

Salmonella Prevention Best Practices

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Complications of *Salmonella*

- Illness lasts 4-7 days usually without the help of antibiotics
 - Diarrhea (severe cases may require hospitalization)
- In rare cases the infection may spread, to other parts of the body
 - Can lead to death
- Antibiotic resistance

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High risk infection groups:

- Children under 5
- Adults older than 65
- People with compromised immune systems

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Sources of Salmonella:

- Eggs
- Leafy greens
- Melon
- Dairy, nut milks, and cheese
- Low moisture food

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Inflation caused the USDA, ERS cost of foodborne illness to rise from \$15.5 billion in 2013 to \$17.6 billion in 2018. (USDA 2021)

Source: <https://www.ers.usda.gov/webdocs/publications/102640/err-297.pdf?v=4694>

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Five Steps to Control *Salmonella* in the Food Industry (Vikan)

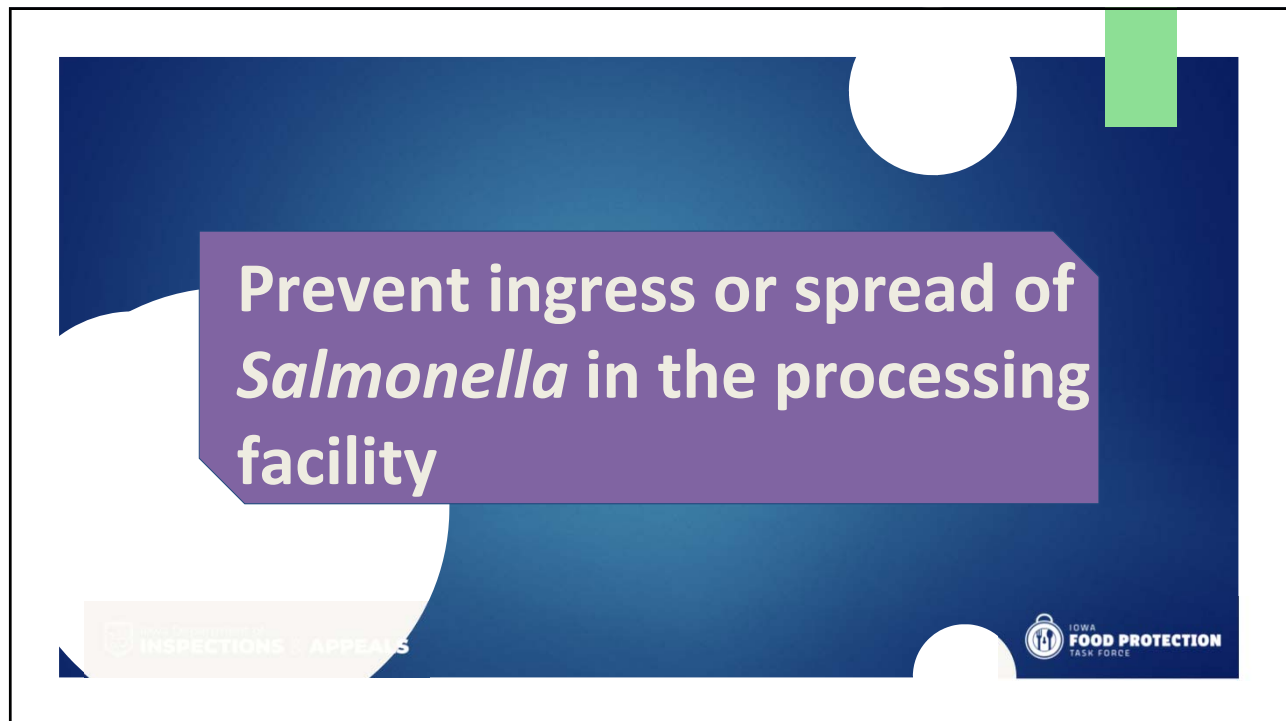
- 1) Prevent *Salmonella* entering the processing facility
- 2) Undertake proper cleaning and disinfection procedures
- 3) Implement *Salmonella* contamination prevention procedures
 - a) Sanitary design
 - b) Drainage design
 - c) Doorway sanitation
 - d) Fogging
 - e) Disinfectant rotation
 - f) Continuous learning
- 4) Use equipment of good hygienic design
- 5) Monitor *Salmonella* in the environment

Six Sanitation Strategies for Controlling *Salmonella* in Food Processing (Diversey 2022)

