South Carolina Farm Auditing Program

Good Agricultural Practices and Good Handling Practices Audit Verification Program

Jack Dantzler
Director of Inspections and Grading
South Carolina Department of Agriculture
History of GAP/GHP Audits

- Wholesalers want assurance
- Shippers and Growers approach USDA to develop an audit system
- Result: GAP/GHP Audit system was developed by USDA and FDA
Audits

- Six components
- Plus a general questions section that must be passed first in order to move on to one or all of the six components
- Must score a minimum of 80 to pass
Six Components

- Part 1: Farm Review
- Part 2: Field Harvesting & Field Packing
- Part 3: House Packing
- Part 4: Storage and Transportation
- Part 5: Wholesale Distribution/Terminal Warehouse
- Part 6: Preventative Food Security Procedures

**Traceback questions have been incorporated into each component.**
## Audit Components

### General Questions

**Implementation of a Food Safety Program**

<table>
<thead>
<tr>
<th>Questions</th>
<th>Points</th>
<th>YES</th>
<th>NO</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-1 A documented food safety program that incorporates GAP and/or GHP has been implemented.</td>
<td></td>
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</tr>
<tr>
<td>P-2 The operation has designated someone to implement and oversee an established food safety program.</td>
<td></td>
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</table>

### Traceability

<table>
<thead>
<tr>
<th>Questions</th>
<th>Points</th>
<th>YES</th>
<th>NO</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>G-1 A documented traceability program has been established.</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G-2 The operation has performed a &quot;mock recall&quot; that was proven to be effective.</td>
<td>10</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

### Worker Health & Hygiene

<table>
<thead>
<tr>
<th>Questions</th>
<th>Points</th>
<th>YES</th>
<th>NO</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>G-3 Potable water is available to all workers.</td>
<td>10</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>G-4 All employees and all visitors to the location are required to follow proper sanitation and hygiene practices.</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G-5 Training on proper sanitation and hygiene practices is provided to all staff</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G-6 Employees and visitors are following good hygiene/sanitation practices.</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G-7 Employees are washing their hands before beginning or returning to work.</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G-8 Readily understandable signs are posted to instruct employees to wash their hands before beginning or returning to work.</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G-9 All toilet/restroom/field sanitation facilities are clean. They are properly supplied with single use towels, toilet paper, and hand soap or antibacterial soap and potable water for hand washing.</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**D = Documentation**

**R = Record**

**P = Procedure**
Quality Manual

- Brief history of operation
- List of employees and duties
- Map of location of operation
- GPS coordinates (if available)
- GAP/GHP training certificates (if available)
- Product floor plan (for packing house)
- Farm maps (where products are located)
- Required procedures and samples of charts
Additional Requirements

- Signs must be in English and Spanish
- Good hygiene practices
- Water test reports
- Pest control
- Temperature logs
- Cleaning logs
General Questions

- Mandatory component of all audits
- Covers employee & visitor hygiene practices
- Training of employees
- Sanitation of farm/facility
- Traceability
Part 1 – Farm Review

- Water
- Manure
- Animal/Wildlife
- Land Use
Part 2 – Field Harvest and Field Packing

- Field Sanitation
- Field Harvesting and Transportation
Part 3 – House Packing Facility

- Water use
- Packing Line Operation
- General Sanitation
Part 4 – Storage and Transportation

- Containers and Pallets
- Pest Control
- Temperature Control
- Transportation/Loading
Part 6 – Wholesale Distribution Center/Terminal Warehouses
Traceback

- Formerly Part 5 & 6A
- Traceback was incorporated into the General Questions Section effective November 2009

- Track produce containers from the farm, to the packer, distributor, and retailer
- Should indicate date of harvest, farm identification, and who handled the produce
Part 7 – Preventive Food Defense Procedures

- Based on FDA’s “Food Producers, Processors, and Transporters: Food Security Preventive Measures Guidance for Industry”

- Audit-based
  - Included as part of GAP & GHP audit; or  Food Defense section only
Where to find GAP/GHP Audit Info:

- USDA website
  www.ams.usda.gov/gapghp

- SCDA website
  www.agriculture.sc.gov
Website

http://www.ams.usda.gov/gapghp

- Program information
- Current audit checklist and score sheet
- Specific audit specifications
Automatic Failure

- Immediate food safety risk
- Presence of rodents, pets, etc.
- Employee practices that might jeopardize the safety of produce
- Falsification of records
- No Quality Manual (Question G-1)
- No one designated to oversee an established food safety program (Question G-2)
Requesting an Audit

- Call for a “Request Form”
- Must consent to an unannounced visit
- Send copy of Quality Manual prior to on-site visit
Program Requirements

- Unannounced verification visit.
  - One announced yearly audit as close to beginning of season as practical.
  - At least one unannounced verification visit performed sometime during the remainder of 12 month cycle.
Fees

- $92 per hour
- $50 administrative fee (each time)
- Billing starts when inspector leaves office until inspector returns to office
- Grants available for first time producers
- Travel time can be shared between multiple producers in same area
Contact Information

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Slides in this presentation were originally developed for North Carolina State University’s MarketReady Program by NC Cooperative Extension and NCSU College of Agriculture and Life Sciences

www.ncmarketready.org
http://harvest.cals.ncsu.edu
NC MarketReady Team

N.C. MarketReady team from left to right: Rod Gurganus, Diane Ducharme, Gary Bullen, Leah Chester-Davis, Blake Brown
The MarketReady project received funding from the N.C. Tobacco Trust Fund Commission, Sustainable Agriculture Research & Education (SARE) and Risk Management Agency.
Good Agricultural Practices

Preparing Your Farm for a GAPS and GHP Audit
Purpose

- A GAPS and Good Handling Practices (GHP) audit assesses a participant’s efforts to minimize risk of contamination of fresh fruits, vegetables, nuts, and miscellaneous commodities by microbial pathogens.
- GAPS and GHP guidelines are based on the U.S. Food and Drug Administration (FDA) “Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables.”
Eight Principles of GAPs

1. Prevent microbial contamination
2. Use GAPs
3. Human/animal feces
4. Water
5. Animal manure
6. Worker hygiene/sanitation
7. Follow all applicable laws
8. Traceback/recordkeeping/documentation
<table>
<thead>
<tr>
<th></th>
<th>GAPs</th>
<th>GMPs</th>
<th>GHPs</th>
<th>HACCP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Definition</strong></td>
<td>Good Agricultural Practices</td>
<td>Good Manufacturing Practices</td>
<td>Good Handling Practices</td>
<td>Hazard Analytical Critical Control Points</td>
</tr>
<tr>
<td><strong>Stages Involved</strong></td>
<td>Production &amp; Field Packing</td>
<td>Juice &amp; Minimal Processing</td>
<td>Postharvest handling &amp; Packing</td>
<td>Juice Processing</td>
</tr>
<tr>
<td><strong>Regulation</strong></td>
<td>Voluntary</td>
<td>Voluntary</td>
<td>Voluntary</td>
<td>Required</td>
</tr>
<tr>
<td><strong>Corrective and Preventive Action Required</strong></td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Record Keeping Required</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Programs</strong></td>
<td>Environmental Control</td>
<td>Environmental Control</td>
<td>Environmental Control</td>
<td>Process Control</td>
</tr>
</tbody>
</table>
Why Produce Is Becoming a Risky Food?

- Each person consumes about 20 pounds more fresh produce today compared to two decades ago.
- Fresh produce is increasingly imported.
- Pathogens not previously associated with fresh produce (Escherichia coli O157:H7, Salmonella, Norovirus) have emerged.
- Distribution chain of produce is different than 25 years ago:
  - Produce now comes from all over the world – it’s not limited by seasonality.
  - Better packaging technology is available, with more “fresh-cut” options.
Challenges with Fresh Produce

- Contamination occurs from farm to fork.
- Education of produce handlers and consumers is essential.
- Fresh produce has no kill step
Why Should We Care?

