1. Make a flow chart of the flow of produce from the field through the packing area into storage and out to transportation.
2. Identify areas where produce may directly contact surfaces, equipment, or workers hands directly.
3. Identify and list other areas that may introduce food safety risks, such as animals or adjacent land.
4. Action Plan: List and develop practices, systems and plans to reduce risk

<table>
<thead>
<tr>
<th>Potential Risks</th>
<th>Action</th>
<th>Who</th>
<th>When</th>
<th>SOP</th>
<th>Training</th>
<th>Record</th>
<th>Rank 1-3</th>
<th>Check-in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policies, Practices, Systems To Reduce Risk</td>
<td>Who is required to do this?</td>
<td>When is this done?</td>
<td>SOP</td>
<td>Is there a separate written SOP?</td>
<td>What training is done, who, and when?</td>
<td>What record keeping system is kept for this action?</td>
<td>1. IAR 2. CAN 3. COM</td>
<td>Done</td>
</tr>
</tbody>
</table>

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# Harvest, Postharvest, and Transportation Handling And Sanitation

<table>
<thead>
<tr>
<th>Harvest</th>
<th>Receive</th>
<th>Clean</th>
<th>Sort</th>
<th>Pack</th>
<th>Cool</th>
<th>Store</th>
<th>Transport</th>
</tr>
</thead>
</table>

- Physical
- Chemical
- Biological

What Is Your Plan?
Cleanliness

General

– Keep things in their place and prevent contamination
– Manage pests, trash, standing water . . .
– Human health, hygiene, and training
– Remove dirt and debris

Advanced

– 4-step cleaning and sanitation process
Cleaning Versus Sanitizing

• Cleaning: Physical removal of dirt from surface, using soap and potable water

• Sanitizing: Treating a surface with a sanitizer to reduce microorganisms after it has been cleaned.
Food Safety ACTION PLAN

General Harvest, Post Harvest, and Transportation Policy – Contact Surfaces

If an object comes into contact with fresh produce it must be clean and in good working condition. This includes:

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Harvest, Postharvest, and Transportation Sanitation and Practices - Food Safety Action Plan

1. Map the flow of produce from the field through the packing area into storage and out to transportation.
2. Identify areas where produce may directly contact surfaces, equipment, or workers hands directly.
3. Identify and list other areas that may introduce food safety risks, such as animals or adjacent land.
4. List and develop practices/systems and action plans to reduce risk

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Food Contact Surfaces

1. **Remove** obvious dirt and debris
2. **Apply** soap and **scrub** surfaces
3. **Rinse** with potable water
4. **Apply** a sanitizer. Let surface air dry

**FSMA**: “. . . as frequently as reasonably necessary”

You can’t sanitize a dirty surface
Establish Cleaning Systems for Harvest Equipment

Before using your knife, wash with soap and water, rinse and dip into sanitizing water.

Antes de usar su cuchillo, lavarlo con jabon y agua, enjuagar y ponerlo en el agua con Tsunami.
Zone 4- outside or adjacent to packing area

Keep Contamination Out Of Flow Zones

If it’s in the environment it can get on the produce.
Zone 4- outside or adjacent to packing area

Keep Contamination Out Of Flow Zones

If it’s in the environment it can get on the produce.
Zone 3 – Areas and materials inside of packing area
Zone 2 – Areas and surfaces close to contact surfaces
Pathogens are often below your feet. How would you clean these cracks?
Zone 1 – Direct food contact surfaces
Hygienic Design

• **Smooth Surfaces** – Pathogens attach to rough surfaces
• **Scratch Free** – Pathogens can hide in scratches
• **NO Produce/Soil Catching** – Nutrient source
• **Hollow Bodies** – Harbor and reproduction area
Old or wooden equipment can be cleaned on a regular basis and sanitized.
• Physical
• Chemical
• Biological

It does not require a state of the art packing facility to reduce risk on these issues.
Vehicles - Transportation
- General cleanliness
- Has it been used for other purposes? Clean & Sanitize
- Broken plastic, glass windows, metal parts
- Dripping oil, anti-freeze, ...
- Does the load need to be covered?

