

# Listeria in the Dairy Industry

Effective control of *Listeria monocytogenes* in dairy processing facilities is critical to produce safe food

Updated: January 10, 2023

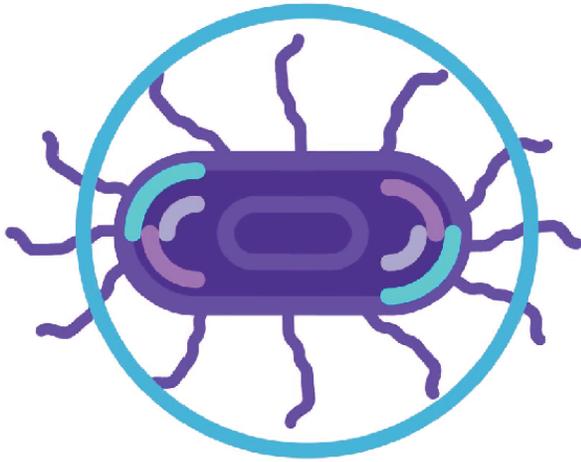


Image credit: Food Safety CTS, LLC

In this article and the accompanying video, you will learn about *Listeria monocytogenes*, a dangerous foodborne pathogen, and how to prevent the contamination of food with *Listeria*. The article provides additional information to that presented in the video.

*Listeria monocytogenes* is a bacterium which causes the disease listeriosis. While healthy people are normally not affected by listeriosis, the disease can be life threatening in the elderly, pregnant women, infants, and people who are immunocompromised. In the United States, approximately 1,600 people get listeriosis every year due to consumption of contaminated food, and 260 people die. Given the severity of listeriosis and its high death rate, it is important to keep food free from *Listeria*. Dairy products such as soft cheese, raw milk, raw milk cheeses, and ice cream have been identified as sources of *Listeria monocytogenes* in recent outbreaks.

*Listeria monocytogenes* has some unique characteristics in comparison to other foodborne pathogens:

- It is widespread in natural environments, including soils, and farms;
- It can survive freezing;
- It can grow at refrigeration temperatures;
- It can grow at high salt concentrations; and
- It can grow at a wide range of pH.

Of these characteristics, two are key for dairy processors. *Listeria's* ability to grow at low temperatures allows it to persist in dairy processing environments and outcompete bacteria that cannot grow well in the cold. *Listeria's* ability to survive in high salt concentrations can be a concern for cheesemakers who use brine solutions.

*Listeria* can enter food processing facilities with raw materials including raw milk or be brought in on employee's clothes and shoes. Other routes by which *Listeria* can enter the dairy processing environment include contaminated ingredients and pests. Once inside the processing facility, *Listeria* can hide in spots that are difficult to clean, such as cracks in floors and inside drains. Places that may accumulate water, such

as coolers or condensate pans are ideal hiding spots for *Listeria*. *Listeria* is killed during pasteurization. However, in dairy processing plants, cross-contamination of products by *Listeria* can occur after pasteurization.

How can we effectively control *Listeria* and prevent contamination of dairy products? We can:

1. Monitor raw ingredients to prevent *Listeria* from getting into the processing facility. Implementing supplier controls can help to identify raw ingredients, including raw milk, that can introduce *Listeria* into the dairy processing facility.
2. Use proper pasteurization conditions in a properly designed and operating pasteurizer to kill *Listeria* that may be present in raw milk, ice cream mix, or other raw dairy blends. You can learn more about pasteurization and the Pasteurized Milk Ordinance in [this Penn State Extension article](https://extension.psu.edu/the-grade-a-pasteurized-milk-ordinance) (<https://extension.psu.edu/the-grade-a-pasteurized-milk-ordinance>).
3. Implement Good Manufacturing Practices, including personnel hygiene and hygienic zoning to prevent cross-contamination between the environment and finished products. Training of personnel on the importance of hygiene in food production is key to manufacturing safe foods.
4. Clean and sanitize food processing environments, focusing on hard-to-clean areas to prevent *Listeria* from hiding in the environment and on equipment. Written protocols for cleaning and sanitizing can help in consistent sanitation and personnel training. Cleaning and sanitizing must be validated frequently to assure its effectiveness. You can learn more about cleaning and sanitizing in [this Penn State Extension video](https://extension.psu.edu/cleaning-small-scale-dairy-plants-cleaning-equipment) (<https://extension.psu.edu/cleaning-small-scale-dairy-plants-cleaning-equipment>), and key concepts on writing sanitizing standard operating procedures in [this Penn State Extension article](https://extension.psu.edu/writing-sanitation-standard-operating-procedures-ssops) (<https://extension.psu.edu/writing-sanitation-standard-operating-procedures-ssops>).
5. Conduct environmental testing to monitor *Listeria* in the processing environment and verify the effectiveness of cleaning and sanitizing procedures. Frequent sampling of environmental surfaces to detect *Listeria* will help identify gaps in your environmental cleaning and help prevent the cross-contamination of food. When designing an Environmental Monitoring Plan (EMPs), the number of samples taken, sampling locations, and the frequency of sampling will depend on the facility size, products, processes, and previous history with *Listeria* contamination. If *Listeria*-positive samples are found in the environment, a root cause investigation needs to be conducted to identify the source of *Listeria*. A thorough cleaning and sanitizing of the positive site, followed by resampling to prove the *Listeria* is eliminated will be needed to prevent the risk of contaminating other dairy products in the facility.

