiness has occurred.

The World Health Organization (WHO) defines food terrorism as "an act of deliberate contamination of food for human consumption with chemical, biological, or

radionuclear agents for the purpose of causing injury or death to civilian populations and/or disruption of social, economic, or political stability" *(45)*. There have been instances of intentional food contamination in which human pathogens have been used. In virtually all foodborne illness cases, however, biological contamination of food is incidental and is attributed to common food related microorganisms or their toxins. Food defense (in the context of food terrorism) must consider both the intentional use of exotic agents (such as anthrax or botulinum toxin) along with the intentional application of traditional foodborne pathogens (such as *Salmonella* and *E. coli* O157:H7). In the latter scenario, it could be difficult, if not impossible, to distinguish the contamination event as being of an intentional nature.

Several years have passed since the events of September 11, 2001 prompted the food industry to increase their food defense awareness and implement actions to guard against potential acts of intentional contamination. The motivation for aggressively maintaining industry-based food defense programs may have diminished, as some individuals or companies perceive a decreasing threat and the passing of time without incidence may have led to complacency. However, many food industry and security experts acknowledge the vulnerability of our food supply to intentional contamination *(24)*.

Peter Chalk, an analyst at RAND specializing in South East Asia international terrorism and emerging threats, has said:

> The U.S., more by luck than design, has not experienced the type of major agricultural and other food-related disasters which other countries and polities such as the UK, Malaysia, and Taiwan, have been subjected to in recent times. As a result, there has been no real appreciation of either the consequences or the potential threat of such events taking place in this country. This false sense of security has been further fueled by the agricultural sector's relative "invisibility" by American society *(12)*.

The Commission on the Prevention of Weapons of Mass Destruction Proliferation and Terrorism has recently published a report stating, "The simple reality is that the risks that confront us today are evolving faster than our multilayered responses" *(25)*. The Commission concluded that the risk of terrorism in America is growing *(25)*.

CHAPTER 2-The How and Why of a Potential Intentional Food Contamination Event

2.1 Why food may be intentionally contaminated

Intentional contamination of the food supply is not a new concept. History books document instances of armies poisoning the wells of cities under siege or distributing contaminated blankets from previously diseased people *(5)*. Religious groups, eco-activist groups, individuals and ideological groups could view intentional contamination as a means of enacting revenge, carrying out sabotage, or furthering political or ideological causes. Because the food supply provides a large target from coast to coast, an attack does not have to be in just one locale. Deliberate, simultaneous, and coordinated contamination of the food supply in multiple regions of the country would devastate the industry by causing public distrust in the safety of the food supply. Such an attack would be attractive due to the significant attention it would bring to the perpetrators. Furthermore, the incubation period of many microbial agents is long enough for a perpetrator to disappear before the first case appears and the authorities can recognize it as a bioterrorist event.

Potential aggressors include disgruntled employees, criminals, activists, subversives and terrorists. Common tactics for attacks include insider compromise, exterior attack, covert entry, or forced entry *(20)*. Food processing establishments provide an efficacious target in part due to the high employee turnover rates and the use of migrant workers *(20)*. Small and very small establishments may lack the resources to incorporate food defense concepts or may have insufficient knowledge and/or commitment to food defense, making them an easier target. Another consideration is the relatively small cost of obtaining biological agents and the comparative ease by which some of these agents can be procured *(6)*.

An example of intentional contamination of the food supply occurred in Oregon in September of 1984. Approximately 750 people became ill when a religious group intentionally contaminated salad bars with *Salmonella enterica* Typhimurium in an attempt to influence local elections in favor of their candidate. The cult, known as the Rajneesh,

obtained the bacterial strain from a commercial medical supply company *(41)*. An act of deliberate contamination such as this could potentially occur in a food processing establishment leading to a greater number of people becoming ill because of the larger amount of food involved and a wider distribution.

2.2 How food may be intentionally contaminated

Biological agents and their toxins, along with chemicals, seem to be the most likely choice to use for intentional contamination. These agents could be dispersed into raw ingredients and/or finished products and some could survive normal processing operations. Toxins, such as ricin and botulinum toxin, may take a long time to recover and identify. An optimum agent would impart little change to the sensory properties of a food, thus neither food sellers nor consumers would be suspicious that the food had been contaminated. The most effective agents would be potent, stable, dispersable, and easy to conceal. The most likely agents for a food contamination event remain common industrial chemicals and microbes with which the food industry and public health professionals are very familiar, even though governmental and research efforts seem to have focused on more exotic materials. This in itself can make the determination as to an intentional or incidental contamination event more difficult.

The Centers for Disease Control and Prevention (CDC) has identified and categorized several foodborne pathogens as critical agents for possible terrorist attacks. Those identified as high-priority biological agents ("Category A" agents) include *Bacillus anthracis* (anthrax) and *Clostridium botulinum* (botulism), both of which are deadly pathogens that may contaminate food. Botulinum toxin is highly lethal and known to cause foodborne illness in improperly canned foods, smoked products such as fish, and low-acid foods stored anaerobically. Most of the foodborne biological agents identified by CDC are categorized as "Category B" agents because they are moderately easy to disseminate and cause moderate morbidity and low mortality. The “Category B” biological agents include *Salmonella* species, *Shigella dysenteriae*, and *Escherichia coli* O157:H7, and ricin *(9, 39)*. Several of these pathogens naturally pose a significant threat to public health due to incidental contamination of food.

It is difficult to predict with any confidence what types or categories of foods might be targeted because many factors could come into play in such a decision. It would likely include aspects such as where the access point presents itself in the food chain (i.e., restaurant, centralized food service operation, food manufacturer, or distributor/warehouse operation). Additionally, certain foods might be higher on a target list if a perpetrator were focusing on a particular demographic group (i.e., children, ethnic group, or a religious population) or a specific company, brand, or organization. Generally, however, food products that are ready-to-eat and frequently consumed would be likely targets. Foods or ingredients that are prepared in large batches which could allow an agent to be introduced into a large quantity of mixed product and then made into a large number of servings, and products that are comminuted or blended, fluid injected, or are homogeneous liquids might be attractive targets. Because of these characteristics, they could be rapidly consumed before a hazard was detected. Food products are often distributed over large distances in a short amount of time and reach many people. The speed and efficiency of distribution would make it difficult to respond in a timely manner; thus, a significant public health impact could occur in a matter of hours or days over a wide geographical area.

CHAPTER 3-Impact of an Intentional Food Contamination Event

The impact of an intentional food contamination incident could have far-reaching consequences on public health services, the economy, and international trade. The confidence in the safety of the food supply and the perceived effectiveness and responsiveness of the government would be questioned by the public should an intentional contamination event occur.

3.1 Impact on public health services

The CDC, in cooperation with local health departments, investigates approximately 2,500 outbreaks of foodborne illness per year and estimates that 76 million illnesses, 300,000 hospitalizations, and 5,000 deaths occur annually as a result of incidental food contamination *(32)*. An act of deliberate contamination may not be recognized as such at the time an outbreak is identified, particularly if the causative agent had previously been associated with an incidental event. In fact, certain deliberate acts of contamination might never be identified unless some entity actually claimed responsibility.

Traditional foodborne illnesses have a major impact on public health. The epidemiology of foodborne diseases is changing as new pathogens emerge and previously recognized pathogens (i.e., *Salmonella, E. coli* O157:H7) increase in prevalence, acquire various virulence or survivor traits, or become associated with new food vehicles. Foodborne illnesses do not just cause acute gastroenteritis; many pathogens may additionally cause chronic sequelae or disability. For example, *E. coli* O157:H7 can cause hemolytic uremic syndrome (HUS), which is the leading cause of acute kidney failure in children; listeriosis can cause miscarriages or result in meningitis; salmonellosis can cause reactive arthritis; and campylobacteriosis can cause Guillain-Barré syndrome *(1)*.

Determining the cause of a food contamination event takes time. Multiple cases need to emerge in a local setting for doctors to become aware of a potential problem. The laboratories then need to confirm diagnosis, local and state health authorities would be alerted, and then the CDC would become involved. This process would take days, and more

likely weeks. The time required for the investigative process to conclude the event was intentional could be even longer, especially if a common foodborne pathogen were introduced into an atypical food vehicle. An investigation could be delayed looking for normal sources and result in additional time for investigators to find the unusual source of the disease. During the time one locality is investigating an outbreak, another outbreak in a different area may also emerge, depending on the amount of agent used and the distribution of the product. If the food vehicle is a common product that is considered a staple in many households, the number of potential patients increases in each area. This type of situation could cause a strain on physician time and laboratory capabilities as the outbreak progresses. If an "exotic" agent was involved, an additional strain on public resources would almost assuredly occur due to the public's fear and reactions (i.e., everyone with an upset stomach, headache, or sniffle might believe the symptom to be a part of the intentional contamination event and would present themselves to a physician's office or emergency room).

3.2 Economic effects

Deliberate contamination of food may also have enormous economic implications, even if the episode is minor in terms of the number or type of resulting illnesses, and/or the geographic distribution of products involved. In fact, disrupting the economy may be a primary motive for a deliberate act targeting a product, manufacturer, industry, or country. Mass casualties are not required to achieve widespread economic loss and disruption of trade. For example, the alleged deliberate contamination of Chilean grapes with cyanide in 1989 led to the recall of all Chilean fruit from within Canada and the U.S. The perpetrators in this event—who phoned the authorities and stated they had contaminated the product—wanted to bring attention to the living conditions of the lower class in Chile. There were no casualties as a result of this alleged contamination and only two red grapes were found to contain small amounts of cyanide. However, the economic impact totaled several hundred million dollars, and more than 100 growers and shippers went bankrupt *(26)*.

If a food product were intentionally contaminated, the affected food company and related distributors and warehouse operators would face the cost of recalling product. Suppliers, retail outlets, and restaurant chains would also suffer losses. Loss of consumer

confidence would hurt sales both domestically and in foreign markets, and other countries could ban imports of U.S. products. The producing establishment would experience financial losses through recalling affected product, compensating customers for the loss of product, and potential litigation from illness caused by the product.

As an example of the potential economic ramifications for a food company faced with addressing a large scale contamination event, in 1998 a U.S. company recalled approximately 31 million pounds of frankfurters and luncheon meats potentially contaminated with *Listeria*. The company closed the plant and estimated their total losses to be $50–70 million *(8)*. Estimates suggest this company also spent an additional $100 million to improve their food safety programs and restore consumer confidence in their products in the aftermath of the recall *(15)*. This event was the result of incidental contamination of the product by a common foodborne pathogen. The economic impact would likely be substantially greater if the same scenario occurred involving deliberate contamination with an "exotic" or uncommon agent because increased public fear would amplify recall and company recovery issues, regulatory bodies would likely prolong plant closure for remediation and investigation activities, and the public health system would have to respond to a much more complex investigative and treatment protocol.