- A. Sanitary design:**
Design the food production environment to reduce the risk of contamination.
- A. Drainage design:**
All soils, contaminants, chemical, and even food waste converge in drains and drainage systems that often sprawl across the production site
- A. Doorway sanitation:**
Installing sanitary systems in doorways can reduce microbial spread/contamination from employee movement
- A. Fogging:**
Fogging is an effective alternative to high pressure cleaning sprays that can aerosolize salmonella (and other bacteria), particularly in high air turnover areas and hard-to-reach surfaces
- A. Disinfectant rotation:**
Recommended to prevent increased tolerance to disinfectants in microbes
- A. Continuous learning:**
Ensuring all employees/personnel are properly trained, retrained, and practice good hygiene including paying particular attention to possible contamination sources

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FACILITY MAINTENANCE, HYGIENE AND PEST CONTROL ARE NECESSARY TO AVOID OR MINIMIZE THE INGRESS OF *SALMONELLA* INTO THE PROCESSING FACILITY

➤ Control of People

- Employees are a contamination risk by tracking in contaminants
- Improper handling practices are a contributing factor

➤ Control of Places

- Improper traffic patterns of both personnel and equipment can contribute
- Improper airflow and ventilation increase contamination risk

➤ Control of Things

- Raw materials can be a source of *Salmonella*
- Pests bring contaminants into the facility

Common Industry Practices

- 1) **HAZARD ANALYSIS** TO DETERMINE POTENTIAL SOURCES FOR *SALMONELLA*
- 2) **REGULAR INSPECTIONS** OF THE FACILITY AND TIMELY CLOSURE OR REPAIR OF ANY OPENINGS
- 3) **ESTABLISH PROCEDURES** TO ENSURE THAT CONTAMINATED EQUIPMENT IS NOT BROUGHT INTO THE FACILITY
- 4) **ESTABLISH CONTROLS** TO SEGREGATE INGREDIENTS KNOWN TO BE CONTAMINATED WITH *SALMONELLA*.
- 5) **ESTABLISH SUPPLIER CONTROL PREREQUISITE PROGRAM** TO REVIEW AND APPROVE RAW MATERIAL SUPPLIERS
- 6) **PREVENTING CROSS CONTAMINATION**
- 7) **ESTABLISH WATER QUALITY MAINTENANCE PROGRAM** TO MINIMIZE THE RISK OF WATER AS A CONTAMINANT
- 8) **CONTAINING AREAS** OF CONSTRUCTION AND MAJOR EVENTS SUCH AS REMODELING
- 9) **ESTABLISH TRAINING PROGRAMS** TO EDUCATE EMPLOYEES ABOUT POTENTIAL SOURCES OF *SALMONELLA* CONTAMINATION, ADHERENCE TO TRAFFIC PATTERNS, AND PROPER HYGIENIC PRACTICES



Questions For Retail Facilities

1. How do you manage the identified controls (employee training, traffic flow, pest control, regular in-house inspections, prevention of cross contamination, containing construction areas) in your facility?
1. How are you able to manage separation of ingredients or materials known to be sources of *Salmonella* in your facility, if you store them and use them in your processes?

Enhance the stringency of
hygiene practices and controls in
the Primary *Salmonella* Control
Area (PSCA)

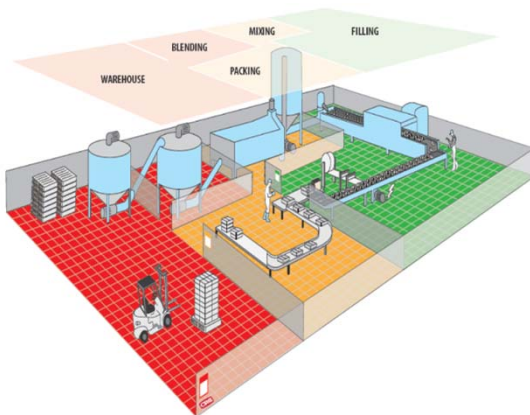
Benefits of a designated Primary *Salmonella* Control Area

► Control of People

- PSCA requires the highest level of hygiene control, prior to inactivation treatment, or it may encapsulate the entire processing area
- Hygiene areas other than (and including) the PSCA may need to be established as well, but the idea is to minimize *Salmonella* contamination to the greatest extent possible in the PSCA
- Cleanliness and good hygiene throughout the GMP is essential to maintaining the integrity of the PSCA



Benefits of a designated Primary *Salmonella* Control Area



► Control of Places

- Barriers can restrict traffic and prevent potential *Salmonella* sources from passing between the GMP and PSCA. Whenever possible, there should be no direct connection between the PSCA and basic GMP area
- Airborne contamination can be combated by filtering the air supply to the PSCA

