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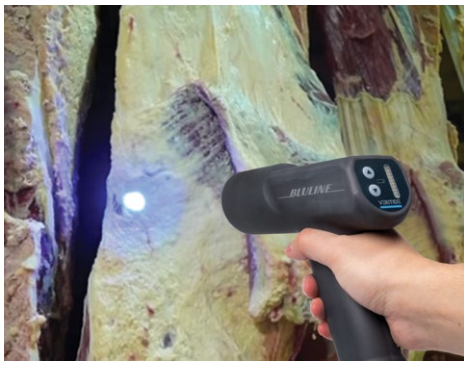
KEEPING CONTAMINATION AT BAY



In today's climate of health hyper-awareness, the need to ensure food safety has never been more critical. It begins on the slaughter floor.

There's no pleasant way to put it: A large part of preventing contamination in the meat supply chain begins with what comes out of the back end of the animal. And to that end, there are several major problems with fecal contamination on carcasses.

First, pathogenic bacterial cell counts are almost always higher on contaminated carcasses compared to clean carcasses. This increases the risk of negative (and sometimes catastrophic) human health outcomes if the contamination makes its way through the supply chain to the consumer. *E. Coli* is the main risk (specifically, O157:H7 is the highest risk). However, pathogens such as *Salmonella*, *Listeria* and *Staphylococcus aureus* can all make people very sick.

The ripple effects are substantial in the event that consumers are exposed to such pathogens. Consequences can include product recalls, which are enormously expensive and time-consuming. Any ensuing litigation is likely to be very costly as well, damaging the reputation of the company and its brand. But beyond those problems, bacterial cell counts also impact negatively on product shelf life, with spoilage bacteria such as pseudomonads and lactic acid bacteria leading to higher product losses for downstream suppliers. Those factors impact a meat processor's reputation for product quality and its ability to command the strongest price.

Regulatory Considerations

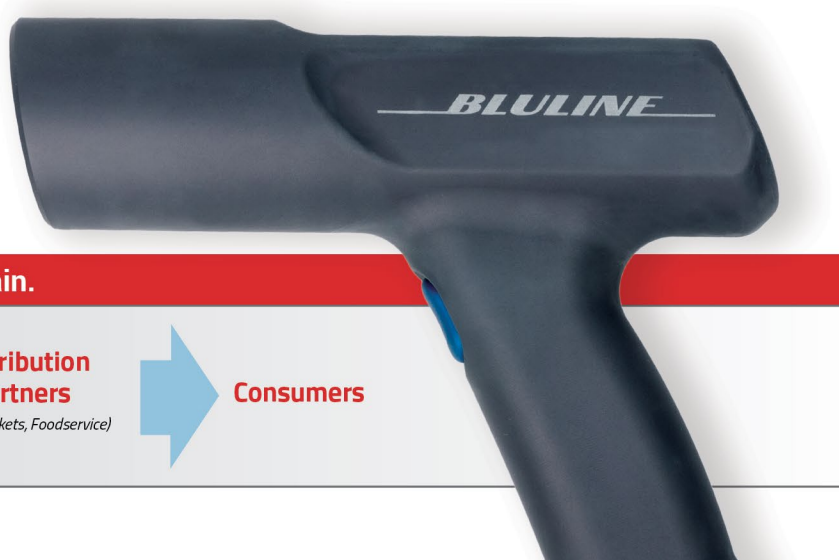
Alongside the market-driven consequences of carcass contamination, there is a regulatory element to consider. The USDA, through its FSIS federal inspection services arm, oversees and monitors the performance of meat processors and their contamination management strategies – SOPs, HACCP analysis and the like. FSIS inspectors conduct random sampling/swabbing activities. As there is a zero-tolerance policy on fecal contamination past the slaughter floor, these inspectors have the power to close down an operation if they find consistent evidence of contamination making its way beyond that point in the plant.

Conventional contamination detection functions have included laboratory testing and visual inspection procedures. With lab testing, processors can precisely identify and quantify the presence of bacteria – but there are drawbacks. Turnaround times on tests are slow – often 24 hours. Moreover, the testing is based on random swabbing procedures, which generally means that only a small portion of any one carcass is tested. Some contaminated locations can be missed, with potentially significant repercussions.

As for visual inspection, this can be conducted on the line, with immediate identification and removal of any visual contamination. But visual inspections cannot identify invisible contamination, plus with the rapid speed of most processing lines, visual inspection is almost impossible to carry out effectively.

Intervention techniques to remove contamination from carcasses include targeted manual trimming along with steam-cleaning, hot and cold water washing, and acid washing. Trimming and steam-cleaning techniques can do a reasonable job of immediately removing visibly identified contamination. By contrast, hot/cold water and acid-wash techniques are more general in their application, but enable cleaning large portions of carcasses in one treatment cycle.

