

Title: Development of a Quantitative Food Supply Vulnerability Tool Exploring Public Health Risks

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Center of Excellence: Food Protection and Defense Institute (FPDI)

COE Lead/Co-Lead Institution: University of Minnesota

Project Start Date: 07/2014

Project Completion Date: 12/2016

Project Status: Complete

Research Theme: Risk Analysis

Participating State(s): New Jersey, Pennsylvania, Minnesota

Amount Awarded to Date: \$276,023

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Abstract: The FSMA (2011) Section 106 requires that a vulnerability assessment of the food system be conducted, including biological, chemical, radiological or other risk assessments. While defining vulnerability DHS (2010) noted that a practical measure is the "likelihood that an attack is successful, if it is attempted." The success of an attack on the food system depends on 1) the malicious actor gaining access to the product to contaminate it, and 2) the ability of the hazard to persist in the product at high enough concentrations to cause health impacts after distribution. This second component of vulnerability is the focus of the project with the aim to inform decisions to improve resiliency of the system, including the first component of vulnerability, i.e. access (and others). The primary goal of the proposed work is to develop a web-based food supply chain vulnerability assessment tool for agents of concern, which provides quantitative estimates that directly measure risk and vulnerability using public-health based metrics. This tool is generic in nature, enabling application to multiple food systems and enabling exploration of the impact of risk mitigation measures upon the vulnerability of the system. At the request of NCFPD/DHS the work focusses on microbial agents of concern however the architecture being developed is readily adapted to include chemicals in the future should it be desirable. A prototype simulation tool has been developed with a rudimentary web interface. This will be refined in Year 2 of the work. The result of the work will be a tool for both policy makers and the food industry to quantitatively explore vulnerability in directly comparable measures of public health risk. The results can be used directly to prioritize procedures to minimize the risks to public health from attacks on the food supply chain, enhancing the resiliency of the food supply chain.

Project Type: Research

End User Engagement:

- Academic Community
- Food and Agriculture Industries
- Food and Drug Administration
- U.S. Department of Agriculture

Executive Summary (2017): The primary goal of the proposed work was to develop a web-based food supply chain vulnerability assessment tool for agents of concern, which provides quantitative estimates that directly measure risk and vulnerability using public-health based metrics. This tool is generic in nature, enabling application to multiple food systems and enabling exploration of the impact of risk mitigation measures upon the vulnerability of the system exploring both chemical and microbial hazards. The result of the work is a tool for both policy-makers and the food industry to quantitatively explore vulnerability in directly comparable measures of public health risk. The results can be used directly to

prioritize procedures to minimize the risks to public health from attacks on the food supply chain, enhancing the resiliency of the food supply chain. The tool development process involved a comprehensive review of the literature into the types of food production processes in use across the industry, the behavior of microbial agents of concern in food and their response to food production processes (growth, inactivation, toxin production et.) and the subsequent mathematical description of these process in terms of their impact upon microbial agents. The simulation is coded in R with a custom API The final product is a novel web-based simulation tool to assess the vulnerabilities in food processing systems in terms of public health risk and burden of disease. The final tool provides industry and other stakeholders with a system to explore the vulnerability of diverse food processing systems in terms of the impact on public health, facilitating the identification of components of production that should be targeted for enhanced risk control, and hence increase resiliency of the food supply chain. The completed tool will now be transitioned to commercialization by RSI. We will continue to work with industry to ensure that the tool meets their needs in terms of meeting the requirements set out by FMSA in a manner that is defensible, rigorous, science-based and can be readily applied, which includes both offering a complete commercialized solution (software), or a vulnerability assessment as a service. The FSMA (2011) Section 106 requires that a vulnerability assessment of the food system be conducted, including biological, chemical, radiological or other risk assessments.

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