Control of *Listeria* in the processing environment is critical for preventing the contamination of food.

## Additional resources:

- [Key Concepts in Cleaning and Sanitizing](https://extension.psu.edu/key-concepts-of-cleaning-and-sanitizing) (<https://extension.psu.edu/key-concepts-of-cleaning-and-sanitizing>) (Article)
- [Sanitation Tips for Small-Scale Cheese Plants](https://extension.psu.edu/sanitation-tips-for-small-scale-cheese-plants) (<https://extension.psu.edu/sanitation-tips-for-small-scale-cheese-plants>) (Article)
- [Facilities for the Value-Added Dairy Foods Processor](https://extension.psu.edu/facilities-for-the-value-added-dairy-foods-processor) (<https://extension.psu.edu/facilities-for-the-value-added-dairy-foods-processor>) (Webinar, recorded)
- [Cleaning Small-Scale Dairy Plants: Cleaning the Facility](https://extension.psu.edu/cleaning-small-scale-dairy-plants-cleaning-the-facility) (<https://extension.psu.edu/cleaning-small-scale-dairy-plants-cleaning-the-facility>) (Video)
- [Cleaning Small-Scale Dairy Plants: Cleaning Drains](https://extension.psu.edu/cleaning-small-scale-dairy-plants-cleaning-drains) (<https://extension.psu.edu/cleaning-small-scale-dairy-plants-cleaning-drains>) (Video)
- [Cleaning Small-Scale Dairy Plants: Cleaning Equipment](https://extension.psu.edu/cleaning-small-scale-dairy-plants-cleaning-equipment) (<https://extension.psu.edu/cleaning-small-scale-dairy-plants-cleaning-equipment>) (Video)
- [Equipment for the Value-Added Dairy Foods Processor](https://extension.psu.edu/equipment-for-the-value-added-dairy-foods-processor) (<https://extension.psu.edu/equipment-for-the-value-added-dairy-foods-processor>) (Webinar, recorded)

## Key references:

- [Facts about Listeria from Center and Disease Control and Prevention.](https://www.fda.gov/animal-veterinary/animal-health-literacy/get-facts-about-listeria#statistics) (<https://www.fda.gov/animal-veterinary/animal-health-literacy/get-facts-about-listeria#statistics>)

- General description of *Listeria monocytogenes* and listeriosis. Donovan *et al.* 2015. [Listeriosis: a Rare but Deadly Disease](https://doi.org/10.1016/j.clinmicnews.2015.08.001) (https://doi.org/10.1016/j.clinmicnews.2015.08.001). Clinical Microbiology Newsletter 37(17):135-140. DOI.org/10.1016/j.clinmicnews.2015.08.001
- [Control of \*Listeria monocytogenes\*. Guidance for the U.S. Dairy Industry.](https://www.usdairy.com/getmedia/ae7f5c2-b462-4f4f-a99d-870f53cb2ddc/control%20of%20listeria%20monocytogenes%20guidance%20for%20the%20us%20dairy%20industry.pdf) (https://www.usdairy.com/getmedia/ae7f5c2-b462-4f4f-a99d-870f53cb2ddc/control%20of%20listeria%20monocytogenes%20guidance%20for%20the%20us%20dairy%20industry.pdf)
- Review on the persistence of *L. monocytogenes* in food processing environments: Carpentier and Cerf (2011). [Review – Persistence of \*Listeria monocytogenes\* in food industry equipment and premises.](https://pubmed.ncbi.nlm.nih.gov/21276634/) (https://pubmed.ncbi.nlm.nih.gov/21276634/) International Journal of Food Microbiology. 145:1-4. doi:10.1016/j.ijfoodmicro.2011.01.005
- Review article on Environmental monitoring programs in food processing facilities: Zoellner *et al.* 2018. [Design Elements of Listeria Environmental Monitoring Programs in Food Processing Facilities: A Scoping Review of Research and Guidance Materials.](https://pubmed.ncbi.nlm.nih.gov/33350161/) (https://pubmed.ncbi.nlm.nih.gov/33350161/) Comprehensive Reviews in Food Science and Food Safety 17(5):1156-1171. doi: 10.1111/1541-4337.12366.

**Acknowledgements:** This program was developed by Food Safety CTS, LLC, for Penn State University.

**Funding source:** This material is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, through the Northeast Sustainable Agriculture Research and Education program under subaward number GNE19-215, and by USDA National Institute of Food and Agriculture and Hatch Appropriations under Project #PEN04666 and Accession #1017568.

## Authors

Kerry E. Kaylegian, Ph.D.

Associate Research Professor

### Expertise

- Dairy Food Processing & Quality
- Dairy Food Safety
- Sensory Analysis of Dairy Products
- Dairy Foods Extension
- Artisanal Cheese

Laura Rolon

PhD Candidate in Food Science

Penn State University

mlr355@psu.edu

---