ECOLAB®

WORLD CLASS
EXPERTISE

# ENVIRONMENTAL MONITORING & CONTROLLING PATHOGENS IN FOOD PROCESSING

WAFFP 2019

**John Kummer**

# JOHN KUMMER

## ECOLAB FOOD & BEVERAGE ACCOUNT MANAGER

- Education:
  - Graduated from WSU in 2010 with my BA in Operations Management
  - Graduated from WSU in 2016 with my Executive MBA
- Work History:
  - Five years in the Shell & Liquid Egg Processing Industry as Plant Manager and Assistant Plant Manager
  - Two and a half years with Lamb Weston as a Shift Supervisor through Project Manager.
  - Little over two years with Ecolab
- Personal Life:
  - Married in 2016 to my beautiful wife Megan (7th year together this year)
  - Baby boy Alexander 17 months old
  - Acquired four cats and two dogs along the way
    - Foster failures accounted for one cat and one dog

# PURPOSE, PROCESS, AND PAY OFF

- Purpose:
  - Provide practical information on Environmental Monitoring Program (EMP) and how to control environmental pathogens
- Process:
  - EMP Importance
  - EMP Objectives
  - EMP Implementation
  - Controls for Microbial Contamination
- Pay Off:
  - An effective, efficient, and compliant Environmental Monitoring Program

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# EMP IMPORTANCE AND VALUE

# WHY MONITOR?

- Environmental monitoring is testing the processing environment for pathogens and/or spoilage organisms.
- High Profile Foodborne Illness Outbreaks & Recalls

# WHY MONITOR?

- CDC Data

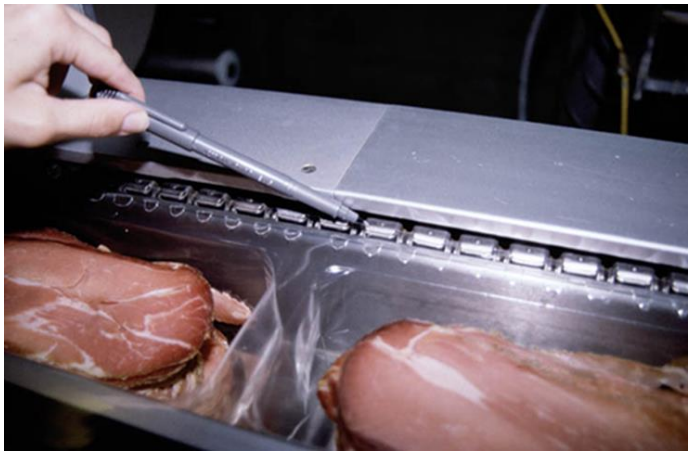
48 million illnesses

128,000 hospitalizations

3,000 deaths

# WHY MONITOR?

- The consequences are HIGH
  - Recalls
  - Tarnished brand name
  - Loss of sales
  - Legal ramifications
  - Product loss
  - Rework
  - Customer complaints



- It can make your operation better
  - Eliminate niches/hot spots before they cause trouble
  - Demonstrates your food safety competence to visitors
    - Auditors, buyers & regulators
  - A powerful training tool
    - Can bring food safety home to workers

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# EMP OBJECTIVES

# PROGRAM OBJECTIVES

- Validation and Verification of cleaning and sanitation program
  - Are we cleaning effectively?
  - Are we cleaning often enough?
    - Rule of halves
- Early detection for pathogens and a provides an opportunity to eliminate them before reaching a food contact surface
  - Proactive vs. reactive approach
- Evaluating the frequency of Preventative Maintenance
  - Replacing gaskets, hoses, or belts
- Evaluation of existing plant equipment or evaluation of new equipment
  - It is cheaper but is it better?
- Compliance with FSMA Regulations
  - Some finished product and environmental testing is required, “appropriate to facility, food, and nature of preventive control” (LM, *Salmonella)*

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# SANITATION CONTROLS – 2 DISTINCT TYPES (PER FSMA RULES)

