Testimony

Before the Subcommittee on Emerging Threats, Cybersecurity, and Science and Technology
Committee on Homeland Security
United States House of Representatives

"Food Defense: Post-Harvest Preparedness"
July 19, 2007

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Mr. Chairmen and Members of the Subcommittee, thank you for giving the National Center for Food Protection and Defense, a Department of Homeland Security funded Center of Excellence, based at the University of Minnesota (NCFPD) the opportunity to discuss recent events involving the food system in the United States and our future needs for reducing the possibility of intentional disruption or contamination of the U.S. food system. The rapid globalization of our food supply chain has added demands upon our existing food safety systems. The threat of intentional contamination of the U.S. food system represents a further significant increase in the challenges that must be addressed to reduce the probability of public harm. Building upon prior experiences with challenges in the United States, one of the important pillars of an effective defense is fundamental and applied research to develop new strategies, tools and approaches to address the threat. This program would include preparation, prevention, response, and recovery. The university research community is one important partner with the public and private sectors in developing innovative solutions to the problems presented by intentional food contamination. The National Center for Food Protection and Defense is honored to have the opportunity to provide one perspective on both the continuing research needs and also how university researchers such as those participating in NCFPD can help address the considerations of intentional attacks on the food system.

Before moving into specific concerns and future needs, some historical perspective is provided on food system contamination to position the challenges ahead of us. While the horrific events of September 11, 2001 have changed our national view on nearly everything, food terrorism is not a new threat.

The use of food as a weapon is actually one of the oldest weapons that is still of concern for catastrophic harm. The Athenians' contaminated the drinking water for the city of Kirrha of the Amphictyonic League in 590-600 B.C., taking advantage of the resulting severe gastrointestinal illness of all inhabitants to overtake the city. A similar strategy was employed by the Carthaginian General Maharbal, utilizing contamination of wine left for his enemy which then rendered them defenseless to his ensuing attack. In more modern times, the Japanese Army experimented with the use of food for the delivery of pathogens such as *Bacillus anthracis, Shigella* spp*, Vibrio cholerae, Salmonella* Paratyphi and *Yersinia pestis*.

Frequently cited examples of intentional contamination of food for political gain or intentional harm in the U.S. include the 1984 Rashnishee cult contamination of salad bars in Oregon and the disgruntled grocery worker who contaminated ground beef in Michigan in 2002. Importantly, these historical examples all represent local contamination. Our ever more global food system means that intentional contamination at one location does not limit the impact of such an act to its immediate environment or a single geographic location. As illustrated by recent foodborne illness outbreaks as well as the recent contamination of wheat gluten with melamine from China, food adulteration from around the world can now have direct consequences across the nation. The challenges of our global, just-in-time food system represent a unique area of concern which was recognized by the Administration in implementing Homeland Security Presidential Directive 9 (HSPD-9).

The public, independent of sophisticated risk and vulnerability assessments, intuitively understands the concerns associated with intentional contamination of the food system. In a

survey conducted by NCFPD supported researchers at the University of Minnesota in 2005, consumers ranked the *probability* of an intentional attack on the food system behind attacks on air transportation, all other public transportation, the energy grid, national monuments and the release of a threat agent in an urban area. In contrast, however, consumers ranked the food system as the infrastructure of this list in which they are most *concerned* about an attack based on their recommendation that more funds be invested in food protection than in the other sectors. This apparent paradox is actually not surprising. The food system is the one critical infrastructure that reaches into every home, every day, with the potential for those of ill will to cause direct, widespread harm. It is the one critical infrastructure where you can not take yourself out of the target population.

The intuitive insight of the public into the importance of attending to the defense of the food system does not, unfortunately, translate into easy, readily available solutions to close potential vulnerabilities. The federal and state agencies involved in the food system have made dramatic strides in protecting the food system from potential terrorism since it became a front and center concern. Similarly, the private sector, which owns and manages the food system, has also worked incredibly hard to identify and address potential food system vulnerabilities. There is, however, much more to be done, and we should not be surprised by this.

For many of us, Upton Sinclair's exposé and novel "The Jungle" was our introduction to food safety and the need for private and public sector efforts to ensure a safe food supply. After more than one hundred years experience with the food safety regulations that this groundbreaking book helped push forward, food safety continues to pose a significant public health challenge. In the last year, foodborne illness outbreaks associated with spinach, lettuce and peanut butter, among others, have reminded us of these concerns. This spring the melamine contamination of vegetable proteins, diethylene glycol contamination of toothpaste and drug residues in fish serve as surrogate models of how intentional food adulteration can pose a far more significant challenge than unintentional food contamination. There is thus much more work to be done to protect the food system. Some of these research needs that are central to effective and full implementation of HSPD-9 are addressed by NCFPD.

