Cleaning for Food Safety – Best Practices

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Awareness Exercise

• What do you think was the leading cause of food recalls in 2017?

FDA RECALL
Lunchables
BLUE BELLE ICE CREAM
Food Recall Stats – 2017

- The USDA and FDA issued 456 recalls in 2017
- 47.8% of the recalls were due to undeclared allergens
- 32.2% were due to potentially harmful bacteria in ready-to-eat food
  - 68.7% of those recalled for potentially harmful bacteria were due to *Listeria monocytogenes*
- Any recall affects the industry as a whole
  - Loss of consumer trust, legal costs, healthcare costs and sometimes, loss of life
- We need to get a handle on the issues of contamination

YOUR JOB MATTERS!

Outline

- Food Recall Stats
- Allergens Overview and Importance of Sanitation in Their Control
- *Listeria* Overview and Importance of Sanitation in its Control
- Cleaning Factors
- Cleaning Overview
- Cleaning Methods
- Hand Hygiene
- Summary
Allergen Overview

- 8 food allergens account for 90% of all food-allergic reactions
  - Milk
  - Eggs
  - Peanuts
  - Tree nuts
  - Soy
  - Wheat
  - Fish
  - Shellfish
- Food allergies in children increased by 50% from 1997 to 2011
  - Cause of increase unknown
  - Affects 1 in every 13 children
  - Economic cost of children's food allergies is approximately $25 billion per year

There is no cure for food allergies
- Best approach is avoidance of the food allergen

Importance of Sanitation in Allergen Control

- Cleaning is considered a first line of defense in prevention of allergen cross-contact on shared processing lines
  - Studies have shown inadequately cleaned equipment was deemed responsible for causing people to experience allergic reactions from milk- or peanut-contaminated foods
- Some facilities use equipment and product lines to produce both allergen and non-allergen products
  - The allergen residue (protein) must be removed before non-allergen containing products are run
Listeria Overview

- *Listeria monocytogenes* is a pathogen that causes listeriosis
  - Organism grows in refrigerated environments; resistant to heat, freezing temps, low pH and high salt content

- Healthy individuals exposed develop no to few symptoms, but highly fatal (30% to 40%) for:
  - Fetuses/Newborns/Infants
  - Pregnant Women
  - Elderly
  - Immune Compromised

- Current Challenges:
  - Aging population = increase in susceptible persons
  - *Listeria* is widespread in the environment
  - Diversification of foods of implicated with Listeria

Importance of Sanitation in Listeria Control

- Virtually every *Listeria*-related outbreak and/or recall has been linked to poor sanitation practices

- "Environmental contamination is the principle source of contamination in processed foods. It is from the post-processing environment”
  - Kornacki, J.L. 2009 Food Safety Magazine. Feb/March

- Example: Blue Bell recall – did not have a robust environmental monitoring program
  - 2290 products were tested: 99.4% were positive for *Listeria monocytogenes*
Factors in Cleaning

- There are 4 key factors in cleaning:
  - Concentration of the cleaning solution
  - Temperature of the cleaning solution
  - Length of Time of cleaning
  - Physical Action
- Each can be independently varied to adjust the cleaning operation to a particular plant or problem
- Select the conditions that give the best cleaning at the lowest cost
Concentration

- There is a minimum concentration of each detergent product that is necessary to get the job done – don’t skimp
- Increasing concentration increases cleaning efficiency, but at a decreasing rate (see graph), assuming all other cleaning factors are held constant
- Note: Too much detergent may actually give poorer cleaning results due to poor risibility of detergent residues.

Temperature

- Temperature is extremely important in cleaning operations
- Increasing temperature has the following effects:
  - Decreases the strength of bonds between soil and surface
  - Decreases viscosity and increases turbulent action
  - For soluble materials, solubility rate increases
  - Chemical reaction rates increase
Temperature

- **Cleaning & Rinse Temperature Criteria:**
  - For many food products within a temperature range for 90°F to 185°F, an increase in temperature of 18°F will approximately double the cleaning operating efficiency
    - Below approximately 90°F, milk fat remains in a solid state
    - Above 185°F, heat-induced interactions bind many proteins more tightly to the surface, decreasing cleaning efficiency
  - The maximum cleaning temperature depends upon the temperature the protein in the system is denatured
    - Temperatures above the denaturation point increase the adhesion of the protein faster than the cleaning efficiency is increased
  - Rinse temperatures must not be to excessive, otherwise “flash drying” will occur