- General Sanitation Controls
  - Includes most environmental sanitation
  - Manage as pre-requisite programs/cGMP
  - *Monitoring recommended* (not required by FSMA)

e.g. sanitation of mix kettle before kill step

- Preventive Sanitation Controls – required by FSMA Preventive Controls Foods rule
  - Applies to sanitation done to specifically address significant hazards identified in the Hazard Analysis process
  - Manage as Preventive Controls as part of the Food Safety plan with:
    - Routine monitoring
    - Corrections
    - Verification
    - Recording
  - Must be performed as designed on a <u>continual</u> basis

e.g. sanitation of filler/packaging equipment where RTE food after its kill step could be exposed to environmental hazard of *Listeria monocytogenes* or an allergen hazard

e.g. record review

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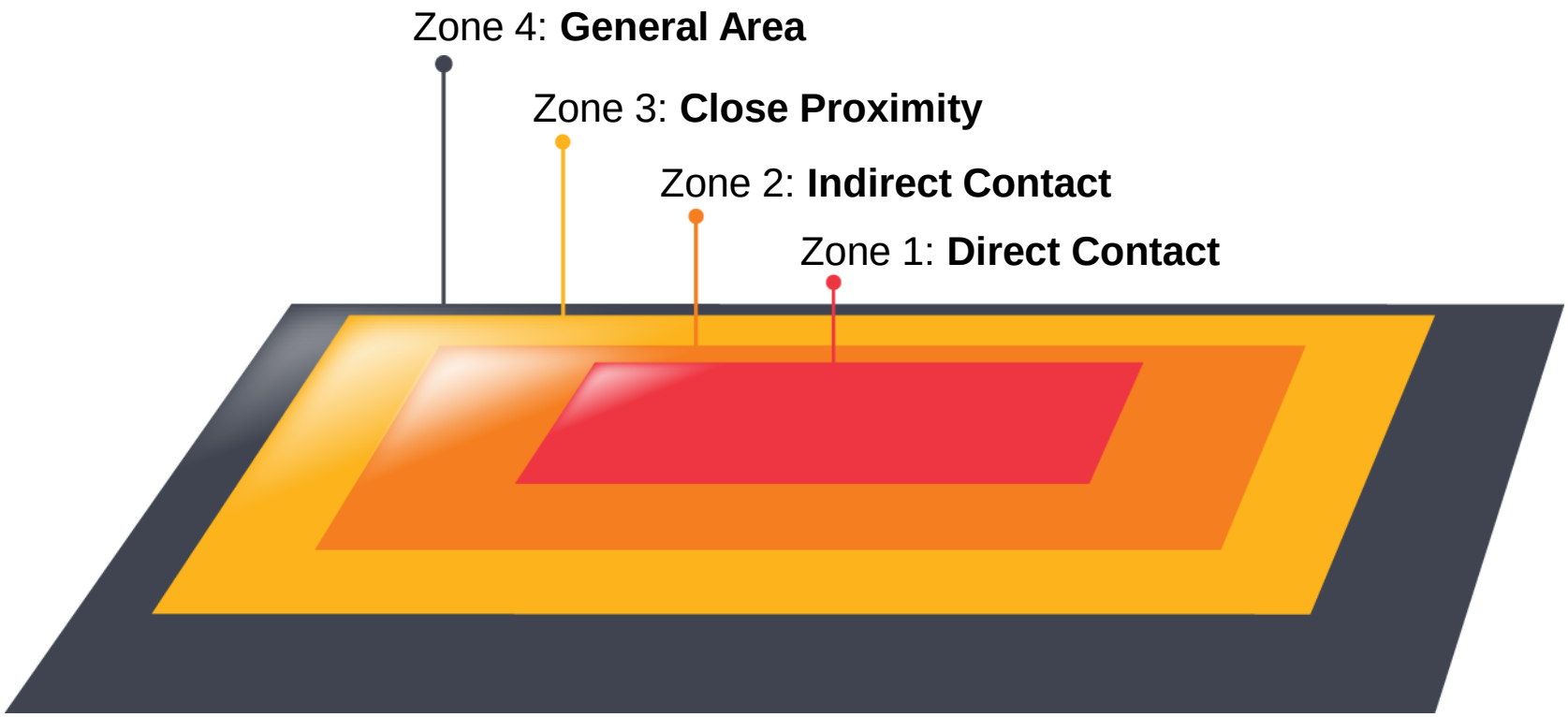
# EMP IMPLEMENTATION

# SANITARY ZONES

Plant environment can be divided into distinct sanitary zones based on food proximity/contact

