GOOD AGRICULTURAL PRACTICES
for
Production, Handling and Shipping
of
FRESH MARKET SPINACH

Complied by:
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Department of Horticultural Sciences

Sponsored by:
The Wintergarden Spinach Producers Board
CRITICAL HAZARD CONTROL POINTS

Harvest and post-harvest operations of fresh market spinach

(Areas of potential problems for spinach contamination with food borne pathogens)

<table>
<thead>
<tr>
<th>Worker Hygiene</th>
<th>Containers</th>
<th>Water</th>
<th>Equipment</th>
<th>Sanitation</th>
<th>Transportation</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>field</td>
<td>Bulk bins</td>
<td>Irrigation</td>
<td>Harvesters</td>
<td>Field</td>
<td>Field trucks</td>
<td>Storage</td>
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<tr>
<td>shed</td>
<td>Blues</td>
<td>Wash</td>
<td>Graders</td>
<td>Sheds</td>
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<td>Semis</td>
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</tbody>
</table>

PRODUCTION

Land prep

Planting

Water and Irrigation

Pest control

HARVEST

Machine harvest

Field transporting

POST HARVEST/SHED

Unload

Wash

Grade/Sort

Hydrocool

Centrifuge dry

Blue tote pack

Top ice

Palletize

Temporary cold storage if needed

TRANSPORTATION TO MARKET

Truck sanitation

Load for transport and delivery
**CHECK LIST:** Minimizing pathogen contamination in fresh market spinach production

**PROMOTE WORKER HYGIENE**

One of the major sources of food borne pathogen contamination is worker’s hands. Therefore the single most effective method of preventing spinach contamination with these organisms is proper hand washing.

**Hand washing:**

* Provide clean restroom facilities with soap, clean water and single use towel
* Teach all workers about the microbial risk and the importance of good hygiene
  - Poor hygiene can cause themselves as well as and others to become sick and even die
* Train all field, shed and office workers in proper hand washing techniques
  - 20 seconds with vigorous scrubbing with soap and hot water
  - Thoroughly dry with disposable hand towels
  - Properly wash hands after each visit to rest rooms facilities and/or before handling equipment, machinery and raw spinach

**Injuries and illnesses:**

* Do not allow workers with open wounds to work
  - Open wounds can contaminate fresh spinach
  - Bandages are necessary to protect wounds but can become contaminated themselves, best to have workers with bandaged wounds to work only in areas that do not come in contact with fresh spinach
  - If hand wounds are bandage, latex rubber gloves must be worn to prevent the bandages from becoming a source of contamination

* Workers who exhibit symptoms of illnesses should not be allowed to work
  - Explain to them that they can transmit their sickness to other and that is why they are not allowed to work

* Supply and demand workers coming in contact with fresh spinach to wear latex gloves
  - Gloves can also become contaminated
  - Change and discard gloves periodically
  - Never use gloves with tears, holes etc in them

**PRODUCTION**

Contamination of produce with E. coli 0157:H7 is a major health concern, especially as that organism relates to on-farm food safety. The major source of on-farm E. coli is from animal feces. Therefore, steps to
insure contamination from animal waste should be a major priority when livestock and wildlife are common to the spinach production area; and/or when manures are use as fertilizers

Land preparation:
* Select intended spinach fields carefully
  - Review field history for animal manure use and avoid those recently used for animal grazing
  - Avoid fields near animal feed lots and grazing pastures
  - Prevent runoff or drift from animal operations from entering fields
  - Berm fields downstream from these operations if they must be used
* Select fields upstream from animal operations
* Determine surface water uses upstream from potential spinach plantings
  - Berm fields near streams having history of flooding
* Select fields free of debris that might house harmful bacteria
* Clean and disinfect tractors, plows, and bedders etc. prior to use in preparing spinach fields
* As much as possible, keep pets, livestock and wildlife out of fields
* Use only properly composted manure
  - never use raw or non-composted manure
  - Store manure piles on down side of spinach fields
  - Obtain data on composting technique, maintain use records
* Promote and enforce worker hygiene in the field
  - Provide and maintain clean restroom facilities near work areas
  - Stock such facilities with soap, clean water (hot is possible), and single-use-towels for hand washing
* Train all workers in good hygiene and demand that they follow these measures
* Maintain a daily log of all worker training and activities performed to insure maximum food safety of spinach grown, packed and shipped form facility