3.3 Loss of confidence in the food supply and government

A loss of confidence in the food supply or government does not necessarily have to be caused by an act of terrorism. Illnesses linked to a restaurant or a specific product brand often lead to avoidance by the public. If authorities were to determine that illnesses were caused intentionally by an act of terrorism, the level of fear and uncertainty would increase dramatically. The public might then begin to wonder why the government's food inspectors did not prevent the situation, why certain steps were or were not taken in response to the event, why specific legal steps or policy interpretations were or were not taken, or why a production facility was allowed to resume operations at a particular point in time.

An example of loss of confidence in the government occurred in early 2007 and involved the deaths of many cats and dogs leading to a large recall of numerous brands of pet foods *(30)*. The culprit was melamine contamination of common protein additives

wheat gluten, rice protein concentrate, and corn gluten all imported from China. Melamine had been fraudulently added to these additives to raise the nitrogen content values, thereby implying a higher protein content and making them more valuable *(43)*. In 2008 in China, 300,000 illnesses (100 of them serious), 13,000 hospitalizations, and 6 deaths occurred as a result of fraudulent melamine contamination of infant formulas and milk powders *(44, 46)*. The list of products identified as containing melamine has expanded internationally to include those with milk-derived ingredients such as cookies, chocolate, instant coffee, and milk tea products. Consumer confidence in these products, and in the Chinese government's regulation of them, dropped dramatically and left many wondering what may be next. According to one source, "China's melamine scandal has been particularly damaging to consumer confidence because it comes after Beijing said it had tightened regulations and heightened vigilance in the wake of problems with tainted dog food, also made in China, that sickened or killed thousands of dogs worldwide last year, and other tainted products" *(22)*.

CHAPTER 4- Food Safety versus Food Defense

In the U.S., estimates suggest that 76 million illnesses occur annually due to food that has been inadvertently contaminated by pathogens—therefore, based on current population data, approximately one out of every four Americans will develop a food-borne illness each year. Foodborne illnesses range from temporary ailments that may not require medical treatment, to acute and chronic illnesses that can lead to death or debilitation.

Food safety is often defined as the prevention of incidental contamination of food. The risks associated with potential food safety hazards can be mitigated through Good Manufacturing Practices and systematic approaches such as Hazard Analysis and Critical Control Points (HACCP) programs. HACCP in particular addresses the potential hazards (biological, chemical, or physical) at each step in a process and determines if they are reasonably likely to be introduced, controlled, or eliminated at that step. Even with these systematic manufacturing controls in place, food can become incidentally contaminated as evidenced by documented foodborne illness outbreaks and frequent product recalls. Following are examples of incidental foodborne illness outbreaks that have impacted large numbers of people.

- In 1981, over 800 people died and 20,000 were injured in Spain because of a chemical contaminant in cooking oil. Rapeseed oil, the major ingredient in the product, contained aniline and other chemicals used to denature oil for industrial purposes. The oil had been improperly processed and then sold to the population *(42)*.
- In 1985, approximately 170,000 people in the U.S. became ill after consuming pasteurized milk contaminated with *Salmonella enterica* Typhimurium. Poor sanitation practices allowed raw milk to contaminate the processed milk after pasteurization *(36)*.
- In 1991, an outbreak of hepatitis A caused by tainted raw clams affected nearly 300,000 people in China–this incident may be the largest foodborne disease incident in history *(27)*.

- In 1993, an outbreak of *E. coli* O157:H7 linked to undercooked hamburgers from the Jack-in-the-Box restaurant chain affected an estimated 500 people and resulted in 4 deaths *(7)*.
- In 1994, an outbreak of *Salmonella enteritidis* linked to contaminated ice cream pre-mix affected an estimated 224,000 people in 41 states in the U.S. *(28)*.
- In 1996, about 8,000 children in Japan became ill and four died after eating *E. coli* O157:H7-tainted radish sprouts served in school lunches *(35)*.
- In 2006, approximately 200 people, in 26 states, were affected by Shiga toxin producing *E. coli* O157:H7 from fresh spinach or spinach-containing products. Two elderly adults and one child with hemolytic uremic syndrome (HUS) died. Approximately 30 others suffered from acute renal failure brought on by HUS *(32)*.

As illustrated by these outbreaks, contamination can occur at any point along the food chain. Milk became contaminated after pasteurization, a processing step that kills pathogens. Ice cream pre-mix became contaminated during transportation. The tanker carrying it had not been thoroughly cleaned after hauling raw eggs. Clams, radish sprouts, and spinach were contaminated prior to harvest. Because they were consumed raw, no processing step occurred to rid them of pathogens. Ground beef became contaminated during slaughter and/or fabrication operations and was then served undercooked *(7)*. In the case of spinach contamination, the pathogen likely entered the product in the field (pre-harvest) and was further spread during produce washing operations.

Food defense is a set of activities designed to prevent intentional contamination of food (FDA 2006). Historically, there are documented instances in which civilian food supplies have been sabotaged during military campaigns and, more recently, to terrorize or otherwise intimidate civilian populations *(31)*. Following are some examples.

- In 1970, four college students were unknowingly exposed to a massive dose of embryonated *Ascaris suum* eggs placed in their food by a disgruntled post-doctoral student while attending a winter carnival in Canada *(37)*.

- In 1996, a disgruntled employee at a Texas hospital sickened twelve people by intentionally contaminating pastries with *Shigella dysenteriae.* Four had to be hospitalized *(33)*.
- In 1998, curry laced with arsenic was sold at a community fair in Japan, resulting in 60 illnesses and four deaths *(3)*.
- In 2001, a snack shop owner in China deliberately contaminated food in his competitor's store with a powerful rat poison; approximately 300 customers became seriously ill and at least 38 people–many of them schoolchildren–died *(2)*.
- In 2003, fifteen people were sickened and one person died from arsenic-laced coffee served at a church. A parishioner placed chemical containing arsenic in the coffee pot before church members gathered after a service. The culprit reportedly sought retaliation against church members for a perceived wrong *(40)*.
- In 2003, 200 pounds of meat at a Michigan grocery store was intentionally contaminated with an insecticide, sickening over 100 people *(10)*.
- In 2008, three babies died and 300,000 babies have been sickened, including 158 with acute renal failure after being fed milk formula fraudulently contaminated with melamine *(13, 46)*.

The above examples demonstrate that deliberate contamination of food can occur at any point along the food chain and that certain people with access to foods are willing to harm others through this vehicle. Although the incidents above were localized (with the exception of the melamine example) they illustrate how a minimal level of planning and technical capability can cause harm to a significant number of people.

CHAPTER 5-Policy Approaches

Prior to September 11, 2001, The Federal Anti-Tampering Act of 1983 was the latest law enacted to address the tampering of certain consumer products, including food in interstate commerce. The law was enacted after an unknown individual(s) contaminated Tylenol™ packages with cyanide, killing seven people in the Midwest *(23)*. Prior to 2002, the FDA and FSIS had written procedures for responding to acts of contamination and the removal of suspect food from the marketplace, and the Federal Bureau of Investigation was involved with the criminal investigation associated with any incidents of intentional food contamination. FDA and FSIS had no additional procedures in place for addressing intentional acts.

5.1 Department of Homeland Security

Approximately four weeks after the events of September 11, 2001, President Bush signed an Executive Order to form the Office of Homeland Security. The Department of Homeland Security (DHS) was then established on November 25, 2002, by congressional passage of the Homeland Security Act of 2002.

In February of 2003, Homeland Security Presidential Directive-5 (HSPD-5) was issued to enhance the ability of the U.S. to manage domestic incidents by establishing a single, comprehensive, national incident management system. Issued in December of 2003, HSPD-7 (Critical Infrastructure Identification, Prioritization, and Protection) identified DHS as the entity responsible for coordinating the national effort to enhance the protection of the critical infrastructure and key resources of the U.S. It also established a national policy to defend the agricultural and food system against terrorist attacks, major disasters, and other emergencies. Prior to this, the U.S. agricultural sector had not been identified as a critical infrastructure.

HSPD-9, issued in February of 2004, assigned the DHS Secretary Tasks specific to the defense of food and agriculture. These included mitigating vulnerabilities in food, agriculture, and water systems; developing a robust biological threat awareness capacity;

enhancing screening procedures for domestic and imported products; and enhancing response and recovery procedures.

5.2 U.S Food and Drug Administration

In June of 2002, Congress passed the Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (Bioterrorism Act), which addressed agroterrorism preparedness and response vulnerabilities. Specifically, the Bioterrorism Act expanded the FDA's authority over food manufacturing and imports, tightened control of biological agents and toxins under rules by the United States Department of Agriculture (USDA) Animal Plant and Health Inspection Service and the CDC, expanded agricultural security activities and security upgrades at USDA facilities, and increased criminal penalties for terrorism against enterprises and violation of the select agent rules.

The Bioterrorism Act mandated four key actions by food companies:

1) It required all food facilities, foreign and domestic, to register with the FDA;

2) It afforded the FDA administrative detention authority on suspect foods;

3) It mandated the establishment and maintenance of records for at least two years; and,

4) It required importing companies to provide prior notice of shipments beginning December 12, 2003 *(4)*.

The first of these regulations to take effect required registration of food facilities, defined as domestic and foreign facilities that manufacture/process, pack, or hold food for human or animal consumption in the U.S., with the FDA. The purpose of this requirement is to enable the FDA to quickly identify and locate affected food processors and other establishments in the event of deliberate or accidental contamination of food. As of October 29, 2008, FDA had received 362,966 registrations, of which 213,244 were foreign facilities and 149,722 were domestic facilities *(11)*.

The second regulation to take effect, Administrative Detention, gives the FDA the right to detain suspicious food for up to 30 days. The FDA may detain an article of food on the strength of credible evidence or information resulting from an inspection, examination,

or investigation. This allows the FDA to prevent a suspect product from entering commerce until its safety is determined.

The third regulation became effective in December of 2004 and requires companies to maintain records regarding the origins of food, and allows the FDA to inspect these records as needed. This regulation allows the FDA to deal more effectively with food-related emergencies that pose a significant health threat in the food supply.

The final regulation requires that importers and brokers notify the FDA, in advance, when specific food shipments are to arrive at U.S. ports of entry and what those shipments will contain. This intent of this advance information is to allow the FDA, working in conjunction with U.S. Customs and Border Protection, to more effectively target inspections and ensure the safety of imported foods.

In 2003, the FDA Center for Food Safety and Applied Nutrition (CSFAN) published a series of pamphlets outlining food defense guidelines; these guidance documents were then updated in 2007. Each guidance document is divided into five sections that relate to individual components of a food establishment's operation: management, human element–staff, human element–public, facility, and operations.