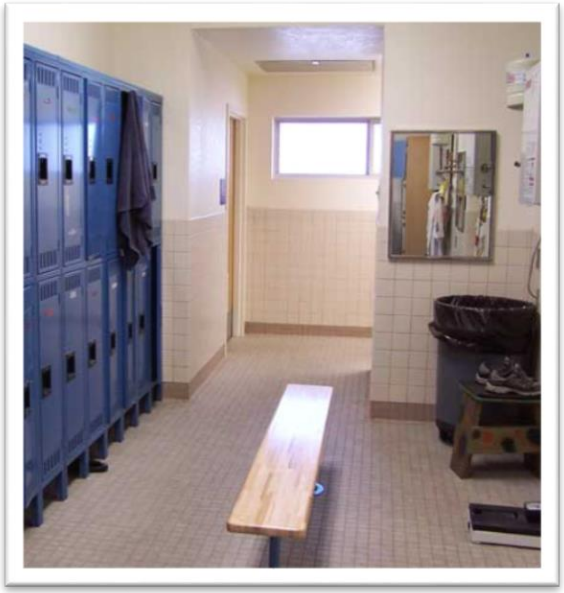


# SANITARY ZONES

Zone 4: **General Area**

Zone 4 is furthest from food, no direct food contact

- General Area: outside the process areas
- Areas that, if contaminated, could spread to the processing area via foot or equipment traffic
- Includes:
  - Employee areas
  - Locker rooms
  - Lobby
  - Loading docks
  - Roof
  - Parking lot
  - Plant grounds

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# SANITARY ZONES



Zone 3 is in close proximity to food, no direct food contact

- Close proximity: within the process room but more remote from FCS
- Areas of parts of the facility that, if contaminated, could not reasonably lead to FCS contamination without mechanical or human intervention
- Includes:
  - Floors
  - Drains
  - Walls
  - Totes
  - Waste bins
  - Packaging
  - Ingredient storage
  - C&S equipment
    - hoses, brushes, buckets

# SANITARY ZONES

Zone 2: **Indirect Contact**

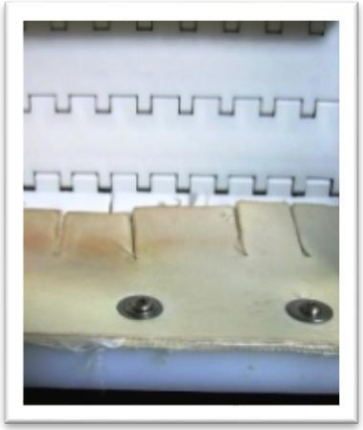
Zone 2 close proximity; indirect food contact

- Indirect Contact: non-food contact surfaces within close proximity to FCS
- Processing areas where the product may be in contact with the environment. Areas or parts of the facility that, if contaminated, could reasonably lead to a FCS contamination (i.e. under normal operational practices)
- Includes:
  - Equipment structural supports
  - Conveyor rails and framework
  - Cold storage
  - Anything adjacent to direct food contact surface

# SANITARY ZONES


Zone 1 includes direct food contact surfaces

- Direct Contact; Food Contact Surfaces (FCS)
- Product contact surface in the sensitive processing room.
- Includes:
  - Inside surfaces of production equipment (e.g. vats, fillers, pipes & tanks)
  - Ceilings
  - Conveyors
  - Chutes
  - Utensils, etc.



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# ESTABLISHING THE EMP

- What do we do first?
  - Establish the Zones
  - Assemble the team
    - This should include members from all departments and levels of the organization
    - Much like the HARPC Team there is value from different perspectives
  - Evaluate the process and identify the risks
    - Targeting recontamination or cross contamination risks
  - Identify the plant sanitary zones
  - Based on the evaluation the team selects monitoring sites
    - Higher risk site equates to more swabs and more frequent swabbing
      - For example, a Zone 2 is swabbed more frequently than a Zone 4

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# EXAMPLE: ZONE SAMPLING PROGRAM FOR ENVIRONMENTAL MONITORING

| Zone | Example of Sites | Test For | Frequency | Number of Samples |
|---|---|---|---|---|
| **1** **DIRECT** | Conveyors, packaging equipment, filler hoppers, utensils. | Indicator organisms – APC (Salmonella only when dictated in Corrective Actions) | After sanitation | Depends on the line |
| **2** **INDIRECT** | Exterior of equipment, control panels, carts, control panels | Salmonella | Weekly, Biweekly, Monthly | 5-10 |
| **3** **CLOSE PROXIMITY** | Drains, wall/floor junctions, forklifts, cleaning tools | Salmonella | Weekly or Monthly | 3-6 |
| **4** **GENERAL AREA** | Warehouse, lab, employee welfare areas, trash compactor | Salmonella | Monthly or Quarterly | 2-4 |