Benefits of a designated Primary *Salmonella* Control Area



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► Control of Things

- Ingredients that do not go through further inactivation steps are exposed to the environment when processed through the PSCA and thus require that extra care is taken to avoid contaminating the environment



Common Industry Practices

- **ESTABLISH DESIGNATED AREAS** IN THE FACILITY WITH DIFFERENT LEVELS OF HYGIENE CONTROLS TO MINIMIZE THE SPREAD OF SALMONELLA (24)
- **ESTABLISH BARRIERS** FOR THE PSCA (AROUND THE ENTRANCE AND EXIT TO THE PSCA, THE EXIT FROM THE GMP, AND TRANSITIONAL AREAS) (25)
- **CONTROL ALL TRAFFIC** BETWEEN THE PSCA AND THE REST OF THE FACILITY (25)
- **MINIMIZE DUST ENTRY** INTO THE PSCA THROUGH PHYSICAL SEPARATIONS (26)
- **ESTABLISH A MASTER SANITATION SCHEDULE** TO ASSURE TIMELY AND EFFECTIVE SANITATION
- **ESTABLISH APPROPRIATE CLEANING AND HYGIENE PROCEDURES** FOR THE PSCA AND THE BUFFER/VESTIBULE AREA TO THE PSCA
- **ROUTINELY REMOVE PRODUCT BUILDUP**



Questions for Retail Facilities

1. Retail facilities may not have PSCAs, but do you identify areas of concern, and if so, what interventions do you establish?
2. Have any of you used barriers or other methods to restrict traffic flow between areas of concern and areas where *Salmonella* control may not be a primary concern?
3. Do you restrict processing ingredients or material known to be sources of *Salmonella* in certain areas of or equipment in your facility?
4. Do you use master sanitation schedules with more frequent timelines to clean the highly susceptible areas, including the requirement to frequently remove product buildup?

Apply hygienic design
principles to building and
equipment design

Because *Salmonella* exposure inside a facility is probable, it is essential to ensure that appropriate hygienic design standards are applied to building design and layout, equipment, process, and infrastructure to reduce the likelihood of *Salmonella* becoming resident/endemic.

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Common Industry Practices

- APPLY SANITARY DESIGN PRINCIPLES SUCH AS USING THE FEWEST NUMBER OF PARTS, AND HAVING PARTS ACCESSIBLE FOR CLEANING
- IF WATER IS NECESSARY IN THE FACILITY, DESIGN THE INFRASTRUCTURE AND EQUIPMENT TO ACCOMMODATE WATER, PREVENT MICROBIAL GROWTH NICHES, HAVE RAPIDLY-DRYING DRAINAGE SYSTEMS, AND PREVENT FURTHER WATER INTRUSION
- ENSURE PROPER DRY CLEANING PROCEDURES, MOISTURE EXCLUSION, AND ELIMINATING/MINIMIZING CONDENSATION ARE DEVELOPED.
- CONSTRUCTION AND MAINTENANCE ACTIVITIES CAN CAUSE FACILITY CONTAMINATION BY DISLODGING MICROBIAL GROWTH NICHES - DESIGN THE PLANT WITH STRICT ADHERENCE TO SANITATION PERFORMANCE SPECIFICATIONS.
- CLEAN EQUIPMENT ACCORDING TO HYGIENIC PROCEDURES AND AS OFTEN AS IS POSSIBLE, ON A ROUTINE BASIS. AVOID UNSCHEDULED MAINTENANCE.
- ACCESSORY TOOLS LIKE SUPPORTS AND LADDERS INSIDE LARGE EQUIPMENT OR EVEN IN THE PSCA NECESSITATES HYGIENIC DESIGN. AVOID HOLLOW BODIES, LOOSE PARTS, OR UNCLEANABLE SURFACES.
- DESIGN ELEVATED INFRASTRUCTURE TO MINIMIZE DUST AND DRY MATERIAL ACCUMULATION, ESPECIALLY PIPES/OVERHEAT STRUCTURES/PLATFORMS DIRECTLY ABOVE EXPOSED PRODUCTS OR PRODUCTION LINES.



Questions for Retail Facilities

1. Do any of you use dry cleaning methods in your facilities? What are they?
1. Have you had issues with water accumulation in your facility and what improvements did you make in your designs?

Prevent or minimize the
growth of *Salmonella* within
the facility

Moisture Control and Dry Cleaning are effective ways to reduce *Salmonella* growth (especially in the PSCA)

“Water in the dry processing environment is one of the most significant risk factors for *Salmonella* contamination, as water allows for pathogen growth, significantly increasing the risk for product contamination.”