The following titles are available:

- *Food Producers, Processors and Transporters: Food Security Preventive Measures Guidance*
- *Importers and Filers: Food Security Preventive Measures Guidance*
- *Retail Food Stores and Food Service Establishments: Food Security Preventive Measures Guidance*

In 2007, CARVER+Shock software was made available through the FDA and USDA Food Safety and Inspection Service (FSIS) websites for industry to use in conducting vulnerability assessments for their facilities. The acronym stands for criticality, accessibility, recuperability, vulnerability, effect, and recognizability.

Criticality: measure of public and economic impacts of an attack.

Accessibility: ability to physically access and egress from target.

Recuperability: ability of system to recover from an attack.

Vulnerability: ease of accomplishing attack.

Effect: amount of direct loss from an attack as measured by loss in production.

Recognizability: ease of identifying target.

Shock: assess the combined health, economic, and psychological impacts of an attack within the food industry.

The assessment tool is a free download and can be used to assess the vulnerabilities within a system or infrastructure to an attack. The program was adapted from the military for use in the food industry. It allows the user to think like an attacker to identify the most attractive targets for an attack. By conducting a CARVER+Shock assessment of a food production facility or process, the user can determine the most vulnerable points in their infrastructure and focus resources on protecting the most susceptible points in their system *(17)*.

5.3 USDA-FSIS actions

In 2002, the USDA Food Safety Inspection Service (FSIS) created an Office of Food Defense and Emergency Response (OFDER) to develop and coordinate all FSIS activities to prevent, prepare for, respond to, and recover from non-routine emergencies resulting from intentional and non-intentional contamination. OFDER has conducted vulnerability assessments for selected domestic and imported food products to determine the most vulnerable products, likely agents, and potential sites of contamination, as well as countermeasures to reduce risks. OFDER also serves as the agency's central office for homeland security issues and ensures coordination of its activities with the USDA Homeland Security Office, the Department of Homeland Security, the FDA, other federal and state government agencies with food-related responsibilities, and industry.

In April of 2002, FSIS published the guidance document, "*Security Guidelines for Food Processors.*" The guidelines were developed to assist federal and state inspected plants that produce meat, poultry, and egg products in identifying ways to strengthen their security plans for food protection. The guidelines covered areas such as outside security, inside security, slaughter and processing, storage, shipping and receiving, the water and ice supply, mail handling, and personnel security. These guidelines were developed only as a

first step to ensure that information to protect this part of the nation's food supply was accessible.

In May of 2002, the FSIS issued "*Guidelines for the Transportation and Distribution of Meat, Poultry, and Egg Products*." This document, which was published to assist small facilities and shippers, provided a list of safety and defense measures that could be adopted to prevent the contamination of meat, poultry, and egg products during loading and unloading, transportation, and in-transit shipping. FSIS continues to publish and make available guidance material for small and very small facilities to encourage and assist in developing food defense programs that are suitable for each establishment's operation.

In February of 2003, the Government Accountability Office (GAO) published a report to congressional requestors titled, "*Food-Processing Security: Voluntary Efforts are Underway, but Federal Agencies Cannot Fully Assess Their Implementation*." Although there is no requirement for meat and poultry establishments to conduct vulnerability assessments or develop and implement food defense plans, FSIS strongly encourages all establishments to maintain a food defense plan. Because food defense plans are not mandated, the FSIS has little means to determine the extent to which food processors have adopted or implemented security measures. The GAO conducted a survey of FSIS circuit supervisors by telephone to determine their perception of the extent of the industry's adoption of security measures. The results stated that "more than half of the respondents indicated that large plants… had implemented a range of security measures… Fewer of these respondents observed these security measures at smaller plants." *(24)*

Following is a list of currently available USDA guidance materials for establishments to review and use in the development of their food defense program:

- *Food Security Guidelines for Food Processors* April 2002
- *Guide for Security Practices in Transporting Agricultural and Food Commodities* October 2004
- *Industry Self-Assessment Checklist for Food Security* April 2005
  This document is a self-assessment instrument to provide a tool for establishments to assess the extent to which they have secured their operations. The contents of the

instrument are based primarily on the food security guidelines that FSIS published in 2002, *Food Security Guidelines for Food Processors.*

- *Elements of a Functional Food Defense Plan* April 2006
- *Developing a Food Defense Plan for Meat and Poultry Slaughter and Processing,* (January 2007; updated June 2008)
- *Guide to Developing a Food Defense Plan for Warehouse and Distribution Centers* January 2008
- *Guide to Food Defense in Slaughter and Processing Facilities* October 2008

In August of 2006, FSIS in-plant personnel conducted a survey of all federally inspected facilities to determine the status of voluntary adoption of food defense plans. They found only a 27% adoption rate. In November 2007, another survey was conducted and showed a small increase to a 31% adoption rate. In August of 2008, a third survey was conducted and the results showed an increase to 41% adoption *(21)*. The expectation from FSIS is that 90% of establishments will adopt a functional food defense plan.

Following traditional best food safety practices will not provide sufficient protection against a terrorist attack on our food supply. Understanding the vulnerabilities within an industry is vital to developing programs to effectively protect the food supply.

CHAPTER 6-Research Objective

The intent of this survey was to gain insight from, meat and poultry processing establishments across the U.S. regarding their understanding and the perceived importance of various food defense concepts and/or activities. Questions ranged from demographic (e.g., size of establishment, geographic location) to ranking the likelihood of an intentional contamination event occurring in the U.S. The size of an establishment is defined by the number of employees or the establishment's annual sales figures according to the USDA *(18)*. Very small establishments are defined as having fewer than 10 employees or annual sales of less than $2.5 million. Small establishments are defined as having 10-499 employees (regardless of annual sales). Large establishments are defined as having 500 or more employees (regardless of annual sales).

This survey also sought to address specific questions such as:

- How many very small and small establishments identified the definition of food defense as "protecting against intentional contamination?"
- Is food defense, in general, important to small and very small establishments?
- Are there more very small establishments than small and large that do not have a written food defense plan?
- What is the perception of the likelihood of an intentional food contamination event occurring in the U.S.?
- What is the perception of the likelihood of an intentional food contamination event occurring in the respondents' own establishment?
- Do large establishments perceive they are more prepared for a potential intentional food contamination event?

Limited time and company resources may prevent small and very small establishments from (1) performing a thorough vulnerability assessment, and (2) recognizing areas of food defense that need improvement in their establishment. Since potential threats, physical components of the manufacturing facility itself, and the

operations within an establishment may change over time, a food defense plan should undergo regular assessment and company personnel need to be regularly retrained. Therefore, industry guidance and training materials should be updated regularly to reflect the current understanding of threats, highlight new and proven food defense technologies or approaches, and ensure delivery of these resources to processors by effective means. The information gathered through this survey could be utilized by universities or governmental agencies to develop various training materials for the meat and poultry industry to assist in the development and maintenance of effective food defense programs and to inform establishments of policy decisions.

CHAPTER 7-Survey Methodology

7.1 The survey

In accordance with university requirements for research involving human subjects, the survey instrument and protocol for its administration were submitted to the Kansas State University Institutional Review Board (IRB) for review and approval. The IRB determined the survey to be exempt from further review (KSU IRB #4491).

A web-based survey was developed to gain insight into the opinions of the various establishments on the importance of different food defense areas. The population of interest included establishments that slaughter or produce meat and poultry products in the U.S. A brief introduction (0was sent via email to representatives of three national and five state organizations explaining the project and requesting participation.

The survey form contained questions based on those asked in the CARVER+Shock assessment program. The majority of the questions were from the "Accessibility" node that evaluates the ability of a potential perpetrator to physically access and egress from a target. These questions were selected to help determine the perceived importance individual establishments place on the potential vulnerabilities identified in the vulnerability assessment.

A draft survey was made available to a group of people associated with the meat and poultry industry for pilot testing. The group consisted of a meat science college professor, the president of a state meat trade organization, a local operator of a very small meat slaughter and processing establishment, and a retired owner of a small meat processing establishment in New York. They were asked to give feedback on the clarity and relevance of the questions to the industry. The questions were revised based on these suggestions. The draft survey also tested the hyperlink to the Kansas State University Axio online survey system.

The official survey was circulated through three industry trade organizations: North American Meat Processors Association (NAMP), American Association of Meat Processors (AAMP), and the American Meat Institute (AMI). Members of these national organizations

represent various processing sectors and facility sizes. NAMP's membership consists of 175 meat processors. AAMP's membership totals 1369 businesses of which 1116 are U.S. meat processors. AMI has a membership totaling 248 processors of meat and poultry products. Employees with knowledge of, or experience with, the food defense preparedness activities of individual plants were solicited to respond to the survey. The survey instrument was comprised of multiple choice, ranking, and yes or no questions. Questions ranged from demographic (e.g., size of establishment, geographic location) to ranking the likelihood of an intentional contamination event occurring in the U.S.

The final survey (0) was published and the hyperlinks were made available to the three trade organizations for publication on their websites from January 25, 2008 through February 29, 2008.

On February 2, 2008, the survey was completed in hard copy format by members of the Kansas Meat Association during a meeting held in Manhattan, Kansas. Thirteen surveys were handed out and nine were returned. These data were added to those obtained from the electronic survey offering.

To encourage participation from the members of NAMP, an email was sent to members listed in a 2006 association directory. The emails requested the recipient to visit the NAMP site and participate in the survey. Not all members had email or web addresses and some establishments listed were distribution sites only or sites located in Canada. Those members were not contacted.

At the end of the survey period, all results were combined into one data set and reviewed for completeness. Participants were not required to answer every question; data were included from those respondents who answered, at a minimum, the demographic questions and the questions regarding the definition of "food defense" and if they had some type of food defense plan.

7.2 Limitations

A limitation for this survey was the potential for a low response. To help counter this situation, the trade organizations were given a brief announcement to send out to their membership via email or bimonthly newsletter encouraging participation, prior to the introduction of the web-link.

Another limitation that may affect the data includes the potential for the respondents to purposely misreport their perceptions or views on the topics. This survey relied on "self-reported" data; that is, it depended on participants to truthfully and accurately report on their attitudes, activities, and characteristics *(47)*.

Survey studies are subject to various types of bias. For example, since respondents know they are being studied, and have at least some idea why, they may change their answers, either consciously or unconsciously, to show themselves in a better light or to conform to the expectations of those who are studying them *(47)*. Another potential bias is that the survey could only be accessed through the internet. The survey was made available only to those establishments that had access to the member section of each organization's website. Therefore, only those people who had internet access could participate.

CHAPTER 8-Preliminary Survey Results and Discussion

The potential number of respondents is unknown since these organizations' memberships are not solely comprised of meat and poultry producers, but also include suppliers, distributors, and retail companies. The number of responses appears low and may be because the initial notification of the survey was not sent directly to trade members but was listed on the organization's web site. The expectation was for a higher number of responses. Secondly, the survey was only available in the members' section of the trade organization's web site. This would require members to recall that the survey was available and log in to the website. If potential respondents were busy during the day and did not receive a direct reminder, the survey may have been forgotten. A total of 141 responses were received Respondent surveys were eliminated if they did not answer the required demographic questions, the question asking about the definition of food defense, and the question asking if the respondent's establishment had some type of food defense plan. The number of responses that were usable decreased from 141 to 121 after these considerations.

