Microbiology 201
for Small Meat Processors

August 29, 2012 Webinar

www.nichemeatprocessing.org
MICROBIOLOGICAL SAMPLING

Penn State Department of Food Science
Microbiological Sampling

• Microbiological Sampling Introduction
• Environmental Sampling
• Product Sampling
• Testing Laboratories
Goals of Microbiological Sampling

- Determine risk associated with the process
- Establish historical benchmarks
- Help identify trends
- Verify process or procedures
- Identify and correct issues
Microbiological Sampling

Remember

- Sampling cannot guarantee product safety if there is no preventive control;
- You cannot rely on government testing alone;
- Because pathogens are often present in low levels, they may not be detected by testing.
Microbiological Sampling

Risks vary by plant.

- There is no “one plan fits all” approach;
- The mix of plant environments, processes, and ingredients is complex;
- This complexity is different for each plant;
- This complexity affects what type of pathogens are found and where.
Microbiological Sampling

General

- Prepare a written plan.
- Consider sample types – environmental, ingredient, in-process, and finished product testing. You may want to focus on environmental.
- Develop written procedures for sampling, handling, testing, and verification.
- Document your results.
- Your plan should continually evolve.
Designing a Sampling Program

- Purpose of sampling – Why?
  - Verification of process, customer requirement, etc.
- What will be sampled
- Frequency of sampling
- Sample size
- Analytical method
- Effectiveness of method
Designing a Sampling Program

Aseptic Sampling Technique

- Do not add organisms to sample during collection
- Microorganisms associated with hands, clothing, sample containers may lead to erroneous results
Microbiological Sampling

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Environmental Testing

Testing the surrounding environment and those surfaces that come into contact with food

- Not normally statistically designed, but often based on prior experience
- More cost effective than product testing
- Use for trend analysis, verification of sanitation, evaluating the risk of exposure to pathogens
- Helps discover bacteriological niches
Environmental Testing

- **Where**
  - Areas that are good indicators of control
  - e.g., exposure to food, cross contact, high traffic
- **Frequency**
  - 2 to 10 samples weekly?
  - Enough to assess control.
- **Composite samples can be done, but individual samples are better to show trends**
Environmental Testing for Listeria

Zone 1
Product contact surfaces

Zone 2
Exterior of equipment; framework; floors

Zone 3
Phones; forklifts; walls; drains

Zone 4
Locker rooms, cafeteria, halls
Environmental Testing for Listeria

Food Contact Surfaces – Zone 1

- 25% or less of your samples
- Best to get pre-operational and operational (mid-shift samples)
- Alternate sampling sites each week (to get an entire set within 1 to 3 months)
Environmental Testing for Listeria

Non-Contact Surfaces

• Split between Zone 2 and Zone 3 with a few from Zone 4
• Best to get pre-operational and operational (mid-shift samples)
• Areas of focus: high traffic, high moisture, product build-up
Environmental Testing for Listeria

Zone 1
Product contact surfaces

Zone 2
Exterior of equipment; framework; floors

Zone 3
Phones; forklifts; walls; drains

Zone 4
Locker rooms, cafeteria, halls
Corrective Action for Listeria

You must:

• Take corrective action, whether you test for *Listeria* spp. or *L. monocytogenes*

• Have a written protocol for non-contact and product contact surfaces

• Keep records of corrective actions taken
Additional Considerations

If you take composite samples, conduct additional sampling and testing to determine the specific surface or area that is contaminated.
Additional Considerations

- Test waste product from the bottom of conveyors, etc.
- After taking sponge samples on pre-operational product contact surfaces, sanitize entire area
- Consider collecting operational samples in addition to pre-operational samples
Verification of Sanitation

Why:

- Best way to verify effectiveness of cleaning and sanitizing
- Establishes a record for review
- May help identify trends and thus prevent potential issues
Verification of Sanitation

Types of analysis

• Microbiological testing
  • APC
  • Coliforms
  • Yeast and Mold
  • Listeria?
• ATP testing
• Food residuals
Verification of Sanitation

Types of Surfaces

- Food contact
- Non-contact
- Personnel
- Air sampling
Verification of Sanitation

Establish a program

• Standardize your methodology
• Establish frequency
• Identify areas for sampling
• Randomly sample areas, but resample trouble areas, areas not appearing clean

Go off the program occasionally to test new items (maintenance tools, etc.)
Verification of Sanitation

Program

• Analyze data for trends
• Ensure follow-up on high count areas, including resampling
• Standards for APC
  • <100 cfu /50 sq cm (<100 cfu /~8 sq in) USPHS*
  • <5 cfu / sq cm (USDA 1994)
  • <1.3 log cfu / sq cm (<20 cfu / sq cm)
  • <100 cfu / 4 sq in

*Compendium of Methods for the Microbiological Examination of Foods 2001
Verification of Sanitation

Program

• Coliforms
  • Generally looking for negative results (<10 cfu/area) in pre-operational checks, especially in post-process areas

• Pathogen testing
  • Normally conduct absence/presence testing using sponges for sampling
  • Looking for negative/area sponged
Procedures and Methods
Environmental Testing Program

1) Establish procedures, including a sampling map of the process
2) Record site numbers into spreadsheet along with locations and zone determination

<table>
<thead>
<tr>
<th>Area</th>
<th>Number</th>
<th>Location</th>
<th>Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh</td>
<td>1</td>
<td>Drain in Receiving</td>
<td>3</td>
</tr>
<tr>
<td>Processing</td>
<td>2</td>
<td>Floor in Cold Storage</td>
<td>3</td>
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<td></td>
<td>3</td>
<td>Unloading table</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Conveyor Switch</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Drain in Processing</td>
<td>3</td>
</tr>
</tbody>
</table>
Procedures and Methods
Environmental Testing Program

3) Determine sampling regimens

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Procedures and Methods
Environmental Testing Program

4) Conduct Sampling
Pathogens – moistened sponge
Procedures and Methods
Environmental Testing Program

4) Conduct Sampling

APC – Moistened swab and a template
Procedures and Methods

Environmental Testing Program

5) Test Samples – send to outside lab or test in-house (in-house not recommended for pathogens unless strict controls are established).

Pathogens

• Enrichment – looking for positive or negative result
• Rapid versus cultural procedures

APC or Coliforms

– Direct plating – looking for a number
Procedures and Methods

Environmental Testing Program

5) Test Samples

- Consider testing for *Listeria species* on non-contact surfaces and for *Listeria monocytogenes* on contact and product samples
- Consider using rapid methodology with a high degree of specification
6) Record Results

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<tbody>
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<td>Drain in Receiving</td>
<td>3</td>
<td>Negative</td>
<td>NS</td>
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<tr>
<td>Processing</td>
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<td>Floor in Cold Storage</td>
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<td>3</td>
<td>Negative</td>
<td>Negative</td>
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</table>
Procedures and Methods

Environmental Testing Program

7) Follow-up

- Complete corrective action each time there are unacceptable results
- Record corrective action
- Sample more frequently in problematic areas
Microbiological Sampling

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• Testing Laboratories
Product Sampling

Reasons for product sampling

• Comply with government regulations
• Verification testing
• Incoming ingredient testing
• Problem solving
Product Sampling

Carcass Sampling – Sponge technique for generic *E. coli*

Product Sampling

Trim samples for *E. coli* O157:H7 (or STEC).

- Define product lot before beginning
- Each supplier tested separately
- Excise 60 ‘thin’ slices from exterior surface of product (12 each for 5 combo bins)
- Product is composited to obtain 325 to 375 gram sample (each slice must contribute ~6.25 grams)
- N60 sampling provides 95% confidence of detecting contamination if 5% of slices within the lot were contaminated
Product Testing for Verification

- Consider testing a limited number each month as verification
- Frequency will depend on processing procedures, amount produced, establishment history, etc.
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Using a Contract Laboratory

Consider establishing a relationship with a contract laboratory for:

- Pathogen analysis
- Non-routine testing
- Emergency back-up
- Surge
- In-depth analysis, such as identification
- Second opinion
- Independent and “official” tests for COAs, regulatory, customer, etc.
Using a Contract Laboratory

• Do they possess the knowledge and skill?
• Are they certified?
• What is the price?
• What is the turn-around time?
• How will the samples be delivered?
Get to know your laboratory service provider

• Do they specialize in food and have they worked on the type of products you want tested?
• What methodologies will they use?
• What are further capabilities (identification, chemical, etc.)?
• Do you expect trending, interpretation, and/or early alert?
• Who will be reporting your results to you? Are they knowledgeable? Will they be responsive?
• Regulatory assistance
Using a Contract Laboratory

Get to know your laboratory service provider

- Laboratory size and location
- Quality and Certification
  - ISO / IEC 17025: assesses the managerial and technical competence of testing laboratories, and assures the "precision, accuracy and repeatability" of analytical results
  - A2LA or other certification
  - Internal Quality Systems
  - Proficiency or Check Sample Programs
Using a Contract Laboratory

Get to know your laboratory service provider

- Discuss methodologies, skills, etc.
- Discuss delivery options
- Negotiate price (total cost)
- Send test samples
- Visit laboratory
- Compare to other contract laboratory service providers
- Review performance
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Thank you!
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