Time

- Time is a critical component in the cleaning process
- Longer cleaning solution contact time with the soil will result in more soil removal IF the other factors are properly chosen for the application
- Longer contact times do not necessarily give improved results
- There is a minimum time for effectiveness, and a practical maximum economical cleaning time
Physical Action – Force or Velocity

- Physical action is extremely important to facilitate cleaning
- Force provides energy or work to the surface which assists the chemical and temperature in overcoming the bond to the surface
- The solution must contact all surfaces of the equipment
  - Plugged spray balls in a silo C.I.P. cycle will not provide the cleaning solution throughout the entire surface area

Physical Action – Force or Velocity

- Types of cleaning forces:
  - **Hand or manual cleaning**, force is applied by “elbow grease”
  - In **C.I.P.** systems, fluid flow applies the force (the shear forces of turbulence)
    - Clean-In-Place fluid velocities should be at 5 feet/sec. to give effective cleaning, according to the regulations
  - In “push/pull” **C.O.P.** systems, force is supplied by recirculating pumps
  - **High pressure spray** systems supply as much as 1000 p.s.i. of impact force to the surface
    - Too much pressure can simply “blow” soils around and cross-contaminate areas
Sanitation Program Objectives

- Control microbial activity
- Preserve quality, freshness and palatability of food and beverage products
- Ensure healthfulness and freedom from disease
Sanitation Begins With Cleaning

- Proper cleaning is the most critical step in a sanitation program
- Effective cleaning requires:
  - Adequate water supply of sufficient quality
  - Understanding of cleaning variables
  - Chemistry, detergent performance and function of cleaning agent(s)
  - Conducting proper cleaning steps
- Sanitizing is ONLY effective on clean surfaces

Considerations for An Effective Cleaning Program

- Materials of construction
  - May restrict the type of chemicals that can be used
- Amount of moisture already in plant
  - Wet vs. dry cleaning methods
- Composition of soils
  - Organic, inorganic, biofilms
- Presence of allergenic material
- Personnel exposure levels to applied chemicals
- Foam (or non-foaming) requirements
- Discharge limitations of some chemicals
**Know What Kind of Soil You Have**

- The composition of the soil you are trying to clean will dictate what kind of cleaner you need
  - **Inorganic Residues**
    - Mineral scale, iron, silicates, soaps
    - Removed by inorganic acid cleaners
      - Phosphoric, Nitric, Sulfuric, Hydrofluoric
  - **Organic Soils**
    - Proteins, carbohydrates and FOG (fats, oils, greases)
      - Harbor bacteria and can inhibit physical contact between a sanitizer and bacteria
      - May inactivate the sanitizer active ingredient
    - Removed by alkaline cleaners / caustic cleaners and enzymatic detergents

**Biofilm – A Unique Soil Situation**

- Biofilm is a "slime" layer that adheres to surfaces
  - A complex matrix made up of bacteria that secrete EPS (ExoPolySaccharides) and organic residues
    - Organic residues made up of proteins, glycoproteins, minerals, polysaccharides, etc.
  - Develops on a variety of surfaces: processing equipment, pipes, membrane filters, cooling devices
  - Often undetected until microbial issues arise
- Biofilm is a constant source of contamination due to the unpredictable release of microbes
  - Biofilm will slough off a layer of cells periodically causing bacterial count "spikes" to occur
Biofilm Formation

• Biofilm development stages
  1. Organic cells adsorb/fixate on the surface
  2. Growth of bacteria and EPS matrix
  3. Mature biofilm; cells begin to slough off causing product contamination

Biofilms often harbor a variety of organisms incl. *Pseudomonas, Listeria, and Salmonella* species.