Source: GMA. 2009. Control of *Salmonella* in Low-Moisture Foods

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# SAMPLING PROCEDURE TIPS

- Many different methods and tools used for sampling
  - Sponge, ATP, sterile bags, and cups
- Move from Zone 1 to Zone 4
- Practice good hygiene to prevent contamination of the sample
  - Wash hands before putting on gloves
  - Wash and then sanitize gloves before taking sample
  - Sanitize gloves between samples
- Submit a negative control swab with the rest of the swabs
  - Taken out and returned without being used.
- Test for indicator organisms on Zone 1
  - Non pathogens, TPC, or Coliforms
  - Typically for Zone 1 and taken after cleaning and before sanitization
- Testing for specific pathogens on Zone 2-4
  - Listeria mono., Salmonella, E. Coli
  - Taken 2-4 hours after the start of production

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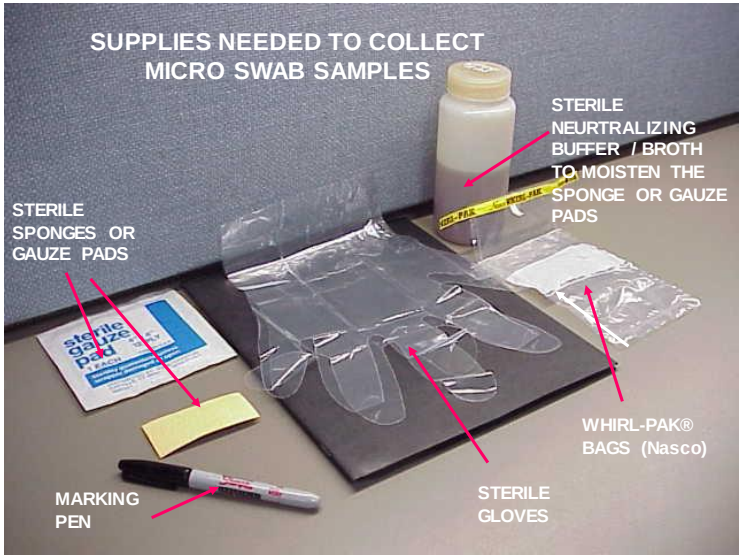
# SAMPLING PROCEDURE TIPS

- Is sample representative:
  - Is size, volume and/or number of samples large enough to make a valid and accurate conclusion?
- Do you have the correct results and are you interpreting them properly?
- Is management committed and are employees properly trained and accountable?



# INTERPRET RESULTS APPROPRIATELY

- Occasional findings of transient pathogens (*Listeria*) in the environment may not be unexpected
  - *Salmonella* should not be present
- Recurring positives are a reason for concern and demand attention
- Be ready to escalate testing frequency and preventive controls in response to recurring positives

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# FOOD SAFETY HAZARD CONTROLS FOR THE PLANT ENVIRONMENT

# MICROBIAL CONTAMINATION:

## Plant Environment Control Summary

- Control incoming contamination sources
  - Employees
  - Suppliers/Ingredients/Materials/Equipment
  - Pests

- Eliminate harborages/growth niches in plants
  - Walls & Floors, Ventilation
  - Equipment design and maintenance

- Control vectors (means of transmission) inside the plant
  - Employees
  - Forklifts, pests, water, air, etc.

- Remove growth factors: nutrients, water
  - Regular, effective, and thorough Cleaning and Sanitizing
  - Minimize Operational Sanitation

- Validate & Verify effectiveness of control strategies
  - Includes periodic sampling & testing