- 76 million cases of foodborne illnesses each year:
  - 325,000 hospitalizations
  - 5,200 deaths
  - Economic losses between $10 and $83 billion

A recent study suggests produce-related illnesses accounted for the largest number of cases – 29%.
Produce-Related Outbreaks by Decade, 1973-2008

Decade

Outbreaks / year

Source: CDC
Distributions of *Escherichia coli* O157:H7 Outbreaks in spinach, 2006

*Confirmed cases reported as of 1:00 p.m. EDT on September 26, 2006.*

**Source:** CDC, MMWR Sep 29, 2006
Distributions of Salmonella Outbreaks in tomatoes and peppers, 2008

FIGURE 1. Number* and incidence rate† of laboratory-confirmed cases of *Salmonella* Saintpaul (outbreak strain), by state — United States, 2008§

* N = 1,442.
† Per 1 million population.

Source: CDC, MMWR August 29, 2008
E. coli O157:H7 and Bagged Spinach

- The president and CEO of America’s largest producer of fresh fruits and vegetables admits that the company was incorrect in assuming consumers would return to bagged salad.
- This company cut acreage, sold some land, raised prices and altered its operations.
- Losses for 2\textsuperscript{nd} quarter totaled $15 M.
It Is a Local Problem!

- In 2003-2005, 19 produce-related outbreaks occurred in Florida, Georgia, North and South Carolina and Tennessee.
- More than 1,413 people became ill.
- The largest single outbreak was 425 school children.
- The most common source was leafy greens and the agent was Norovirus.
Produce-Associated Outbreaks Affect Business

- Strawberry industry lost an estimated $50 million in 1996 after mistakenly being indicated as source of pathogens in an outbreak.
- Apple juice (Odwalla Inc.) shareholder value dropped approximately 41 percent ($12.4 million) in six months after *E. coli* O157:H7 outbreak in 1996.
- Outbreaks reduce effectiveness of produce-promotion campaigns.
- Outbreaks may result in unwanted legislation or regulation.
Large Chain Grocers’ Response

- Our first priority is to be sure the fruits and vegetables we sell are safe and wholesome.
- Our suppliers must implement GAPs.
- Our food suppliers must provide a copy of their third-party food-safety audit.
Human disease causing organisms

Unless noted, photos courtesy of USDA ARS Image Gallery
Pathogens of Concern

- **Bacteria** – Single-celled organisms that live independently
- **Viruses** – Small particles that live and replicate in a host
- **Parasites** – Intestinal worms or protozoa that live in a host animal or human
Produce Commonly Implicated

- Leafy greens
- Tomatoes
- Sprouts
- Berries
- Melons
## Bacteria Associated with Produce

<table>
<thead>
<tr>
<th><strong>Bacteria</strong></th>
<th><strong>Associated Produce</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><em>E. coli</em> 0157:H7</td>
<td>Iceberg lettuce, radish sprouts, unpasteurized apple cider/juice, spinach</td>
</tr>
<tr>
<td><em>Salmonella spp.</em></td>
<td>Tomatoes, bean sprouts, sliced watermelon, sliced cantaloupe, coleslaw, onions, alfalfa sprouts, root vegetables, dried seaweed, hot peppers</td>
</tr>
<tr>
<td><em>L. monocytogenes</em></td>
<td>Cabbage, lettuce</td>
</tr>
<tr>
<td><em>B. cereus</em></td>
<td>Sprouts</td>
</tr>
</tbody>
</table>
Bacterial Reproduction

Adopted from www.fda.gov
<table>
<thead>
<tr>
<th>Viruses Associated with Produce</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hepatitis A virus</strong></td>
</tr>
<tr>
<td><strong>Norovirus</strong></td>
</tr>
</tbody>
</table>
## Parasites associated with Produce

<table>
<thead>
<tr>
<th>Cryptosporidium</th>
<th>Apple cider</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyclospora</td>
<td>Raspberries</td>
</tr>
</tbody>
</table>
Where Microbial Pathogens Live?

Inhabitants of soil
- *Listeria monocytogenes*
- *Bacillus cereus*
- *Clostridium botulinum*

Residents of human and animal intestinal tracts
- *Salmonella*
- *E. coli O157:H7*
- *Shigella*
- *Campylobacter*
- Viruses
- Parasites
Frequency of Pathogens on Field-Harvested Produce

- **Vegetables (from literature):**
  - *Salmonella*: 1-8%
  - *L. monocytogenes*: 2-3%
  - *Shigella*: 1 percent

- Investigators found no difference in the frequency of pathogens between organically and conventionally grown produce.

- **FDA Produce Surveillance Program**
  - Imported produce has 4% positive rate for *Salmonella* and *Shigella*.
  - Tests on domestic produce currently being conducted.

*Source:* Cornell University GAPs
Produce Wash-water Solutions

Population

Cantaloupe cubes

Dip treatment
Antimicrobial Washes and Rinses

- Chlorine
- Chlorine dioxide
- Ozone
- Organic acids
- Electrolyzed water
Introduction of Hazards at Pre-harvest

- The environment as contaminant
- Agricultural inputs -- water, soil, organic and chemical fertilizers
- Inadequate handling of supplements -- mixtures, storage, dosage
- People and animals
- Inappropriate facilities
- Contaminated tools
- Production methods, crop-seed quality protection methods, planting distances, fertilizing, irrigation, pests and disease controls, shrub management
Introduction of Hazards at Post-harvest

- Inadequate facilities
- Unsuitable packaging
- Inadequate/contaminated equipment -- storage rooms, grading equipment
- People and animals
- Inputs for post-harvesting -- washing water, waxes
Physical Hazards

- **Glass** -- bottles, jars, light, fixtures, utensils, covers
- **Wood** -- field sources, pallets, boxes, building materials
- **Stones** -- field, building
- **Insulation** -- building material
- **Plastic** -- packaging pallets, equipment
- **Personal effects** -- jewelry, hair clips, pens
Components of a GAPS Audit
USDA Good Agricultural Practices & Good Handling Practices
Audit Verification Checklist

This program is intended to assess a participant’s efforts to minimize the risk of contamination of fresh fruits, vegetables, nuts and miscellaneous commodities by microbial pathogens based on the U.S. Food and Drug Administration’s “Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables.”

Firm Name: __________________________________________
Contact Person: ________________________________________
Audit Site(s): __________________________________________
Main Address: __________________________________________
City: ___________________ State: _____ Zip: _____________
Telephone No: _______ Fax: ______
E-mail: _______________________________________________
Auditor(s): (list all auditors with the lead listed first) __________________________________________

USDA or Fed-State Office performing audit: ____________________________
Date & Time Arrived: ______________________ Date & Time Departed: ______________________
Travel Time: ___________________________ Code: ______________________
Person(s) Interviewed: (use back of sheet if necessary to list all persons interviewed) ____________

Did the auditee participate in GAP & GHP training?
Yes [ ] No [ ]

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AMS, FVP, Fresh Products Branch
November 9, 2009
Page 1
Components

- **General Questions** – all audits must begin with and pass this portion, others depend on operation.
- Part 1 – **Farm Review**
- Part 2 – **Field Harvesting and Field Packing Activities**
- Part 3 – **House Packing Facility**
- Part 4 – **Storage and Transportation**
- Part 5 – Not used
- Part 6 – **Wholesale Distribution Center/Terminal Warehouses**
- Part 7 – **Preventive Food Defense Procedures**
Site Map and Floor Plan

- Map accurately representing farm operations
  - Legal Description/GPS/Latitude-Longitude of Location
  - Inclusion of crop production areas located on map

- Floor plan of packing house indicating flow of product, storage areas, cull areas, employee break rooms, restrooms, and offices
General Questions

Implementation of a Food Safety Program
Traceability
Worker Health and Hygiene
Conditions with Unsatisfactory

- To pass, must score 80% of total points.
- Unsatisfactory audit when:
  - Immediate food safety risk is present when produce is grown, processed, packed or held
  - Presence or evidence of rodents, an excessive amount of insects or other pests in the production area during packing, processing, or storage.
  - Observation of employee practices (personal or hygienic) that jeopardize or may jeopardize the safety of the produce.
  - Falsification of records.
  - Answering “No” P1 (food safety plan) or P2 (traceability).
Food Safety Program

- A documented food safety program that incorporates GAP and/or GHP has been implemented.
  - Assemble a binder that includes all required documents.
  - Maintain appropriate records
- The operation has designated someone to implement and oversee an established food safety program.
  - Identify who is responsible for monitoring and verifying that GAPs monitoring is properly completed.
Traceability

- Documented traceability program has been established.
- Operation has performed a “mock recall” that was proven to be effective.
Worker Health and Hygiene

- Potable water
- Proper handwashing – employees and visitors
- Training
- Signage
- Toilet facilities
- Reporting illness
- First aid kit
- Disposition of contaminated food
- Licensed personnel to apply chemicals.
Worker Health and Hygiene

The major source of human pathogens are worker’s hands, so the single most effective public health measure to prevent disease is *proper handwashing.*
How Do Pathogens Get Transferred?

- Human-to-human/produce contact
- Human-to-soil contact
- Soil-to-produce contact
- Container/equipment-to-soil contact
- Contaminated water contact
- Improper sanitation
  - Oral-fecal contact
  - Produce-fecal contact
Sick Workers

- Sick farm workers increase the risks of contaminating produce on the farm.
- Cultural practices can lead to food-borne diseases: for example, eggs and home-made cheese.
Signs of Sudden Illness

- Changes in consciousness
- Nausea or vomiting
- Difficulty speaking or slurred speech
- Numbness or weakness
- Loss of vision or blurred vision
- Changes in breathing

- Changes in the skin color
- Sweating
- Persistent pressure or pain
- Diarrhea
- Seizures
- Paralysis or inability to move
- Severe headache
Understand the Circumstances of Farm Workers

- No sick pay
- No sick leave
- No health insurance
- No transportation
Signage

• Readily understandable signs are posted to instruct employees to wash their hands before beginning or returning to work.
• Signage needs to be in English and other languages.
• Sources for signs include:
Proper Handwashing

• Remove rings/watches/bracelets.
• Use running water.
• Use soap.
• Lather hands, wrists, fingers.
• Scrub thumbs, under nails, and in between fingers.
• Wash your hands for 20 seconds.
• Dry hands with disposable paper towel.
Proper Handwashing Reduces Risk

Probably #1 source of foodborne illness is unsanitary worker conditions.
Training

- Training on proper sanitation and hygiene practices is provided to all staff.
- Educate staff about:
  - Pathogens
  - Pathogen origins
  - How pathogens can spread
  - Symptoms of foodborne illnesses
  - Health and hygiene policies and practices
Cultural Differences

- In some Latin American countries, flushing toilet paper clogs the toilet. As a result, people put it in trash can.
- To prevent this practice, remove trash cans from stall areas.
- Using education posters helps enforce flushing toilet paper.
- Supervisors checking workers helps ensure flushing toilet paper also.
When to Wash Hands

- Before beginning work
- After each restroom visit
- Before and after eating/smoking/other breaks
- After other activities not including produce handling
- Any time hands become dirty
Handwashing Facilities
Restroom and Handwashing Facilities

- According to OSHA regulations, one toilet facility and one handwashing facility shall be provided for each 20 employees.
- Facilities shall be located within a one-quarter-mile walk of each hand laborer’s place of work.
Employee Restroom Facilities

- Number, condition and positioning of field toilets
- Should not be cleaned in field
- Hand-washing stations readily available
Pathogens Spread through Air

- Researchers have found that some pathogens, such as *Salmonella*, could persist in the air after flushing the toilet.
- Researchers also found that flushing the toilet resulted in contamination of the toilet seat and the toilet seat lid.
- *Salmonella* was also isolated in the toilet bowl below the waterline for up to 50 days after seeding.
Sanitary Facilities Disposal

- Use caution when servicing portable toilets.
- Never dispose of sewage in the field.
- Plan for the containment and treatment of any effluent in the event of a leak.
Restroom and Handwashing Facilities
What’s Wrong?
Field Worker Hygiene

Are gloves worn?

Are facilities accessible?

Are toilets well-stocked?

Courtesy of Trevor Suslow

Courtesy of William C. Hurst, UGA
What’s Wrong?
What’s Wrong?
Good Example
Toilet Paper in the Woods
Break Time!
Mmmm – Tastes Good!
Good Intentions
Workers Showing Symptoms or Injury

- Supervisors should put workers showing symptoms of illness on tasks that do not involve direct contact with produce.
- Workers with injuries that may come in contact with produce should be given tasks not involving direct contact with produce.
- Employees should be encouraged to report illness and injury to their supervisors.
Check Farm Workers’ Health Daily

- Supervisors or small growers should have a worker policy that encourages employees to report illnesses.
- When possible, growers should ask one of their supervisors to check the restrooms several times every day and make sure they are well-supplied, there are no clogs in the toilets, the farm workers are washing their hands and they are not sick.
Other Protective Practices

- Hair nets or ball caps
- Clean aprons
- Clean shirts, pants or other worker clothing
- Absence of jewelry
Single-Use Gloves

- Can be a hygienic practice, if used properly.
- Is especially useful with wounds and open sores.
- Can be a vehicle for transferring surface germs.
- Must be used in combination with proper handwashing.
- Must be discarded, hands washed and new gloves changed each time wearer needs to wash hands.
Visitors Should Also Follow Good Hygiene Practices

- Require product inspectors, buyers and other visitors to comply with established hygienic practices whenever they come into contact with fresh produce.
- All visitors must have easy access to a clean facility, plenty of good quality water, soap, and paper towels.
- When necessary, visitors should wear appropriate, safe footwear for working in the fields.
- As a way of better protecting South Carolinians from food-borne diseases, customers should be encouraged always to wash all of their produce.
Health Policy and Injuries

- Establish health and safety policies to protect workers and produce.
- Types of injuries:
  - Soft tissue
  - Closed/open wound
  - Lacerations
  - Avulsions
  - Punctures
- Procedures to address body fluids contacting produce and surfaces.
First-Aid Kit

The American Red Cross recommends that all first-aid kits include at a minimum the following:

- 2 absorbent compress dressings (5 x 9 inches)
- 25 adhesive bandages (assorted sizes)
- 1 adhesive cloth tape (10 yards x 1 inch)
- 5 triple antibiotic ointment packets (approximately 1 g each)
- 5 antiseptic wipe packets
- 2 packets of aspirin (81 mg each)
- 1 blanket (space blanket)
- 1 breathing barrier (with one-way valve)
- 1 instant cold compress
Disposition of Contaminated Food

- Policy describing procedures for how to handle produce or food-contact surfaces that have come into contact with blood or other bodily fluids.
- Must include for:
  - Field harvest
  - House packing facility
  - Storage and Transportation
  - Wholesale Distribution Center/Terminal Warehouses
Licensed Chemical Applicators

- Company personnel or contracted personnel that apply regulated pre-harvest and/or post-harvest materials are licensed.
- Company personnel or contracted personnel applying non-regulated materials have been trained on proper use.
Part 1: Farm Review

Water Usage
Water Quality Risks
Sewage Treatment
Animals/Wildlife/Livestock
Manure and Municipal Biosolids
Raw Manure
Composted Manure
No Manure/Biosolids Used
#1 Source of Contamination = Water

Anytime water comes in contact with fresh produce, its quality determines the potential for pathogen contamination since water may carry different types of microorganisms.

Courtesy of FDA
Pathogens in Water

Water can be a source of and vehicle for:

- *Escherichia coli*
- *Salmonella spp.*
- *Vibrio cholerae*
- *Shigella spp.*
- *Cryptosporidium parvum*
- *Giardia lamblia*
- *Cyclospora cayetanensis*
- *Toxoplasma gondii*
- *Norwalk virus*
- *Hepatitis A*
Water Contamination Sources

Surface sources -- rivers, streams, irrigation ditches and canals

Unprotected well head

Livestock in surface

Courtesy of William C. Hurst, UGA
Agricultural Water

- Usually, water for agricultural uses comes from:
  - Surface sources such as ponds, rivers, streams, irrigation ditches and canals
  - Wells (open or capped)
  - Municipal water systems

Courtesy of FDA
Water

- **Water Source:**
  - Pond
  - Stream
  - Well
  - Municipal

- **Water Use**
  - Irrigation
  - Application of agricultural chemicals
  - Frost protection
  - Post-harvest handling processes
Surface Water

- Surface sources:
  - ponds,
  - rivers, and
  - streams
Municipal Water
Well Water

- Ground water from wells (open or capped)
- When waters from various sources are combined, there is a potential for pathogen growth.
- Water sources must be tested for generic *E. coli*. 
Frost Protection
Protect Water

- Water used for agricultural production can easily become contaminated with human and/or animal feces by direct or indirect routes.
- Keep animals and children out of fields and processing facilities and provide workers with properly constructed restrooms or sanitary mobile units.

Courtesy of FDA
Irrigation Methods

- Flood
- Drip
- Sprinkler
- Other
Sprinkler Irrigation
Drip Irrigation
Irrigation Concerns

- Surface water might contain pathogens and parasites of humans.
- Well (ground) water is less likely to harbor pathogens, depending on depth, but may contain pesticide residues or heavy metals.
Irrigation Practices

- Overhead irrigation is more likely to spread contamination to above-ground plant parts than root-zone irrigation (furrow or drip).
- Consider proximity of water source to livestock (water runoff).
- Maintain separation in distance and topography.
- Maintain records of safe irrigation practices.
Checklist for Irrigation

- Evaluate irrigation water storage conditions and the means of reducing, controlling, or eliminating potential contamination.
- For surface water sources, review the impact of storm events on water quality.
- Evaluate irrigation methods for potential to introduce, support, or promote the growth of human pathogens.
Checklist for Irrigation

- Use procedures for storing irrigation pipes and drip tape that reduce potential pest infestations.
- For spraying and mixing pesticides and for frost protection, use water that has quality equal to the water used for direct or indirect application to edible portions of lettuce and other leafy greens.
- When waters from various sources are combined, consider the potential for pathogen growth.
- Water sources must be tested for generic *E. coli*. 
Application of Agricultural Chemicals

- Crops can become directly contaminated with pesticides if improperly applied.
- Crops can become directly contaminated with pathogens if contaminated water is used to mix pesticides.
Water Testing

• Research is needed relating to the quality and risks of field irrigation water.
• Fecal coliform is only partially useful as an indicator. Testing for generic *E. coli* is recommended.
• **Remember** -- very low bacterial counts of *E. coli* O157:H7 will cause disease.

Courtesy of Cornell University
General Wellhead Protection

- Never mix pesticides or other agricultural chemicals in close proximity to the well.
- Never apply untreated manure within 100 feet of wellhead.
- Inspect wells annually.
- Use backflow prevention fittings.
- Retire abandoned or unused wells.
Chlorination Unit
Water Contaminated with Human and/or Animal Feces

To protect water sources:

- Provide field workers with properly constructed and maintained restrooms or sanitary mobile units.
- Remind workers to wash hands frequently!
Microbiological Testing Considerations for Agricultural Water

- Microbiological testing is used to track safety, not for daily monitoring activities.
- Records become very important in the event of a microbiological outbreak investigation.
- Document the frequency and results of each water test for comparison purposes. Changes might help identify problems.
Testing Water

- Municipal water supplies are regulated and are required to be potable.
- Private well water may or may not be potable, and growers have the responsibility for testing.
- Surface water is subject to various uncontrollable influences and should be considered non-potable.
## Water Source Will Determine the Possible Frequency of Testing

<table>
<thead>
<tr>
<th>Source</th>
<th>Possible Water Testing Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipal/District water system</td>
<td>Test annually and keep records from the municipality/district water system (monthly, quarterly or annual report).</td>
</tr>
<tr>
<td>Closed system, under the ground or covered tank</td>
<td>One annual test at the beginning of season</td>
</tr>
<tr>
<td>Uncovered well, open canal, water reservoir, collection pond</td>
<td>Every month during the production season</td>
</tr>
</tbody>
</table>
Indicator Organisms

- Total coliform
- Fecal coliform
- Generic *E. coli*
Irrigation Water Sampling Frequency Recommendations

- Sample within 60 days before beginning seasonal irrigation program.
- Additional samples (to achieve means) shall be collected at intervals of no less than 18 hours.
- Sample monthly. Or sample every 30 days.
- If samples exceed limits, STOP irrigation, start remediation.
Water-Quality Considerations for Pre-harvest Irrigation

- Where edible portions of the crop **ARE NOT** contacted by water:
  - Generic *E. coli* sample parameter
    - Acceptance Criteria: Less than or equal to 126 MPN/100mL (geometric mean of five samples)
    - Acceptance Criteria: Less than or equal to 576 MPN/100mL (for any single sample)
Water Quality Considerations for Pre-harvest Irrigation

- Where edible portions of the crop **ARE** contacted by water, generic *E. coli* sample parameter:
  - Acceptance Criteria: Less than or equal to 126 MPN/100mL (rolling geometric mean n=5)
  - Acceptance Criteria: Less than or equal to 235 MPN/100mL (for any single sample)
Remedial Actions

- Discontinue use for foliar and direct contact with the edible portion of the plant applications until it returns to compliance.
- Conduct a sanitary survey of water source and distribution system.
- Eliminate any identified contamination source(s).
- For wells, perform a sanitary survey and/or treat.
Remedial Actions

- Retest the water as close to the source as possible and at the same sampling point after conducting the sanitary survey and/or taking remedial actions.
- Test daily for five days, approximately 24 hours apart, at the point closest to use.
- If any of the next five samples is >235 MPN/100mL, repeat sanitary survey and/or remedial action.
Remedial Actions

- A more aggressive sampling program (i.e., sampling once per week instead of once per month) shall be instituted if an explanation for the contamination is not readily apparent.

- Do not use water from that water system, in a manner that directly contacts edible portions of the crop, until the water can meet the outlined acceptance criteria for this use.
Exemptions

- For wells and municipal water sources, if generic *E. coli* are below detection limits for five consecutive samples, the sampling frequency may be decreased to once every six months and the requirements for 60 and 30 days sampling are waived.
Collecting Water Samples

- Use a sterile sample bottle to collect samples.
- When collecting samples from the distribution system, run the system for 1 to 3 minutes before the sample is taken.
- Never rinse sample bottles prior to taking samples. This might introduce residual chlorine into the bottle and kill bacteria.

Photo: Courtesy of FDA
Collecting Pond Water Samples

- Sub-sample from several locations around the pond about 1 to 2 feet below the surface.
- Invert the sample container until the desired sampling depth is reached.
- Do not collect debris floating on the surface or scrape the sides or bottom of the pond while sampling.
- Take samples at least 6 feet from the side of the pond.
Collecting Surface Water Samples

- Use a collection container on the end of a pole or by wading into the stream and dipping the sterilized sample container into the stream.
- Remove the cap once it is below the surface or plunge the sample container quickly below the surface to prevent collection of surface scum.
- Leave 1 to 2 inches of headspace in the collection bottle to allow for mixing.
Delivering Water Samples

- Deliver the sample to the laboratory as soon as possible, and no longer than 24 hours after its collection.
- Samples must be kept on ice during transportation.
- Check with specific lab for any additional protocols.
Flooded Fields

FDA considers any crop that has come into contact with floodwater to be an “adulterated” commodity that cannot be sold for human consumption.
Best Practices for Flooded Fields

- Do not harvest within 30 feet of the flooding (to prevent cross contamination).
- Plan for a 60-day time interval before re-planting, providing soil has sufficient time to dry out after flooding.
- Shorten the waiting period to 30 days if soil testing indicates concentrations of pathogens are lower than recommended standards for processed compost.
Animals/Wildlife/Livestock

- Animal feces are a main source for pathogenic organisms.
- Because animals are in contact with soil, manure and water, they can easily pick up contaminants from these sources.
- Some pathogenic bacteria commonly found on animals include *Salmonella*, *Staphylococcus* and *Streptococcus*.
- Maintain records of pest control program.

Courtesy of FDA
Proximity of Animals
Livestock Concerns

- Exclude animals from surface water sources as well as from drainages to those sources.
Keep Grazing Animals 30 Feet from Water Source
Control Sources of Rodent and Bird Contamination
Runoff

- Runoff from fields containing livestock manure can contaminate surface water with pathogens as well as with nutrients.
- Algal blooms are a symptom of a potential problem.
Cleaning Considerations for Surrounding Areas

- Keep grass and weeds short to avoid the presence of rats, reptiles and other pests.
- Keep all areas free of garbage.
- Remove all unnecessary equipment -- old and broken equipment can provide protection for rats and insects.
Keeping Animals Out

• Place rodent traps around the perimeter of buildings and monitor them daily.

• Electronic insect repellants or traps can be used inside buildings.

• Dead or trapped animals, such as birds, insects, rats, must be disposed of promptly to avoid attracting other animals. The proper disposal procedures are to bury or incinerate the animal.
Livestock

CAFOs are non-vegetated areas that have at least a minimum number of animals (e.g., 200 mature dairy cows; 300 heifers, steers or bulls; 750 swine of greater than 55 pounds; 150 horses; 9,000 chickens [when a liquid manure-handling system is used]), or have been identified as “...a significant contributor of pollutants to waters of the United States.” (40 CFR 122.23)
Livestock

Photo from presentation by Doug Sanders
Livestock

Photo from presentation by Doug Sanders
Fencing and Buffers
Livestock
Rats with Wings?
Pets

• Keep pets out of field during growing season, using barriers as necessary.
• Animals can bring not only their waste but can carry pathogens from the waste of other animals.
Wild Animals

- Watch out for evidence of large populations of wild animals.
- Fencing, scare tactics, depredation and/or modification of the surrounding environment are potential management measures.

Trevor Suslow, UC-Davis
Manure and Municipal Biosolids

- Inorganic fertilizers originate from synthetic chemicals, so pathogenic bacteria are not likely to be present.
- Incompletely composted manure might contain pathogenic bacteria.
- Use only well-composted manure.
- Maintain records of safe fertilization practices.
Survival of Human Pathogens in Raw Manure

- Pathogens most often associated with manure:
  - E. coli 0157:H7
  - Salmonella
- Pathogens reported to survive in raw manure for one year or longer.
- No one knows precisely how long manure-borne pathogens survive after application to fields.
- When not possible to maximize time between application and harvest, never use raw manure.
Manure and Municipal Biosolids

- Three options as relates to the farm operation:
  - **Option A: Raw Manure** -- Raw manure or combination or raw and composted manure is used as a soil amendment.
  - **Option B: Composted Manure** -- Only composed manure/treated municipal biosolids are used as a soil amendment.
  - **Option C: No Manure/Biosolids Used** -- No manure or municipal biosolids of any kind are used as a soil amendment.
Production Practices to Reduce Risks Related to Use of Raw Manure

- Use Best Management Practices (BMPs) to reduce contamination:
  - Proper storage
  - Incorporate
  - Target time of application
  - Target crop
  - Proper and thorough composting
  - Keep records
Raw Manure

- Apply early, keeping nutrient concerns in mind.
- Do not apply manure or manure-containing litter while eaten part is present.
- Cornell GAPs suggest applying and incorporating manure at least 120 days before harvest.
Raw Manure

- Pathogen survival dependent on:
  - Type of pathogen
  - Rainfall
  - Soil moisture
  - Temperature
  - Soil type
  - Whether or not it is incorporated.

**SOURCE:** Franz et al., 2005; Guan and Holley, 2003; Ingham et al, 2005; Natvig et al., 2002; Oliver et al., 2006; Saini et al., 2003; Scott et al., 2006
Raw Manure

- Incorporation might lead to longer pathogen survival.
- Avoid runoff if manure is left on surface for a time.
- Incorporation might reduce chance of contamination by soil splash and reduce chance of runoff into water sources.
- Mulches reduce soil splash.
Raw Manure

- A NC DENR permit is required for manure disposal if owners have at least:
  - 75 horses
  - or 100 dairy cows
  - or 250 hogs
  - or 1,000 sheep
  - or 30,000 broilers or layers (liquid waste systems)
Raw Manure

- USDA National Organic Program regulations specify how early manure must be incorporated:
  - 120 days before harvest for crops if the consumed part comes into contact with soil particles
  - 90 days before harvest if the consumed part does not come into contact with soil particles.
  - Do not contaminate irrigation water, crops, finished compost or other materials with raw manure.
Manure Treatment Methods

- Aging (passive)
- Composting (active)
- Other active treatments
  - Pasteurization
  - Heat drying
  - Aerobic and anaerobic digestion
  - Alkali stabilization
Composted Manure

Composting guidelines often based on federal biosolids law (40 CFR 503):

- At or above 131°F for at least three (within-vessel or static aerated pile) or 15 (windrow) days
- Turned at least five times (windrow only)
Composted Manure

- USDA audit:
  - Only composed manure and/or treated biosolids used as a soil amendment
  - Composted manure and/or treated biosolids properly treated, composted, or exposed to environmental Conditions that would lower the expected level of pathogens
  - Composted manure and/or treated biosolids properly stored and protected to minimize recontamination
  - Analysis reports available for composted manure/treated biosolids.
Composted Manure

• If compost is not produced in a satisfactory way, precautions similar to those for raw manure must be used.
• Concern about compost is related to animal materials
Manure Slurry

• Faster decline in *E. coli* and *Salmonella* numbers in slurry than solid manure at temperatures between 70°F and 100°F (Guan and Holley, 2003; Oliver et al., 2006)

• Cornell: Store 60 days before application in summer (90 in winter)
Manure and Compost Teas

• No manure teas
• Compost tea safety dependent on compost used and protection from contamination
• Heat treatment possible
Other Animal Byproducts

- Examples include: bloodmeal, bonemeal, feathermeal, fish emulsion
- Little information about safety
- Process check
- Watch for contamination with manure
Biosolids

- Use of “sewage sludge generated during the treatment of domestic sewage in a treatment works” is regulated by federal law (40 CFR 503).

- Class A
  - Can be sold directly to public

- Class B
  - Applied by producer, under permit that states how long before harvest it must be applied
Biosolid Concerns

- Pharmaceutical agents are sometimes present.
- Little information about uptake by plants, but it has been shown in manure-amended soil.
- Allowable heavy metal concentrations are regulated by law.
- Levels of heavy metals are typically low in domestic biosolids.
Soils -- Site Selection

- Risk assessment
  - Has the site been exposed to activities or conditions in the past that might have resulted in contamination?
  - Is adjacent land being used for purposes that might result in contamination of crop land?
- Land use history
  - Livestock or manure
  - Flooding
  - Hazardous chemicals
- Current proximity to livestock operations, cull piles, refuse dumps and debris
Site Selection

Farm layout

Slide modified from D. Sanders presentation
Site Selection

- Farm diagram
- Feedlot drains into irrigation pond
Soils

• When previous land use history indicates possibility of contamination, preventative measures have been taken to mitigate risk.
• Soil has been tested for contaminants.
• Land use is commensurate with test results.
• Crop production areas subjected to flooding are tested for potential microbial hazards.
Soil Testing

- Soil can be tested for fecal bacteria, heavy metals or chemical contamination.
- Fecal coliforms or *E. coli* are often used as indicators of contamination by manure or sewage.
Traceability

- Each production area is identified or coded to enable traceability in the event of a recall.
Part 2 – Field Harvest and Field Packing Activities

Field Sanitation and Hygiene
Field Harvesting and Transportation
Field Harvest

- Harvest containers
- Field equipment
- Field packing
- Bins
Field Harvest
Harvest Sanitation

- Prevent contact between fruits, vegetables, bins and soil.
- Avoid bruises or cuts to fruits or vegetables that may allow internal contamination.
- Do not use open-water sources for field washing.
- Provide restrooms and handwashing stations.
- Clean and sanitize bins and harvest equipment after each use.
Strawberry Harvest Cart

Courtesy of Jeff Brecht
Field Conditions Can Increase Risk
Field Harvesting and Transportation

- Clean and sanitize harvesting containers and bulk hauling vehicles.
- Clean and disinfect hand harvesting equipment and implements on a scheduled basis.
- Repair or throw out damaged containers.
- Harvesting and transportation equipment in good repair.
- Light bulbs and glass on harvesting equipment protected and procedures on what should be done if glass or plastic breaks.
- Procedures on what should be done if production contamination from chemicals.
Field Harvesting and Transportation

- Inspect for foreign objects.
- Harvesting containers not used for non-produce items.
- Water used is safe.
- Remove dirt and mud from product and containers.
- Product covered when moved from field to storage.
- In ranch or field pack operations, only new or sanitized containers used for packing products and properly stored.
- Product moving out of the field identified to enable traceability.
Part 3 – House Packing Facility

Receiving
Washing/Packing Line
Packing House Worker Health and Hygiene
Packing House General Housekeeping
Pest Control
Traceability
Receiving

- Product delivered from the field in a staging area is protected from possible contamination.
- Prior to packing, product is properly stored and/or handled to reduce possible contamination.
Washing/Packing Line
Wash Water Quality

- Wash water must be potable and properly chlorinated to keep it safe.
- Testing procedures must be implemented to insure the proper chlorination levels are consistently maintained in the water.
Acceptance Criteria

- Water in direct contact with produce should meet EPA MCLG microbial drinking water quality standards.
  - Generic *E. coli* negative test or below detection limit
  - If not, remediation is needed (disinfect).
    - >1 ppm free chlorine (pH 6.5-7.5) or ≥ 650 mV ORP (pH 6.5 – 7.5)
    - Other approved water treatments for human pathogen removal (EPA labeled)
Best Practices for Washing Produce

- Check available chlorine levels often or use automated monitoring systems.
- Use chlorine or other labeled disinfectant in wash water.
- Change water at least daily, or more frequently when dirty.
- Monitor water quality and record results.
- Keep dump tank water $\leq 10^\circ F$ cooler than produce.
- Wash, rinse, and sanitize belts and conveyors regularly.
Wash Water and General Chlorine Recommendations

- Maintain available chlorine levels between 100 to 150 parts per million.
- Maintain pH between 6.5 and 7.5.
- Drain tanks often (e.g., daily) and refill with clean water.
- Use self-cleaning screens in dump tanks to remove large debris and organic matter.
Wash Water and General Chlorine Recommendations

- Water in direct contact with produce should meet U.S. EPA MCLG microbial drinking water quality standards.
  - Generic *E. coli* negative test or below detection limit
- Maintain free chlorine levels between 100 to 150 parts per million.
- Maintain pH between 6.5 and 7.5.
- Drain tanks often (e.g., daily) and refill with clean water.
- Use self-cleaning screens in dump tanks to remove large debris and organic matter.
# Chlorination of Wash Water

<table>
<thead>
<tr>
<th>Crop</th>
<th>Chlorine Strength (available chlorine), ppm</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bell Peppers</td>
<td>300-400/150-200</td>
<td>Dump Tank/Sprayer belt</td>
</tr>
<tr>
<td>Melons</td>
<td>100-150</td>
<td>Dump Tank/Sprayer</td>
</tr>
<tr>
<td>Lettuce, cabbage, leafy greens</td>
<td>100-150</td>
<td>Sprayer belt / Hydrocooler</td>
</tr>
<tr>
<td>Potatoes</td>
<td>200-300/100-200</td>
<td>Flume/Sprayer belt</td>
</tr>
</tbody>
</table>

**Source:** Post-harvest Chlorination, Trevor Suslow UC Davis
Monitor Process Water

- Dump or soak tanks.
- Washing lines.

Photo: William C. Hurst, University of Georgia
Monitor Process Water

- Hydrocoolers.
- Infiltration into product might be an issue.

Photo: William C. Hurst, University of Georgia
Monitor Process Water

- Top ice and liquid-ice injection
- Ice makers

Photos: William C. Hurst, University of Georgia
## Maintain Records

**Packing Line:** Tomato grading line  
**Specific Location:** Water in dump tank  
**Control Limits:** Available Chlorine = 100-150 ppm/ pH = 6.5-7.5

<table>
<thead>
<tr>
<th>Date</th>
<th>Free Chlorine</th>
<th>pH</th>
<th>Operator Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Verified by: _______________________

   Tomato Line Supervisor
Monitoring Options

- **Test Strips** – be sure available or “free” chlorine measured.
- **Colorimetric kits** -- if sample dilution is required, dilute with distilled water.
- **Electronic Sensors** -- oxidation Reduction Potential, ORP, pH
A single error at a critical control point is capable of magnifying problems in sanitation or hygiene management.
Agents Used to Sanitize Fruits and Vegetables

- Chlorine
- Chlorine dioxide
- Bromine and iodine
- Hydrogen peroxide
- Peroxyacetic acid
- Electrolyzed water
- Ozone
- UV-C illumination
Avoid Mechanical Injury
Post-harvest and Processing Water

Poor management at a critical point is capable of magnifying an error in sanitation or hygiene control.
Areas to Monitor

- Dump or soak tanks
- Washing lines
Other Concerns – Washing/Packing Line

- Food-contact surfaces are in good condition and cleaned and sanitized.
- Product flow zones are protected from sources of contamination.
Packing House General Housekeeping

- Microbes survive and grow on surfaces that remain wet (brush/sponge rolls; floors).
- When plant material is in contact with surfaces:
  - waxes and plant sap accumulate.
- Partially decayed plant material:
  - sticks to surfaces
  - is loaded with microbes.
- Use of dump tanks:
  - Pathogens can accumulate during packing.
Sanitation in the Packing House

- Maintain constant sanitizer levels in dump tanks and spray washers.
  - Regularly check automated equipment during packing.
- Sanitize facilities and equipment regularly.
  - **Daily:** Change dump tank water, packing line equipment (particularly areas that remain wet), floors, drains and breakrooms/bathrooms.
  - **Monthly or between loads in the cold room:** floors, walls, ceilings, refrigeration coils, doors and curtains.
Sanitation in the Packing House

• Discard fruits and vegetables that fall on the floor.
• Exclude animals from packing house.
• Prepare cartons only as needed.
• Remove fruit and vegetable culls and debris promptly.
• Provide restrooms and hand-washing stations.
• Maintain sanitation records.
Biofilms

- Biofilms are sticky to slimy accumulations of fungi and bacteria that accumulate on wet surfaces.
- Plant residues + moisture + microbes + warm temperatures = biofilms.
- Sanitizers will prevent their formation, but do not penetrate existing biofilms.
Pathogen Control in Packing House

Chlorine/ORP System

Ozone System
Other Housekeeping

- Plant grounds free of standing water.
- Outside garbage receptacles/dumpsters closed or located away from packing facility entrances.
- Packing facilities are enclosed.
- Packing facility interior is clean and maintained in an orderly manner.
- Floor drains free of obstructions.
- Pipes, ducts, fans, and ceilings over food handling areas are clean.
Use Gloves on the Packing Line
Temperature Management

- Low temperatures supplement good sanitation practices.
- Avoid delays that postpone cooling.
- Consider:
  - time from harvest to packinghouse
  - time from arrival to cooling of produce
  - speed of cooling and final temperature.
Temperature Management

• Cooling method
  • forced-air, hydrocooling, vacuum cooling, package and top icing
  • 7/8 cool (7/8 of field heat removed before storage or transport).

• Proper hydrocooler management
  • water sanitized continuously
  • incomplete cooling = wet, warm produce = ???
Temperature Management

- Storage and transport temperatures:
  - Optimum temperatures for fruits and vegetables range from 32°F/0°C to 59°F/15°C.
  - Most human pathogens grow slowly or not at all below 45°F/7°C.
  - *Listeria monocytogenes* is a special concern in refrigerated environments.

- Maintain records of temperature management.
Packing in Cold Room
Procedures for Cleaning Room and Equipment

- Empty and sweep cold rooms.
- Pre-rinse equipment or walls.
- Visually inspect surfaces.
- Apply appropriate cleanser -- scrub from top, downward.
- Do not allow cleanser to dry on surfaces -- rinse from top, downward.
Procedures for Cleaning Room and Equipment

• Visually re-inspect surfaces.
• Apply a high level sanitizer according to label directions.
  • Let stand for 20 minutes.
  • Rinse with potable water.
• Apply regular level sanitizer according to label directions.
  • Rinse with potable water.
Cleaners and Sanitizers

- Steam
- Hot Water
- Radiation (UV, gamma, x-ray, e-beam)
- Chemicals
  - Halogens (chlorine, iodine, bromine)
  - Quaternary ammonium compounds (quats)
  - Acid sanitizers
  - Hydrogen peroxide
  - Ozone
  - Impregnated surfaces.
Cleaning and Sanitizing the Packing Line
Final Steps

- Clean and put away supplies.
- Document cleaning practices.
- Periodic QA inspection/swabs.
- Have regular training for employees.
Pest Control

- Pest control traps and bait stations should be stationed inside and outside the facility at key locations.
- Measures are taken to exclude animals/pests from facilities.
- Established pest-control program with service reports will be maintained.
- Interior walls, floors, and ceilings well maintained and free of major cracks and crevices.
Pest Control -- Bird Droppings on Belt
Can You Use These?
Animal control is important!
Pest Control -- Trap Placement
Pest Control -- Packing Line
Traceback and Traceforward Topics

- Why is they important?
- Intertwining of existing laws
- Components of traceability
- Defining a system
- Recall
Or........One step back
One step forward

- “Who/Where did I get it from and Who/Where is it going.”
- A traceback investigation is the method used to determine and document the distribution and production chain, and the source(s) of a product that has been implicated in a food-borne illness investigation, quickly and accurately.

Why Is This Documentation Important?

- Quickly & accurately = locate foods in the distribution system
- Quickly & accurately = prevent illnesses and possible deaths
- Quickly & accurately = allow for integration of other existing program requirements
- Quickly & accurately = less economic impact to growers
The Consumer Speaks….

• Food scares erode confidence in food safety.
  • 46 percent worry about getting sick from food.
  • 52 percent have only some or little confidence in the food inspection system.

• Consumers support traceability solutions.
  • 86 percent support labeling produce so it can be tracked.
  • 80 percent support federal safety standards for produce.
  • 92 percent support COOL.

Sources: AP-Ipsos poll July 18, 2008; Harvard School of Public Health poll June 12, 2008; Consumers Reports survey July 10, 2007.
Country of Origin Labeling

- Or COOL
- 2008 Farm Bill extended to:
  - Beef, pork, lamb, goat, chicken, fresh/frozen fruit & vegetables, peanut, pecan, ginseng and macadamia nuts.
- COOL information includes:
  - Producer affidavits
  - Purchasing/receiving records
  - Production/harvest records.
Bioterrorism Act (2002)

Sets forth the establishment and maintenance of records for persons who manufacture, process, pack, transport, distribute, receive, hold or import food in the U.S. (21CFR part 1, subpart J).

“Generally, everybody in the supply chain must be able to trace one step back and one step forward.”
Traceback Components

- A documented traceback program has been established.
- Finished product is traceable to:
  - the packing house
  - a group of growers/the specific grower
  - a group of orchards or fields/to the specific orchard or field.
  - a group of harvest dates/a specific harvest date
  - a packing date.
- The operation has performed a “mock recall” that was proven to be effective.
Internal + External = Whole-Chain Traceability

- Internal = confidential or proprietary data and processes companies use within their own span of operations to track/trace product (e.g. packer).
- External = the data exchange and business processes that take place between trading partners to track/trace product (grower => packer => retailer).
Three Pillars of Traceability

**Movement Event**
Relies on efficient data collection,
Records change of premises

**Product ID**
Associates a unique tag number to a unit, case, or pallet

**Premises ID**
Unique number for a physical location
Renew annually for data integrity
Define a System

• Grower
  – Uniquely identify all growers in a value chain
  – Machine readable (barcode or RFID)
  – And human readable (growers name, address)

• Specific Field location (Premises ID)
  – Coordinates (get a map of your fields online)
  – Use the Farm Service Agency numbers

• Assign a Product ID for each commodity
• Identify each picker or group of pickers
• Date of harvest (and time of day)
• Date of pack
Define a System (cont’d)

- Movement codes (harvest, pack, ship…)
- Receipt date
- Ship date
- Personnel health records linkage
- Documentation for fresh produce needs to be kept for at least one year.
Continuing with a Systematic Linkage…

- Based on information like the field number and date.
- These can be linked to:
  - Pesticide records
  - Notes on unusual events (flooding, foul/wildlife damage, etc.)
  - Personnel health/hygiene records.
    (Needed information if you are to go into a Recall situation.)
Initiating a Standardization for Traceability

- Produce Traceability Initiative
  October 8, 2007
  - Produce Marketing Association (PMA)
  - Canadian Produce Marketing Association (CPMA)
  - United Fresh Produce Association (UFPA)

**Produce Traceability Initiative**

- **Obtain Company Prefix for growers, packers and repackers.**
  - **Q1 2009**

- **Assign GTIN Numbers according to GTIN assignment strategy from associations.**
  - **Q1 2009**

- **Provide GTIN Info to Buyers for use in scanning and retail POS systems.**
  - **Q3 2009**

- **Encode lot code info in a barcode and in human readable format on cases.**
  - **Q3 2010**

- **Read & Store Info on Inbound cases.**
  - **2011**

- **Read & Store Info on Outbound Cases.**
  - **2012**

- **Unique identification of products (cases) from the farm (first packer).**

- **If product is repacked, linkage of incoming case code to new outgoing code.**

- **Capturing and storing of data by every receiver all along the supply chain.**

- **Final tracking outbound from DC to retail store, restaurant.**

![Barcode Example]

- **Company Prefix**
- **Reference Number (i.e. Case Number)**
- **Check Digit**
Traceback on the Farm

- Produce Traceability Initiative system designed to case level (First Packer).
- Important to have a system defined from the farm level that identifies
  - Grower
  - Lot number (attached to harvested field)
  - Harvest/Pack date.
Traceback Investigation Conducted

1. to identify the source and distribution of the implicated food and remove the contaminated product from the marketplace.

2. to distinguish between two or more implicated food products.

3. to determine potential routes and/or sources of contamination in order to prevent future illnesses.

Source: http://www.fda.gov/ora/inspect_ref/igs/epigde/epigde_content.html#intro
Agencies Involved in an Investigation

- FDA Emergency Operations Center (EOC)
- CDC
- State health regulatory officials – NCDA, DENR
- Local health officials
Mock Recall Topics

- Regulatory guidance
- What is a recall?
- Recall classifications
- Next steps
Regulatory Guidance


- U.S. Food and Drug Administration (FDA) has authority over most other foods.

- USDA Food Safety and Inspection Service (USDA/FSIS) has authority over meat and poultry products.
FDA NEWS

Marketing of MS Drug Tysabri Suspended
Illegal SciFit Product Dietary Supplements Seized
New Product Approved to Treat Smallpox Vaccination Complications
New Improvements in FDA's Drug Safety Monitoring Announced
Cellular, Tissue and Gene Therapies Advisory Committee to Meet March 3-4
Recalls, Product Safety

FDA Activities
About FDA

Food Industry
Register a Facility
Prior Notice of Imports

More Hot Topics...
Fly Information
PPA
Losing Weight
Cell Phones
Imported Drugs
Counterterrorism
Bioterrorism Act
Buying Medicines Online
Counterfeit Drugs

Multiple images of FDA employees and areas of regulation.
Situations Prompting Recalls

- Allergens
- Bacterial /chemical contamination
- Communicable disease
- Company-generated information
- Foreign objects
- Illnesses identified by State Health Dept. Or CDC
- In-house sabotage
- Misbranding
- Packaging defects
- Real or fraudulent consumer claims
- Scientific reports
- Suppliers’ notification
- Tampering and tampering threats
- Undeclared ingredients
What Is a Recall?

- Recalls are the procedures conducted to identify and recover potentially adulterated, misbranded, and/or hazardous foods from trade and/or consumer channels effectively.
- Voluntary actions by manufacturers.
- FDA does have the authority to seize adulterated products or to acquire an injunction against distribution or may initiate recall process by informing firm that an adulterated product in commerce has been identified.
Why Should I Care?

- An effective recall program will protect company employees and brand names from adverse legal, regulatory and publicity actions.
- “Natural” occurrences of food contamination have been documented.
  - Prevention is far from 100% achievable
- Preventing purposeful contamination.
- Part of an effective traceability program.
Recall Classifications

- Numerical designation assigned by the FDA to indicate the relative degree of health hazard presented by the product
  - Class 1
  - Class II
  - Class III
Class I

- Class I is a situation in which there is a reasonable probability that the use of, or exposure to, a violative product will cause **serious adverse health consequences or death**.

- Examples of this are:
  - *Listeria monocytogenes*, *Salmonella*, *E. coli O157:H7*
Class II

- Class II is a situation in which use of, or exposure to, a violative product may cause temporary or medically reversible adverse health consequences, or where the probability of serious adverse health consequences is remote.
  - Hard/sharp foreign objects 7 - 25 mm.
  - Undeclared yellow 5 & 6.
  - Unapproved/uncertified colors.
  - *Shigella*, staph toxin.
  - Undeclared wheat.
Class III

- Class III is a situation in which use of, or exposure to, a violative product is not likely to cause adverse health consequences.
  - Mold, yeast, lactobacillus.
  - Hard/sharp foreign objects less than 7 mm.
  - Off odor/off taste from contaminant at levels not likely to pose a hazard to health.
Recall Worksheets

- Production dates
- Product names, labels, package sizes and types (Vac Pak, cartons)
- Amount produced / distributed
- Distribution level and locations
Next Steps

- Develop a Food Safety Plan.
- Work with local extension agent.
- Attend commodity specific events.
- Review the PMA/United Fresh “Produce Traceability Initiative.”
- Review any FDA crop specific guidance.
Resources

- Improving the Safety and Quality of Fresh Fruits and Vegetables: Good Manufacturing Practices for Handling, Packing, Storage and Transportation of Fresh Produce (Section III) Univ. of MD. 2002
- AFDO Product Recall Workshop, Cecelia Wolyniak, Recall Coordinator, FDA, CFSAN. http://www.afdo.org/afdo/training/Listeria-Recall-Workshop-05.cfm
Traceability Resources

- Traceback – Assigning Blame PPT – Dr. James Rushing Clemson University.
Traceability Resources

- CFSAn and ORA Farm investigation Questionnaire

- Guide to Produce Farm Investigations
  http://www.fda.gov/ora/inspect_ref/igs/farminvestigation.html

- FDA Recalls, Market Withdrawals, and Safety Alerts
  http://www.fda.gov/opacom/7alerts.html
Part 4 – Storage and Transportation

- Product, Containers, and Pallets
- Pest Control
- Ice and Refrigeration
- Transportation
- Worker Health and Personal Hygiene
- Traceability
Product, Containers, and Pallets

- Storage facility clean and orderly.
- Bulk storage facilities inspected for foreign materials – records maintained.
- Storage rooms, buildings, and facilities protected from external contamination.
- Floors in storage areas reasonably free of standing water.
- Wastewater spillage prevented.
Ice and Refrigeration

- Water used for cooling or ice is potable.
- Facilities and equipment used to make and deliver ice have been sanitized.
- Climate controlled rooms monitored for temperature.
- Thermometers checked for accuracy.
- Refrigeration system condensation does not come in contact with produce.
- Refrigeration equipment cleaned on a scheduled basis.
- Ice product does not drip on produce stored below.
Part 6 – Wholesale Distribution Center/Terminal Warehouses

- Receiving
- Storage Facility/Temperature Control
- Pest Control
- Repacking/Reconditioning
- Worker Health and Personal Hygiene
- Shipping/Transportation
- Traceability
Receiving

- Companies that supply fresh produce have passed a third party audit verification of GAP and/or GHP.
- Conveyances clean, in good physical condition, and free of obvious objectionable odors, dirt, and debris at time of unloading.
- Company does not load or unload produce not protected from contamination.
- Refrigerated commodities monitored for temperatures at time of receiving.
- Written policy regarding disposition of product not at proper receiving temperatures.
Repacking/Reconditioning

- Repacking/reconditioning confined to established location.
- Food-contact surfaces cleaned, sanitized and in good condition.
- Water used for ice and processing is potable.
- Only food grade approved and labeled lubricants used in repacking equipment/machinery.
- Pallets clean and in good condition.
- Packing containers properly stored and protected from contamination.
Part 7 – Preventive Food Defense Procedures

Secure Employee/Visitor Procedures
Secure Facility Procedures
Secure Employee/Visitor Procedures

- Documented food defense plan
  - Food defense training provided to all.
  - Employees aware of whom in management to contact about security problems/issues.

- Visitors
  - required to check in and out.
  - Purpose of visit verified before admittance to the facility.
  - Visitors prohibited from packing/storage areas unless accompanied by employee
  - Incoming and vehicles subject to inspection.
Secure Employee/Visitor Procedures

- **Staff**
  - Prohibited from bringing personal items into handling or storage areas.
  - Staff access limited to area of their job function and unrestricted areas.

- **Management**
  - Aware of which employees on premises and area assignments
  - System of positive identification of employees.
Secure Facility Procedures

- Uniforms, name tags, and identification badges collected prior to termination.
- Mailroom located away from packing/storage areas.
- Computer access restricted
- A system of traceability of computer transactions
- Background checks
- Routine security checks
- Perimeter secured by fencing or other deterrent
- Checklists used to verify security of doors, windows, and other points of entry
Secure Facility Procedures

- All keys accounted for
- Emergency lighting system
- Facility enclosed
- Storage and vehicles kept locked
- Delivery schedules established
- Off-loading of incoming materials is supervised
- Established policy for rejecting deliveries
- Only accepted returned containers that are sanitized
- Program to inspect returned product for tampering
Secure Facilities Procedures

- Identify who is responsible for recalling product.
- Perform a mock recall.
- Segregate imported product from domestic product.
- Segregate allergens.
- Store floor plans, product flow plans, and or segregation charts in a secure location.
- Register with the FDA and have registration number.
Written Policies

- Handling/disposition of produce or food-contact surfaces that have come into contact with blood or other body fluids.
- Written policy regarding the use of hair nets/beard nets in the production area.
- Written policy regarding the wearing of jewelry in the production areas.
- Policy describing procedures for handling/disposition of finished product which is opened, spilled or comes in contact with the floor.
Programs/Plans

- Documented Food Safety Plan that incorporates GAP and/or GHP
- Documented Traceability Program
- Documented Food Defense
- Response plan is in place for the event of a major spill or leak of field sanitation units or toilet facilities.
Standard Operating Procedures

- Measures to take in case of glass/plastic breakage and possible contamination during harvesting operations.
- Measures to take in case of product contamination by chemicals, petroleum, pesticides, or other contamination factors.
Monitoring and Recordkeeping

- Monitor initially:
  - Crop production areas monitored for presence or signs of wild or domestic animals entering the land.
  - Pre-harvest assessment on the crop production areas.

- Analysis reports available for:
  - composted manure/treated biosolids.
  - water quality testing
Monitoring and Recordkeeping

• Daily:
  • Processing water temperature used in dump tanks, flumes.
  • Water treatment (strength levels and pH) and exposure time
  • Bulk storage facilities inspected for foreign materials
  • Accuracy of thermometers checked.
  • Refrigerated rooms monitored for temperature
Other Records

- Service reports for the pest control program are available for review.
- Records of the source of incoming product and the destination of outgoing product
Training

- Staff must be trained on proper sanitation and hygiene practices.
- Company personnel or contracted personnel applying non-regulated materials must be trained on proper use.