FSMA: “Adequately clean before use in transporting produce” . . .
*Inspect vehicles for the following items:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Signs of pest intrusion</td>
<td>4. Foreign materials: manure, garbage, glass, oil, chemicals</td>
</tr>
<tr>
<td>2. Damage (e.g., splinters, holes)</td>
<td>5. Maintenance required (e.g., hinges, locks or load-security devices)</td>
</tr>
<tr>
<td>3. Odors (e.g., chemicals, oil)</td>
<td>6. Refrigeration (e.g., leaking)</td>
</tr>
</tbody>
</table>

**Corrective Actions: If any hazards were identified above, the following may be considered:**

<p>| | | |</p>
<table>
<thead>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Refusal to load product onto vehicle</td>
<td>B. Sweep</td>
<td>C. Rinse</td>
</tr>
<tr>
<td>D. Maintenance (e.g., repair hinges, locks, load securing devices)</td>
<td>E. Wash/clean with soap</td>
<td>F. Other</td>
</tr>
</tbody>
</table>
Pooping on people
In 12 easy lessons.
PICK IT CLEAN
Inform Workers
Make a decision about what to do with contamination

RISK ASSESSMENT - General

<table>
<thead>
<tr>
<th>Inspection Date</th>
<th>Location/Field</th>
<th>Risks identified?</th>
<th>Corrective and/or preventative actions if necessary</th>
<th>Identified by: initials</th>
<th>Date corrective action completed</th>
<th>Completed by: initials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Policy and Training - Action Plan!

- Harvesters avoid cut produce surfaces contacting soil by . . .
- Excessive dirt and mud are removed as much as possible from produce at harvest
Lot Tracking: Product Identification at Harvest
HARVEST AND POSTHARVEST WATER

Must have no detectable generic E.coli
- If it contacts produce during or after harvest
- Is used to make ice
- Is used on food contact surfaces
- Is used for hand washing
All “Harvest Water” Must Be Potable

- No detectible E. coli -

TEST FOR GENERIC COLIFORMS & E. COLI

FSMA

Ground: 4 times a year base, then once a year
Municipal: Request municipal records

• Test close to end use
• Keep records of result
• Protect wells and infrastructure from contamination
SPRAY WASH VERY DIRTY PRODUCE
The “industry” is generally moving away from dunk tanks and into spray systems.
The wash system needs to be evaluated for risk and farms may change their practices as a result.

Dunk Tank

Challenges:
- Pathogens can transfer from product to product
- Pathogens can be imbibed

Depth, temperature and length of time influence infiltration
We have to distinguish between water use for quality for food safety.

- Hydro-Clean
- Hydro-Cool
- Hydro-Crisp

If there is a food safety consequence, it trumps cleaning, cooling, and crisping.
Leafy greens have been associated with more food borne illness than other vegetables

- Eaten raw with no cooking step to kill pathogens.
- Grow close to the ground. Soil is often on the crop. Can lead to contamination with harmful bacteria.
- Often immersed in water. May sit in water with soil and debris.
Show the reduction of e-coli in the rinse water.

Vern Grubinger – University of Vermont

Do Not Interpret This Research To Mean That Pathogens Can Be Washed Off Of Produce!
• Reduces microbe levels in water
• Can extend shelf life
• Provides a cleaner, higher quality product

**Triple Washing Greens**

USE A SANITIZER!