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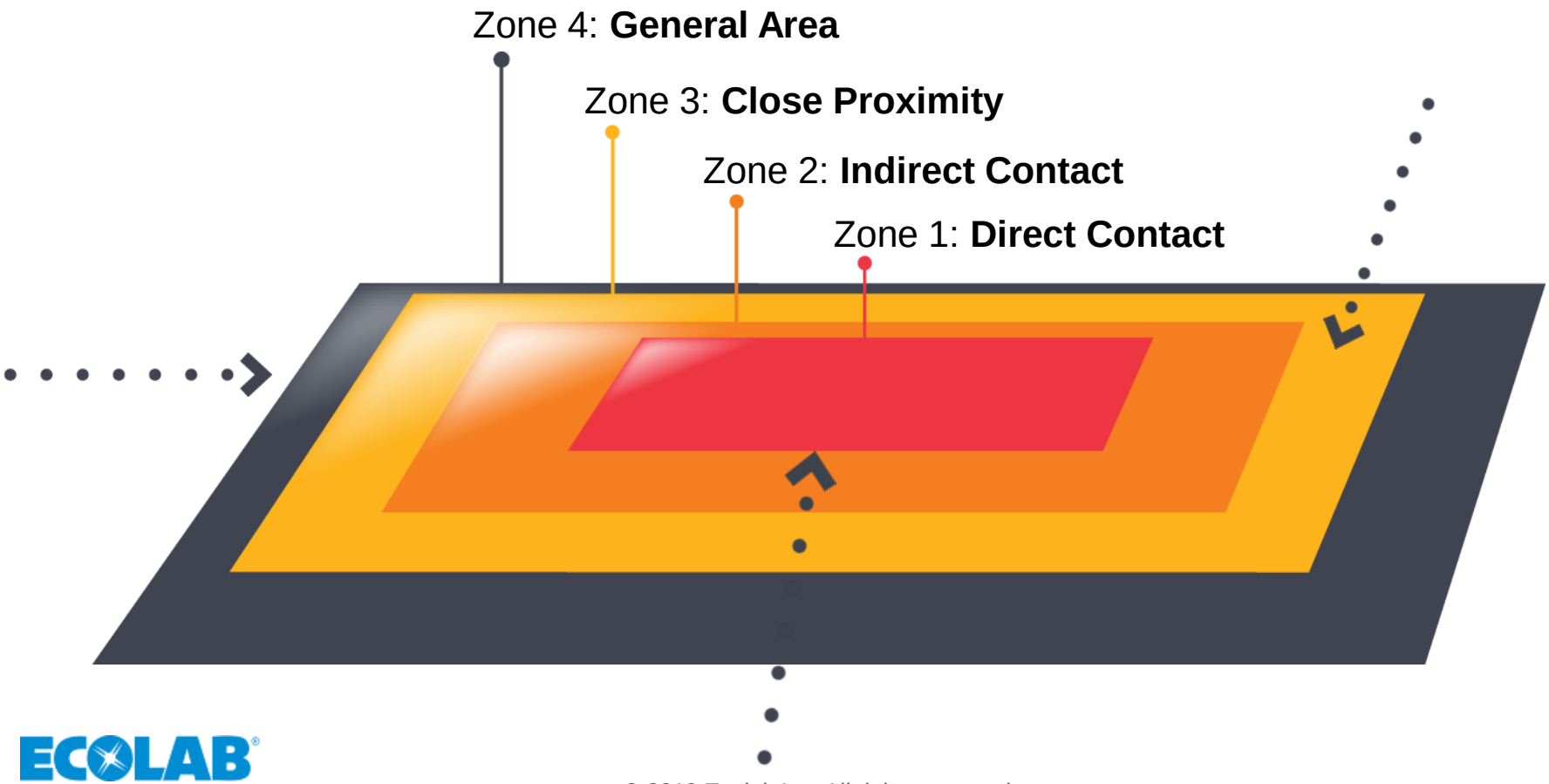
# SANITARY ZONES

First Focus: Incoming Contamination







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# INCOMING CONTAMINATION

## Facility Controls

| Potential Hazard | Control |
|---|---|
| **Employees/Visitors** | – Personal Hygiene  |
| **Pests** | – Pest Elimination Program<br>– Reduce/eliminate openings to outside  |
| **Equipment** | – Sanitary Design<br>– Shakedown outside of plant |
| **Raw Materials** | – Isolate receiving areas from processing areas<br>– Manage foot and forklift traffic to minimize cross-contamination<br>– Routinely maintain and clean vehicles, equipment that moves in and out of the plant |
| **Air & Water** | – Test to ensure quality meets appropriate standards  |
| **Suppliers** | – Approved Supplier Program |

# HARBORAGES/NICHES

Definition

- Areas within the plant which cannot be effectively cleaned and sanitized in a reasonable time with normal tools and supplies
  - Hot spots in plant environment for microbial and allergen hazards
  - Can  be found in all Sanitary Zones
- Examples:

| Facility | Equipment |
| --- | --- |
| – Floor drains | – Hollow conveyor rollers |
| – Overhead structures | – Coolers/freezers |
| – Cracks in floors & walls/panels | – Electrical Boxes |
| – Damaged Wooden Structures | – Hard to Reach Components |
| | – Temporary Repairs |

# HARBORAGE CONTROL

## Begins with Sanitary Design

- Production Equipment Sanitary Design Criteria:
  - Safety of Personnel (installation & use)
  - Prevention of Microbial Contamination, Cross-Contamination
  - Cleanability
  - Customer Satisfaction / Brand Protection
- Sanitary Design also delivers:
  - Production Cost Savings
    - Better, Faster Cleaning
    - Sustainability – More Efficiency
      - Water
      - Effluent
      - Environmental