Planting:
* Clean and disinfect tractors and planting equipment prior to entering a spinach field
* Promote and enforce worker hygiene in the field
  - Provide and maintain clean restroom facilities near work areas
  - Stock such facilities with soap, clean water (hot is possible), and single-use-towels for hand washing
* Train all workers in good hygiene and demand that they follow these measures
* Maintain a daily log of all worker training and activities performed to insure maximum food safety of spinach grown, packed and shipped form facility

Water use and irrigation:
* Anytime water comes in contact with fresh spinach, its quality determines the potential for pathogen contamination since water can be a carrier of a number of organisms
**Test water source for bacterial contaminants**
- Uncovered sources (rivers, tanks etc) every 3 months during the season
* Surface water is a high risk source 
* Potable well water has minimal risk if well casing is maintained and livestock is excluded from active recharge area
  - Test well water at least annually
  - Chlorine treat wells if needed
  - Record test dates and keep test records
* If municipal/District sources are used obtain and keep records of their test periods and results
* Clean vegetation areas around water sources: well heads, streams, rivers and tanks used as water sources
* Filter or use settling ponds to improve water quality when streams or rivers are the sources of irrigation water
* Store gated and sprinkler pipe above ground and take measures to prevent animals and birds from rousting in them when not in use
  - Clean pipe of debris, dead animals and/or their droppings
* Maintain a daily log of all worker training and activities performed to insure maximum food safety of spinach grown, packed and shipped form facility

**Pest control:**
* Use potable water for crop protection sprays
* Clean sprayers with potable water and store in protected structures after each use
* Take appropriate measures to keep birds and animals from nesting in spray tanks or on spray rigs
* Train all workers in good hygiene and demand that they follow these measures
* Maintain a log of all activities

**HARVEST**

**Machine harvest:**
* Clean harvester with high pressure wash and sanitize before and after each use and store in a protected structures
* Take appropriate measures to keep birds and animals from nesting in or on harvest equipment
* Inspect routinely and repair equipment as needed
* Keep pets and unauthorized personnel out of spinach fields
* Provide port-a-potties and sanitation facilities near in readily accessible locations near spinach fields.
* Train all workers in good hygiene and demand that they follow these measures
* Maintain a daily log of all worker training and activities performed to insure maximum food safety of spinach grown, packed and shipped form facility
Field transportation:
* Clean tote, bins and field wagons, truck etc. with high pressure wash and sanitize before each use
* Prohibit workers from standing on spinach in bins, field wagons, trucks etc.
* Store totes and bins in a protected areas
* As feasible keep birds, rodents and pets out of areas where tots and bins are stored and use appropriate pest control measures to rid areas of rats, insects etc
* Maintain a daily log of all worker training and activities performed to insure maximum food safety of spinach grown, packed and shipped form facility

POST HARVEST/PACKING SHED

Water is the prime vehicle for spreading contaminants to fresh spinach. Once water becomes contaminated everything it comes into contact with can become contaminated. Therefore, preventing contamination of water in these facilities is one of the major keys to insuring consumers get a safe product.

Wash water:
* Include a disinfectant such as chlorine in the wash water
* Use only potable water for all washing and rinsing activities
* Avoid dump tank water temperatures 10 degrees F greater than the fresh spinach the field temperature (Higher temperature differential can cause any bacteria present to be sucked into spinach tissue
* Continuously monitor and maintain water levels of:
  - chlorine levels at 150 ppm
  - pH level at 6.0-7.0
* Final spinach rinse water use be maintained above 100 ppm

ICE:
* If ice produced at the shed, use only potable water
* Clean and sanitize all ice making or crushing machines daily
* Provide an elevated enclosed area to store crush ice
* Clean and sanitize all shovels etc used to handle ice
* Do not allow worker to walk in ice storage areas
* Water is the prime source of contamination
  - Ice is a solid form of water and can also cause contamination of clean spinach if it contains pathogens

Facilities:
* Provide clean well stocked restroom facilities (soap, hot water, single use hand towels)
* Post signs encouraging the use of good personal hygiene
* Prohibit smoking or eating in the work areas
* Provide a clean designated break room for eating, smoking etc.
* Prohibit pets, animals; birds etc. from entering sheds
* Restrict facility to authorized individuals only and request all approved non worker to abide by personal hygiene and other sanitation regulations.
* Clean all work areas daily
  - field soil that may have made it way into the shed may be source of contamination
  - remove and discard all spinach leaves that have fallen onto floors
* Maintain a daily log of all worker training and activities performed to insure maximum food safety of spinach grown, packed and shipped from facility
  - Include dates and function performed and by whom
* Appoint designate individuals responsibilities for supervising specific areas of critical hazard control points and maintaining logs of what and when preventive measures were accomplished
* Conduct routine self audits to insure GOOD AGRICULTURAL PRACTICES are being followed
* Maintain records of all of these activities