- ▶ *Salmonella* **growth** is only possible in water
- ▶ Humidity and condensation accumulation may cause invisible moisture niches
- ▶ Water may occur/remain due to improper use of water during cleaning
- ▶ Standing water that has dried out presents a risk of contamination, including the generation of airborne contaminated dust
- ▶ Serious *Salmonella* problems may develop as a consequence of wet cleaning, as it introduces moisture under equipment supports, into floor cracks, and in any other hidden/difficult-to-clean areas (harborage sites)
- ▶ Product accumulation should be removed ASAP

Common Industry Practices


- MINIMIZE USE OF WATER IN THE ENTIRE PLANT ENVIRONMENT
- SPECIFY THE TYPE OF CLEANING PRACTICES TO BE USED IN DIFFERENT HYGIENE AREAS
- USE DRY CLEANING PRACTICES ROUTINELY IN THE PSCA AND CONTROLLED WET CLEANING INFREQUENTLY AND ON AN AS-NEEDED BASIS
- CONTROLLED WET CLEANING MAY BE NECESSARY. USE THE MINIMUM AMOUNT OF WATER AND TEST ENVIRONMENTS FOR *SALMONELLA* THAT HAVE BEEN WET CLEANED
- ELIMINATE WATER AND MINIMIZE WATER DISTRIBUTION SYSTEMS IN THE PSCA
- ESTABLISH APPROPRIATE DRY CLEANING MEASURES FOR THE PSCA
- SEPARATE CLEANING TOOLS USED IN DIFFERENT HYGIENE AREAS



Questions for Retail Facilities

1. Have you considered restricting humidity or condensation accumulation in your facilities to minimize *Salmonella* growth? What interventions did you implement?
2. Do your cleaning procedures include proper cleaning and sanitizing of areas of standing water?
3. If your facility uses water for cleaning, how to you prevent or minimize aerosolization of water (for example, no high-pressure hoses to clean floors)?
4. Have any of you used separate cleaning tools in different hygiene areas? What method or system works best for you?

Establish a raw
materials/ingredients control
program



- THERE IS A NEED TO HAVE KNOWLEDGE ABOUT INGREDIENT SOURCES, THEIR CONTROL PROGRAMS, AND THE VERIFICATION OF SAID PROGRAMS
- *SALMONELLA* SENSITIVE INGREDIENTS: INGREDIENTS THAT HAVE HISTORICALLY BEEN ASSOCIATED WITH *SALMONELLA*, HAVE BEEN IMPLICATED IN PAST OUTBREAKS, OR ARE USED TO MAKE PRODUCTS THAT ARE INTENDED FOR AT-RISK INDIVIDUALS
- A VERIFICATION PROGRAM SHOULD BE DEVELOPED (IN PARTICULAR FOR SENSITIVE INGREDIENTS) TO ASSESS THE ADEQUACY OF CONTROL



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Common Industry Practices

- **CREATE A LIST OF *SALMONELLA*-SENSITIVE INGREDIENTS**, EMPHASIZING THOSE THAT ARE USED WITHOUT FURTHER INACTIVATION STEPS IN THE FINISHED PRODUCT
- **OBTAIN SENSITIVE INGREDIENTS FROM AN APPROVED SUPPLIER**
- **DEVELOP A PROGRAM FOR TESTING AND USING SENSITIVE INGREDIENTS** WITHOUT INACTIVATION STEPS
- **WHEREVER POSSIBLE, SOURCE AN ENTIRE LOT AND AVOID SPLIT LOTS**
- **ENSURE MATERIALS BEING TESTED FOR *SALMONELLA* REMAIN UNDER THE MANUFACTURER'S CONTROL UNTIL ACCEPTABLE RESULTS ARE RECEIVED**



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Question for Retail Facilities

How do you make staff aware of the *Salmonella* sensitive ingredients you might use without further inactivation steps in finished products, or do you avoid using these particular ingredients?

The use of non-heat treated flour in raw edible cookie dough is one example of a *Salmonella* sensitive ingredient used in a food with no inactivation step.

Validate control measures to
inactivate *Salmonella*

VALIDATION

It is important to avoid recontamination after the lethality step has been applied. The best way to avoid this is through good hygiene practices verified by environmental monitoring.

Thermal processing is the most commonly used control measure to inactivate *Salmonella*, but it is not the only control measure available. It is helpful to review available scientific data to find the processing method of interest.

- ▶ Heat resistance in a product with low a_w is much greater than that in a high-moisture product.

