

Post-Harvest Food Safety Risk Reduction

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The food industry in the United States has evolved into a complex, integrated, global system of production, processing, distribution, marketing and consumption. The system is ever changing and becoming increasingly consumer driven. Over 50% of the consumer food dollar is now being spent on eating away from home. When consumers do choose to eat at home, they are moving away from less expensive ingredients that take time and labor to prepare a meal at home to convenient, high quality, relatively expensive meal solutions, including “heat and eat” or “ready to eat” home meal replacement items.

However, these convenient, minimally processed foods also contain a minimum of preservatives, thereby increasing the risk of foodborne disease. In addition, as consumers become less involved with food preparation, they are also less aware of safe food handling practices. But ironically, due to increased media coverage of foodborne illness outbreaks, consumers are more aware and more concerned about food safety issues and are placing more demands on the entire food system to ensure the safety of the food supply.

Each portion of the food chain plays an integral part in food safety, thus the need for the “farm-to-table” approach including production, transportation, processing, distribution, retail, foodservice and consumers. Implementation of HACCP from farm-to-table requires that process controls be in place at all Critical Control Points (CCPs) throughout the food system. Each sector in the food system must work together to form a strong food safety system by improving its own system and by cooperating with other segments in the system to see that problems do not occur as food products move from one segment to the next. However, to be successful, HACCP must be tailored to fit each individual sector of the food system. Everyone has a role in producing safe food—farm to table.

As the meat and poultry industry strives to produce an even safer product, it must now step out in front and take the leadership in regard to safety reform. The meat and poultry industry can give itself high marks for what has been accomplished in regard to preventing diseased animals from entering the marketplace, for removing physical contaminants from meat and poultry products

and for reducing violative chemical residues to almost zero. It is now time for the industry to declare war on bacteria (pathogens) that cause foodborne disease. We do have a safe meat and poultry supply, but more needs to be done when over 9,000 people die from foodborne illness each year. The key question is how.

It is obvious that the industry cannot wait on the federal government to initiate food safety reform or it may be too late. The meat and poultry industry must move forward aggressively designing and implementing risk based food safety systems supported by science and not influenced by the political agenda of the day. To wait any longer would be a disservice to the public who depends on the U.S. meat and poultry industry to produce the safest food possible.

The food safety agenda for the future will be a farm-to-table agenda with an aggressive industry taking the lead with oversight from the federal regulators. Consumers will also play a role in the food safety agenda since they must know how to correctly and safely handle any food product they consume.

The elusive silver bullet. Much emphasis of late has been placed on the use of rapid microbial tests to solve the food safety problem. Rapid tests are important if used properly. However, rapid tests are not a cure for foodborne illness. Rapid tests are not suitable for end product inspection strategies. We cannot inspect out the problem. We must prevent it from becoming a problem. End-product testing is plagued by problems with sampling. Contrary to popular belief, pathogens that cause foodborne illness are rarely present on raw meat and poultry. For example, the infamous E. coli O157:H7 is usually found in less than 0.2% of beef carcasses sampled. No reasonable sampling plan would be sensitive enough to effectively detect this organism at such low frequencies. For example, if 50,000 pounds of ground beef contained 50 BBs, one would have to sample almost 10,000 pounds to find the BBs (assuming that you wanted to be 95% certain that you found the BBs). Sampling at this level is not realistic. Most sampling would occur at no more than 10%; thus, the BBs may not have been detected—giving a false sense of security and allowing pathogens into the food chain.

Rapid methods should be used to verify the effectiveness of HACCP CCPs (intervention systems) or to conduct microbial trend analysis over time. Intervention systems are defined as technologies that can kill or reduce pathogens. During the E. coli outbreak in January 1993, only

one intervention system was in place—final cooking of the beef patty. As we all know, that intervention system failed, and unfortunately children died. Today, we have the science for interventions at the following locations:

- carcass dehairing (currently being tested by the private sector)
- antibacterial rinses after the hide is removed and in the final rinse
- Hot pasteurization
- Steam pasteurization
- Low-dose irradiation or pasteurization (recently approved by FDA for red meat)

Unfortunately, the industry has no effective interventions after the slaughter floor until the final cooking step. A very high priority for the industry is to obtain and use technology to develop interventions at each stage of the conversion process (slaughter, fabrication, grinding, food service, retail, etc.). These technologies will give the industry a series of sequential kill steps which will greatly reduce the pathogen level and the risk to the consumer if the product is mishandled. These interventions will eventually be coupled with the interventions at the pre-harvest level that will be developed with new science.