**Worker hygiene:**
* Require workers to wash hands and clean booths or shoes prior to entering work areas
* Require workers to wear clean clothing each day
  - Avoid the use of clothing that enhance the possibility of collecting and distributing dirt and plant residue
* Require the use of latex gloves, clean booths/shoes and clothing
* Require workers to wash hands prior to and after eating, smoking etc.
* Train all workers in good hygiene and demand that they follow these measures

**Equipment sanitation:**
* Inspect equipment for biofilm buildup (sticky to slimy accumulations of fungi and bacteria that accumulate on wet surfaces) and clean with high pressure wash and sanitize
  - Sanitizers do not penetrate biofilms readily
  - They can help prevent formation and buildup
* Conveyors, dump bins, grading and sorting tables should be cleaned with high pressure wash water and sanitized prior to the start of harvest and daily during the season
* Clean floors daily with high pressure wash
* Use only potable water for all washing and rinsing activities
* Train specific workers in procedures for cleaning equipment and facilities

**TRANSPORTATION TO MARKET**

The final step in the spinach production process is loading in vans for shipment to distant markets. To insure that a clean boxed product does
not become contaminated by a dirty van, require that they cleaned and washed inside and out before loading the final product.

**Trucks:**

* Check prior use of vans, require drivers to high pressure wash prior to loading
* Make certain that evaporator coils and fins are cleaned as well
* Sanitize vans if animal products were previously hauled
* Pre-cool vans prior to loading

*Acknowledgements:* Above information has been adapted from “Reduce Microbial Contamination with Good Agricultural Practices” Originally written and compiled by Anu Rangarajan, Marvin Pritts, Steve Reiners and Laura Pedersen and updated with assistance from Victoria Zeppelina and the Cornell University GAPS team

*Above information also supplemented with data from:*  
Fresh Produce Food Safety; Southeast Training Program Team, Coordinated by Drs. Doug Sanders, Dennis Osborne and Donn R. Ward, North Carolina State University

UC GAPs Primer A Microbial Food Safety Training and Farm Audit by Dr. Trevor Suslow, University of California-Davis
APPENDIX

*/ Good Agricultural Practices: A self-audit for growers and handlers (short form)

*/ Sample Daily Pre-inspection Log

*/ Sanitizers

/* Information from the UC GAPs PRIMER, A microbial food safety training and farm audit resource. Dr. Trevor Suslow, Department of Vegetable of California-Davis
Davis, CA 95616

For a copy of the Primer email request to Dr. Suslow at:
tvsuslow@ucdavis.edu

Good Agricultural Practices
A Self-Audit for Growers and Handlers

Audit questions designated by * are the most vital GAP considerations. Compliance with these issues is absolutely essential in controlling microbial risk, or with obeying the law (Code of Federal Regulations, Cal-OSHA, OSHA).

Land Preparation/maintenance

Physical Location
Yes No Topographical features (slopes, depressions, swales, etc.) exist near the field that might encourage run-off?
Yes No *Does the field have a well-documented land history?
Yes No *Do adjacent fields present microbial risks?
Yes No *Is movement of animals controlled to prevent microbial contamination?
Yes No Does the area have a continual or periodic high bird population?

Pre-Plant Field Preparation
Yes No Fumigate
Yes No Deep Rip
Yes No Slip Plow
Yes No Level
Yes No Fertilize
Yes No Compost
Yes No Aged Manure
**In-Season Cultivation**
Yes No  Rip  
Yes No  Disc  
Yes No  Springtooth  
Yes No  Crowder  
Yes No  Roto-Till  
Yes No  Other: ____________________________________  
Yes No  Non-Cultivation Used

**Field Sanitation**
Yes No  *Are appropriate containers used?  
Yes No  Are containers inspected and replaced regularly?  
Yes No  *Are containers cleaned and sanitized according to a standard procedure?  
Yes No  Is farm equipment cleaned and sanitized routinely?  
Yes No  Are storage facilities cleaned and sanitized regularly, kept free of pests?