Event Modeling

One of the primary criticisms from the 9/11 Commission was that the various federal agencies suffered from a "lack of imagination". In short, terrorists had explored more innovative threat scenarios than those for which the government had prepared. Having learned this lesson once, we can not afford to do so again. The recent melamine contamination provides a stark reminder, even though it was a simple case of economic subterfuge. Although not its apparent intent, the event outlined a pathway of contaminating a pet food raw material as a means of getting a contaminant into animal feed so that it could make its way into the human food supply. While no public harm resulted from this non-obvious scenario, it did demonstrate the ability to contaminate the U.S. food system from afar. It is therefore worth further investigation if only for the economic and psychological consequences of such an event.

Realistic, flexible and dynamic models of potential food system events are thus a very important tool for consequence and vulnerability assessment, development of shields and mitigation strategies, resource allocation and decision support during an event. One such

modeling system has been developed through collaboration of NCFPD investigators, the Food and Drug Administration – Center for Food Safety and Applied Nutrition (FDA-CFSAN), the U.S. Department of Agriculture – Food Safety Inspection Service (USDA-FSIS), the Centers for Disease Control (CDC) and a broad range of state agency experts and the private sector. Although highly successful, including its use for the 2008 Bioterrorism Report from the National Bioterrorism Analysis and Countermeasures Center, efforts on this and other models have highlighted some significant challenges. While there are specific research projects already underway in each of these areas, there is still far more to do:

- Food and ingredient movement is generally very well understood within firms, but it is not well characterized across firms or food and ingredient products. This importantly includes the degree to which the federal, state and local agencies can access specific details on movement either in real time or for planning purposes. Given that supply chain management is the core competency of many food system companies, it is unrealistic to expect them to provide details on how the system works in real time without clear assurances of the protection of such information. A clearinghouse for such information that would be accessible for research and threat assessment purposes, but with no potential for private sector competitive disadvantage, would be a significant step forward;

- Imported products, especially ingredients, represent a special challenge with which the current data and information systems were not designed to deal. The Department of Commerce data on imported food products is based on a categorization system designed to ensure compliance with various tariffs, duties and import/export restrictions. Efforts by USDA such as the Offshore Pest Inspection System (OPIS) and the FDA's Operational and Administrative System for Import Support (OASIS) are significant strides forward, but more robust systems to both enable analysis of product and country specific imports over time as well as real time targeting for inspection based on such analyses would be beneficial;

- Like all catastrophic event models, food system event models are based on a broad range of assumptions of how the various stakeholders in an event would respond – from the impacted food company to potential patients and everyone in-between. Event models would be much more useful for all involved if there were a more robust, exercise driven database on probable responses and their potential effectiveness.

<u>Agent Behavior</u>

One of the outstanding questions from the *E-coli* 0157:H7 outbreak associated with spinach last year is how was the spinach actually contaminated – did the bacteria come from the soil, animal feces, process/harvest cross contamination, irrigation/surface water contamination or some other source? This challenge stems at least partially from limited understanding of the bacteria's interaction with such diverse environments, something which the industry has stepped forward to address through a competitive research program. Intentional contamination of food for public health or economic harm elevates the challenge of understanding how agents interact with the food system to an entirely new level. This importantly encompasses agent/matrix based vulnerability assessments, new detection and diagnostic strategies and potential event response.

DHS, EPA, FDA and USDA, among others, have probed various aspects of this select agent/matrix challenge. Fundamental projects at both FDA and USDA on some select agents and other contaminants of concern, and how they might impact product characteristics or survive in food products, have increased our knowledge base. NCFPD investigators' efforts on detection (e.g., botulinum neurotoxin detection technologies, micro-fluidic pre-analytical sample processing), inactivation (e.g., *Bacillus anthracis* process inactivation) and decontamination (multiple agents in complex systems) are important steps forward but also illustrative of the challenges ahead, including;

- Traditional "Select Agents" comprise only a small subset of the agents of concern. With the food itself serving as a very effective and efficient delivery vehicle, the agents of concern go well beyond those of traditional chemical and biological weapons considerations. If the food can be used to deliver nutritionally important, targeted levels of vitamins and minerals, agents that can cause harm could also be thus delivered. The range of agents that need to be well understood consequently is far longer than the Select Agents of general concern;