To illustrate the geographic distribution of the respondents, a map of the U.S. was divided into six zones chosen to be similar to those of the USDA Office of International Affairs (OIA) and the location of USDA regional offices (see Figure 2). Zone 1 consisted of Maine, Massachusetts, New York, Vermont, New Hampshire, Pennsylvania, Connecticut, New Jersey, Rhode Island, Maryland, Delaware, Virginia, and West Virginia. Zone 2 included North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, and Tennessee. Zone 3 included Kansas, Oklahoma, Texas, New Mexico, Arkansas, Louisiana, and Colorado. Zone 4 consisted of Minnesota, Michigan, Iowa, Missouri, Wisconsin, Indiana, Illinois, Ohio, and Kentucky. Zone 5 included North Dakota, South Dakota, Nebraska, Montana, Wyoming, and Idaho. Zone 6 included Oregon, Washington, California, Nevada, Utah, Arizona, Hawaii, and Alaska. The number of responses from the six zones, in order from most to least, were Zone 3 (n=35), Zone 4 (n=31), Zone 2 (n=21), Zone 1(n=17), Zone 5 (n=10), and Zone 6 (n=7) (Figure 2).

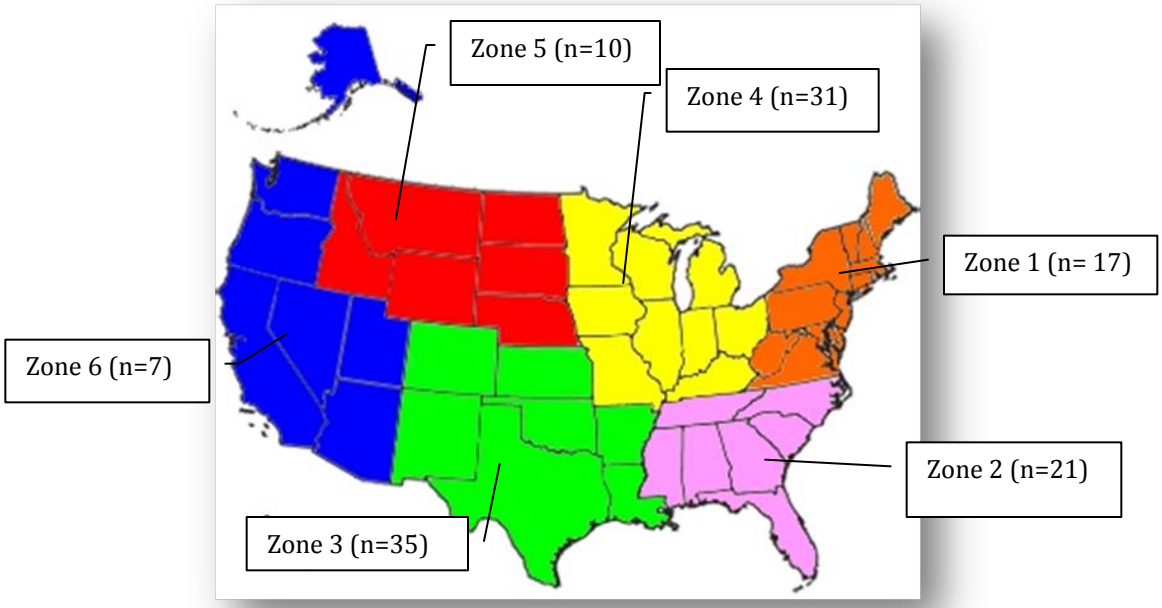

Figure 2 Number of respondents in each zone.

The majority of the large and small establishments were located in Zones 3 and 4. Table 1 summarizes the percent and/or number of respondents grouped according to size of establishment, type of inspection (federal or state), job title of the person responding, types of products produced, and whether the establishment serves special customer groups, such as the military or school lunch programs.

Table 1 Demographics of Respondents (N=121)

Percent of respondents by establishment size	
Establishment Size	Percent of Respondents
Very Small	15.10%
Small	52.10%
Large	32.80%

Percent of respondents by type of inspection	
Type of Inspection	
Federal or State	92.90%
State	7.10%

Percent of Job Titles held by respondents	
Job Titles	
Owner	5.60%
Manager	17.40%
HACCP Personnel	17.70%
Quality Assurance Personnel	43.80%
Other	15.40%

Processing Categories conducted in each Respondent's Establishment[1]	
Process Categories	Number of Respondents
Slaughter	44
Raw, Not Ground	80
Raw, Ground	68
Fully Cooked, Not Shelf Stable	60
Not Heat Treated Shelf Stable	11
Heat Treated Shelf Stable	23
Heat Treated Not Fully Cooked, Not Shelf Stable	10
Secondary Inhibitor	9
Thermal Processing	2

[1] Each respondent may have identified more than one processing category.

Number of Respondents Who Serve Special Customer Groups[2]	
Special Customer Groups	
Military	16
Airline	5
Religious	10
School Lunch Programs	28

[2] Not every respondent identified with one of these groups.

8.1 How respondents perceive the definition of food defense

Respondents were asked a multiple-choice question regarding the definition of food defense and whether it relates to protection of the food supply from intentional or incidental contamination. The majority (68%) responded correctly that food defense relates to protecting the food supply from intentional contamination, while 13% incorrectly defined it as protecting the food supply from incidental contamination, 14% defined it as addressing both intentional and unintentional contamination, and 4% selected "none of the above." Figure 3 shows the responses to this question by establishment size.

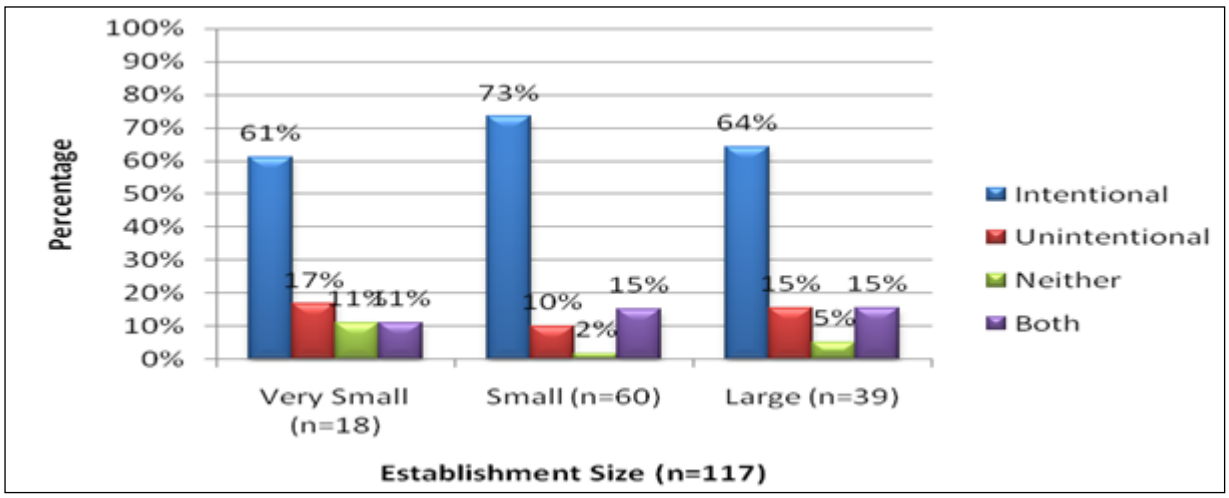

Figure 3 Within establishment size, the percent of respondents who selected each of four multiple choice answers regarding the definition of food defense.

Sixty-one percent of the very small, 73% of the small, and 64% of the large establishments correctly identified the answer as protecting against intentional contamination. Seventeen percent of the very small, 10% of small, and 15% of large establishments felt that food defense was defined as preventing against incidental contamination. An equal number (11%) of very small establishments chose "none of the above" and "both" intentional and incidental contamination as the answer. Two percent of the small and 5% of the large chose "none of the above," and 15% of the small and 15% of the large chose "both" as the answer.

In constructing the survey, it was important to determine how respondents defined food defense. Food safety is commonly defined as protecting against incidental

contamination. All meat and poultry establishments are required by law to operate under a HACCP plan to prevent the incidental contamination of products during production processes. Food defense is a voluntary program that incorporates many elements such as establishing building security, securing products during transportation, protecting incoming materials, and employee screening and control. It is necessary for establishments to be able to differentiate between the two concepts to understand how to develop and implement effective programs for both. The results of this survey indicate that the majority of the establishments identify food defense as protecting against intentional food contamination. However, the results also show that there is a meaningful percentage that incorrectly identified food defense as incidental contamination, a combination of incidental and intentional contamination, or neither. Of the respondents who answered "neither," the majority represented very small establishments. These data suggest that there are still meat and poultry establishments that need guidance in understanding the concepts and in responding accordingly to set up effective programs in both areas. The first step to developing an effective food defense plan must be to understand the overall purpose of the plan.

8.2 How respondents perceive the importance of food defense

Respondents were asked to identify the importance of food defense to their production facility using a Likert scale with 1= Not Important, 2= Somewhat Important, and 3= Very Important. Slightly more than half of all respondents (59%) rated food defense as "very important," 33% as "somewhat important," and 9% as "not important." When this number is stratified by size, 29% of the very small establishments rated food defense as "very important," 43% as "somewhat important," and 29% as not important. Over half of the small establishments (66%) rated food defense as "very important," 29% as "somewhat important," and 5% as "not important." For the large establishments, more than half (59%) rated food defense as "very important," 34% as "somewhat important," and 6% as "not important" (Figure 4).

Although these survey results are not necessarily representative of all meat and poultry establishments, these data suggest that food defense issues may be perceived as less important to very small establishments as compared to small and large establishments.

Very small establishments may not consider themselves to be likely targets for an intentional food contamination event; therefore, food defense may not be as important to them. There are a few possible explanations for this difference in how the very small establishments view the importance of food defense, or specifically why they may feel they are a lesser target, compared to small and large establishments. They produce a smaller volume of product and the distribution of finished product is typically fairly local compared to larger establishments; thus, the "impact" of a targeted attack would not be as large or widespread.