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# VECTORS OF CONTAMINATION

Spread the Organism or Hazard

Definition:

- Means of transmission
- Vehicle for movement of contaminants in the facility
- Transfer point: any surface between a growth niche and the product




# VECTORS

Anything that moves within the facility

- Water
- Air-Flow Systems
- Personnel
- Conveyors
- Forklifts/Vehicles
- Cleaning Tools
- Construction
- Equipment/Process Change
- Packaging/Pallets
- Rework
- Waste Removal Containers
- Pests

# VECTORS

Harborage in a Niche + Vector

Contamination

Potential Human Illness

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# VECTOR CONTROLS: WATER

- Eliminate standing water
- Determine which areas remain dry and which areas will have wet activities.
- Keep processing areas clean and dry during production
  - No water in process environment
  - No use of high-pressure hoses during production
  - Repair leaks
- Restricted Water Use – No Aerosolization
- Control Condensation
- Use SANITIZER

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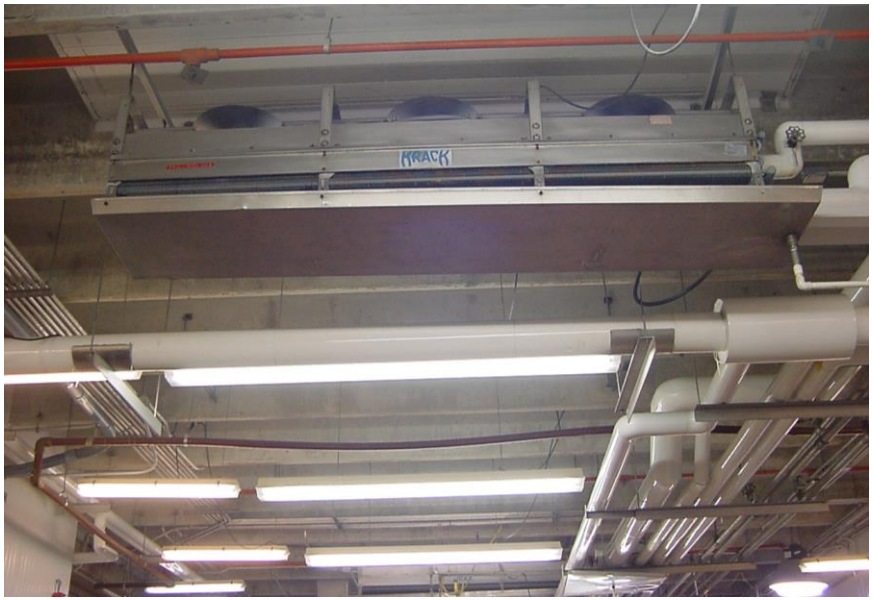
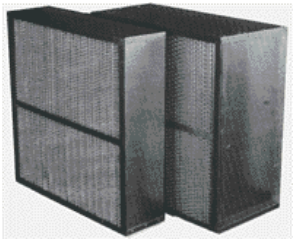
# VECTOR:  AIR FLOW SYSTEMS

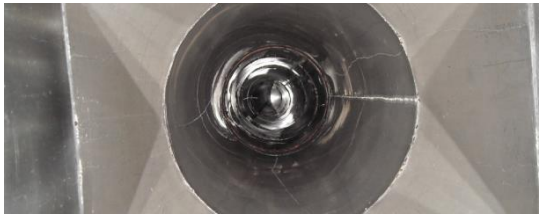
HVAC condensation draining onto floor of process area



# VECTOR CONTROLS: AIR FLOW SYSTEMS

- Plant/Equipment Design
  - Clean Room
- Compressed Air/Air Blow
  - Clean & Dry
  - 0.2 micron filtration at point of use
- HVAC System
  - Maintain ducts, condenser pans, controls
  - Proper filters
  - Drain into drain, not onto floor
- Production Room Under Positive Pressure
  - HEPA filtration
  - Humidity controlled





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# VECTOR: PERSONNEL


# VECTOR CONTROL: PERSONNEL

- Train employees on personal hygiene and cGMPs
  - Hand Hygiene
  - Ensure proper clothing and PPE are worn
- Boots or shoes should be dry when entering dry processing or packaging areas
  - Boots should be scrubbed and sanitized with an EPA-registered sanitizer as directed by the product label at shift end
  - Allow to dry before entering the processing area
  - Captive shoes