First Rinse | Second Rinse | Third Rinse
--- | --- | ---

Average reduction of E. coli in leafy greens wash water, compared with a single rinse

91% | 98%
# Sanitizing Agents for Fresh Produce

<table>
<thead>
<tr>
<th></th>
<th>Rinse Required</th>
<th>pH Control</th>
<th>NOP Allowed</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ecolab</strong></td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
<td>Produce only</td>
</tr>
<tr>
<td><strong>Tsunami™</strong></td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
<td>Produce only</td>
</tr>
<tr>
<td><strong>SaniDate</strong></td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
<td>Produce &amp; food contact surface</td>
</tr>
</tbody>
</table>

**BENEFITS of peroxide based cleaners:**
- No taste residue
- No dumping restrictions, environmentally responsible
- Less affected by organic matter than chloride
- Effective against microorganisms that affect shelf-life

**Chlorine Bleach**
- Not from grocery
- Yes
- Yes
- Yes
- Produce & food contact surfaces

Sanitizer must be labeled for contact with product – Read the label
Sanitizer: Prevent Cross Contamination

- Reduces risk of pathogen infiltration
- Reduces plant pathogens that affect shelf life
• Test strips: Correct Concentration. *(Record)*
• Efficacy decreases with time and dirt. *(Clean)*
• Discard and change water as needed. *(Test)*
Turbidity is an “indicator only.” Judge the water quality by the test strip not by eye.
What corrective action should be taken if the sanitizer test shows the concentration is too low?

1. IAR
2. CAN
3. C
“What I would expect from an auditor, is that they would walk into the facility, look at the wash and dry lines, know they weren’t using a antimicrobial, and say, ‘the audit is done. You have to stop your operation.’”

-- Trevor Suslow, on the Jensen farm outbreak
Action Plan

Food Safety Action

What we are doing to keep the process water sufficiently treated with antimicrobials so that the water does not become infected and as a result it cross contaminates other produce.
Wash tank water is changed [how often] and water sanitizer [say what the sanitizer product is] levels are maintained at [insert levels here], and tested [say testing method and how often] and documented on the Water Sanitizer Log.

<table>
<thead>
<tr>
<th>Product being washed</th>
<th>Date</th>
<th>Time</th>
<th>Water temp °F</th>
<th>pH</th>
<th>Pre Test results from dip strip</th>
<th>Corrective actions taken</th>
<th>Post test results from dip strip</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green Beans</td>
<td>9/10/11</td>
<td>9:15 am</td>
<td>45</td>
<td>6.5</td>
<td>70 ppm</td>
<td>Added x amount Tsunami</td>
<td>80 ppm</td>
<td>MP</td>
</tr>
</tbody>
</table>
- Wear clean outer garments.
  - Change clothing or don aprons if coming from the field.

- Maintain personal cleanliness.

- Wash hands thoroughly:
  - Before starting work.
  - After each absence from work station.
  - At any time when hands become soiled.
ZONE Management
WATER TEMPERATURE

FSMA Requirements For Water Used In Harvesting, Packing, and Holding Produce:

“must maintain and monitor water temperature to minimize the potential for infiltration of microorganisms into covered produce”
Use The Proper Temperature of Water In The Dunk Tank

“For leaf and root crops, water is used to cool the product. Because water comes directly from the ground, it is cooled to approximately 45° on receipt from the field.”

-- Rock Springs Farm, Chris Blanchard Food Safety Plan

Research show tomatoes and cantaloupe infiltrate water when the water is colder than the produce

For cantaloupe & tomatoes, “pulp temperature” of produce is cooler than the water.
E. coli O157:H7 and L. monocytogenes generally increased <2 log CFU/g during transport, retail storage, and display.
Maintaining the Cold Chain