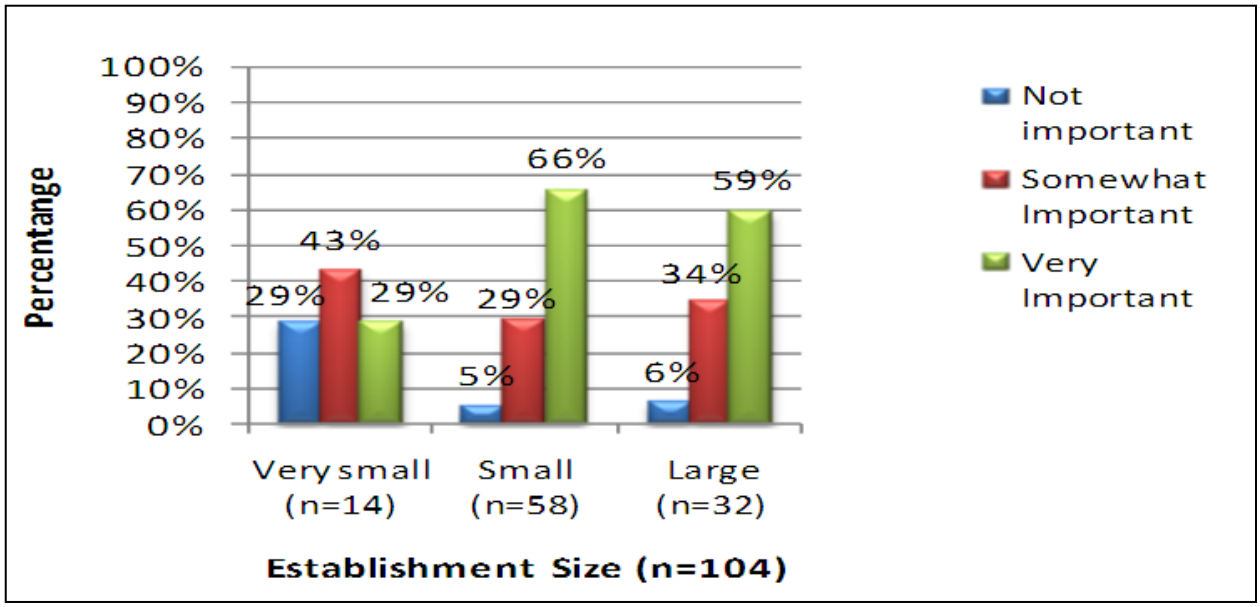

Figure 4 Within establishment size, the percent of respondents who rated the importance of food defense as "very," "somewhat," or "not important."

Perhaps very small processors feel that they are "hidden" in small communities or rural areas out of sight and mind of potential attackers. Additionally, the employee turnover rate tends to be lower, as many of these establishments are family owned and operated. This means that fewer new employees enter their establishment which decreases the possibility of an outside person intentionally contaminating products.

These data were also stratified by zones to see if the perception regarding the importance of food defense differed by zone (i.e., geographically) (Figure 5).

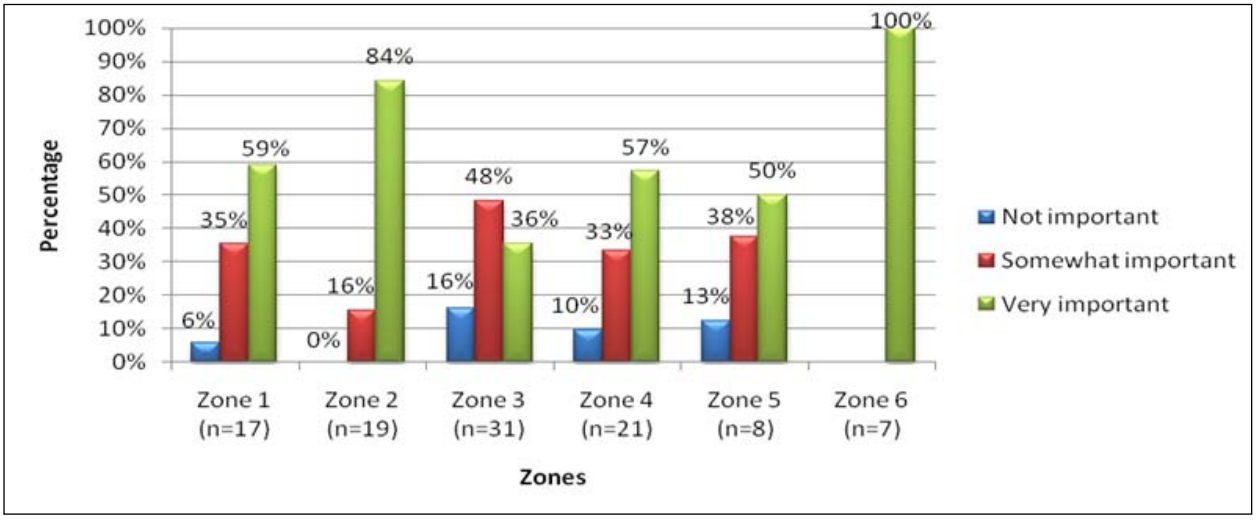

Figure 5 Within each geographic zone, the percent of respondents who rated the importance of food defense as "very," "somewhat," or "not important."

Zones 2 and 6 had the highest percentage of respondents identifying food defense as "very important" (84 and 100%, respectively) followed by Zone 1 (59%), Zone 4 (57%), Zone 5 (50%), and Zone 3 (36%). Zone 3 had the highest percentage of respondents identify the importance of food defense as "somewhat important" (48%) followed by Zone 5 (38%), Zone 1 (35%), Zone 4 (33%), and Zone 2 (16%). Four zones (1, 3, 4, and 5) had lower percentages of respondents who identified the importance of food defense as "not important" (6%, 16%, 10%, and 13%, respectively). No statistical comparisons can be drawn with this data—these were general observations only. The initial hypothesis was that Zone 1 would have the highest percentage of respondents who felt food defense was "very important" because it contains the states of New York and Virginia (Washington, D.C. area) where terrorism events have recently occurred (World Trade Center and anthrax mailings, respectively). However, Zones 2 and 6 had the highest percentage of respondents indicating food defense as "very important." Zones 2 and 6 include locations that have also experienced bioterrorism events. Zone 2 includes Florida where letters containing anthrax were also delivered in October 2001 killing five people and sickening 17 *(14)*. Zone 6 includes Oregon where a religious cult sprayed *Salmonella* Typhimurium onto local salad bars to sicken residents in the community in September 1984 *(41)*. These events may have

caused respondents from these areas to have an increased awareness of bioterrorism potential and to state that food defense is "very important."

Interestingly, Zone 3 was the only zone where the percentage of respondents rating the importance of food defense was higher for "somewhat important" than "very important." One thought is that respondents in Zone 3 feel less threatened by a potential terrorism event since they are in the middle of the U.S. These respondents may think they are insulated from threats of terrorism and may feel the importance of food defense is lower than those respondents on the coastlines or in larger population areas.

The data were analyzed to determine if these results appeared to be influenced by size of the establishment (Figure 6).

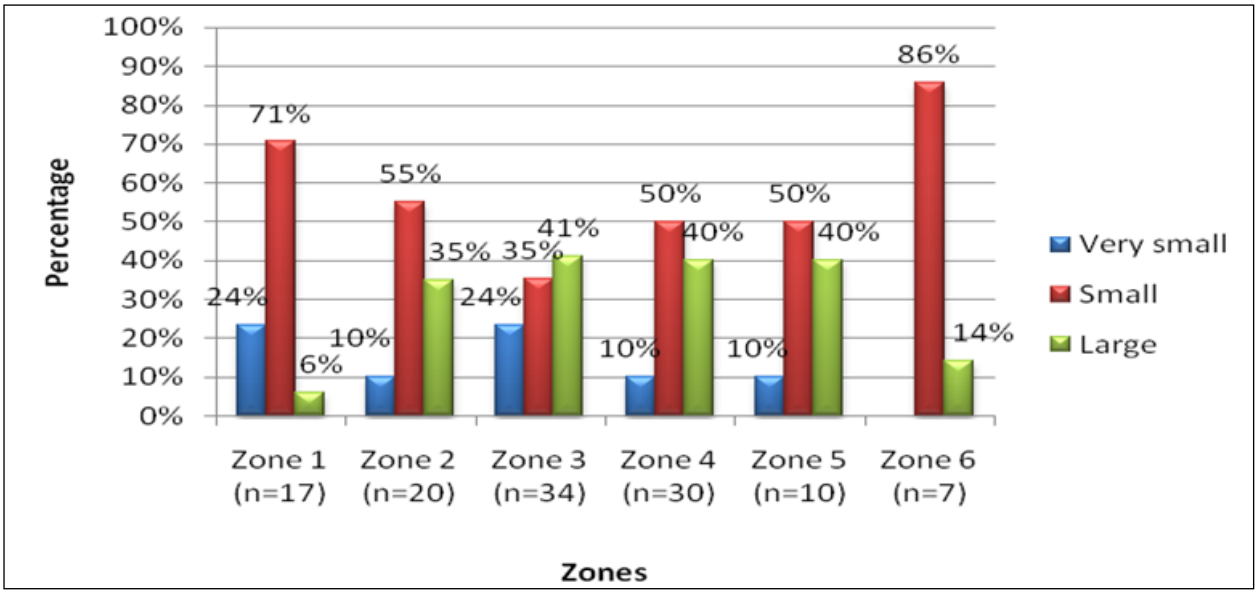

Figure 6 Within each zone, the percent of respondents representing very small, small, and large establishments.

The hypotheses was that the percentage of very small establishments might be higher in Zones 1, 3, 4, and 5 which might lower the overall perceived importance of food defense Figure 4 and Figure 5). The previous graphs indicate that the small and large establishments perceive the importance of food defense as "very high" (66 and 59%, respectively) compared to the very small establishments (20%). Figure 6 shows that the percentage of small establishments is higher in all zones except Zone 3. There are more large establishments in Zone 3 than small and very small establishments. Therefore, it is

difficult to conclude that the size of establishment influenced the importance of food defense in each zone.

8.3 Written food defense plans

Respondents were asked if their establishment had a written food defense plan. Seventy-four percent responded that that they did have a written plan (Figure 7).

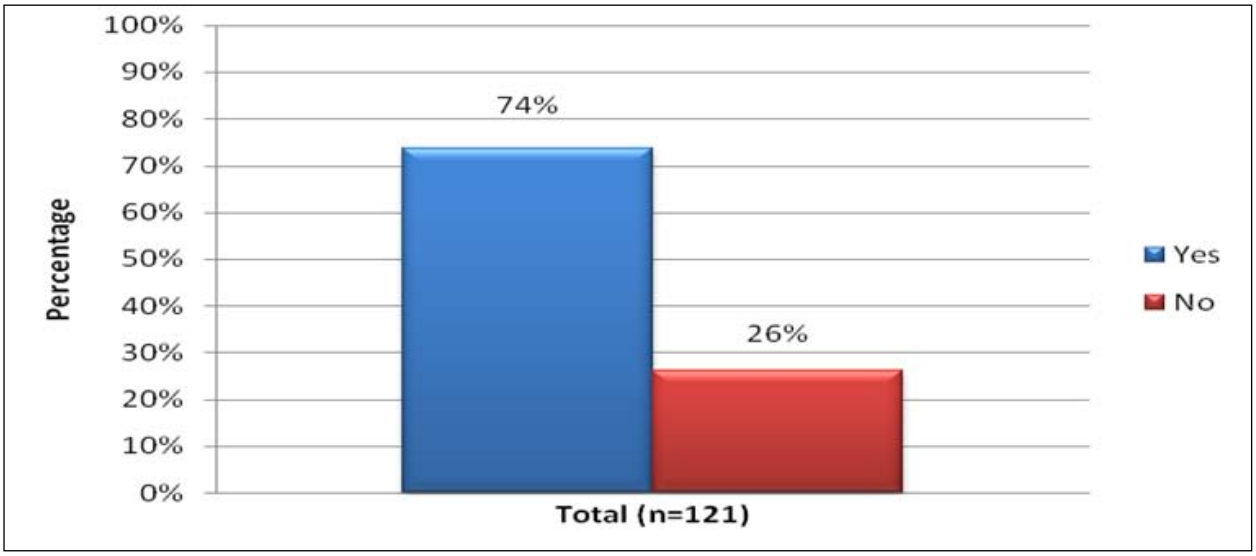

Figure 7 Percent of respondents who indicated the establishment they represent did (yes) or did not (no) have a written food defense plan.