VALIDATION

Collecting and evaluating scientific data and technical information to demonstrate that the control measures and associated critical limits, applied at a critical control point, result in safe products following the lethality step.

“Validation of lethality steps for low-moisture foods involves determining an appropriate log reduction for *Salmonella*, determining the critical limits in the process required to achieve the reduction, and confirming the process equipment consistently delivers the critical limit parameters in the operation.”

Common Industry Practices

- **DETERMINE THE TARGET LEVEL OF *SALMONELLA* REDUCTION** IN THE PRODUCT AND PROCESS UNDER CONSIDERATION. USE SUPPORT DOCUMENTS INCLUDING THE RATIONALE OUTLINES BY NACMCF (2006), HAZARD ANALYSIS, OR REGULATORY/INDUSTRY STANDARDS
- **DETERMINE THE ADEQUACY OF THE SELECTED CONTROL MEASURE(S)** AND ASSOCIATED CRITICAL LIMITS FOR PROCESSING.
- **USE PUBLISHED DATA** TO GUIDE THE DETERMINATION OF WHETHER A CHALLENGE STUDY IS NEEDED FOR CONTROL MEASURE VALIDATION.
- **CONSIDER BOTH THERMAL AND NON-THERMAL CONTROL MEASURES**, WITH VALIDATION, TO ELIMINATE *SALMONELLA*.
- **ONCE THE LETHALITY PROCESS IS VALIDATED BY SCIENTIFIC DATA, ENSURE OPERATIONS CAN DELIVER THE CRITICAL LIMITS** AND THAT THE PARAMETERS ARE CONSISTENTLY MET THROUGH IN-PLANT VALIDATION.
- **ENSURE RAW MATERIAL/INGREDIENT SUPPLIERS VALIDATE THEIR PROCESS** AND CONTROL MEASURES.



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Question for Retail Facilities

While this is not often performed in **retail** facilities, does your corporation or your suppliers perform validation for any products you prepare and/or sell?

Examples are challenge studies for foods, environmental monitoring in their plants or even environmental monitoring in your facilities on a routine basis

Establish procedures for verification of *Salmonella* controls and corrective actions

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Frequency of Verification

One goal of environmental monitoring is to correct problems areas before they pose a risk to the finished product. The adequacy of the *Salmonella* control program should be verified on an ongoing basis.

- ▶ Enterobacteriaceae are a useful indicator of process hygiene and it may be monitored in parallel to *Salmonella* monitoring as a hygiene indicator for verification of general sanitation effectiveness.
- ▶ Within the PSCA, non-product contact surfaces (non-PCSs) adjacent to PCSs should be monitored with relatively high frequency.

Weekly monitoring may be considered a starting point, with the frequency revised based on results over time.

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Common Industry Practices

- **DEVELOP A WRITTEN PROGRAM FOR ROUTINE ENVIRONMENTAL MONITORING** UNDER NORMAL OPERATING CONDITIONS. ROTATE THE AREAS BEING MONITORED AND TEST DIFFERENT SURFACES AS OFTEN AS POSSIBLE.
- **INCREASE ENVIRONMENTAL MONITORING** AS WELL AS OTHER CONTROL MEASURES IN RESPONSE TO PLANT EVENTS SUCH AS DURING AND AFTER CONSTRUCTION, AFTER EQUIPMENT INSTALLATION, AND ONCE MAJOR REPAIRS ARE COMPLETED.
- **DEVELOP A POLICY ON WHETHER AND WHEN TO TEST PCSAs AND/OR FINISHED PRODUCT** AND A PROGRAM FOR THIS TESTING.
- **USE AN OFFICIAL OR VALIDATED METHOD TO TEST SAMPLES** TAKEN FROM THE ENVIRONMENT OR FINISHED PRODUCT.
- **TAKE APPROPRIATE CORRECTIVE ACTIONS** WHEN *SALMONELLA* IS DETECTED IN AN ENVIRONMENTAL MONITORING OR FINISHED PRODUCT SAMPLE, INCLUDING PRELIMINARY/PRESUMPTIVE *SALMONELLA* TEST RESULTS.



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Questions for Retail Facilities

1. Do any of you perform environmental monitoring? Is it on a regular basis or only after an outbreak or significant event (construction, major remodeling, flood, etc.)?
1. If you do perform environmental monitoring, what do you do if you get positive results for *Salmonella* or other pathogens?

How can the Iowa Task Force help you?

If your company is using some of these tools to help with *Salmonella* prevention and control, what has been successful?

What interventions for retail or industry are lacking?

Do you have resources or tools which can be shared with our members and the public?

Let's Brainstorm Together



Thank you!

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