- Harvest
- Cleaning
- Cooling
- Storage
- Transport

<table>
<thead>
<tr>
<th>CROP</th>
<th>Harvest Quality</th>
<th>Cooling Method</th>
<th>Respiration Rate</th>
<th>ICED Store Temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apples,</td>
<td>bracts at tip closed</td>
<td>R, F, H</td>
<td>low</td>
<td>32-38</td>
</tr>
<tr>
<td>Asparagus</td>
<td>fresh, tender leaves</td>
<td>H, I</td>
<td>extremely high</td>
<td>YES 35</td>
</tr>
<tr>
<td>Basil</td>
<td>fresh, tender leaves</td>
<td>R, F, H</td>
<td>high</td>
<td>NO 50</td>
</tr>
<tr>
<td>Beans, snap</td>
<td>seeds developed, plump</td>
<td>R, F, H</td>
<td>very high</td>
<td>NO 41-46</td>
</tr>
<tr>
<td>Beans, lima</td>
<td>crisp pods, seeds immature</td>
<td>R, F, H</td>
<td>high</td>
<td>NO 41-43</td>
</tr>
<tr>
<td>Beets, bunches</td>
<td>crisp fresh leaves</td>
<td>H, I</td>
<td>high</td>
<td>YES 32</td>
</tr>
<tr>
<td>Beets, root</td>
<td>firm, deep red roots</td>
<td>R, F</td>
<td>moderate</td>
<td>Can 33-36</td>
</tr>
<tr>
<td>Blackberries</td>
<td>full color, sweet</td>
<td>R, F</td>
<td>high</td>
<td>NO 32</td>
</tr>
<tr>
<td>Blueberries</td>
<td>full color, sweet</td>
<td>R, F</td>
<td>moderate</td>
<td>NO 32</td>
</tr>
<tr>
<td>Broccoli</td>
<td>firm head, buds not open</td>
<td>I, F, H</td>
<td>very high</td>
<td>YES 32</td>
</tr>
<tr>
<td>Brussel sprouts</td>
<td>firm sprouts</td>
<td>H, V</td>
<td>very high</td>
<td>YES 32</td>
</tr>
<tr>
<td>Cabbage</td>
<td>crisp, firm, compact head</td>
<td>R, F, F</td>
<td>moderate</td>
<td>NO 32</td>
</tr>
<tr>
<td>Cantaloupe</td>
<td>full slip, rind color</td>
<td>H, F</td>
<td>moderate</td>
<td>NO 36-41</td>
</tr>
<tr>
<td>Carrots, topped</td>
<td>tender, sweet roots</td>
<td>I, R</td>
<td>moderate</td>
<td>YES 32</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>compact, white curds</td>
<td>H, V</td>
<td>high</td>
<td>YES 32</td>
</tr>
<tr>
<td>Celery</td>
<td>crisp, tender</td>
<td>I</td>
<td>moderate</td>
<td>YES 32</td>
</tr>
<tr>
<td>Corn, sweet</td>
<td>plump tender kernels</td>
<td>H, I, V</td>
<td>extremely high</td>
<td>YES 32</td>
</tr>
<tr>
<td>Cucumbers</td>
<td>crisp, green, firm</td>
<td>F, H</td>
<td>moderate</td>
<td>NO 50-55</td>
</tr>
<tr>
<td>Eggplant</td>
<td>seeds immature; shiny, firm</td>
<td>R, F</td>
<td>NO</td>
<td>50-54</td>
</tr>
<tr>
<td>Endive</td>
<td>fresh, crisp, tender leaves</td>
<td>H, I</td>
<td>very high</td>
<td>YES 32</td>
</tr>
<tr>
<td>Garlic</td>
<td></td>
<td>N</td>
<td>low</td>
<td>NO 32</td>
</tr>
<tr>
<td>Leafy Greens</td>
<td>crisp, dark green leaves</td>
<td>H, I</td>
<td>very high</td>
<td>YES 32</td>
</tr>
<tr>
<td>Herbs</td>
<td>fresh, crisp, tender leaves</td>
<td>NO</td>
<td></td>
<td>32-41</td>
</tr>
<tr>
<td>Leeks</td>
<td>size, crisp</td>
<td>H, I</td>
<td>high</td>
<td>YES 32</td>
</tr>
<tr>
<td>Lettuce</td>
<td>compact head, crisp, tender</td>
<td>H, I</td>
<td>moderate</td>
<td>YES 32</td>
</tr>
<tr>
<td>Mushrooms</td>
<td>size, firm</td>
<td>H, I</td>
<td>very high</td>
<td>NO 32</td>
</tr>
<tr>
<td>Onions, bulb</td>
<td>firm bulbs, tight necks</td>
<td>N</td>
<td>low</td>
<td>NO 32</td>
</tr>
<tr>
<td>Onions, green</td>
<td>crisp stalks, firm white bulbs</td>
<td>H, I</td>
<td>very high</td>
<td>YES 32</td>
</tr>
<tr>
<td>Parsley</td>
<td>crisp, dark green leaves</td>
<td>H, I</td>
<td>extremely high</td>
<td>YES 32</td>
</tr>
<tr>
<td>Pears</td>
<td></td>
<td>F, R, H</td>
<td>moderate</td>
<td>NO 32</td>
</tr>
<tr>
<td>Peas, in pods</td>
<td>tender, green, sweet pods</td>
<td>F, H, I</td>
<td>extremely high</td>
<td>CAN 32</td>
</tr>
<tr>
<td>Peppers, bell</td>
<td>firm, shiny, thick walls</td>
<td>R, F</td>
<td>moderate</td>
<td>NO 45-50</td>
</tr>
<tr>
<td>Peppers, hot</td>
<td>firm, shiny, thick walls</td>
<td>R, F</td>
<td>moderate</td>
<td>NO 41-50</td>
</tr>
<tr>
<td>Potatoes, early</td>
<td>well shaped, defect free</td>
<td>R, F</td>
<td>moderate</td>
<td>NO 50-59</td>
</tr>
<tr>
<td>Potatoes, late</td>
<td>well shaped, defect free</td>
<td>R, F</td>
<td>very low</td>
<td>NO 40-54</td>
</tr>
<tr>
<td>Pumpkins</td>
<td>hard rind, good color, heavy</td>
<td>N</td>
<td>moderate</td>
<td>NO 54-59</td>
</tr>
<tr>
<td>Radishes</td>
<td>firm, crisp, dark green leaves</td>
<td>H, I</td>
<td>high</td>
<td>YES 32</td>
</tr>
<tr>
<td>Raspberries</td>
<td>full color, sweet</td>
<td>R, F</td>
<td>high</td>
<td>NO 32</td>
</tr>
<tr>
<td>Strawberries</td>
<td>firm, skin smooth surface</td>
<td>R, F</td>
<td>high</td>
<td>NO 32</td>
</tr>
</tbody>
</table>
Ice Cooling