When these results are stratified by establishment size, only 28% of the very small establishments indicated that they have a food defense plan. A much greater percentage of small and large establishments indicated that they had a written food defense plan (82 and 85%, respectively) (Figure 8).

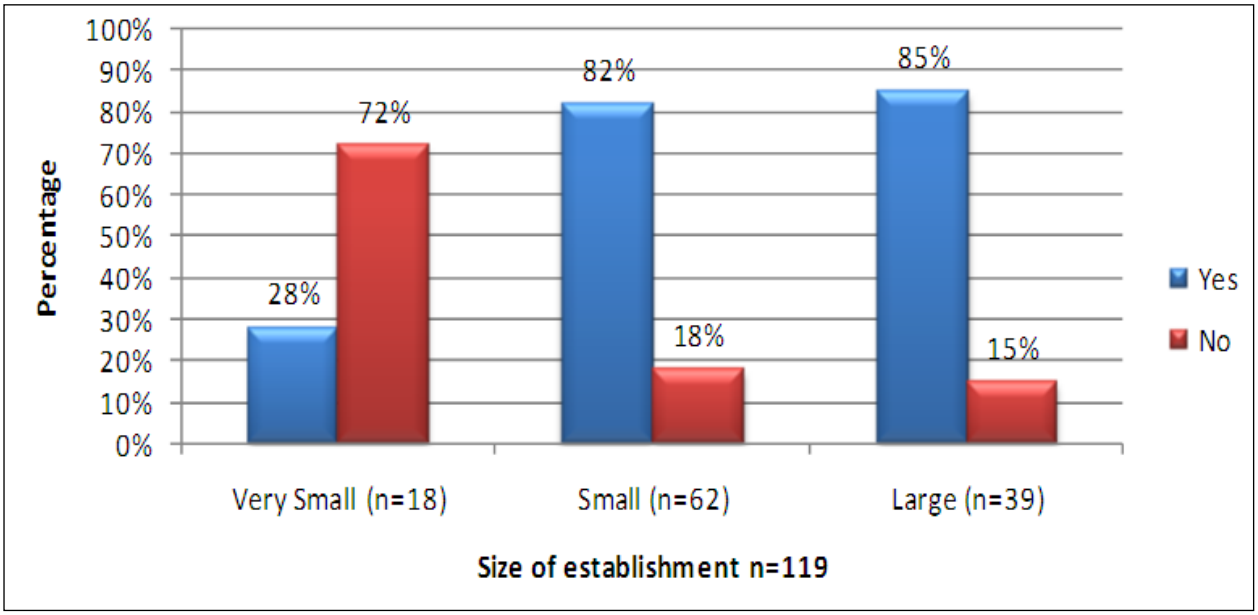

Figure 8 Within each establishment size, percent of respondents who indicated the establishment they represent did (yes) or did not (no) have a written food defense plan.

There are a few hypotheses regarding why 72% of the very small establishments responding to our survey do not have a food defense plan. Federally inspected establishments are not required by USDA-FSIS to adopt a food defense plan. FSIS strongly encourages all establishments to have a food defense plan. It is difficult to expect an establishment to have a plan if they are not required to by the government due to the associated costs and time requirements involved. Secondly, if FSIS does not require federally inspected establishments to have a plan, then an establishment may think that food defense is not a significant concern. Although there is guidance material available on the FSIS and FDA websites, there may be situations where a very small establishment might not have access to a computer. More commonly, very small establishments are often family run businesses. Family members produce the products as well as run the business and accounting. This may not allow them time to research and gather information on developing, implementing and operating an effective food defense program. Furthermore, if the available guidance suggests utilizing programs or technologies that a very small establishment may not have the resources to implement, it would be easy for them to dismiss the information as not being applicable for them.

The majority of the small and large establishments have a written food defense plan, although it is not possible to determine the merits of each individual plan. It is the goal of the FSIS to have 90% of all federally inspected establishments adopt a food defense plan *(21)*. Therefore, it is important to determine why various establishments do not have a plan so that specific educational materials can be developed to encourage a higher adoption rate.

8.4 Perceptions about the likelihood of an intentional contamination event

Respondents were asked their opinion, using a Likert scale of 1=not likely, 2=somewhat likely, and 3=very likely, about the likelihood of an intentional contamination event occurring in the U.S. Overall, 33% felt an intentional contamination event in the U.S. was "very likely," 50% of the respondents felt it was "somewhat likely." and only 17% felt it was "not likely" (Figure 9).

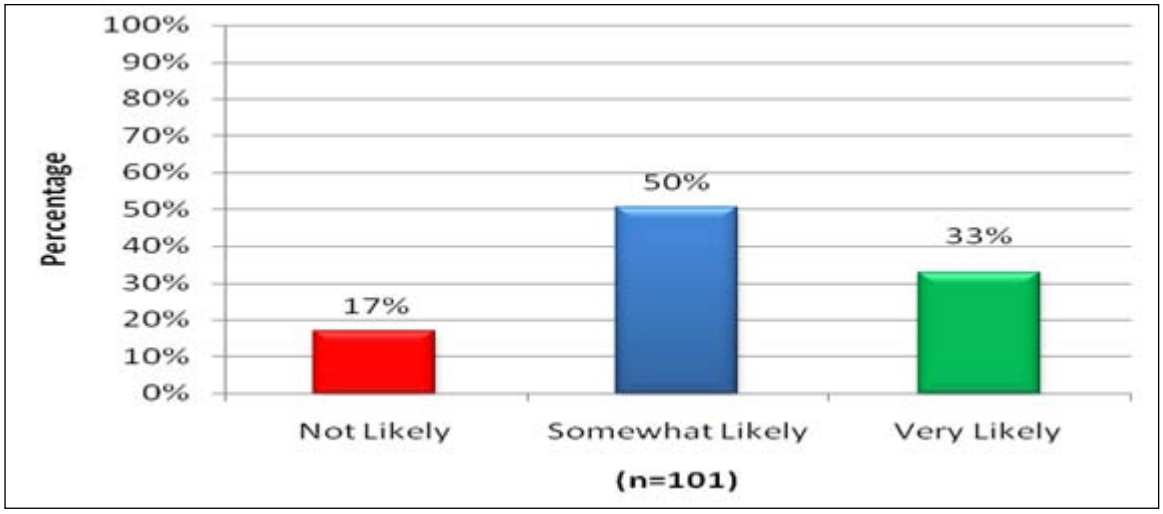

Figure 9 How respondents perceived the likelihood of an intentional contamination event occurring in the U.S. (as shown by percent of respondents selecting Likert scale options of "not," "somewhat," and "very" likely).

When the responses are grouped by establishment size, 40% of the respondents from large establishments felt it was "very likely" to occur, 50% "somewhat likely," and 10% "not likely." The respondents from the small establishments responded with 27% "very likely," 56% "somewhat likely," and 16% "not likely." The respondents from the very

small establishments indicated that 38% thought an intentional contamination event was "very likely," 31% said "somewhat likely," and 31% decided it was "not likely" (Figure 10).

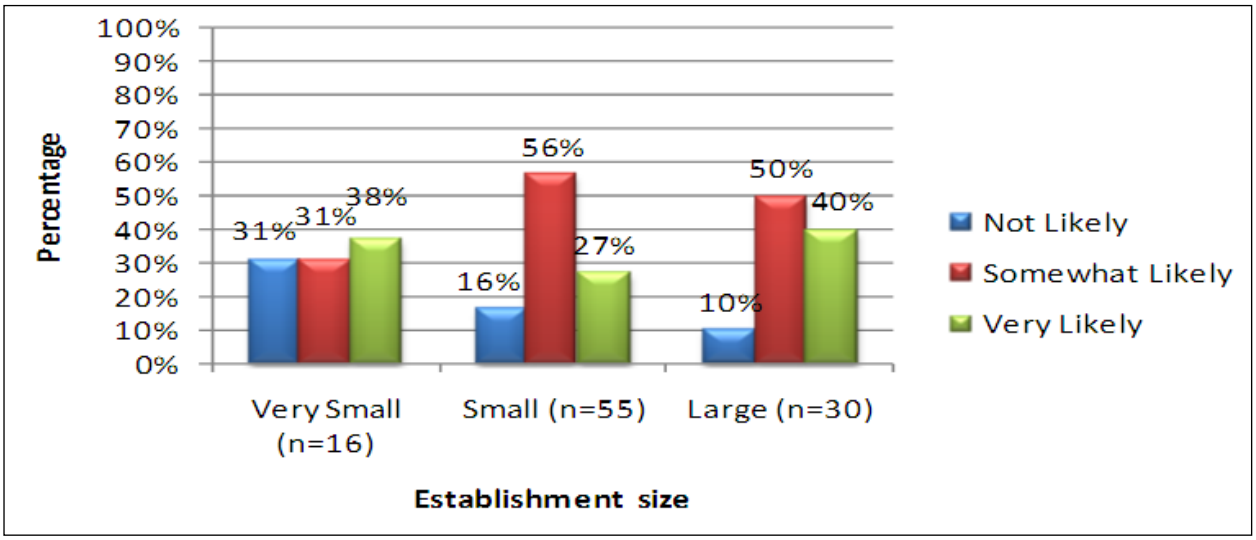

Figure 10 Within establishment size, the perception of respondents regarding the likelihood of an intentional contamination event occurring in the U.S. (as shown by percent of respondents selecting Likert scale options of "not," "somewhat," and "very" likely).

Over 80% of the respondents from the small and large establishments combined felt that the likelihood of an intentional contamination event in the U.S. was "somewhat likely" to "very likely." Interestingly, almost a third of very small establishments that responded indicated that an intentional contamination event was "not likely" to occur in the U.S. This response from the very small establishments may be a reason there is a high percentage that do not have a food defense plan or consider food defense as important.