It is up to the industry to generate and use science, in cooperation with universities, to provide these interventions that will kill or reduce the pathogens. These interventions will eventually be used in farm-to-table HACCP systems.

Where does microbiological testing fit into this agenda?

We recognize that microbiological testing is an essential tool that must be a part of any food safety program. Unfortunately, we also realize there are right and wrong ways to use microbiological testing in regard to food safety. Many times, the “wrong” way can do much harm, giving false perceptions of safety, etc. What follows is a brief discussion of what we feel to be the right and wrong way to use microbiological testing.

I. Microbiological Testing to Support GMP/SSOP and HACCP

- A. GMP/SSOP. Microbiological testing can and should be used to measure the effectiveness of good GMP/SSOP programs. There are rapid tests on the market that effectively measure the effectiveness of these programs. Some of the more popular and effective tests use the ATP-bioluminescence approach. This type of microbiological testing will normally be conducted by industry.
- B. HACCP. Microbiological tests can be conducted to measure the effectiveness of the management of some of the Critical Control Points in a HACCP system. These tests will normally use non-pathogen indicator tests such as generic E. coli, ATP, APC, Coliforms, etc. These tests are normally used by the industry.
- C. Baseline/trend sampling. We feel that it is important for industry and government to benchmark products and points in the food chain so that they will be able to use this baseline or benchmark to measure change and effectiveness of new and existing programs over time. The pathogens of choice in these benchmarking programs will likely be those with a higher incidence in the food chain such as Salmonella. E. coli O157:H7 is found at such a low level in meat and poultry that it does not qualify as being a pathogen of choice for these monitoring programs. Within a company or store, this type of information can be used to measure the effectiveness of food safety programs over time and to identify potential problems before they get out of hand. Government regulators can use this type of information over an entire industry segment to measure effectiveness of national programs. We do not feel that it is proper to make decisions or publicize this type of information by store or company since this data is for trend analysis only. Looking at small pieces of data over a short period of time is not scientifically valid.

II. The Wrong Way.

Bacteria, unlike chemical residues, is not uniformly distributed in food. This presents a tremendous sampling problem. Test and hold or lot testing programs are almost never scientifically valid, and that includes USDA's national testing program for E. coli O157:H7. USDA takes over 5,000 samples per year to test for this organism. E. coli O157:H7 is considered

by USDA to be an adulterant in raw ground beef. Whether it should or should not be an adulterant in uncooked ground beef will not be debated here. When USDA takes a sample for O157:H7, it pulls one sample per lot. Statistically, given the level of O157:H7 normally found in ground beef, the sample size per lot should exceed 3,000 to be statistically valid. The scientific community has agreed for almost three decades that end-product test and hold microbiological testing is not scientifically valid because of the number of samples that would have to be taken to produce valid results. In fact, that was why HACCP was developed for NASA. The scientific community feels that it is not scientifically valid, and it gives false assurance to the industry and the consumer. Negative results do not mean that the product has no or low levels of pathogens, and positive results do not mean that the food is unsafe. We realize that this type of testing is practiced by many in the food service segment of the food industry for perception and due diligence purposes only. These industry segments agree with the scientific invalidity of this approach; thus, they effectively practice GMP/SSOP and HACCP

Thus, the elusive “silver bullet” probably does not exist. It certainly is not a rapid method that would be used to test meat and poultry products for pathogens at the end of the process. The problems with statistical sampling may never be overcome because of the low levels and incidence of pathogens in meat and poultry. The industry, and hopefully the government, must put their faith in an effective, preventative HACCP system that utilizes scientifically proven pathogen interventions as science provides them. Rapid methods should be a good tool in evaluating the effectiveness of those interventions but not as an end release product test. USDA can be helpful in this process by emphasizing research on pathogen interventions and speedy approvals for its use as new science becomes available.