- Use Potable Water
- Sanitize Machine
- Create Ice Policies
- Do NOT drip on other
Cold Storage Space
Floors can be pathogen laden!
PEST MANAGEMENT
Eliminate pest nesting areas
What Zone Do You Want Your Culls/Trash In?
The common housefly is a known carrier of diseases and pathogens, including Listeria and even Salmonella.
Perform And Record Regular Inspection

1. IAR
2. CAN
3. C
Monitor and Control For Pests
Hot Spot –
- Make necessary changes to system
- Clean and sanitize
- Upgrade control and monitoring until the area is rodent free for 10 days
Sloped Floors and Surfaces – Pathogens and flies can breed in standing water.
Floor Drain – Everything ends up there! Clean it! Dispose properly so it doesn’t contaminate fields!
Sediments and algae blooms can be a key site for pathogen persistence in water bodies.

Biofilms can provide protection from environmental stress and predation by other microbes.
Pathogens prefer diseased plant parts
- Inspect and maintain equipment
- Use food grade lubricants
- Don’t store chemicals in the packing area
- Only items related to packing should be in the area
- Keep the packing area tidy
Shipping Containers
Standardized – Test Strength – Ventilation – Waxed for Wet
REUSE? Use a Food Grade Liner
SOPS you might include:

- Everything that is a policy to address food safety risks
- Pest monitoring method
- Cleaning/sanitizing material preparation and process
- Monitoring of cold areas
- Inspection procedure

Beware of SOPing Your Staff To Death!
Harvest, Postharvest, and Transportation Sanitation and Practices - Food Safety Action Plan

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