8.5 Perception of the likelihood of an intentional food contamination event occurring in the respondents own establishment.

The respondents were also asked their opinion, using the Likert scale with 1=not likely, 2=somewhat likely, and 3=very likely, about the likelihood of an intentional contamination event occurring in their particular facility. The majority (66%) felt it was "not likely" to occur. Interestingly, 34% of all respondents perceived it was "somewhat likely" to "very likely" that their establishment would be attacked. (Figure 11)

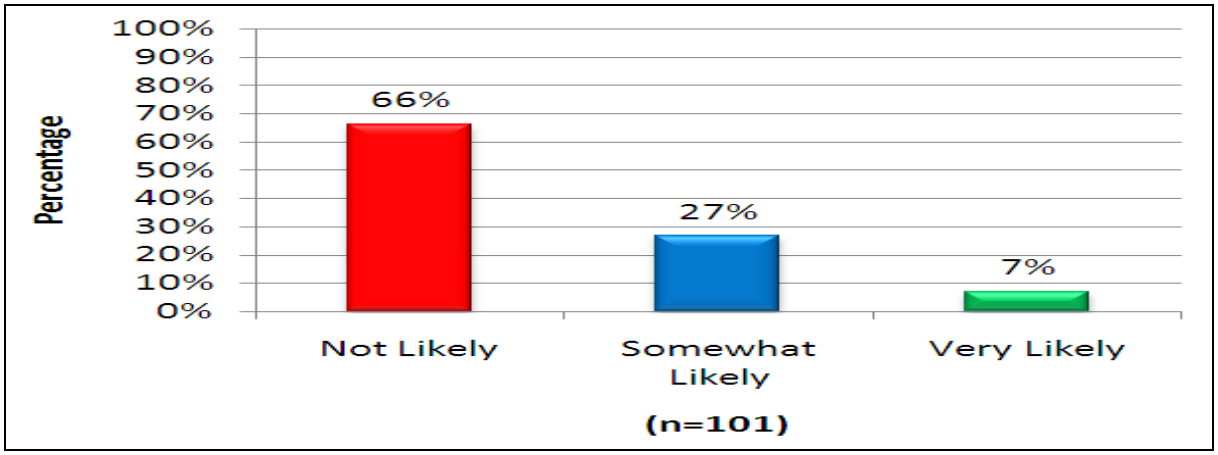

Figure 11 How respondents perceived the likelihood of an intentional contamination event occurring in their establishment (as shown by percent of respondents selecting Likert scale options of "not," "somewhat," and "very" likely).

When this information is broken down by establishment size, the 7% of respondents from the very small establishments indicated that an intentional contamination event in their establishment was only "very likely," 13% indicated "somewhat likely," and 80% indicated "not likely." Within the small establishments 6% of respondents indicated that an intentional contamination event in their establishment was "very likely," 21% responded "somewhat likely," and 73% indicated "not likely." For the large establishments, however, 10% of respondents indicated that an intentional contamination event was "very likely," 43% reported "somewhat likely," and 47%indicated "not likely" (Figure 12).

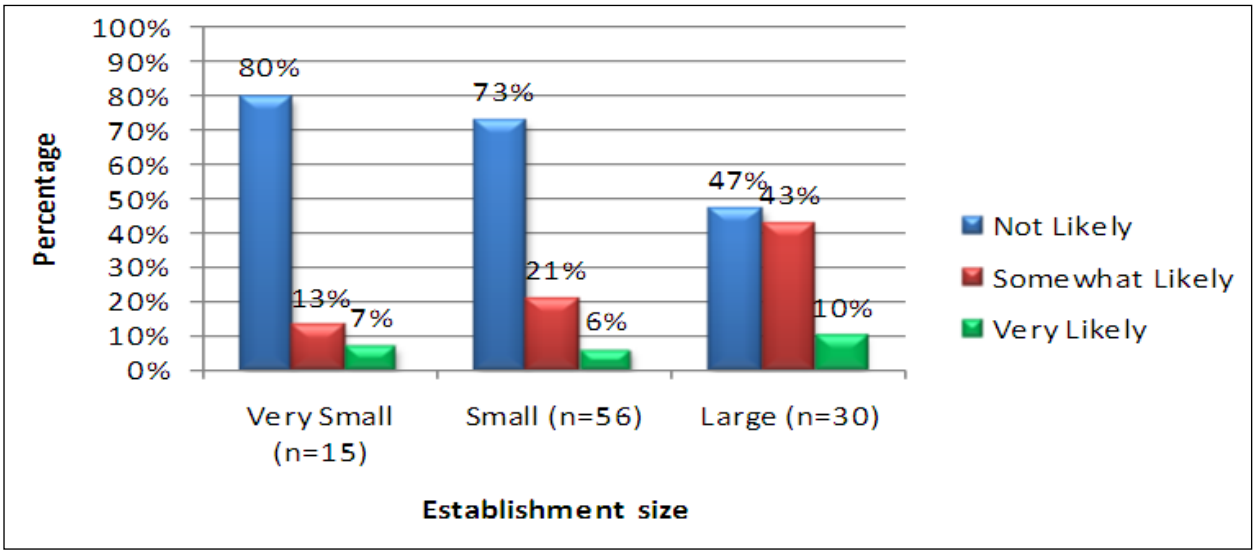

Figure 12 Within establishment size, the perception of respondents regarding the likelihood of an intentional contamination event occurring in their establishment (as shown by percent of respondents selecting Likert scale options of "not," "somewhat," and "very" likely).

Respondents from very small and small establishments perceived an intentional contamination event was not likely to occur in their establishment.

In contrast, the percentage (43%) of respondents from large establishments that identified the likelihood of a contamination event in their establishment as "somewhat likely" was similar to the percentage (47%) that identified the likelihood as "not likely." It appears that the large establishments may be more aware of the vulnerabilities and threats that their establishment may encounter. By acknowledging that their establishment may be vulnerable to an intentional contamination event, it might be concluded that large companies will be more likely to continually assess their vulnerable areas and address them to prevent an attack.

8.6 Respondents' perception of their preparedness for a potential intentional food contamination event

The respondents were asked their perception of preparedness for their establishments using a Likert scale with 1=not prepared, 2=somewhat prepared, and 3=very prepared. Overall, 35% of the respondents indicated they felt "very prepared," 53% were "somewhat prepared," and 12% were "not prepared" (Figure 13).

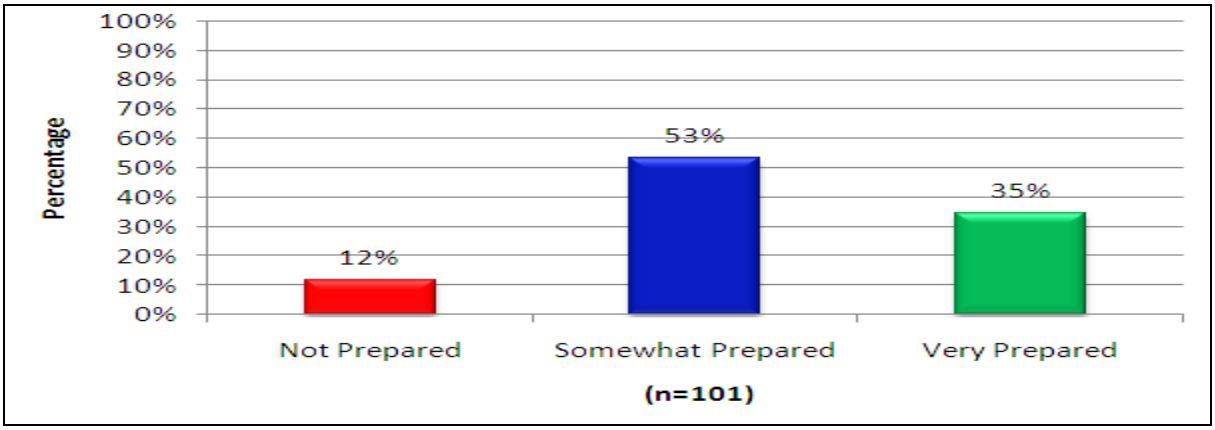

Figure 13 Percent of respondents who indicated their establishments were "not," "somewhat," or "very" prepared for an intentional contamination event.

When these responses are broken down by establishment size, 20% of very small establishment respondents felt "very prepared" for an intentional contamination event, 60% felt "somewhat prepared," and 20% felt "not prepared. The small establishment respondents felt 35% "very prepared," 59% "somewhat prepared," and 7% "not prepared." The respondents from the large establishments felt 43% "very prepared," 40% "somewhat prepared," and 17% "not prepared" (Figure 14).

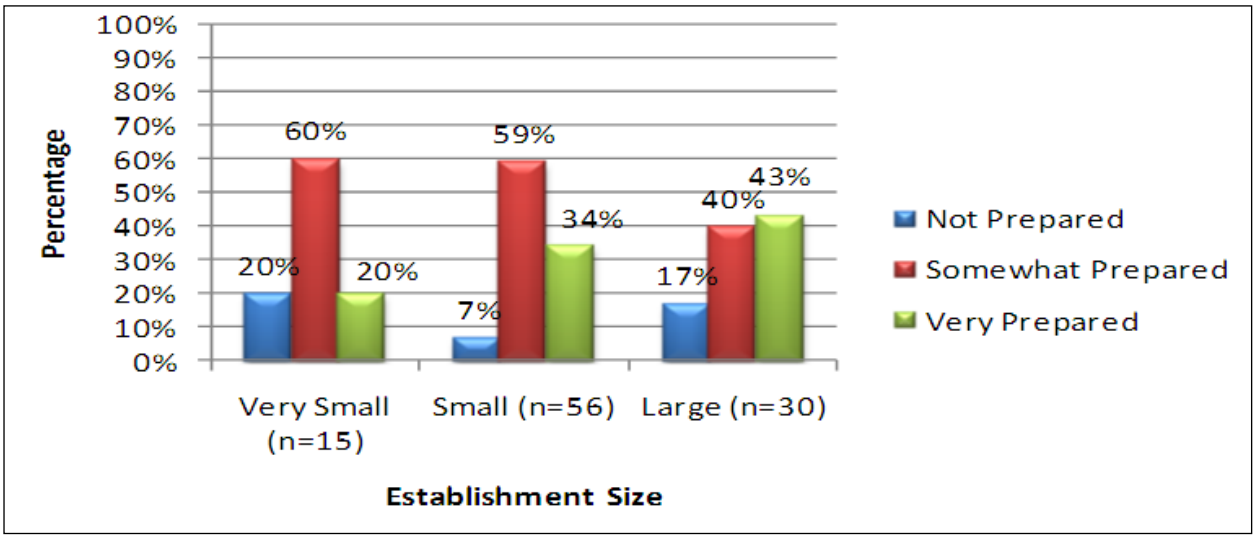

Figure 14 Within each establishment size, the percent of respondents who indicated their establishments were "not," "somewhat," or "very" prepared of an intentional contamination event.