CLEANING METHODS
Wet Cleaning

• **Four categories:**
  – Clean in Place (CIP)
    • Minimal or no disassembly
    • Cleaning fully automated
  – Clean Out of Place (COP)
    • Equipment partially disassembled and cleaned in tanks
  – Foam or Gel Cleaning
    • Chemical applied to equipment as foam or gel for increased contact time with soil
  – Manual or Hand Cleaning
    • Equipment fully disassembled and cleaned by hand

Wet Cleaning – 2

• Food processors need to evaluate the efficacy of cleaning protocols for each:
  – Type of food soil
  – Food contact surface
  – Piece of equipment
  – Processing line
• Studies have shown no one protocol works for everything
  – Cold milk soils easier to remove than hot milk soils
  – Cleaners more effective at higher temperatures for removing peanut butter residues
Dry Manufacturing

- Dry goods manufacturing (i.e. baked goods, spray-dried foods) may not be designed to accommodate water
  - May even be designed to be free of water to facilitate the manufacture of certain products
- Introducing water to equipment and environments not designed for it may cause significant problems
  - May promote uncontrolled microbial growth
  - May cause development of sites that harbor bacteria
    - Pitting, corrosion
- May cause equipment failure
  - Electronics not water-safe

Dry Cleaning

- Need to balance effective allergen control with effective pathogen control
- Managing allergenic foods in dry foods plants and lines requires rethinking traditional equipment design
  - To increase equipment accessibility and cleanability
- Reportedly more than 50% of companies use dry cleaning practices
  - Most companies use dry cleaning in combination with wet cleaning when water is permissible
Dry Cleaning – 2

- **Main Categories:**
  - Brush/Scrape
  - Sweep
  - Compressed Air
  - Wipe
  - Vacuum
  - "Push-through" with non-allergenic foods
    - Salt, flour, and starch

Dry Cleaning – 3

- **Brushes/Sweepers/Scrapers**
  - Should be color coded
  - Dedicated for use on allergenic lines to prevent cross-contact contamination to non-allergenic lines

- **Compressed Air**
  - Often used to dislodge food residue from inaccessible areas of equipment or the environment
  - Introduces significant hygienic challenges to surrounding areas
    - Generates aerosols and airborne dusts
  - Should be used with discretion and as a last resort
Dry Cleaning – 4

- Disposable cloth or paper wipes saturated with water or alcohol
  - Used where water is not compatible with the manufacturing equipment and/or processing environment
  - Localize water and minimize dust generation
- Vacuum
  - High-efficiency particulate air filtration vacuum systems
  - Designed to remove and contain dust and debris during dry cleaning of food plant areas

Dry Cleaning – 5

- “Purge” or "Push-through" with non-allergenic foods
  - Salt, flour, and starch
  - "Clean" equipment by purging (pushing through) the allergenic food from surfaces and equipment
  - SQF Code: three product flushes may be required to assure removal of the material of concern

- Important to note with any of the wet or dry methods: microbiologically clean does not mean allergenically clean!
  - Allergens are REMOVED, not “killed”
  - Monitor and test accordingly
Did you know?

That 1 trillion germs can live in one gram of feces – (that's the weight of a paper clip!)

Hand Hygiene Fast Facts

- There are 5,000 germs on a hand at any given time
- The majority of colds transmission comes from hand-to-hand contact and transfer of germs, not coughing and sneezing
- Studies estimate that up to 75% of food processing individuals do not wash their hands correctly
- Approximately 35% of food contamination comes from hands
- Increase in ready-to-eat foods has compounded the need for proper hand hygiene
Carrier vs. Infection State

Frequently seen in infections involving *Salmonella, Shigella, Clostridium* and *Norovirus*

- Infection state: Obvious symptoms of an infection with *Salmonella* typically last 2 – 3 days
- Carrier state: Organism can remain in the gastrointestinal tract of the individual for several months to years, making them a carrier even though they aren’t “sick”
- Failure to wash hands, particularly after using the restroom, greatly increases the chance of passing *Salmonella* to someone via the fecal-oral route

*Norovirus* also spreads quickly via the fecal-oral route on cruise ships and college campuses

Summary

- Proper sanitation is a critical requirement for control of allergens and microbes
- Consider materials of construction; water hardness, temperature and quality; soil type; cost, and method of application when selecting a cleaner
- Microbiologically clean does not mean allergen-free
- Sanitizing is not a substitute for poor cleaning practices
  - Sanitizing is only effective on clean surfaces
- Proper hand hygiene is essential
Thank You

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