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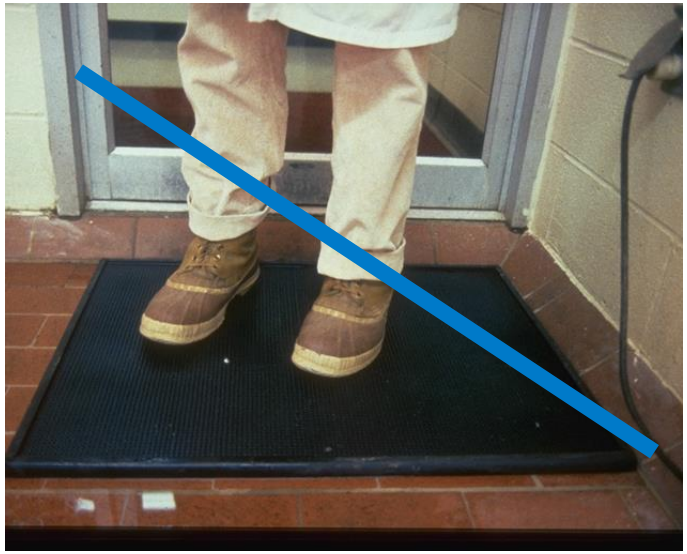
# VECTOR CONTROL: PERSONNEL

Use Entryway Sanitizing Systems to help to reduce cross-contamination between areas

- Entryway Sanitizing Systems in passageways between areas sensitive to micro contamination:
  - Filler rooms
  - Further processing
  - Ready-To-Eat areas
  - Packaging lines
  - Starter culture rooms
- And less critical areas of the plant:
  - Utility rooms
  - Packaging storage
  - Chemical storage
  - Break/restrooms
  - Outdoors



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# VECTOR: FORKLIFTS/VEHICLES


# VECTOR CONTROL: FORKLIFTS/VEHICLES

- Maintain and routinely clean forklifts and other wheeled vehicles/carts that move through the plant
- Control forklift traffic
  - Dedicate forklifts and other vehicles to specific areas of the plant
- Physically isolate receiving area from the rest of the plant with no direct openings into processing areas
- Isolate routes for wet and dry ingredients
  - Especially raw eggs, milk, meat and poultry

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# VECTOR CONTROL: CLEANING TOOLS

- Use color-coded system for use and storage of all cleaning equipment
- Properly select, use, dedicate and maintain C&S application equipment




# VECTOR CONTROL

## Waste Disposal

- Dedicate waste containers to specific plant locations
- Clean & Sanitize waste containers with the room

# SANITATION VERIFICATION

- A pre-operational examination of the food processing equipment/facilities
  - Emphasize Zones 1 & 2
- Determines if cleaning & sanitation have been effective
- Establishes corrective steps to be taken if sanitation has been inadequate
- Provides documentation of this process

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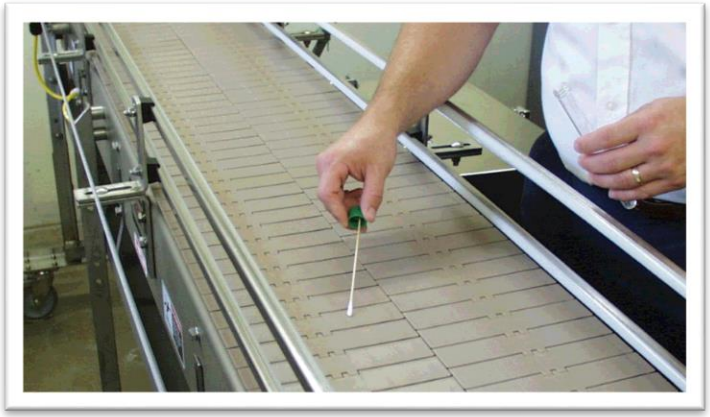
# SANITATION VERIFICATION

- Establishing the plant standard of clean
  - Industry guidance
  - Create your own standard with data
- Results > Acceptable Limit = Sanitation Failure
  - A failing result requires a response
- Corrective actions include:
  - Repeat sanitation & verification (visual/ATP/allergen).
  - Product holds, review of sanitation practices & product testing (microbiological swabs).
- Documentation is critical!