- The range of potential agents highlights a detection challenge. Melamine is a good example of a potential agent that would only have been found in the wheat gluten if you knew to look for it. Conventional quality assurance test methods would not have highlighted its presence. This would also be true for a broad range of food/agent combinations so there is a need for both specific detection technologies for specific agents of concern and broadly useful techniques to rapidly identify that something is amiss and thus requires further testing;

- Understanding how such agents behave in complex food matrices and processes is a nascent area of research, and one that is not traditionally rewarded. Knowing that a particular chemical will turn a certain fluid food product a strange color, thus eliminating that combination as a potential threat, is an incredibly valuable finding for removing a food/agent combination from the list of those of concern. It is not, however, the subject of traditional federally-funded research. Results in this area, nevertheless, will make a significant difference in enabling focus on a smaller set of agent/food combinations;

- Private companies, academia, national laboratories and a range of agencies have devoted a great deal of effort to novel detection technologies, pushing the scientific frontier forward in innumerable ways. All of you undoubtedly are very familiar with the "sniffer" at Ronald Reagan National Airport, which represents a great stride forward in detecting potential explosives to prevent them being taken onto airplanes. Food systems, however, provide a unique challenge due to the complexity of the food matrix itself. Food systems from frozen cream of broccoli soup to hot dogs make the challenge ever more so difficult than air or bodily fluids. Novel sample acquisition and pre-analytical processing strategies are therefore a crucial link in any effective detection strategy.

Systems Strategies

The systems-based nature of the food system presents inherent challenges with respect to risk and vulnerability assessments as well as prioritization of investments to enhance food system protection. Unlike many of the seventeen critical infrastructures and key resources, it is primarily composed of complex systems and it is the interdependencies of these systems that are of most concern in the food system, not specific assets at a location with an address. This is the very reason that DHS is funding several projects to look at new approaches for determining criticality and assessing risk and vulnerability for systems-based infrastructures. While working toward new additions to the tool kit for risk and vulnerability assessments for the food system, there are a number of other systems focused efforts that can both deliver near term improvements as well as form the foundation for long term fundamental improvements. Current projects at NCFPD in food supply chain security and transportation system resiliency are being coupled with economic assessment tools to help focus potential investments. In addition, new approaches to both public health systems surveillance/response and social sciences such as risk communication are important ongoing NCFPD research efforts and aim at closing other research gaps. Examples include:

- For many foodborne illness outbreaks today, the detection system that identifies that a food has been contaminated is the public health system. For the melamine contamination it was veterinarians identifying unusual patterns of illness and for the *E-coli* 0157:H7 associated with spinach outbreak last year it was the public health authorities at state and local level. In both cases, however, much of the food had already been consumed before anyone identified the problem. Any approach that could therefore decrease the time from first presentation of illness to recognition of the outbreak could dramatically reduce the potential consequences.

  An ongoing example of such efforts that includes investigators from NCFPD, other academic institutions and collaborators across federal agencies and associations is an examination of how various local, state and federal agencies respond to and manage foodborne illness disease outbreak investigations. The goal is to develop a set of performance standards that result in an even more rapid response to any food related disease outbreak than is already provided today;

- Reducing the potential vulnerability within any specific food supply chain, including its distribution system, first requires characterizing how that system functions in the interdependent infrastructures we have today. Once characterized, more effective vulnerability and risk assessments are possible, thus highlighting points for the most effective introduction of interventions by either the private or public sector. Projects are underway that look at best practices in the food industry as a starting point. These studies will be complemented by recently initiated efforts on more detailed analyses of the transportation system and imported product pathways. Perhaps more so here than in any other area, public-private partnerships are crucial to moving things forward as each group has detailed information in different areas that have to be brought together for an effective outcome;

- A challenge for all investments in terrorism prevention, response and recovery is determining how much should be spent to reduce the probability or the consequences of an attack. In either the private or the public sector, there is a limited amount of potential funding available and it has to be focused on the points of greatest impact. This is perhaps even more important in the food system than in some of the other critical infrastructures because of its complicated, globally dispersed and highly dynamic, privately held, nature. Secondary benefits for food defense-motivated investments, alternative investment returns through vehicles such as insurance/re-insurance and better means of capturing the potential impact of events at the firm and system level are all areas of ongoing research that should help guide future investments;