Unfortunately, time, energy and environmental costs can be substantial for such intervention techniques. And even so, the fact remains that fecal and bacterial contamination are still prone to sneak past and go deeper into the supply chain. Trimmers and steam-cleaning can miss contaminated spots, and washing techniques are applied liberally – but not precisely – on

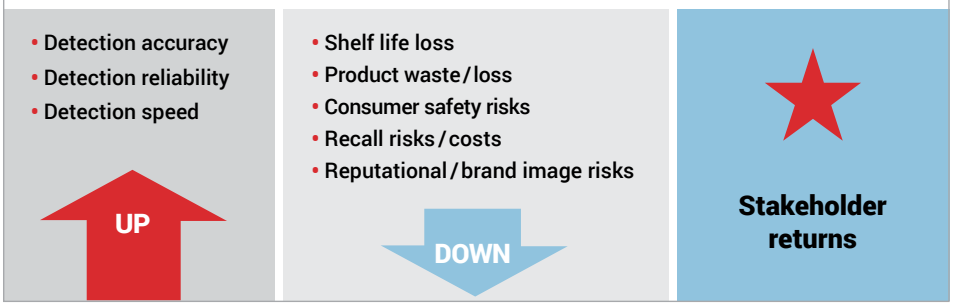


Benefits that accrue throughout the entire supply chain.

Meat Processor/ Manufacturer → **Meat Inspection Services** *(QA/QC, Regulatory Agencies)* → **Distribution Partners** *(Supermarkets, Foodservice)* → **Consumers**

Contamination Detection Taken Further

The BluLine Scanner improves on the effectiveness of conventional contamination detection procedures.



the contaminated locations. Often, contamination is simply diluted rather than removed through the washing process.

A New Approach

A newer, more effective technique for controlling contamination on carcasses is real-time, line-speed portable contamination detection performed via a hand-held scanner. Such a device has now been introduced, supplementing current contamination management strategies and optimizing the effectiveness of plant SOPs and HACCP systems. Known as the BluLine Scanner, this "bionic eye" tool helps eliminate the subjectivity that is inherent in human, visual inspection processes. It goes further in that it illuminates both visible and invisible contamination on the carcass.

The BluLine Scanner refines current swabbing and lab testing procedures by identifying specific locations on the carcass that might be contaminated with bacteria – thereby providing processors with far more accurate and objective data on contamination rates, bacterial cell counts and contamination locations. As a result, the "feedback loop" into the processor's SOPs for contamination management is amplified substantially.

By adding more precision to the work done by trimmers and steam-cleaning, the BluLine Scanner helps deliver positive outcomes regarding product yields, operator productivity and energy consumption. Moreover, QA/QC and operations managers can utilize the scanning results to improve upstream line processes such as hide removal, evisceration techniques, and cross-contamination risk reduction with staff training.

From Concept to Commercial Application

Like many advancements, perfecting the technology behind the BluLine Scanner began in a university setting, where promising research results led to the creation of Veritide, a commercial start-up entity. Initially developed to detect the presence of anthrax, the science's potential for pathogen control in meat processing environments soon became evident. Beginning in 2016, extensive testing of the scanner was conducted in meat processing facilities. The success of those trials led to unveiling the product at the IFFA Trade Fair in Germany in May 2019. Since then, the BluLine Scanner has been adopted by a range of processing plants in the United States, Europe, China and Oceania.

The successful introduction of the BluLine Scanner is spawning additional R&D initiatives as well. Meat processors are looking to integrate these capabilities with automation and robotics to achieve a real-time, full-carcass, line-speed contamination management solution – in other words, automated contamination detection combined with automated contamination removal. At the same time, efforts are being undertaken to adapt the science to fecal matter on pork and poultry products – two non-herbivore species. If successful, the benefits of controlling supply chain contamination will become available to even more processing plants.

How the BluLine Scanner Works

The science behind the operation of the BluLine Scanner is based on pioneering research conducted at the University of Canterbury in Christchurch, New Zealand. In a nutshell:

- Fluorescence technology and a mathematical algorithm are employed to detect chlorophyll and its metabolites within fecal material found on the surface of meat. The chlorophyll detection indicates the presence of feces, which is the vector for bacteria.
- Fluorescence, also known as photoluminescence, is light emission of a substance *(i.e. luminescence)* when the substance is excited by another light *(i.e. photo)*. Chlorophyll yields strong fluorescence signals for the BluLine Scanner's detectors and sensors, but so do various component parts of meat such as collagen, fat and connective tissue. The scientific challenge has been to isolate and identify the chlorophyll against this broadly fluorescent background.
- In operation, the BluLine Scanner reacts to the presence of chlorophyll by vibrating and lighting up, alerting the user of possible contamination and providing an "instant result" for follow-up actions.
- Results are also useful for worker training purposes, providing highly effective feedback to improve carcass-dressing procedures.
- Initial usage has been on the carcasses of cattle and sheep, which are herbivores – hence the presence of chlorophyll in their gut systems and feces.

BETTCHER® Industries, Inc.

Contact the technical specialists at Bettcher Industries for additional information on the BluLine Scanner and its contamination control capabilities. Visit **bettcher.com/bluline** or call toll-free **800-321-8763**.