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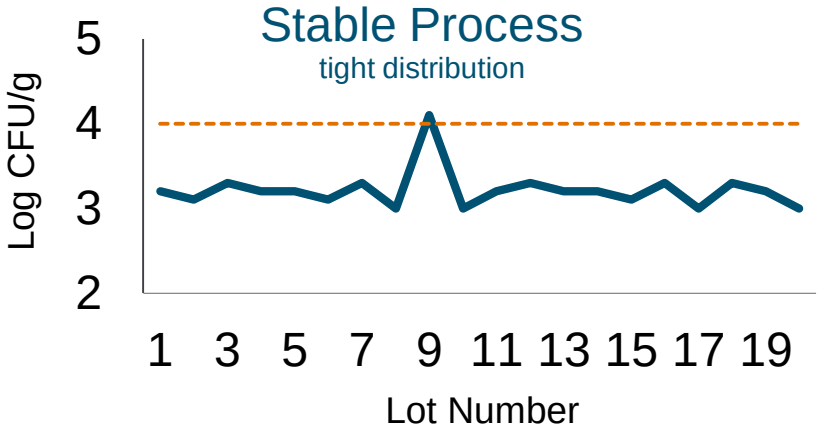
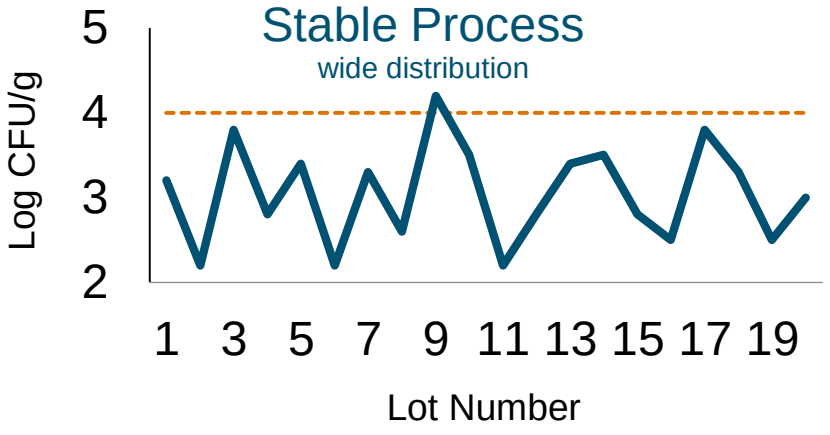
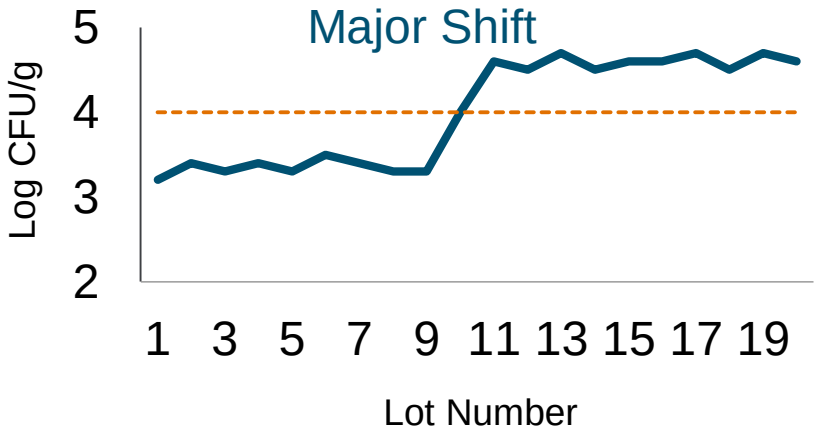
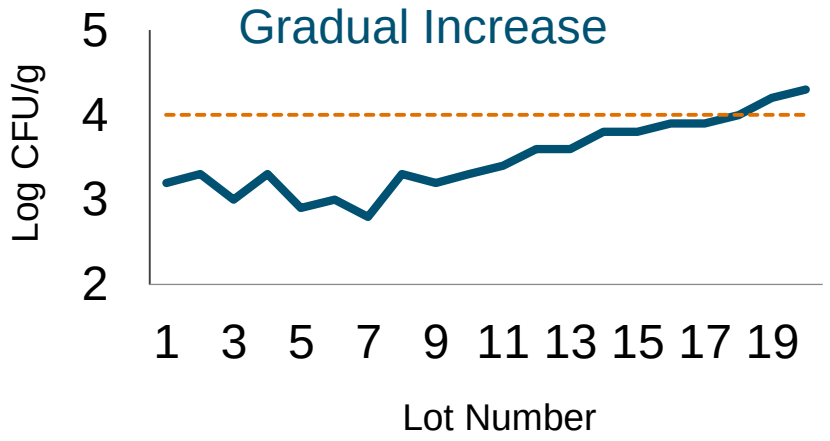
# DATA: ANALYZE THOSE TRENDS

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