Less than half of the respondents within each establishment size reported that their establishment was "very prepared" for an intentional food contamination event. More

large establishments indicated “very prepared” compared to the small and very small, but at least half of the small and very small reported at least “somewhat prepared.” The percentage of respondents who identified “somewhat prepared” or “not prepared” may need more information or assistance in conducting vulnerability assessments to determine what they may need to develop an effective food defense plan. This is particularly true with the very small establishments. They had a smaller percentage of respondents who felt “very prepared” and a higher percentage who felt “not prepared.”

CHAPTER 9-Conclusions

Food defense is commonly referred to as protective measures put in place to prevent an intentional contamination of food *(16)*. Meat and poultry establishments that produce federally inspected products have been encouraged to develop and implement a food defense plan since May 2002 when FSIS published its first guidance material, "*FSIS Security Guidelines for Food Processors*" *(19)*. FSIS has not had the regulatory authority to require establishments to develop or maintain a food defense plan. Food defense remains a voluntary program.

In August of 2006, FSIS conducted a baseline survey to determine how many meat and poultry establishments under their regulatory authority had developed a food defense plan. Out of 5121establishments, inspection personnel reported that only 27% had a food defense plan *(38)*. The FSIS conducted follow-up surveys in 2007 and 2008. The percentage of establishments with a food defense plan rose to 31% in 2007 and then to 41% in 2008 *(38)*. The goal of FSIS is to have at least 90% of all HACCP plants adopting some sort of food defense plan (Figure 15); therefore, a significant improvement in adoption rate is needed.

Please ask the plant management if they have a plan containing food defense measures that they could make available. They may have several plans containing measures for you to consider and not just one such as a food defense plan, crisis management plan, loss prevention or risk management plan.			
Percent of "Yes" Responses			
August 2006 (Baseline Data)	November 2007	August 2008	% Change
N = 6121 plants/6316 targeted 97%	N = 6087 plants/6230 targeted 97%	N = 6012 plants/6083 targeted 98%	
27%	31%	41%	+14% total

Figure 15 Results from FSIS surveys on percentage of federal establishments with a food defense plan (38).

Percent "YES" Responses from Total of Each Size			
Size of Establishment	2006	2007	2008
Large	68%	76%	89% (310/348)
Small	40%	44%	58% (1199/2085)
Very Small	12%	14%	21% (545/2630)

Figure 16 FSIS survey results showing the percentage of establishments with a food defense plan within establishment size (38).

Figure 16 shows the results from the baseline survey conducted by FSIS in 2006, 2007, and 2008 within each establishment size.

The large establishments have come very close to the 90% adoption rate FSIS would like to see. But, the small and very small establishments are far from achieving this compliance goal. Comparing the results from the FSIS 2008 survey and this survey, the total number of establishments with a food defense plan was 41% versus 74%, respectively (Figure 7).

The percentages of respondents in large and very small establishments that identified themselves as having a food defense plan in our survey (Figure 8) are similar to the results that FSIS received. The very small establishments may not have the resources or technology available to them to develop or implement an effective food defense plan. They may also have decided that the large establishments are more of a target than they are so they may not be as concerned about developing a food defense plan. The FSIS has announced that it is looking into mandating that all federally inspected meat and poultry establishments have a food defense plan *(21)*.

The surveys conducted by the FSIS were completed by in-plant inspection personnel after requesting the food defense plan from the establishment. If a food defense plan was available, the FSIS survey asked very specific yes or no type questions regarding the maintenance of the plan and questions about having security measures to prevent

intentional contamination of product in water systems, employee behavior, maintenance, etc. A potential bias may influence the results if FSIS personnel were not given all the pertinent information or it was not requested. Additionally, the information was subject to the interpretation of FSIS personnel, instead of by the establishment, as in our survey. Our survey was voluntarily completed by establishment personnel. If establishment personnel did not feel they had time to participate, then that may be reflected in the relatively low number of responses. Secondly, establishment personnel may not accurately report their perceptions, but may say what they think others want them to say or believe. Thirdly, the lower level of participation in the current survey may be a result of questions that were not clear enough and respondents could not ask for clarification. Finally, potential respondents may not have been comfortable enough with computer functions to participate in a web-based survey.

In conclusion, it appears that the very small establishments lag behind the small and large establishments in having a food defense plan, do not consider food defense as important to their establishment, and perceive a lower likelihood of an intentional food contamination event occurring, both within the U.S. and in their specific establishment. Possible reasons for this may be the general lack of understanding of what a food defense plan involves, and/or a lack of resources to develop an effective plan. They may feel that what they are currently doing is sufficient, or the information was not in a format that was accessible or understandable to the establishment. These are all points where more information is needed to assist the small and very small establishments.

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Appendix A – Survey Introduction

Kansas State University, in cooperation with NAMP, AAMP, and AMI is conducting a survey on food defense among meat and poultry establishments. We are asking for employees of large, small, and very small meat and poultry processing establishments who are involved with, or responsible for, food defense preparedness activities for your company to participate. The purpose of the survey is to better understand the needs of processors in setting up and operating food defense (security) programs, and develop effective training materials and other tools based on the responses. Your participation is voluntary, you may respond anonymously, and all responses are strictly confidential. The results will only be compiled in summary form by respondent groups, meaning information from individual facilities will not be examined. We would like to emphasize very strongly that the survey is done solely to gather information that will be used for the development and support of industry training programs.

The survey will be available through a link on the NAMP, AAMP, and AMI websites, as well as on some state organizations with websites. This is an opportunity for you to give us input on the topic and we would love to hear from you. The survey should take about 15 minutes to complete. Thank you in advance for your interest and participation.

Appendix B – Survey Questions

1. Under what inspection system does your facility currently operate?
   ___Federal
   ___State
   ___None

2. What is the size of your facility, as defined in HACCP regulations?
   ___Very small (Facilities with less than 10 employees or annual sales less than $2.5 million)
   ___Small (Facilities with less than 500 but at least 10 employees)
   ___Large (Facilities with 500 or more employees)

3. In what state is your facility located?

4. Which of the following best describes your job title or is your primary position in your company?
   ___Owner
   ___Manager
   ___HACCP Coordinator
   ___QA Manager
   ___Other:

5. What are the products you produce, by HACCP category? (check all that apply)
   ___Slaughter
   ___Raw, Not Ground
   ___Raw, Ground
   ___Fully Cooked, Not shelf stable
   ___Not heat treated, shelf stable
   ___Heat treated, shelf stable
   ___Heat treated, not fully cooked, shelf stable
   ___Secondary inhibitors, not shelf stable
   ___Thermally processed (canned)

6. Are any of your facility's products strongly identified with any of the following? (Check all that apply)
   ___Military
   ___Airline industry
   ___School lunch program
   ___Religious or ethnic groups (e.g., Halal or Kosher)

7. What product distribution unit (package size) is the primary distribution unit sold by your facility? (Please choose one)

___Individual Servings
___Family Size (#10)
___Boxed Meat (60#)
___Combos
___Sub-primals
___Primals
___Carcass

8. In your opinion, what is your definition of "food defense"?

___Protecting the food supply from intentional contamination.
___Protecting the food supply from unintentional contamination.
___None of the above
___Other

9. Does your facility have a written food defense plan?

___Yes, If Yes, continue to question #10.
___No, If No, skip to question # 12.

10. How often are food defense vulnerability assessments performed at your facility?

___Every six months
___Every 12 months
___Every two years
___Other:

11. How would you rate the importance of these areas in your facility's food defense program?

1 - Not important | 2 - Somewhat important | 3 - Very important

___Perimeter (fences, security personnel)
___Building security (locks on doors and/or windows)
___Water security (restricted access)
___Packaging integrity (reputable vendors)
___Distribution (seals on truck doors)
___Incoming raw materials (reputable suppliers)
___Employees (Training, background checks)
___Computer security (passwords, proprietary information)

12. How prepared do you feel your facility is to handle an intentional food contamination event?

___Not prepared
___Somewhat prepared
___Very prepared

13. Is there a means for the employees of your facility to report suspicious activities within your company?

___Yes
___No

14. Does your facility have a means (e.g., telephone number or email address) by which customers can report concerns or ask questions?

___Yes
___No

15. Does your facility have a procedure for communicating information on a contamination event to the public?

___Yes
___No

16. Does your facility have a procedure in place to identify and monitor visitors and vendors?

___Yes
___No

17. Does your company have a product recall plan?

___Yes
___No

18. How long has it been since your company conducted a mock recall?

___Within the last six months
___Six to twelve months ago
___More than twelve months ago
___Never
___Other

19. How important are the following issues to your facility?
1 - Not important | 2 - Somewhat important | 3 - Very important

___Food defense in general.
___Having a means for customers to report concerns/ask questions.
___Having a procedure for communicating information to the public and/or customers.
___The ability to track your product to distribution centers and retail outlets.
___The ability to trace your facility's raw materials back to their suppliers.
___Training employees in plant security policies.
___Training employees to notice unusual events and report them to management.
___Having a product recall plan.
___Conducting mock recalls.
___Having one person in charge of making recall response decisions.

___Having one person in charge of communicating with USDA/FSIS or Kansas Department of Agriculture/Meat & Poultry Industry in the event of a recall.

20. In your opinion, how likely are the following?
1 **- Not likely | 2 - Somewhat Likely | 3 - Very Likely**

___An intentional food contamination event in the U.S.
___An intentional food contamination event in your facility.

21. Rank the following risks/threats to your facility from highest to lowest. Please use each number only once. (1 = highest risk, 6 = lowest risk)

___Disgruntled employee
___Outside terrorist threat
___Transportation (i.e., theft of trailers, tampering of seals)
___Incoming dry ingredients
___Incoming raw meat materials
___Facility tampering (water, ice, electrical)

22. Have you utilized food defense planning materials available from the USDA or FDA? If yes, please indicate which materials.

___Yes
___No

23. Have you used any online risk assessment tools for developing food defense plans? If yes, please indicate what tool (s).

___Yes
___No
Comments:

24. What source of food defense information is most useful?

___Trade associations
___General internet sources
___USDA
___FDA
___Academia (University)
___Other:

25. What source of food defense information is most easily accessible?

___Trade associations
___General internet sources
___USDA
___FDA
___Academia (University)
___Other:

26. For a facility such as yours, should food defense plans be required and regulated by the USDA?

___Yes
___No

27. What informational format would you find most useful for increasing your awareness and knowledge about food defense?

___Seminars
___Websites
___Newsletter updates
___Other:

28. Would you be willing to be contacted to participate in a telephone interview as a follow-up to this questionnaire regarding your experiences relative to food defense planning or activities? If yes, please provide your preferred email address or pertinent contact information. (All responses are confidential and will be reported only in the whole, not individually.)

___Yes
___No

Information: