FSMA Produce Grower Training Slide Set
An adaptation of the slides from the Produce Safety Alliance Grower Training Course

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Follow along using the two books provided

I) The PSA Grower Training Manual
   This book is yours to keep!
   Contents:
   • Welcome and background on the course
   • The 7 Course Modules
     1) Introduction to Produce Safety
     2) Worker Health, Hygiene, and Training
     3) Soil Amendments
     4) Wildlife, Domesticate Animal, and Land Use
     5-1) Agricultural Water Part I: Production Water
     5-2) Agricultural Water Part II: Postharvest Water
     6) Postharvest Handling and Sanitation
     7) How to Develop a Farm Food Safety Plan
   • References & Resources
   • Glossary
   • The FSMA Produce Safety Rule
   • FDA/USFA Resources (e.g. coverage & exemptions, compliance dates, FDA fact sheets and guidance, USDA GAPs audit program, USDA GroupGAP)

II) The Produce Grower Training Slide Set
   The book contains the PSA Standardized Curriculum slide set transferred to print format. The book should be returned to the instructor after the course.
   Contents:
   Introduction
   1) Introduction to Produce Safety
   2) Worker Health, Hygiene, and Training
   3) Soil Amendments
   4) Wildlife, Domesticated Animals, and Land Use
   5-1) Agricultural Water - Part 1: Production Water
   5-2) Agricultural Water - Part 2: Post-Harvest Water
   6) Postharvest Handling & Sanitation
   7) How to Develop a Farm Food Safety Plan
Side-by-side comparison of content from the PSA Grower Training Manual and the Slide Book

PSA Grower Manual
Use this to highlight key points with your yellow marker

Slide Image Book
Follow along to view the color images enhanced for easier viewing

Slide numbers are synchronized to help keep on track

44 Why Focus On Postharvest Water?
• Cannot eliminate every food safety risk in the field
• Postharvest water has the potential to spread contamination widely

45 Many Postharvest Water Uses
• Rinsing/washing
• Commodity movement (i.e., dump tanks/flumes)
• Cooling
• Ice making
• Postharvest fungicide and wax
• Handwashing
• Cleaning and sanitizing

Notes:

Electronic Public Release Version
To order printed materials visit producesafetyalliance.cornell.edu/order-materials

Produce Safety Alliance Grower Training Course • Version 1.1 • © 2017
Module 1: Introduction to Produce Safety

Learning Objectives

• Develop a better understanding of produce safety on your fresh fruit and vegetable farm
• Identify types of human pathogens that can contaminate fresh produce
• Understand common ways that produce might become contaminated on the farm
• Describe strategies to prevent and reduce risks of contamination by human pathogens
• Understand the value of commitment to implementing food safety practices
Relevance to the Farm

- You can prevent and reduce risks on the farm
- You know your farm and practices better than anyone, but you may not know the consequences of your current practices on food safety risks
- Your actions directly impact food safety and the financial viability of your farm

The Food Safety Modernization Act (FSMA)

- FSMA includes:
  - Produce Safety Rule
  - Preventive Controls for Human Food
  - Preventive Controls for Animal Food
  - Foreign Supplier Verification Programs
  - Accreditation of Third-Party Auditors/Certification Bodies
  - Sanitary Transportation of Human and Animal Food
  - Prevention of Intentional Contamination/Adulteration
- Focused on prevention of food safety issues and encompasses the entire food system
Produce Safety Alliance Curriculum

• Covers both FSMA Produce Safety Rule requirements and many produce safety practices including Good Agricultural Practices (GAPs)
• At least one supervisor from the farm **MUST** complete food safety training at least equivalent to the standardized curriculum
  – The PSA training satisfies this FSMA requirement
• Keep an eye out for the ‘Section - §’ symbol
  – This indicates a specific FSMA Produce Safety Rule requirement is presented on the slide or referred to in the slide notes
• Pay attention to the words **MUST** and ‘should’
• FSMA Regulatory Reference Table is provided to align the curriculum with the regulation
• Glossary terms are in **bold** throughout

FSMA Produce Safety Rule

• First ever mandatory federal standard for growing, harvesting, packing, and holding of fresh produce
• Some growers may be eligible for an exemption or excluded based on:
  – Commodities grown (e.g., rarely consumed raw)
  – Processing activities that include a ‘kill step’
  – Average annual produce sales
  – Average annual food sales and sales to ‘qualified end users’
• Ultimately, **all** growers should understand and take action to reduce food safety risks on the farm
Produce Safety Rule Compliance

<table>
<thead>
<tr>
<th>Business Size</th>
<th>Years to Comply After Effective Date (1-26-16)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>All other businesses (&gt;$500K)</td>
<td>2</td>
</tr>
<tr>
<td>Small businesses (&gt;$250K-500K)</td>
<td>3</td>
</tr>
<tr>
<td>Very small businesses (&gt;$25K-250K)</td>
<td>4</td>
</tr>
</tbody>
</table>

*Compliance dates for certain aspects of the agricultural water requirements allow an additional two years beyond each of these compliance dates.

Outbreaks Associated with Produce

FDA Outbreaks Linked to Produce Contamination Likely Prior to Retail: 1996–2014

- Sprouts, 43 (25%)
- Leafy Greens, 44 (25%)
- Tomato, 18 (10%)
- Berries*, 10 (6%)
- Herbs (Basil, Parsley, Cilantro), 8 (5%)
- Cucumbers, 4 (2%)
- Green Onions, 3 (2%)
- Mangos, 3 (2%)
- Almonds, 2 (1%)
- Grapes, 2 (1%)
- Papayas, 2 (1%)
- Multiple**, 2 (1%)
- Other***, 7 (4%)
- Unknown+, 8 (5%)
## Microorganisms of Concern in Fresh Produce

- **Bacteria**
  - *Salmonella*, *toxigenic E. coli*, *Shigella*, *Listeria monocytogenes*

- **Viruses**
  - Norovirus, Hepatitis A

- **Parasites**
  - *Giardia lamblia*, *Cryptosporidium parvum*, *Cyclospora cayetanensis*, *Toxoplasma gondii*

## Bacteria in the Farm Environment

- Bacteria are microorganisms that can multiply both inside and outside of a host

- Bacteria include pathogens such as *E. coli*, *Salmonella*, and *Listeria monocytogenes*

- They can multiply rapidly given the right conditions:
  - water, food, and the proper temperature

- Good Agricultural Practices can reduce risks by minimizing situations that support bacterial survival and growth
Bacteria

- If conditions are ideal, bacteria can multiply once every 20 minutes
- It is unlikely you’ll ever start with just ONE bacterium
- Some pathogens can make people sick with a dose of 10 cells or less
- What conditions are optimal?
  - Food source
  - Moisture
  - Right temperature

Conditions for Bacterial Growth

<table>
<thead>
<tr>
<th>Time</th>
<th># of Bacteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 min</td>
<td>2</td>
</tr>
<tr>
<td>40 min</td>
<td>4</td>
</tr>
<tr>
<td>1 hour</td>
<td>8</td>
</tr>
<tr>
<td>80 min</td>
<td>16</td>
</tr>
<tr>
<td>100 min</td>
<td>32</td>
</tr>
<tr>
<td>2 hours</td>
<td>64</td>
</tr>
<tr>
<td>4 hours</td>
<td>4096</td>
</tr>
<tr>
<td>6 hours</td>
<td>262,144</td>
</tr>
<tr>
<td>8 hours</td>
<td>16,777,216</td>
</tr>
</tbody>
</table>
**Viruses**

- Viruses are small particles that multiply only in a host, not in the environment or on produce
- Contamination most often linked to an ill worker handling fresh produce (fecal-oral route) or contaminated water
- It only takes a few virus particles to make someone ill
- Can be very stable in the environment
- Prevention is the key to reducing viral contamination
- Limited options for effective sanitizers

**Parasites**

- Parasites are protozoa or intestinal worms that can only multiply in a host animal or human
- Commonly transmitted by water
- Can be very stable in the environment; often not killed by chemical sanitizers
- Can survive in the body for long periods of time before ever causing signs of illness
## Health Impacts by Pathogen Type

### FDA Outbreaks Linked to Produce by Pathogen Types: 1996 - 2014

<table>
<thead>
<tr>
<th>Pathogen Type</th>
<th>Outbreaks (% of total)</th>
<th>Illnesses (% of total)</th>
<th>Hospitalizations (% of total)</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacteria</td>
<td>148 (86)</td>
<td>11,377 (66)</td>
<td>1,844 (89)</td>
<td>65</td>
</tr>
<tr>
<td>Parasites</td>
<td>21 (12)</td>
<td>4,786 (28)</td>
<td>67 (3)</td>
<td>0</td>
</tr>
<tr>
<td>Viruses</td>
<td>3 (2)</td>
<td>993 (6)</td>
<td>156 (8)</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>173</strong>*</td>
<td><strong>17,164</strong></td>
<td><strong>2,067</strong></td>
<td><strong>68</strong></td>
</tr>
</tbody>
</table>

*The total also includes chemical hazards not identified in this table (e.g., a Curcurbitacin toxin outbreak associated with squash).*

## Produce Safety Challenges

- Fresh produce is often consumed raw (i.e., not cooked)
- Microbial contamination on produce is extremely difficult to remove once present
  - Natural openings, stem scars, bruises, cuts
  - Rough surfaces, folds, netting
- Contamination is often sporadic
- Bacteria can multiply on produce surfaces and in fruit wounds, provided the right conditions are present
Contamination Sources

Humans
Soil
Animals
Water
Buildings, Equipment tools

How Contamination Is Spread

• Humans

Workers can spread pathogens to produce because they directly handle fruits and vegetables.

– Improper health and hygiene practices
  • Lack of adequate training and handwashing practices
  • Lack of or inadequate toilet facilities
– Illness or injury
  • Working while sick
  • Injuries that result in blood contacting fresh produce
How Contamination Is Spread

• **Animals**

Domesticated and wild animals can carry and transmit human pathogens to produce.

- Field intrusion may result in direct fecal contamination of crops and fields
- Animal feeding, rooting, and movement through fields may spread contamination
- Animals can contaminate water sources used for produce production
- Manure runoff can contaminate fields, water sources, and crops

• **Water**

Water can carry and spread human pathogens, contaminating entire fields or large amounts of produce.

- Production water
  - Irrigation, crop sprays, frost protection
- Postharvest water
  - Fluming, cooling, washing, waxing, cleaning
- Unexpected events
  - Flooding, runoff
How Contamination Is Spread

• Soil Amendments

Raw manure and other soil amendments can be a source of contamination if not properly handled and applied.

– Application too close to harvest
– Improper/incomplete treatment
– Improper storage
– Runoff and wind spread
– Cross-contamination due to improper sanitation procedures

• Surfaces, equipment, tools, and buildings

Any unclean surface that contacts produce can harbor pathogens and serve as a source of contamination.

– For example, not having an established schedule for cleaning or sanitizing food contact surfaces, including tools

Facility management can also impact risks

– Areas outside buildings that are not kept mowed or clean can serve as pest harborage areas
– Standing water or debris in packinghouses can become a source of cross-contamination
Produce Safety Begins With Your Commitment

• Identify produce safety risks on your farm
• Support the implementation of food safety policies and practices to reduce risks
• Provide equipment and facilities necessary to implement practices that reduce risks
• Support effective food safety training so everyone can actively be involved in reducing risks
• Set a good and consistent example on your farm

Cleaning vs. Sanitizing

What is the difference and why does it matter?

• Cleaning: Physical removal of dirt (soil) from surfaces which can include the use of clean water and detergent
• Sanitizing: Treatment of a cleaned surface to reduce or eliminate microorganisms

Important point: You cannot sanitize a dirty surface.

Cleaning always comes first!
Steps Towards Produce Safety

1. **Assess Produce Safety Risks**
2. **Implement Practices**
3. **Monitor Practices**
4. **Use Corrective Actions**
5. **Keep Records**

Assessing Risks

- **Assess your farm and practices**
  - Location of farm, fields, and adjacent land activities that may represent risks to the crops you grow
  - Fecal contamination risk from domesticated or wild animals
  - Use of water and manure in crop production
  - Worker training programs and hygiene facilities
  - Practices used to grow, harvest, pack, or hold produce and the tools and equipment
  - Typical and atypical (e.g., flooding) situations
Implementing Practices to Reduce Risks

- Focus on preventing contamination
  - Cannot reliably remove contamination
- Address risks most likely to have the biggest impact on produce safety first
- May require modification of current practices and additional training for farm employees
- May require capital investment
- You may already be doing the right thing!
- Ask for help and seek training if you are unsure

Good Agricultural Practices (GAPs)

- This curriculum will focus on GAPs and provide information on how growers can comply with the FSMA Produce Safety Rule
- Key areas will be reviewed as well as practices that can be implemented to reduce risks including:
  - Worker training programs
  - Water monitoring, testing, and treatment
  - Manure and compost management
  - Wildlife and animal monitoring
  - Sanitation programs
Standard Operating Procedures (SOPs)

• A written document defining how to complete a specific food safety practice

• SOPs include:

  1. Step-by-step instructions so that even a person who has never done a practice before can complete it correctly by following the instructions
  2. Location and name of any supplies needed to complete the practice
  3. When and how often the practice should be completed
  4. What records are needed/necessary

Monitoring

• Performed on a schedule or during a specific activity

• Allows you to verify practices are being completed properly

• Helps identify problems before they impact safety
  – Frequent high generic *E. coli* counts in water test results
  – Evidence of animal intrusion and fecal contamination
  – Improper cleaning and sanitation practices resulting in dirty equipment and tools
Corrective Actions

- Can be established in advance
  - Negative consequences for workers not following practices
  - e.g. Plans for a spilled portable toilet
- Fix problems that are identified during monitoring
  - Restock toilet and handwashing facilities
  - Retrain supervisors and farm workers
- May require short and long term planning
  - Establish sanitation programs (short term)
  - Replace equipment (long term)

Recordkeeping

- Recordkeeping includes documenting practices, monitoring, and corrective actions
- There are many templates available
- Should be convenient, or it will not get done
- Required records MUST be dated and signed or initialed by the person who performed the activity
- Some records MUST be periodically reviewed, signed, and dated by a supervisor or responsible party
- Keep all records for at least 2 years
Recordkeeping Benefits

- You can verify practices were done
  - And done properly!
  - Assures you that everyone is sticking to the food safety policies
- Look for trends or unexpected results and eliminate potential problems
- May be required for certain activities
  - Regulatory (i.e. FSMA Produce Safety Rule requirements)
  - Third party audits

Recordkeeping Basics

- Records can be handwritten (pen & paper) or electronic (handheld data entry or scanner)
- Invest in tools that make it work
  - Clip boards with strings attached to pens to keep them easy to find
  - Plastic page sleeves
  - Duct tape
- Use technology to your advantage
  - Phones, apps, tablets, computer software
Recordkeeping Tips

• Establish record keeping schedules that make sense for the record keeper and the action
  – When does it need to be recorded?
  – Who is in charge of documenting it?
  – How often does it need to be documented?
• Build recordkeeping into normal routines
  – Place recordkeeping logs in accessible areas with necessary supplies (e.g., pens, paper)

A Farm Food Safety Plan

• Gets you thinking about YOUR farm and practices
• Keeps you organized so you can focus your time and resources more effectively
• Gives you a plan to follow and assure everyone is involved
• Documents your progress
• Is required by third part audits and some buyers
• Is NOT required in the FSMA Produce Safety Rule, but it’s a good idea!
Summary

• Produce safety impacts your farm
• Microorganisms are the primary produce safety concern
• Your commitment is critical to success
• Produce safety includes:
  - Assessing risks,
  - Implementing practices,
  - Monitoring practices,
  • Using corrective actions,
  • Keeping records
  - Providing the necessary resources to get it done
• A written Farm Food Safety Plan guides your produce safety efforts
Module 2: Worker Health, Hygiene, and Training
Module 2: Worker Health, Hygiene, and Training

Learning Objectives

• Identify potential routes of contamination associated with workers
• Identify adult learning concepts and topics to include in a worker training program
• Describe how to monitor that facilities are maintained on the farm
• Describe corrective actions that may be used to correct identified problems
• Identify recordkeeping tools for worker health and training
Workers Are A Food Safety Concern Because They...

- Can carry human pathogens
  - *Shigella*, Hepatitis A, Norovirus, and others
- Can spread human pathogens
  - Harvest and pack with their hands
  - Fecal-oral route
- Require training to reduce risks
  - Proper handwashing
  - How to handle illnesses and injuries

Routes of Contamination

- Feces
- Clothing
- Hands
- Footwear
- Tools & Equipment
- Illness & Injury
Importance of Training Workers

• Fresh fruits and vegetables often receive no additional processing (such as cooking), so pathogen contamination can result in illness when the produce is consumed

• Workers need to use food safety practices every day to reduce produce safety risks

• Food safety practices are learned so training is key to successful implementation

Potential Training Challenges

• Time for training

• Language

• Literacy level

• Training mid-season

• Variation in hygiene practices and expectations

• Misconceptions/misperceptions
Principles of Adult Learning

• Adults need to understand why food safety practices are important and needed

• Training should:
  – Be relevant to their jobs and daily tasks
  – Outline clear expectations
  – Provide details on practices that reduce risks

• Effective training materials are:
  – Presented through a variety of methods, practical examples and opportunities to practice skills
  – Interactive with visual learning opportunities

Communication

• Good communication supports food safety by improving risk identification and reduction

• Trained workers know:
  – How to identify food safety risks
  – How to reduce risks they find
  – Who to tell if they see a food safety risk they cannot minimize or eliminate
  – That their food safety concerns will be taken seriously
Everyone Needs Training

- Implementing food safety practices is a company wide task
  - Managers, farm workers, office staff, volunteers, interns, family members
- Everyone needs to know:
  - How to identify and reduce food safety risks
  - Practices they are responsible for doing
  - How to report food safety risks they see
- Owners, managers, and supervisors should set a good example and follow company policies

Visitors

- Growers MUST:
  - Make visitors aware of the farm’s food safety policies
  - Provide access to toilet and handwashing facilities
- Other key information for visitors should include:
  - Areas of the farm they are allowed to visit
  - The importance of not visiting the farm when ill
  - How to wash their hands
  - Instructions to keep pets at home
Training Programs MUST Include

• Principles of food hygiene and food safety
• Recognizing symptoms of foodborne illness and the importance of personal hygiene for all personnel and visitors
• Other training relevant to the worker’s job

Training Programs MUST

• Be appropriate for the job
• Conducted upon hiring
• Include refresher training throughout the season (at least annually) or when a problem arises
• Be easily understood
• Be supervised by a qualified person
• Include a process for documenting the training
**Worker Qualifications**

Workers and supervisors **MUST** be qualified to conduct their job duties through:

- Education
- Training
- Experience

**Workers MUST be Trained to Identify and Reduce Risks at Harvest**

- Evaluate contamination risks before and during harvest such as significant animal activity, presence of fecal matter, damaged crops, or extensive animal tracks
- Never harvest produce destined for the fresh market that is visibly contaminated with feces
- Never harvest dropped produce
- Only use clean harvest and packing containers
Reinforcing Food Safety Training

- Post signs and reminders
  - Place signs where they will be most effective
  - Pictures are often better than words
  - Use appropriate language
- Conduct review and refresher training sessions throughout the season or when a problem arises
- Mix it up to keep information relevant and interesting to workers

Resources MUST be Provided to Support Food Safety Practices

- Toilets and toilet paper
- Soap
- Clean water
- Paper towels
- Container to catch wastewater
- Garbage cans
- First Aid Kit
- Break Areas
**Toilet & Handwashing Facilities**

- Provide a sufficient number of toilets and sinks to meet worker and visitors’ needs
  - OSHA requires one facility per 20 workers within ¼ mile of the working area
- Facilities **MUST** be fully serviced on a regular schedule
- Toilet and handwashing facilities **MUST** be well stocked
- Should be monitored every day when in use

**Drinking Water & Break Areas**

- Workers should be provided with drinking water to reduce the risks of dehydration and heat exhaustion
- Break areas do not need to be a separate building but **MUST** be in a designated area
- Healthy workers are better able to do their jobs and implement food safety practices!
Training versus Practices

• The Produce Safety Rule includes requirements for
  – Training programs and resources that **MUST** be provided for workers and visitors, and
  – Practices workers **MUST** follow

• We just finished discussing training and resources.
  - Do you remember what was required?
  - Rule requirements are in the manual notes

Now we will cover practices workers **MUST** do to reduce microbial risks to fresh produce

Workers **MUST**:

• Maintain personal cleanliness
• Avoid contact with animals (other than working animals)
• Maintain gloves in a sanitary condition, if used
• Remove or cover hand jewelry that cannot be cleaned
• Not eat, chew gum, or use tobacco in an area used for covered activities
• Notify their supervisor if they are ill
• Wash their hands when necessary
When MUST Hands Be Washed?

- After using the toilet
- Before starting or returning to work
- Before and after eating and smoking
- Before putting on gloves
- After touching animals or animal waste
- Any other time hands may become contaminated

Proper Handwashing Steps

1. Wet hands with water
2. **Apply soap and lather.** Be sure to wash the front and backs of hands as well as in between the fingers. Rub hands together for AT LEAST 20 seconds
3. **Rinse** hands thoroughly with clean water
4. **Dry** with a paper towel and turn off the faucet with the used towel
5. **Throw** the paper towel in the trash container

Antimicrobial hand sanitizers CANNOT replace handwashing!
Proper Use of Toilets

• All urination and defecation should be done in a toilet, NEVER in the field or nearby production areas
• Toilet paper should be deposited into the toilet, NOT in a garbage can or on the floor
• ALWAYS wash hands after using the toilet

Worker Clothing

• Clean clothes should be worn each day
• Footwear cleanliness is important
  - Designated footwear helps prevent cross-contamination
• Gloves, if worn, **MUST** be changed when they become contaminated or torn
  • If reusable gloves are used, clean often or as needed
• Aprons, gloves, and other food safety equipment should be removed before using the toilet and stored in a clean, designated area when not in use
• Take care with buttons and pins - Cover them so they cannot drop onto produce
**Worker Illness**

- Workers who are sick or show signs of illness can contaminate fresh produce
- Ill workers **MUST** not handle fresh produce
- Symptoms of illness can include:
  - Nausea
  - Vomiting
  - Diarrhea
  - Fever
  - Jaundice (sudden yellowing of eyes)

**Worker Injury**

- **Worker injuries may pose food safety risks**
  - A first aid kit **should** be available, stocked, and monitored
  - Clean and bandage all wounds
    - If the wound is on the hands, a glove should be worn to create a double barrier
  - Discard any produce that may be contaminated
  - Clean and sanitize any items that came in contact with bodily fluids
  - Report all injuries to the supervisor
Monitoring

• **Develop a monitoring process to ensure:**
  – Workers are following food safety practices and farm policies every day
  – Facilities are available, clean, and well stocked every day

• **This can include:**
  – Training supervisors to observe employee behavior
  – Appointing someone to check the facilities for cleanliness each day
  – Using monitoring logs

Corrective Actions Are Needed If:

• **Workers are not following food safety policies**
  – Develop rewards to encourage positive practices
  – Implement deterrents for poor practices

• **Facilities are not cleaned, restocked or are broken**
  – Contact the sanitation company
  – Retrain workers or improve monitoring process

• **Facilities leak in the field or packinghouse**
  – Have an emergency plan in place for spills
Recordkeeping

- You MUST document actions taken to support worker health, hygiene, and training on the farm such as:
  - Worker training programs
  - Monitoring and restocking of toilet and handwashing facilities
  - Illness and injury reporting
  - Restocking of first aid kits

Recordkeeping Tips

- Take advantage of template recordkeeping logs, but be sure to modify them to fit your farm

Recordkeeping

- Example of documenting worker training,
  - Training date
  - Name of trainer
  - Materials/information covered
  - Printed names & signatures of attendees
Summary

• Worker health and hygiene is critical to food safety because workers can introduce food safety risks
• Everyone should be trained but anyone who handles covered produce MUST be trained
• Visitors MUST be made aware of policies too
• Training should emphasize health and hygiene practices that reduce risks
• A written training program should be developed, implemented, and documented
Module 3: Soil Amendments
Module 3: Soil Amendments

Learning Objectives

• Identify potential routes of contamination associated with soil amendments
• Explain soil amendment handling practices that may reduce risks
• Identify key strategies such as composting or application intervals to reduce risks
• Describe corrective actions that may be utilized if a soil amendment presents a risk
• Identify recordkeeping tools for monitoring and managing soil amendment handling, application, and proper use
What Is A Soil Amendment?

- Any chemical, biological, or physical materials intentionally added to the soil to improve and support plant growth and development
- May reduce soil erosion and sediment runoff
- Many different types of soil amendments are available
- Soil amendments can present produce safety risks
- Assessing risks and implementing GAPs can reduce risks

Soil Amendments & Food Safety Risks

- Biological soil amendments, especially those that include untreated (raw) manure, pose significant microbial risks
- Synthetic (chemical) soil amendments can also impact food safety, if not prepared and applied properly
- Risks should be assessed when selecting and applying all soil amendments on produce fields
Assessing Your Risks

- **What type of soil amendments do you use?**
  - Raw manure, composted manure, chemicals?

- **What crops receive soil amendments?**
  - Fresh produce or agronomic crops?

- **When do you apply them?**
  - Days to harvest, time of year?

- **How do you apply them?**
  - Incorporated, injected, surface applied?

- **How much and how often do you apply them?**
  - Excessive application can lead to environmental impacts

Chemical Soil Amendments

- **Minimal risk of human pathogens**
  - Cannot be considered 100% safe
  - Synthetic fertilizers, minerals

- **Can pose chemical risk to humans**
  - Be sure workers are trained to apply properly and use personal protective equipment
  - Follow all application instructions
  - Use proper labeling and storage methods
Human Waste & Biosolids

- Human waste is prohibited for use on produce crops, unless it meets the EPA regulation for biosolids (40 CFR part 503)
- Untreated human waste may contain pathogens, heavy metals, or other contaminants
- May not be accepted by produce buyers
- Management of biosolids not discussed because use is infrequent in fresh produce production

Pre-Consumer Vegetative Waste

- Should not be considered zero risk and may contain:
  - Chemical hazards
  - Physical hazards
  - Biological hazards
- Examples include:
  - Produce food preparation waste
  - Out of date vegetables
  - Food products removed from their packaging
Non-Manure Based
Soil Amendments of Animal Origin

- Should be processed to eliminate pathogens
- If not, then it **MUST** be considered an untreated biological soil amendment of animal origin

Bone meal
Blood meal
Feather meal
Fish emulsion

The Value of Manure

- Increases soil tilth, fertility, and water holding capacity
- It can be part of sound nutrient management and waste utilization system for those with raising animals or that partner with other livestock operations
- It is widely available and cost effective
Pathogens in Animal Manure

- All manures are at risk for carrying human pathogens
- Some animals tend to be reservoirs for certain pathogens
- Many factors can affect animals shedding pathogens in their manure
  - Age
  - Rearing practices
  - Diet
  - Season
  - Environmental conditions

Untreated Soil Amendments

- Untreated biological soil amendments of animal origin are considered high risk since they have not been treated to reduce or eliminate pathogens
- All of the following soil amendments would be considered untreated:
  - Raw manure
  - “Aged” or “stacked’ manure
  - Untreated manure slurries
  - Untreated manure teas
  - Agricultural teas with supplemental microbial nutrients
  - Any soil amendment mixed with raw manure
Reducing Soil Amendment Risks

- Selection of Materials
- Treatment
- Application Timing
- Application Methods
- Handling and Storage
- Recordkeeping

Treated Soil Amendments

- Treatment requires a controlled process such as composting that decomposes organic matter and reduces pathogens
- Temperature is the primary method of pathogen reduction for thermophilic composting; however, chemical and biological factors also contribute
- Only a treatment process that has been scientifically validated ensures pathogen reduction
- Process monitoring and recordkeeping are critical to ensuring the soil amendment is adequately treated
Composting Options

You MUST use a **scientifically valid** process:

1. Aerated static composting: aerobic, minimum 131°F (55°C) for 3 days, followed by curing with proper management to ensure elevated temperatures throughout all materials.

2. Turned composting: aerobic, minimum of 131°F (55°C) for 15 days, minimum 5 turnings, followed by curing.

3. Other **scientifically valid**, controlled composting processes.

Reducing Risks During Application

**Steps you should take to reduce risks:**

- Preferentially apply soil amendments containing manure to crops NOT intended for fresh consumption.
- Maximize the time between application and harvest.
- Do not allow contact with the edible portion of the crop during application.
- Do not side-dress with raw manure.
- Minimize risks to adjacent produce crops if you are field spreading manure.
Minimum Application Intervals

There are currently NO application intervals for raw manure outlined in the FSMA Produce Safety Rule

• Untreated Soil Amendments
  - FDA is currently doing research to determine safe application intervals for raw manure
  - Raw manure MUST not be directly applied to the harvestable portion of the crop

• Treated Soil Amendments
  - There is a zero day application interval for compost treated by a scientifically validated process

Handling Recommendations

• Designate specific equipment and tools for handling soil amendments
• Develop SOPs to clean and sanitize equipment and tools that contact soil amendments and fresh produce
• Direct traffic (foot, equipment) around soil amendment storage or processing areas to reduce the risk of cross-contamination
20 **Storage Area Recommendations**

- Minimize runoff, leaching, and wind drift to reduce contamination of crops, water sources, and handling areas by soil amendments
  - Cover piles
  - Build berms to prevent runoff
- Do not store in locations that are likely to experience runoff or that are close to water sources
- Keep raw manure and finished compost in separate areas to prevent cross-contamination
- Minimize animal access to compost piles

21 **Worker Training**

- **Workers who handle soil amendments, both treated and untreated, should:**
  - Understand SOPs for properly completing tasks which require managing raw manure or compost
  - Make sure clothes, boots, and gloves are clean before handling produce
  - Wash hands after handling
Recordkeeping: Soil Amendments

- Soil amendments can introduce microbial risks, so you should document:
  - Type and source of soil amendment
  - Rates and dates of application
  - Handling and sanitation practices used that reduce risks

There are a few records required for treated biological soil amendments of animal origin within the Produce Safety Rule.

Recordkeeping: On-Farm Composting

- Key factors in the composting process **MUST** be documented.
- These may include the following steps depending on the process used:
  - Time
  - Temperatures
  - Turnings
  - Other processing steps
Recordkeeping: Soil Amendments Supplied by a Third Party

- **Documentation should be kept of:**
  - The name and address of the supplier
  - What soil amendments were purchased
  - The date and amount purchased
  - Lot information, if available

- **Documentation MUST be collected from the supplier:**
  - To ensure the supplier has used scientifically validated treatment processes that were monitoring during the production of the treated amendment (including compost)
  - To ensure proper handling requirements have been met

Corrective Action Plan

- **Outline steps that could be taken if soil amendments:**
  - Pose a microbial risk to the crop
  - Were improperly treated
  - Accidentally contacted the edible portion of the crop

- **Think of alternative market options for the produce**
  - Example: Processing markets that involve a “kill” step

- **Document this in your plan**
Summary

• Soil amendments can introduce produce safety risks, especially those that contain raw manure

• To reduce risks associated with soil amendments:
  1. Apply untreated manure to non-produce fields
  2. Treat raw manure using a scientifically validated, controlled process
  3. Extend the time between application of raw manure and harvest

• Make sure that storage areas do not contaminate fields, water sources, or packing areas

• Train workers who handle and apply soil amendments

• Develop sanitation steps for tools and equipment

• Keep records of soil amendment applications and treatments
Module 4: Wildlife, Domesticated Animals, and Land Use
Learning Objectives

- Identify potential routes of contamination from wildlife, domesticated animals, and land use
- Describe practices to reduce produce safety risks associated with wildlife, domesticated animals, and land use
- Describe co-management strategies that address conservation and food safety goals
- Describe the importance of conducting a pre-plant and pre-harvest assessment of fields
- Describe corrective actions that could be used if significant risks are present in production fields
- Identify records that should be kept to document any management, monitoring, or corrective actions

Animals Are A Produce Safety Concern Because They:

- Can carry human pathogens
  - e.g., E. coli O157:H7, Salmonella, Listeria monocytogenes
- Can spread human pathogens by
  - Depositing feces in fields
  - Spreading fecal contamination as they move
- Are very difficult to control
  - Birds and small animals travel unnoticed
  - If fencing is used, even the best fence can be breached
  - Complete exclusion is not possible
What are some strategies we can use to prevent contamination of produce from animals?
Wildlife on the Farm

- Can be a natural and valuable part of the landscape and farm environment
- Depending on species, management options may be limited by county, state, or federal law
- May be resident or transient migrating species
- Wildlife with close association to human activities may pose greater risks (e.g., seagulls feeding at dumps, starlings feeding in cattle feedlots)

Assessing Risks: Wildlife

- Do you find wildlife feces in your produce fields?
  - How often? Is it widely distributed?
    Is it in contact with produce?
- Is your farm in an area where large numbers of animals visit?
  - (flocks of migrating birds, herds of deer)
- What management practices can limit wildlife contamination of produce fields and water sources?
Co-Management: Striking a Balance

- Farmers **MUST** address food safety requirements, but should keep conservation of natural resources in mind
- Farmers also have stewardship, aesthetic, and business objectives of their own
- Co-management considers both food safety **and** conservation of natural resources

Co-Management Considerations

- Some conservation practices that support wildlife may increase wildlife activity near produce fields
- As food safety concerns have increased, some farms have stopped or reduced their conservation practices, particularly those thought to provide habitat for wildlife (e.g., vegetation and water sources)
- Removal of conservation practices can damage natural resources (e.g., soil, water, wildlife) and may not reduce hazards posed by domesticated and wild animals
Skills to Support Co-Management

- Review the risks and benefits of practices as they relate to food safety and conservation
  - e.g., bare ground buffer and hedgerow vegetation
- Consider the impact on conservation when implementing produce safety practices
  - Unintended consequences?
  - Direct conflicts between produce safety and conservation?

Monitoring Wildlife Activity

- During the growing season:
  - Monitor for feces and evidence of intrusion
  - Evaluate the risk of fecal contamination on produce (e.g., tree vs. root crop)
  - Consider past observations and wildlife attractants
- Immediately prior to harvest
  - Monitor for fecal contamination, signs of animal activity (e.g., trampling, rooting, feeding, tracks)
  - Assess risks and decide if the crop or a portion of the crop can be safely harvested
Deterring Wildlife

Decoys

Fencing & Netting

Visual Deterrents

Noise Deterrents

Tactile Repellent

Relocation
Wildlife & Livestock Interactions

- Pathogens can be transferred between livestock and wildlife
- The level of pathogens in domesticated animals may depend on the species and further impacted by animal management practices on the farm
- Shared grazing lands and water sources may offer contamination pathways among species

Domesticated Animals on the Farm

- Domesticated animals, such as livestock and pets, may harbor human pathogens
- Domesticated animals are sometimes used in fields
  - As working animals
  - As wildlife management (i.e., dogs)
  - To graze crop residues/culls
- Assess the risk if animals are allowed or are likely to enter your production fields
Assessing Risks: Domesticated Animals

- Are domesticated animals allowed in the field while the crop is present as part of the production process?
- Are they working animals?
- Are workers aware of cross-contamination risks from fecal contamination of hands, clothing, shoes, and equipment after handling animals or fecal material?
- Are production fields rotated into grazing land?
  – If manure is present on the ground, you might extend the period of time between when animals were grazed and produce planting.

You MUST develop a system to adequately control excreta and litter.

Assess Risks BEFORE Planting

- **Assess the field location**
  – Topography, wind patterns, water movement
  – Previous uses (e.g., grazing, landfills, manure applications)
  – Impact of domesticated animals

- **Assess adjacent land uses**
  – Animal production, compost, or manure storage?
  – Residential, commercial, or other land uses?

- **Assess wildlife risks**
  – Number, movement, likelihood of fecal contamination
Working Animals

• The best way to minimize risk is to not allow working animals in the field when the edible portion of the crop is present

• If working animals need to be used close to harvest:
  – Establish paths to minimize contact with growing areas
  – Develop SOPs that outline practices to take if an animal defecates in the field or near produce

• Anyone working with the animals should understand risks and be trained to minimize those risks

• Develop SOPs for:
  - Animal and manure handling
  - Handwashing between working with animals and harvesting or handling produce
  - Not using tools to handle raw manure in produce fields unless cleaned and sanitized
  - Other practices necessary after handling animals to prevent produce contamination
Pre-Harvest Assessment

- A process to assess fields before harvest to determine if:
  - Fecal contamination is present, or signs indicate a risk (e.g., tracks, trampling, rooting, feeding)
  - Fresh produce has been contaminated and cannot be harvested
  - Corrective actions, such as no-harvest buffer zones, are necessary before harvest can safely proceed

Pets

- Should be excluded from produce fields
- Visitors to the farm should be instructed to leave their pets at home
- Farms with petting zoos should have handwashing sinks available and signage instructing visitors of the food safety policies
Corrective Actions:
What To Do If There’s Contamination

1. Do not harvest any produce that may be contaminated
2. Determine if no-harvest buffer zones around the contamination are sufficient to reduce risk to allow harvest of the uncontaminated produce (Suggested no-harvest buffer zones vary from a 5-25 foot radius, depending on the crop, climate, contamination event, and harvest equipment)
3. Consider other corrective actions that could reduce contamination risks
4. Make a decision about what to do with the contamination
   - Remove, leave, bury, or use other strategies
   - Consider risks that could result from these actions (e.g., cross-contamination of equipment with feces)
5. Document monitoring and deterrence actions and any corrective actions
Worker Training:

Establishing Your Front Lines of Defense

Workers MUST receive training to:
  • Recognize and not harvest contaminated produce
  • Inspect and correct problems with harvest containers and equipment so they do not become a contamination source,
  • Report issues to a supervisor

Workers MUST:
  • Take measures to not harvest contaminated produce
  • Wash hands after handling animal feces or any time hands may be contaminated

Workers should:
  • Report food safety concerns to a supervisor
Recordkeeping

Records MUST be kept for:

- Worker training

Records should be kept for:

- Pre-plant land assessments
- Monitoring for animal activity
- Actions taken to reduce risks related to animal intrusion into crop (domesticated animals & wildlife)
- Pre-harvest risk assessments
- Intrusion and contamination events
- All corrective actions taken

Example of Recordkeeping

Wildlife and Domesticated Animal Monitoring Log

Name of operation:

Please see the food safety plan for overall wildlife and domesticated animal management, monitoring, and corrective actions. Attach any relevant pictures, maps, or other notes about the monitoring or intrusion event to this recordkeeping sheet.

<table>
<thead>
<tr>
<th>Date</th>
<th>Field or location</th>
<th>Wildlife activity or intrusion event noted (yes or no)</th>
<th>Corrective actions taken</th>
<th>Date corrective actions implemented</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

Reviewed by:            Title:            Date:
Summary

- Feces and urine from domesticated and wild animals can contaminate produce fields and water sources
- Conduct pre-planting and pre-harvest assessments
- Presence of animals in the environment does not necessarily mean that produce is contaminated
- If animal intrusion occurs, fields MUST be monitored during the growing season for evidence of contamination
- Steps should be taken to reduce risks from animals
- Co-management should be used to balance food safety and conservation goals
- Document all actions taken to reduce risks from animals and adjacent land uses
Two Sections on Water

• Part I: Production Water
  – Water used in contact with produce during growing
  – Includes water for irrigation, fertigation, foliar sprays, frost protection

• Part II: Postharvest Water
  – Water used during or after harvest (Next Section)

Agricultural Water Quality

• According to the regulation, agricultural water means water used in covered activities on covered produce where it is intended to, or is likely to, contact covered produce or food contact surfaces
  – Covered produce means produce that is subject to the requirements of the Produce Safety Rule. The term refers to the harvestable or harvested part of the crop

• All agricultural water MUST be safe and of adequate sanitary quality for its pre- or post-harvest intended use.
Thinking it through

- When does water become “Agricultural Water” as defined by FDA and thus subject to the Produce Safety Regulation?
- Consider the crop, the application purpose, and the application method
- **Example:** Summer or winter squash irrigated by an overhead method

<table>
<thead>
<tr>
<th>Water Source</th>
<th>Crop</th>
<th>Application Purpose</th>
<th>Application Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pond</td>
<td>Squash</td>
<td>Irrigation</td>
<td>Overhead</td>
</tr>
</tbody>
</table>

**Step 1: Is this crop covered produce?**
**Answer:** For Summer Squash, yes and for Winter Squash, no

**Step 2: Is a direct application method used?**
**Answer:** Yes, because the water is intended to, or likely to, contact covered produce

**Step 3: Is this Agricultural Water?**
**Answer:** Yes, for summer squash
**Answer:** No, for winter squash
Module 5: 
Part I – Production Water

Learning Objectives

• Identify risks that impact the microbial safety of water sources
• Describe practices such as water application method and timing that can reduce those risks
• Adopt practices that limit impacts to the environment, soil quality, and wildlife habitat
• Describe the importance of water testing
• Describe FDA agricultural water quality criteria
• Describe actions that could be taken if agricultural water related risks are identified
• Identify records necessary to document agricultural water quality and use
Production Water Concerns

- Many factors impact the quality of water
- Human pathogens can be introduced into water and contaminate produce during growing activities

Produce safety is impacted by all these things!

Production Water Uses Include:

- Irrigation
- Fertigation
- Crop sprays
- Cooling
- Frost protection
- Dust abatement
- Other uses where water directly contacts
Evaluating Risks Related to Production Water

Three main impact points for produce safety risks related to production water are:

1. Production water source and quality
   - Public water supply, ground water, surface water
   - Testing frequency and sampling location

2. Application method
   - Water that does not contact the harvestable portion
   - Water that contacts the harvestable portion of the crop

3. Timing of application
   - At planting or close to harvest

Probability of Contamination

<table>
<thead>
<tr>
<th>Public Water Supply</th>
<th>Ground Water</th>
<th>Surface Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated</td>
<td>Open to Environment</td>
<td></td>
</tr>
</tbody>
</table>

Lower Risk

Higher Risk
Preventing Contamination of Water from Public Water Supplies

Public water supplies are treated to meet microbial drinking water standards, but distribution systems can introduce risks, therefore:

- Assess your connection to the public water supply and distribution system downstream
- Test the water if you have any concerns about the water source
- Have a back-up plan if you think water in the distribution system may be unsafe
- Install backflow prevention devices to prevent contamination of the plumbing system

Keep hoses off the ground
Install vacuum breaker on hoses
Preventing Contamination of Ground Water

- Inspect well to ensure it is in good condition
- Inspect wellhead to ensure it is properly capped, well sealed, and elevated
- Be sure land slopes away from wellhead to prevent runoff contamination into the well
- Install backflow prevention devices
Potential Sources of Surface Water Contamination

- Agricultural Runoff
- Septic Tank Leakage
- Waste Water Discharge
- Manure Application/Composting Operations
- Urban and Environmental Runoff
- Wildlife and Domesticates Animal Feces
- Things We Never Thought of

Preventing Contamination of Surface Water Sources

- **Assess nearby land use and upstream water activities to identify risks**
  - Work with neighbors and local watershed groups to understand and minimize identified risks

- **Assess and address runoff risks**
  - Develop diversion ditches, berms or containments to minimize environmental runoff from manure and compost piles, or runoff from livestock feeding areas
  - Monitor and control animal access to irrigation water sources where practical (e.g., irrigation reservoirs)
Methods of Irrigation

• Overhead (sprinkler)
  – Higher risk: A direct water application method resulting in contact with produce

• Flood (surface, furrow)
  – May avoid direct contact with produce
  – Consider risk of contact with contaminated soil during harvest or from splash

• Drip (trickle, subsurface, micro, under canopy)
  – Lower risk: Produce generally not in direct contact (except root crops), reduces foliar diseases, improves water use efficiency

Less Contact with Water = Lower Risk

A key question for evaluating risk:

“Is the water applied using a direct water application method?”

– If the answer is “never”, the risk from water is very low
– If the answer is “yes”, the type of commodity, quality of the water and the timing of the application should be reviewed to assess risks
Pathogens on Produce May Die Off Over Time

- Environmental conditions can influence die-off rates
  - Desiccation (drying out)
  - Sunlight (ultraviolet rays)
  - Temperature and humidity
  - Bacteria starvation and competition
- Some pathogens may be ‘protected’ on the plant and survive for extended periods of time
- Under some conditions, pathogens can even regrow on a plant so avoiding contamination is best

Inspect Agricultural Water Sources and Water Distribution Systems

- Water can be contaminated at the source, or it can become contaminated in the distribution system
- Mapping all water distribution systems is recommended
- Water sources and distribution systems **MUST** be inspected at least annually
- You **MUST** keep water sources free of debris, trash, wild and domesticated animals, and other hazards
Evaluating Water Quality: Use of Microbial Water Quality Profiles

• Testing is the only way to quantitatively evaluate the microbial quality of the water
• The water quality profile can help you understand:
  – long-term quality of source water
  – appropriate uses for each source
  - if corrective measures are needed
  - if the microbial water quality profile exceeds GM and STV criteria in the FSMA Produce Safety Rule

Generic E. coli is an Established Indicator

• *Escherichia coli* (Generic E. coli) is the indicator used to measure water quality in the FSMA Safety Produce Safety Rule
• It is an indicator of fecal contamination
• It is not a direct measure of the presence of human
Microorganisms that can be found in the human or animal feces

**Most coliforms are harmless.**

Some, but not all, *E. coli* can cause human illness *(pathogenic)*

- Generic *E. coli* is an indicator of **fecal** contamination
- *E. coli* is not a direct measure of the presence of human pathogens
- *E. coli* is the indicator used to measure water quality in the FSMA Produce Safety Rule

Pathogenic *E. coli* found in some feces  
Generic *E. coli* found in most feces (most are harmless)

- *E. coli O157* (bacteria)
- *Salmonella* (bacteria)
- *Listeria* (bacteria)
- Hepatitis A (virus)
- *Cryptosporidium* (protozoa)
Water Quality Criteria for Water Used During Growing Activities

• Apply to water used with a direct water application method to covered produce
• Each source of production water MUST be tested to evaluate whether its water quality profile meets the following criteria:
  - Geometric mean (GM) is 126 or less E. coli colony forming units (CFU) per 100 mL water
  AND
  - Statistical Threshold Value (STV) is 410 or less CFU E. coli per 100 mL water

Geometric Means and Statistical Threshold Values

• Test results MUST be used to calculate Geometric Means (GM) and Statistical Threshold Value (STV)
• GM is a log-scale average (the “typical” value)
• STV is the is a measure of variability, the estimated “high range” value (approximately 90 percent of samples are below this value)
In the image below, the water is in compliance with the GM and STV

Tools are available to help calculate these values
Requirements for **Public Water Sources**
- Testing not required -

### Testing Requirements

- None
- Copy of test results or current certificates of compliance is adequate

- With appropriate documentation, there is **NO** requirement to test water that meets the requirements for public water supplies.

---

**Microbial Water Quality Profile:**
Survey of **Ground Water Sources**

### Testing Requirements

- Initial and annual testing required
- 4 or more times during the growing season or over the period of a year
- 1 or more samples rolled into the profile every year after initial year

- Profile samples **MUST** be representative of use and **MUST** be collected as close in time as practicable to, but before, harvest
Microbial water quality profile: 
Survey of Surface Water Sources

**Initial and Annual Testing Requirement**

- 20 or more times over a period of 2 to 4 years
- 5 or more samples rolled into the profile every year after initial survey

- Profile samples **MUST** be representative of use and **MUST** be collected as close in time as practicable to, but before, harvest.

**Where Do I Collect Samples?**

- **Surface water and ground water:**
  - Take a representative sample appropriate for the water source

- **Municipal/public water supply:**
  - No sampling required but testing reports should be obtained from the water utility, treatment plant, or lab
  - Optional sampling at different points in the farm’s internal distribution system can be useful
How Do I Collect Samples?

- Follow all sample submission instructions from the laboratory
- A sterile bottle **MUST** be used to collect samples
- Do not rinse bottle before sampling
- In a distribution system, allow the water to run before sampling in order to collect a representative sample

Where Do I Go For Testing?

- Find a lab that is certified by state and local environmental agencies, or third-party accreditors
- Be certain it can provide the test you need
  - Quantitative analysis using Method 1603 (modified mTEC), or other FDA approved methods
  - The upper limit of the test **MUST** be high enough to measure your water quality and to calculate profile statistics
- Be sure the lab provides instructions for acceptable sampling containers, hold times, and storing and transportation expectations.
Corrective Measures

Three types of corrective measures are allowed if the microbial water quality profile does not meet water quality criteria:

1. Apply a term interval for microbial die-off,
   i. Between last application and harvest
   ii. Between harvest and end of storage and/or removal during commercial washing
2. Re-inspect the water system, identify problems, and make necessary changes and confirm effectiveness
3. Treat the water

Corrective Measures: Water Application and Timing

- Risks may from production water may be reduced by maximizing the time between last application and harvest.
- One option for a corrective measures is to use a microbial die-off rate of 0.5 log per day between last application and harvest for up to four consecutive days

*This is important if your initial water quality profile does not meet GM and STV criteria!*
31 **Corrective Measure: Re-inspection and Corrective Actions**

- If there is a problem with your water, be cautious until you know more!
- Re-inspect the water system for contamination sources
  - Manure runoff, migratory birds, septic tank leaching
- Use corrective actions that address contamination sources under your control
  - Keep in mind state, county, and federal regulations
- Implement strategies to prevent contamination from happening again
- Confirm that the changes were effective

32 **Corrective Measure: Treating Production Water**

- Any chemicals used to treat water **MUST** be EPA registered and labeled for their intended use
- Non-chemical treatments, called pesticide devices by EPA, may be used if they adequately reduce microbial risks
  - such as filter units, UV light units, ozonator units
- You should avoid water treatments that may have negative environmental and soil quality impacts
- You **MUST** keep records for all monitoring done
Corrective Actions Needed?
Unintentional Water Contact

• Broken Emitters and Other Water Application Issues
  – What is known about the quality of the water? How close is harvest?
• Human Mistakes
  – Spray applications accidentally mixed with untreated surface water
  – Forgetting to turn off irrigation pumps, may result in in-field flooding
• Flood Events
  – If the produce has come in contact with flood water from overflowing streams or open bodies of water, it is considered adulterated by the FDA and cannot be used for food
  – Contact with flood water that is not part of a natural disaster may be subject to provisions of the FSMA Produce Safety Rule
Microbial Water Quality Profile:

**Surface Water**

**START:**
Establish initial water quality profile
At least 20 samples over 2-4 years

**ANNUALLY AFTER START:**
Collect at least 5 samples for analysis
Insert annual data into rolling data set

**IF YOUR WATER CHANGES:**
If the water quality profile no longer represents the quality of the water source, establish a new profile

**IF YOUR PROFILE DOES NOT MEET GM OR STV CRITERIA:**
As soon as practicable and no later than the following year, discontinue use of the water unless an allowed corrective measure is applied

**ALLOWED CORRECTIVE MEASURES:**
1. Apply a time interval to allow die-off (before harvest or end of storage) or removal
2. Re-inspect the water system, identify problems, and make necessary changes
3. Treat the water

---

Microbial Water Quality Profile:

**Ground Water**

**START:**
Establish initial water quality profile
At least 4 samples over 1 year

**ANNUALLY AFTER START:**
Collect at least 1 sample for analysis
Insert annual data into rolling data set

**IF YOUR WATER CHANGES:**
If the water quality profile no longer represents the quality of the water source, establish a new profile

**IF YOUR PROFILE DOES NOT MEET GM OR STV CRITERIA:**
As soon as practicable and no later than the following year, discontinue use of the water unless an allowed corrective measure is applied

**ALLOWED CORRECTIVE MEASURES:**
1. Apply a time interval to allow die-off (before harvest or end of storage) or removal
2. Re-inspect the water system, identify problems, and make necessary changes
3. Treat the water
Reviewing Test Results

- If your water test results are higher than expected, take action as soon as possible!
  - Investigate water sources for possible causes
    - Manure application and run-off
    - Fecal contamination from wildlife, migratory birds
    - Incorrect/inadvertent cross connections
    - Wellhead impacts
  - Implement practices to reduce risks

Visualize Water Quality Trends

Looking for data trends in your water test results can help identify possible risks in your water source.

![Seasonal Water Testing Results Graph]

Unusually high test result
## Evaluating Risks: Example 1

<table>
<thead>
<tr>
<th>What Is Your Water Source?</th>
<th>How Do You Apply Water?</th>
<th>When Do You Apply Water?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface</td>
<td>Overhead Applied using a direct water application method</td>
<td>Near Harvest</td>
</tr>
</tbody>
</table>

## Evaluating Risks: Example 2

<table>
<thead>
<tr>
<th>What Is Your Water Source?</th>
<th>How Do You Apply Water?</th>
<th>When Do You Apply Water?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface</td>
<td>Drip Not a direct water application method for this crop</td>
<td>Near harvest Irrigated up to and during harvest</td>
</tr>
</tbody>
</table>
Recordkeeping

- Keep required records such as:
  - Findings of the inspection of water system
  - Water test results
  - Monitoring of water treatments
  - Corrective measures taken, if any
  - Scientific data or information to support compliance (including treatment, calculations, and testing)
  - Scientific data or information to support alternative indicators, criteria, or sampling frequencies
Summary

• Contaminated agricultural water has been implicated in some foodborne outbreaks associated with fresh produce

• Knowing the water quality through long-term testing will help establish management practices for appropriate use of the water

• If the water IS NOT applied by a direct application method to the harvestable portion of the crop, the risks are lower

• Extend time between last application of water and harvest to reduce risks, if water quality is a concern

•Treating water is an option to reduce risks

• Keep copies of all water test results

• Document all water management practices
Module 5:
Part 2—Postharvest Water

Learning Objectives

• Understand the required quality of water for harvest and postharvest activities
• Identify ways water may become contaminated
• Describe cross-contamination and infiltration
• Understand the purpose of using antimicrobial products, including sanitizers
• Describe practices to maintain and monitor the quality of water used in postharvest activities
• Identify records needed to properly document and monitor water quality
• Describe corrective actions to use if postharvest water does meet microbial criteria
Why Focus On Postharvest Water?

• Cannot eliminate every food safety risk in the field
• Postharvest water has the potential to spread contamination widely

Many Postharvest Water Uses

• Rinsing/washing
• Commodity movement (i.e., dump tanks/flumes)
• Cooling
• Ice making
• Postharvest fungicide and wax
• Handwashing
• Cleaning and sanitizing
Postharvest Water Management

• Water
  – You MUST know initial quality and intended use
  – How water interacts with a treatment, if used

• Antimicrobial products, including sanitizers
  – Adding a sanitizer to water is NOT intended to “wash” the product, but instead to prevent cross-contamination
  – MUST be labeled for intended use, such as in water or for contact with fruits and vegetables
  – Many sanitizers are available, including organic options

Cross-Contamination

• Pathogens may be introduced by other produce, non-produce material in or on harvest containers, water, food contact surfaces, or other sources
• Anything that comes in contact with produce could result in cross-contamination including:
  – Worker’s hands
  – Worker clothing
  – Produce containers, packing tables, conveyor belts
  - Water
  - Tools
Water Quality Criterion for Harvest and Postharvest Activities

- Water used for the following **MUST** have NO detectable generic *E. coli* per 100 mL sample
  - Direct contact with covered produce during or after harvest
  - Direct contact with food contact surfaces
  - To make ice
  - For handwashing
- Untreated surface water **MUST NOT** be used for these purposes

What is Required for Testing Untreated Ground Water and Public Water Sources Used for Postharvest Uses?

<table>
<thead>
<tr>
<th>Source</th>
<th>Testing Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated Ground Water</td>
<td>4 or more times during the growing season or over the period of a year 1 or more tests per year after initial year</td>
</tr>
<tr>
<td>Public Water Supply</td>
<td>Copy of test results or current certificates of compliance</td>
</tr>
</tbody>
</table>
Recirculated and Batch Water

- **MUST** have no detectable *E. coli* in a 100 mL sample at the beginning of use
- Safe and adequate sanitary quality of water **MUST** be maintained throughout use
- Treatment is **NOT** required but can be effective for maintaining water quality and to reduce cross-contamination risks
- Any antimicrobial products used in the water **MUST** be EPA labeled for use with fruits and vegetables
- A schedule **MUST** be established for changing batch water or a process in place for minimizing build-up of organic material
Key Water Quality Variables

- **Quality at start of use**
  - No detectable generic *E.coli* in 100 mL of sample

- **pH**
  - Can impact the effectiveness of antimicrobial treatments

- **Temperature**
  - **MUST** be monitored to minimize potential for infiltration

- **Turbidity**
  - Can be used to manage water change schedule

---

Monitoring pH

- Water pH can affect the efficacy of sanitizers, especially chlorine

- There are many ways to monitor pH
  - e.g., pH test strips, handheld pH meters, and titration kits

- Adding chlorine and other sanitizers may change the pH of water
  - You **MUST** monitor the treatment
  - You should adjust pH as needed based on the optimal pH range for effective use of your sanitizer
Temperature

- Temperature differences between produce and bulk tank water may cause infiltration
  - If bulk tank (postharvest) water is contaminated, pathogens can enter the produce with infiltrating water, resulting in a food safety risk
  - Temperature **MUST** be monitored to minimize potential infiltration risk

- Temperature can also affect the efficacy of the antimicrobial products, including sanitizers

If postharvest water temperature is too high and pH is too low, toxic chlorine may ‘gas off’ and become a health hazard for workers.

Background on Infiltration Risk for Susceptible Produce

- Infiltration can increase with deeper submersion and longer contact time
- Wounded or bruised fruit can have a greater risk of infiltration
- Risks can be higher when the produce is warmer than the tank water

Photo shows colored dye from water moving into produce pulp due to infiltration.
Turbidity (Cloudiness)

- Turbidity can be used to indicate when you should change your wash water
  - Monitor your water and change when you reach your set limit
- Methods to monitor turbidity include
  - turbidity meters and the Secchi disk method
- Turbid water may reduce treatment effectiveness
  - May need to add more sanitizer to maintain effectiveness
  - Can affect the accuracy of sanitizer and pH readings

When Should I Change My Water?

- Post-harvest water quality **MUST** be managed, including changing water when necessary
- Water changing schedules should consider:
  - Organic load (soil, leaves, decaying or damaged product)
  - Turbidity measurements
  - Volume of produce
  - Type of produce
  - Type of antimicrobial product
  - Type of equipment
  - Product flow and operating conditions
Choosing an Antimicrobial Product, Including Sanitizers

• Chlorine sanitizers are commonly used
  – Affordable and available
  – Corrosive, highly reactive
• Many non-chlorine chemical options
  – Ozone, peroxyacetic acid, hydrogen peroxide, etc.
• Organic formulations are available
  – Tsunami, Spectrum, Sanidate, VigorOx 15 F&V, etc.
  – Check with organic certifier
• **MUST** be labeled for use on produce

Disposal of Used Water

• Waste water from produce washing or cooling **MUST** be disposed of properly so that it does not serve as a source of contamination to covered produce and fields used to grow covered produce
• Handwashing stations should have catch basins if not connected to a drain
• Check state, local and EPA regulations on discharging water into sewers, leach fields, and/or surface waters
Follow the Label!

- Always read and follow label instructions
- You MUST use the product only as labeled
  - Direct contact with produce vs. food contact surface
- You should use the correct amount of antimicrobial product (in ppm or other measurement)
- Understand factors that affect efficacy
  - Temperature, pH, sunlight, and how it is affected by organic load

Below is just one example of a sanitizer product approved for use by EPA for use in fruit and vegetable wash water. There are several other approved sanitizers from other companies. Check the label or accompanying literature before using!

PUMA (EPA Reg. No. 5813-100)
[REGISTERED AS (Clorox® Regular-Bleach) (Clorox Commercial Solutions®)]
FOR FRUIT & VEGETABLE WASHING
It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Thoroughly clean all fruits and vegetables in a wash tank. Prepare a sanitizing solution of 25 ppm available chlorine. After draining the tank, submerge fruit or vegetables for 2 minutes in a second wash tank containing the recirculating sanitizing solution. Spray rinse vegetables with the sanitizing solution prior to packaging. Rinse fruit with potable water only prior to packaging.

25 ppm Solution
1/4 tsp bleach per 1 gallon water
2 tsp bleach per 7.5 gallons water
Monitoring Antimicrobial Treatments Including Sanitizer Levels

• Each sanitizer will have specific ways to monitor its levels
  – Use the right monitoring tools
  – May be automated or manual

• Any water treatment, including use of sanitizer, MUST be monitored during treatment

• Check with the supplier if you have any questions

• Monitoring can include tools such as Oxidation-Reduction Potential (ORP) sensors

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Oxidation Reduction Potential (ORP)

• ORP sensors can be used to monitor some antimicrobial product levels in water systems

• ORP is measured in millivolts (mV) rather than monitoring sanitizer concentration (e.g., ppm)

• 700-825 mV is the target range for controlling cross-contamination in water with chlorine based sanitizers

• Handheld sensors are effective in small scale systems, but invest in the best quality sensor you can afford
Examples of SOPs for Postharvest Water Management

- Monitoring and adding antimicrobial product
- Monitoring and modifying pH
- Monitoring water and pulp temperatures
- Monitoring turbidity and changing/adding water
- Calibrating thermometers and sensors

Examples of When Corrective Actions Are Needed

- Monitoring indicates that water sanitation procedures are not working
  - Antimicrobial treatment is below the effective level
  - Sanitizer inventory is used faster than expected
  - pH readings are not in correct range
- Workers report a problem
- Monitoring and recordkeeping sheets are not correct
Recordkeeping

- Helps document all water management activities
  - Water quality tests, antimicrobial product use, monitoring, and corrective actions
- Allows management to see that monitoring practices are being completed and working properly
  - Monitoring sanitizer levels, pH, turbidity, water changes, etc.
- Identifies patterns/trends to determine the best

Summary

- Postharvest water management can help prevent a small contamination event from becoming a BIG one
- For harvest and postharvest uses, use only water that has no detectable generic *E. coli* in a 100 mL water sample
- Consider adding a sanitizer to postharvest water
- Develop SOPs for key water management steps
- Monitor key variables of both the water and any sanitizer used to ensure postharvest water quality
- Take corrective actions when needed
- Keep detailed records
Module 6: Postharvest Handling & Sanitation
Module 6: Postharvest Handling & Sanitation

Learning Objectives

- Identify potential routes of contamination associated with harvest and postharvest activities
- Identify practices that reduce risks
- Identify the steps involved in cleaning and sanitizing food contact surfaces
- Define key parts of a pest control program
- Describe key practices for transporting fresh produce that will reduce contamination risks
- List key practices that need to be monitored during postharvest activities
- Describe corrective actions that reduce risks
- Identify key records to document practices
## Keeping Things Clean

- Continue produce safety practices by keeping things clean during harvest and postharvest handling.
- Consider everything that touches or impacts produce:
  - Packing and picking containers
  - Packing equipment
  - Hands and clothing
  - Postharvest water
  - Buildings (i.e., coolers, storage areas)
  - Transport vehicles

## Sanitation Practices

### Basic Concepts
- Using basic housekeeping practices
- Providing facilities and training workers so practices are implemented properly
- Eliminating pests and debris
- Minimizing standing water

### Cleaning and Sanitizing
- Use a 4 step cleaning and sanitizing process when possible for equipment and tools such as harvest containers, packing tables, and packing lines
6  **Worker Training for Harvest and Postharvest Practices**

- Workers must never harvest covered produce contaminated with feces
- Workers must never harvest or distribute dropped covered produce
- Worker health and hygiene practices should include:
  - Wear clean clothing and footwear
  - Follow glove, hairnet, and jewelry policies
  - Use worker break areas, handwashing stations, and restrooms

7  **Not All Packing Areas Are The Same**

**Open**
Open to the environment, may or may not be covered

**Closed**
Has doors and windows, with some ability to control entry into the building
Reduce Risks in All Packing Areas

Keep it clean

- Have proper hygiene facilities for workers

Provide break areas

- Pest management

Avoid standing water

- Keep it organized

Worker Training for Harvest and Postharvest Practices

- Workers must never harvest covered produce contaminated with feces
- Workers must never harvest or distribute dropped covered produce
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Not All Packing Areas Are The Same

- Open to the environment, may or may not be covered
- Closed has doors and windows, with some ability to control entry into the building
Assessing Risks in Packing Areas

- Map the flow of produce from the field through the packing area into storage and out to transportation
- Identify areas where produce may directly contact surfaces and equipment (Zone 1)
- Identify other areas that may introduce food safety risks such as equipment surfaces near food contact surfaces, floor drains, or adjacent land uses (Zones 2, 3, and 4)

Zones in the Packinghouse

Zones help prioritize cleaning and sanitizing efforts by designating areas or “Zones” within the packing area

- **Zone 1** (direct food contact surface)
- **Zone 2** (outside surface of washer)
- **Zone 3** (floor)
- **Zone 4** (outside)
Zone 1: Direct Food Contact Surfaces

- Zone 1 is the biggest concern because if contaminated, it could result in cross-contamination of the produce
- Includes harvest/storage bins, workers’ hands, conveyors, belts, brushes, rollers, sorting tables, racks, and utensils
- Initial efforts should be focused on Zone 1 since it has the most immediate impact on safety

The other Zones: 2, 3, & 4

- Are important because they may contribute to contamination of Zone 1
- Best managed by established cleaning schedules that ensure areas adjacent to or outside of Zone 1 do not introduce contamination
<table>
<thead>
<tr>
<th>Zone 2</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Surfaces and areas in close proximity to the produce and food contact surfaces</td>
<td></td>
</tr>
<tr>
<td>• Not direct food contact surfaces</td>
<td></td>
</tr>
<tr>
<td>• Includes internal and external parts of washing or processing equipment such as sidewalls, housing, or framework</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Zone 2</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Areas inside of the packinghouse</td>
<td></td>
</tr>
<tr>
<td>• Includes trash cans, cull bins, floors, drains, forklifts, phones, foot traffic areas, catwalks or storage areas above packing areas</td>
<td></td>
</tr>
<tr>
<td>• May contribute to spreading contamination due to proximity to food contact surfaces and produce</td>
<td></td>
</tr>
</tbody>
</table>
Zone 4

- Areas outside of or adjacent to the packing area
- Includes loading docks, warehouses, manure or compost piles, and livestock operations
- May provide opportunities for contamination to enter the packing area

Develop Sanitation Practices That Reduce Your Risks

- Implement practices that reduce the risks identified through your risk assessment
- Practices may include:
  - Implementing or reinforcing worker training
  - Establishing pest control programs
  - Cleaning and sanitizing food contact surfaces
  - Converting to equipment that can be easily cleaned and sanitized
  - Cleaning and maintaining coolers
  - Cleaning transportation vehicles
Cleaning vs. Sanitizing

What is the difference and why does it matter?

- **Cleaning:** Physical removal of dirt (soil) from surfaces which can include the use of clean water and detergent
- **Sanitizing:** Treatment of a cleaned surface to reduce or eliminate microorganisms

**Step 1:** Remove any obvious dirt and debris

**Step 2:** Apply an appropriate cleaning chemical (e.g. detergent) and scrub

**Step 3:** Rinse the surface with clean water

**Step 4:** Apply a sanitizer

**Important points:**

You cannot sanitize a dirty surface.

Cleaning always comes first!
18 Cleaning & Sanitizing Food Contact Surfaces

- **Step 1:** Remove any obvious dirt and debris from the food contact surface

1. Remove Deposited Soil & Potential Pathogens
2. Food Contact Surface

19 Cleaning & Sanitizing Food Contact Surfaces

- **Step 2:** Apply an appropriate detergent and scrub the surfaces

2. Apply Detergent
3. Apply Scrub
Cleaning & Sanitizing Food Contact Surfaces

• **Step 3**: Rinse the surface with clean water, making sure to remove all the detergent and soil

• **Step 4**: Apply a sanitizer approved for use on food
Best Case Scenario

Sanitary Equipment Design:

- **Food contact surfaces should be:**
  - Non-toxic, non-absorbent
  - Durable, able to withstand corrosion
  - Able to be easily cleaned and sanitized

- **Equipment should be designed and installed to facilitate cleaning and sanitizing**
  - Easy access to equipment and adjacent spaces
  - Able to remove or access brushes, rollers, and nozzles for easy cleaning and sanitizing
Best Case Is Not Always Possible

- Many farms have old or wooden equipment that is not easy to clean or sanitize. All hope is not lost!
  - Most things can be cleaned, even old equipment!
  - Keep equipment clean (sanitize when necessary)
  - Establish cleaning schedules that reduce contamination risks and prevent biofilm formation
  - Air dry wooden surfaces after washing
  - Equipment and tools that cannot be maintained or cleaned properly may need to be discarded
  - Be sure new equipment and buildings are designed to be easily cleaned and sanitized
Retrofitting Equipment

• Make sure changes or modifications to equipment will not result in an increased risk of contamination
• Use materials that can be cleaned and sanitized
  – No carpet or materials that cannot be cleaned or do not dry
• Consider consulting a sanitation expert if you wish to use equipment for a new purpose or for which it was not designed
• When possible, invest in the right equipment rather than modifying equipment

Reduce Risks BEFORE Entering the Packing Area

• Clean harvest bins before using them
• Develop practices to minimize harvest bin contact with the soil before entering the packing and storage areas to reduce:
  – Risk of contamination in packing and storage areas
  – Accumulation of organic matter in the wash water
  – Frequency of which wash water needs to be changed
  – Risks when stacking produce bins on top of each other
Packing Area Maintenance

- Regularly inspect and maintain equipment to avoid:
  - Cracked hoses, torn rubber door seals
  - Standing water
  - Dirty conveyor belts, brushes, and rusty equipment
  - Condensation: Especially from walls, ceilings, cooling equipment, and pipes over packing lines and in storage areas

- All workers MUST be trained so they know how to identify and reduce risks

Packing Containers

- Only new, single-use containers or cleaned, reusable containers should be used to pack produce

- Packing containers and materials should be stored in a covered area, off the floor, to reduce the risk of contamination from pests, windblown dirt, and other contaminants
### Excluding and Discouraging Pests

- Inspect all walls, doors, windows
  - Repair holes and seal any cracks between floors or walls
  - Make sure door seals are in place to event pest entry

- Deter birds from roosting in rafters with nets or spikes

- Keep doors and windows closed as much as possible

- Cut grass around packing area

- Remove cull piles and garbage everyday, and as needed throughout the day

- Keep produce covered, when possible

### Pest Management

- Traps can help monitor and reduce pest activity
  - Identify all trap locations on a map
  - Place traps along walls of packing or storage operations
  - Check traps regularly and keep records
  - Do not use bait inside the packing area

- Store pallets of produce at least 12” from walls to aid in visual inspection and trap monitoring

- Train all workers to report any pest problems they see

- Be sure your pest control program is controlling the pests!
### Cold Storage Areas

- Inspect regularly to ensure the area is clean and cooling equipment is functioning properly
  - No condensation or dripping on produce
  - Door and window seals are intact
  - Cooler temperatures are monitored and recorded at the beginning of each day
- A cleaning and pest management program should be established for all storage areas
- Cooling is not required, but if used, do it properly!

### Ice and Ice Slurries

- If ice or ice slurries are used for postharvest cooling, it must be made from water that is free of detectable generic *E. coli*/100 mL water
- Equipment used to make and distribute ice should be cleaned and sanitized on a regular schedule
- Ice should be stored in clean containers
- Do not stack boxes containing iced produce above other boxes to avoid dripping and cross-contamination risks
Transportation Considerations

• Many different types of vehicles are used to transport fresh produce
  – Open trucks, closed trucks, vans, wagons
• Some farms may use vehicles for any farming purposes and for personal use
  – Vehicles must be cleaned before hauling produce
  – A clean liner may be used as a barrier if adequate to prevent contamination

Inspecting Vehicles

• All vehicles used to transport produce should be inspected prior to loading to make sure they are clean and free from physical debris and off odors
• If hiring transportation, make cleaning, sanitizing, and documentation a part of your contract requirements
• If refrigeration is required, the inspection should include making sure the refrigeration units are functioning properly and at the proper temperature prior to loading
Standard Operating Procedures

• SOPs guide cleaning and sanitation practices and help ensure they are done correctly

• SOPs can be developed for:
  – Monitoring for pests
  – Preparing cleaning and sanitizing solutions
  – Cleaning and sanitizing produce washing lines
  – Cleaning and monitoring cold storage areas
  – Inspecting trucks prior to loading fresh produce
  – Cleaning vehicles used to transport fresh produce

Are Microbial Risks the Only Ones

• Most of the contamination of fresh produce is caused by microorganisms
  – e.g., *E. coli* O157:H7,
  *Salmonella, Listeria monocytogenes*

• BUT, there are two other types of contamination issues to consider
  – Chemical risks
  – Physical risks
Chemical Food Safety Risks

• Chemical hazards include pesticides, detergents, sanitizers, and other chemicals used on the farm

• To reduce chemical food safety risks:
  – Keep chemicals locked and stored in an area away from produce packing and storage areas
  – Train workers and develop detailed SOPs for them to follow
  – Keep MSDS on site in case of an emergency
  – Use only food grade lubricants, oils, and chemicals according to their labeled use
  – Use non-reactive materials that will not leach into produce

Physical Food Safety Risks

• Include wood, metal, glass, plastic, buttons, pins, or other foreign objects that can end up in the produce

• Reduce physical food safety risks by:
  – Screening or covering overhead light bulbs or replace with shatterproof fixtures
  – Inspect bearings and other moving equipment to make sure they are in good working condition and not introducing metal parts or pieces into the fresh produce
  – Cover packing materials and produce containers to reduce the risk of physical hazards entering
Corrective Actions

- If a food safety risk is identified in the produce packing, storage, or transportation vehicles:
  - Immediately assess the situation
  - Has produce been affected?
  - Can it still be sold or does it need to be thrown away?
  - Determine the cause of the problem
  - What needs to be done to correct it?
  - Adjust practices to address risks, keep records, and monitor to make sure the corrective actions have fixed the problem

Examples of When Corrective Actions Should be Considered

- Pest infestation
- Contamination of the packing line with blood when a worker cuts their finger on a sharp metal edge
- Drain backs up into the produce handling area
- Other situations that pose an immediate contamination risk to produce
Recordkeeping

- As always, records are critical to ensuring the job gets done and is completed properly
- Recordkeeping for postharvest handling and sanitation MUST include cleaning and sanitizing of
  - Equipment,
  - Containers
  - Tools
- Additional records may include:
  - Pest management and monitoring
  - Building maintenance and monitoring
  - Worker training
  - Sanitation SOPs
  - Packing area and cold storage cleaning and monitoring
  - Vehicle cleaning and inspections prior to loading

Corrective Actions

- If a food safety risk is identified in the produce packing, storage, or transportation vehicles:
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Summary

• All packing areas, regardless of age or design, must have sanitation practices that minimize contamination risks

• Identify all of the food contact surfaces as produce moves through the packing and storage areas—focus on keeping these surfaces clean as a first priority

• Cleaning and sanitizing are not the same thing

• You cannot sanitize a dirty surface

• Food safety practices such as cleaning, general maintenance and housekeeping, and pest control need to be in place to reduce risks
Summary

• All packing areas, regardless of age or design, must have sanitation practices that minimize contamination risks.

• Identify all of the food contact surfaces as produce moves through the packing and storage areas. Focus on keeping these surfaces clean as a first priority.

• Cleaning and sanitizing are not the same thing.

• You cannot sanitize a dirty surface.

• Food safety practices such as cleaning, general maintenance and housekeeping, and pest control need to be in place to reduce risks.
Module 7:
How to Develop A Farm Food Safety Plan
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How to Develop A Farm Food Safety Plan

Learning Objectives

• Name the essential parts of a Farm Food Safety Plan
• Describe why one qualified person should be designated as the person responsible for the Farm Food Safety Plan on every farm
• Conduct a risk assessment of the farm’s practices and environment
• Describe management steps and practices to reduce risks
• List key steps involved in developing a traceability system including establishing lots and clean breaks
• Identify resources available to assist in developing a Farm Food Safety Plan
Farm Food Safety Plans

• The FSMA Produce Safety Rule does not require a written Farm Food Safety Plan

• However, writing a Farm Food Safety Plan was identified by PSA Working Committees as a critical component to implementing produce safety practices effectively

• This module will outline considerations when writing a Farm Food Safety Plan by incorporating both GAPs and FSMA Produce Safety Rule requirements

Reasons for a Farm Food Safety Plan

1. Gets you organized and focused on food safety

   • Describes risks you have identified and actions to address those risks
   
   • Defines your practices, policies, and SOPs

   • Efficient and effective use of your time and resources by prioritizing most important risk reduction steps

2. Best way to be prepared!

   • Buyer questions/requirements
   
   • Third party audits
   
   • Food safety regulations
6  YOU Can Identify and Reduce Risks!

• Each farm is unique
  – Practices to reduce risks will be specific to your farm
  – Best done by someone who knows the farm and how it operates

• Each commodity is different
  – Grows on the ground or in trees
  – Harvest by hand or by machine
  – Single vs. multiple harvests

7  Who Is YOUR Food Safety Person?

• Each farm should have one person to lead the development of the Farm Food Safety Plan
  – Will be supported by others on the farm
  – May need a back-up in case the person is unavailable
• Should have food safety training and experience to know how to assess risks and develop a plan
• Should have the authority to make necessary changes and invest in resources to reduce risks
• Should make sure the plan is implemented
• Should be willing to be the farm food safety contact
Knowledge Is Your Friend!

- Writing a plan can be difficult – begin with information you know
  - Start with your general farm information and what you do
- Some basic food safety knowledge is key!
  - Assessing risks requires understanding risks and this requires knowledge and information
  - For many growers, preparing a detailed, written Farm Food Safety Plan may be a new practice

Farm Food Safety Plan Parts

- Farm name and address
- Farm description
  - Commodities grown, farm size, etc.
- Name and contact information for the farm food safety manager
- Risk assessment of practices and environmental conditions on your farm that impact food safety
- Practices to reduce food safety risks
- Records that document practices
Other Items to Include In Your Farm Food Safety Plan

- Farm maps
- Farm policies
- SOPs
- Training records
- Agricultural water test results
- Emergency contact information
- Supplier and buyer information
- Traceability and recall plans
- Contact info for contracted services

Step 1: Assessing Risks

- Review all farm operations to identify practices and conditions that may contribute to or increase produce safety risks
- Review the farm environment and adjacent land
- Focus on microbial, chemical, and physical risks
- Identify risks that are most likely to occur, noting the ones that could happen often
  - Because time and money are limited, prioritize which risks to address first
Ranking Your Risks

- Risks that can lead to whole crop contamination
- Risks that have caused previous outbreaks
  - e.g., Contamination from postharvest water, wildlife fecal contamination
- New or modified farm production practices that may increase risks
  - e.g., Hiring new people, changing processes, retrofitting equipment, changing suppliers

Step 2: Develop Practices to Reduce Risks

- Develop practices that will reduce identified risks
  - Use resources and ask for help if you are not sure!
- Know what resources are required to successfully implement practices
  - Human resources (time and/or people)
  - Equipment or infrastructure (may require changes/ upgrades)
  - Disposables (hand soap, paper towels, etc.)
- Create a list of tasks/steps that need to be done
- Designate a person (s) to be in charge of each task
Step 3: Document and Revise

- Write a plan to guide implementation of practices
- SOPs and policies will outline what needs to be done for those who are responsible for completing the task
- Build recordkeeping into the logical flow of activities
- Revise your plan if it is not working or when practices change
- Review and update your plan at least annually, or whenever practices, personnel, or equipment changes

Educational Resources

- There are many educational resources available to help you write a Farm Food Safety Plan
- Resources are available through:
  - Land grant institutions and extension programs
  - Industry or commodity specific guidance
  - Produce trade associations
  - Federal guidance
  - Independent organizations
- A list of educational resources are provided in your training materials
Food Safety Plan Writing Resources: Be sure to make them your own!

- There are many available resources, including templates
  - pick which one works best for you
- Tailor templates to meet your needs
- Template plans, recordkeeping logs, and SOPs give you someplace to start and are easier than building the plan from scratch
- Be sure to make it your own so you know what is in the plan and that it will work for you

A Few Thoughts About Your Plan

- Only include practices you are doing on your farm
- Do not include things you wish you were doing
- Does not need to be long or complicated
- Pick practices and schedules you know you can do
- Focus on risk reduction!
Final Steps

You have written your plan, your practices are in place, records are being kept, and delicious, high quality, safe produce is being grown and packed.

So now what?

TRACEABILITY

The Value of Traceability

• Following quality
  – Identifying boxes that have quality issues

• Keeping track of amount sold
  – Knowing what sold well and how much money you should be making

• Minimizing foodborne illness impacts
  – Recalling a contaminated load/lot/bin
  – Knowing how much was sold and in the marketplace
  – Knowing who may have purchased/consumed it
Product Tracing: One Step Forward, One Step Back

- Traceability means identifying where the produce came from including inputs (one step back) and where it went (one step forward)
- For growers, this means knowing the field where it was grown (step back) and the buyer (step forward)
- This does not mean you are responsible for the entire system especially if there are multiple steps to the consumer

Understanding a “Lot”

- Product tracing requires defining and following a distinct portion of the crop. This is called a lot.
- A lot is a distinct and limited portion of a crop
  - e.g., all of the same commodity harvested on the same day from the same field
  - It may require establishing a ‘clean break’
- Difficult issue: How big should the lot be?
  - If there is a problem, the whole lot will be recalled, so the bigger the lot, the bigger the recall
Developing a Lot Code

- Can be numbers or letters, or a combination of both (alpha-numeric)
- Should be:
  - able to identify specific details about the lot – e.g. farm, field of origin, harvest date, and more
  - unique to a specific lot
  - able to follow the lot
  - attached with a label, stamp, or sticker to the sellable container (such as a box)

Steps to Developing a Lot Code

- To begin developing a lot code, growers should identify:
  - Field locations
  - Commodities and varieties grown
  - A method for indicating harvest and/or pack date
  - Harvest/packing crews
A Lot Code Could Identify

- Commodity including type (e.g., Empire apples)
- Farm/field/block of origin
- Agricultural inputs applied
- Harvest date
- Harvest crew
- Packinghouse used (if any)
- Packing date (if different from harvest date)
- Packing crew (if different from harvest crew)

Traceability Example

Farm Location: 10 (Rose Farm)
Block: 01
Fruit Type: 01 (Apples)
Variety: 05 (Empire)
Harvest Date: 284 (Julian date)
Labeling

- Each container/lot leaving the farm should be identifiable
- Attaching the lot code to the lot
  - Many ways to get it done
  - Stickers, stamps, bar codes
  - Boxes, clamshells, or individual pieces
- Determine the best system for your farm
  - Size, markets, costs, infrastructure
  - Electronic or paper

Labeling: FSMA Modified Requirements for Growers Who May Be Exempt

“MUST prominently and conspicuously display, at the point of purchase, the name and complete business address of the farm where the produce was grown, on a label, poster, sign, placard...”
Testing Your Traceability System: Conducting a Mock Recall

Steps in a mock recall

1. Select a lot code for produce that has been sold
2. Call a buyer that received some or all of the lot
3. Tell them you are conducting a MOCK recall
4. Ask how much of the product is in stock and how much has been sold. Document the response.
5. Trace the lot in your records (e.g., field of origin, harvest crew, spray records)
6. Can you trace it backward and forward? Yes? good! No? figure out the problem. Either way, document it!

Check with your buyer to determine what requirements they have, if any, for mock recalls!
Summary

• The best person to write the plan is someone who knows the farm and has food safety knowledge
• Identify someone to be in charge of food safety
• Farm Food Safety Plans should include assessing risks, any actions taken to reduce risks, and recordkeeping
• Simple is best: Write what you do, not what you hope to do
• Traceability = one step forward and one step back, as well as inputs to the crop throughout production
• Establish lots, lot codes, and labeling are necessary for developing a traceability system
• Finally, follow the plan and update as necessary