Food Research Institute
UNIVERSITY OF WISCONSIN–MADISON

FRESH Seminar: "Assessing Microbial Cross-Contamination in Food Production Environments"

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MADISON, Wis. (FRI) – Tools developed and used by food companies to assess environmental contamination often are guarded closely, yet sharing these practices to broader audiences can benefit all. Ben Warren of Land O'Lakes recently gave FRESH seminar attendees an inside look at his company's development and implementation of a novel "source and vector" risk assessment program for environmental microbial contamination.

Land O'Lakes is about much more than butter and cheese. With more than 10,000 employees, it is the 2nd largest member-owned cooperative organization in the United States. There are three main divisions of the company: WinField Solutions (agricultural services, crop protection), Purina Animal Nutrition (animal nutrition products in North America for livestock and lifestyle animals), and Land O'Lakes (butter, cheese, and more recently, refrigerated pudding).

A number of factors are prompting companies such as Land O'Lakes to consider revamping their approach to environmental monitoring. First, final rules as part of FDA's Food Safety Modernization Act (FSMA) are expected this August that will put increased emphasis on environmental monitoring programs for human (and likely also pet) food production facilities. Regulatory agencies are increasing the use of swabbing during inspections, with many FDA inspections now including the collection of 100–300 samples. Some states, such as Wisconsin, also are considering using swabs during inspections of food-production facilities. It's also becoming more common for regulators to use technologies like pulsed field gel electrophoresis (PFGE) or whole genome sequencing (WGS) to further characterize any pathogens that may be found in a production environment during an inspection.

The movement by regulators to characterize environmental isolates obtained during routine inspections has contributed to recent recall activity in the U.S. In August of 2014, the FDA inspected a peanut and almond butter manufacturing facility, and sequenced a *Salmonella* isolate collected during the inspection. Submission of the results to PulseNet identified a match with *Salmonella* isolates from several isolated cases reported to the CDC. The recall resulting from this work is believed to be the first triggered by connecting environmental monitoring isolates from a routine inspection to patient isolates obtained through the public health system. Another recent recall (*Listeria* linked to the Mexican cheese

quesito casero) reported genetically similar isolates found in the plant-production environment as was obtained from the implicated product. Clearly, regulators are considering and using environmental monitoring data more and more to make decisions and take actions.

Since 2008, Land O'Lakes has worked to develop a systematic connection between HACCP and prerequisite programs (PRPs). While HACCP focuses on raw materials, products, and processes, the emphasis of PRPs is on the production environment, including people and facilities. Land O'Lakes employed outside consultants to assess their programs and systems and provide recommendations. Their work with one of these consultants resulted in two collaborative publications.

Reducing pathogens in the environment is not sufficient; they need to be eliminated. Although it is important to identify where pathogens hide (their sources), it is also important to examine how they move around (vectors). These principles guided the strategy developed by Land O'Lakes and its consultant, which involved identifying harborage sites (where bacteria may survive but not grow), growth niches (sites where the bacteria can grow), and vectors of contamination (air, gases, water, material, people, etc. that move within the facility and can transport microbes between locations within the facility).

Land O'Lakes has focused on four main ways to control microorganisms by developing a thorough understanding of how people and processes interact:

1. Prevent entry of microorganisms into the facility through control of raw materials, pest management, hygiene, and procedures for visitors and contractors working within the facility.
2. Kill or remove pathogens by cleaning and sanitation procedures and design of equipment and facilities.
3. Control transfer by changing traffic patterns for people and materials, separating raw vs. finished product, etc.
4. Control growth of microbes by control of water, sanitation design, sanitation frequency, and time and temperature controls.

Fishbone diagrams were already used for root cause investigations within its manufacturing environment, so Land O'Lakes elected to use that familiar tool (instead of a massive checklist) to more systematically identify sources of microbes within plants. The information from the fishbone diagrams could then be imported into a risk assessment spreadsheet. Each source was given a risk score based on the frequency of cleaning and sanitation for that area, the ability of the hazard to spread, and the potential for microbial growth.

The scoring of source hazards involved certain challenges, including prioritization of hazards and calibration of the scoring system across plants. Sources with scores above a certain threshold were targeted for immediate risk mitigation actions. In addition, longer-term fixes that might require capital

investment were identified, with the worksheet coupled to a capital planning process worksheet to allow efficient capture and communication of this information. Calibration of the system was necessary in order to compare scores across all plants.

The scoring matrix was piloted at one plant prior to implementation to work out kinks and find possible holes. Regional meetings, including both classroom training and hands-on activities, were held at several plants to train personnel on the source/vector strategy. Risk scoring and mitigation plans were developed following this training. Quarterly reviews of plant risk assessments are conducted.

The Land O'Lakes source/vector scoring program has linked together HACCP, PRP, source vector evaluation, and the capital planning process. It has brought with it other benefits, including an opportunity to better educate personnel involved in sample collection and an improved thought process during corrective actions. It has helped maintain a focus on driving out the risk for microbial contamination and has provided a forum for discussion around risk assessment and potential mitigation strategies. It also has strengthened the capital planning process by identifying issues with the most risk within and across plants.

About the Food Research Institute

The Food Research Institute (FRI), a part of the College of Agricultural and Life Sciences at the University of Wisconsin–Madison, operates its own laboratories and administers its own research and service programs. The mission of FRI is to catalyze multidisciplinary and collaborative research on microbial foodborne pathogens and toxins and to provide training, outreach and service to enhance the safety of the food supply. To fulfill this mission, FRI conducts fundamental and applied research, provides accurate and useful information and expertise, delivers quality education and training, and provides leadership in identifying and resolving food safety issues to meet community, government, and industry needs.

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