- In the focus on "hard" tools for event prevention and response, the importance of "soft" tools such as risk communication is often overlooked. Effective risk communication before, during and after an event will significantly reduce the consequences of the event itself. Food, because of its very personal nature, requires that any such risk communication strategies take into account the very different information and communication needs of the range of groups and cultures in the U.S. Research on how to communicate most effectively with various underserved and non-traditional audiences is highlighting the range of strategies required. This research importantly includes the current collaboration of NCFPD investigators and other experts with the various federal, state, local and private sector groups who are front and center in any food system event. Products such as the NCFPD developed Risk Communication Best Practices are only a start in the significant effort to use risk communication as an effective intervention strategy.

Summary

Outstanding progress has been made by both the private and public sectors in reducing the probability and potential impact of intentional food contamination. Much more, however, is needed for full and effective implementation of HSPD-9. This includes the need for ongoing basic through applied research to address each of the primary policy areas identified in HSPD-9 for effective protection of the food system:

- Prioritization of the critical food protection and defense needs is a continual process due to the dynamic nature of our food system. As the system changes, our research strategies, prevention efforts and preparedness must change. Supply and demand changes, new products, new markets, and new consumer demands drive the ever changing nature of our food system. The shift of corn from animal feed to ethanol production illustrates this well;

- Forewarned is forearmed. Understanding changes underway and anticipating their impacts underpins effective early warning systems and robust prevention and preparedness. Public-private partnerships can support robust food system intelligence to recognize potential threats. While imports of wheat gluten from China nearly doubled between 2005 and 2006, and economic adulteration was rampant, we were unaware;

- Mitigating vulnerabilities at critical production, processing, distribution and other nodes builds off of the identification and prioritization of critical elements and resources within the food system, but includes the need to develop new mitigation strategies as the vulnerabilities continue to evolve. Collaboration across DHS, EPA, FDA, USDA, state/local agencies, the private sector owners of the food system and academia will be an important ongoing partnership for vulnerability mitigation strategy/technology development and cost effective deployment;

- Melamine contamination, antibiotic residues in imported fish and other imported product adulterations illustrate the need for enhanced screening procedures for imported products. Foodborne illness outbreaks associated with domestically sourced products reinforce that the same need exists for domestic production. Unfortunately it is just as unlikely to successfully "test in" food system defense as it is to "test in" food safety. Enhanced procedures for targeting inspection and detection will continue to be important from the farm (wherever in the world it is) through distribution to the final containment point, prior to consumer access;

- Given the degree to which the global food system is necessarily open and therefore potentially vulnerable, efforts must include enhancing response and recovery procedures to deal with the realistic probability that there will be an actual food system event. Both public/private partnerships and very innovative strategies for preparedness will be required for effective response and recovery efforts;

- Determining the right way to communicate to underserved communities is best not done in the face of a crisis just as designing practical facility decontamination and contaminated product disposal protocols is best not done when you have contaminated facilities and products. It will take continual effort to develop flexible strategies to make response and recovery efforts most effective;

- Across all of these policy goals for HSPD-9, the need to develop the future leaders in food protection and defense is central to creating the enduring capability that is needed in the future. The students, from high school through post-doctoral, that are engaged in NCFPD and other academic programs in food protection and defense are how the policy goals outlined by HSPD-9 and addressed above are made sustainable over the long haul.

In conclusion, Mr. Chairmen and Members of the Subcommittee, thank you again for the opportunity to talk with you about recent food system events and the challenges they represent for protecting and defending our food supply. The threat of intentional contamination of our food is real. While we all have come to enjoy an abundant, affordable, diverse and safe food supply as our birthright, our overall successes have made us complacent. Our food system is global and will always be global: we all demand coffee and chocolate; bananas and bonita… and our year-round cornucopia of food results from an ever-changing global supply chain. Ironically, the very advances that afford us these luxuries also create new dilemmas: a small intentional contamination can become a national foodborne disease outbreak due to the scale of production and wonder of the supply chain. We need better food system intelligence, more flexible and

responsive prevention, preparedness, response and recovery strategies, and an expanded armamentarium of technology, training professionals and tested interventions to meet these new challenges. The university research community is an important partner in this national imperative. As Co-Director, on behalf of the National Center for Food Protection and Defense (NCFPD), we are honored to have provided you with our perspective on continuing research needs and how university researchers can help address this global threat to food system and American way of life, and defend the safety of the food system through research and education.