**Field Transport Equipment (Bins, Totes, Buckets, etc.)**
Yes No  Containers are free of debris  
Yes No  Containers are cleaned on a regular basis  
Yes No  Containers are made of a washable material such as plastic  
Yes No  Cleaning is documented Records are available for review at: __________________  
Yes No  Cleaning crew list of duties List is available for review at: __________________

**General Pest Control**
Yes No  Organic  
Yes No  Conventional  
Yes No  Licensed pest control advisor makes recommendations  
Yes No  Applications made by certified applicator  
Yes No  Fields posted when Category I materials are applied  
Yes No  Applicators comply with applications restrictions  
Yes No  Herbicide applications are restricted to periods when wind gusts do not exceed 10 mph for ground and 10 mph by air  
Yes No  Applications avoid potential ground water contamination  
Yes No  Reentry guidelines are observed  
Yes No  Harvest intervals are observed Pesticide permit number: _______________ Person responsible for permit: __________________  
Yes No  Pesticide application records on file with county Records are available for review at: __________________  
Yes No  Pesticides used according to label  
Yes No  Pesticides authorized for crop by U.S. EPA  
Yes No  Empty containers are disposed of properly  
Yes No  Equipment is checked and maintained on a regular schedule  
Yes No  Equipment inspections are standardized  
Yes No  Equipment is kept clean  
Yes No  Application services are subject to county, state ordinances  
Yes No  Applicators are fully trained

**Water**
Yes No  *is the best water quality reserved for post-harvest operations?  
Yes No  *is contact minimized between irrigation water and the edible plant parts?  
Yes No  Are wells constructed optimally for water protection?  
Yes No  Is the water source protected from run-off and flooding?  
Yes No  *is water source protected from animal contamination?
<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is potable water used in dust-control operations?</td>
<td></td>
<td></td>
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<tr>
<td>*Are wells maintained and repaired regularly?</td>
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<td></td>
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<tr>
<td>Are all unused wells properly shut down?</td>
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<td></td>
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<tr>
<td>Are devices in place to prevent back-siphonage in all water lines?</td>
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<tr>
<td>Is the water used to deliver chemicals and other amendments to plants of post-harvest quality?</td>
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<tr>
<td>*Is post-harvest water clean and sanitary?</td>
<td></td>
<td></td>
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<tr>
<td>*Are all unused wells properly shut down?</td>
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<tr>
<td>*Is the equipment used to maintain post-harvest water quality inspected and repaired regularly?</td>
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<tr>
<td>*Is the dump tank water properly maintained?</td>
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<td>Are appropriate wash methods used for produce?</td>
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<tr>
<td>Is the wash water used efficiently?</td>
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<td>*Are antimicrobials used properly in post-harvest water?</td>
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<tr>
<td>*Is water reused counter to the production line?</td>
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<tr>
<td>Are cooling temperatures maintained properly?</td>
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<tr>
<td>Is cooling equipment maintained properly?</td>
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<tr>
<td>*Is cooling medium maintained properly?</td>
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<tr>
<td>Have any adverse water testing results been acted upon?</td>
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</table>

**General Irrigation Practices**

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
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</thead>
<tbody>
<tr>
<td>Well water</td>
<td></td>
<td></td>
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<tr>
<td>Well is maintained</td>
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<tr>
<td>Well casings are checked regularly Year built: _________________________</td>
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<tr>
<td>Canal water Canals are maintained by: ________________________________</td>
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<tr>
<td>On-farm reservoir</td>
<td></td>
<td></td>
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<tr>
<td>On-farm reservoir is “shocked” periodically</td>
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<tr>
<td>Furrow irrigation</td>
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<tr>
<td>Drip irrigation</td>
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<tr>
<td>Drip line is buried</td>
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<tr>
<td>Sprinkler irrigation</td>
<td></td>
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<tr>
<td>Pipe?</td>
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<tr>
<td>Center pivot</td>
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<tr>
<td>Fertilization is practiced</td>
<td></td>
<td></td>
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<tr>
<td>Chemigation is practiced</td>
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<td></td>
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<tr>
<td>“Gray water” is used?</td>
<td></td>
<td></td>
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<tr>
<td>Gray water is treated with disinfectant</td>
<td></td>
<td></td>
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<tr>
<td>Gray water is filtered</td>
<td></td>
<td></td>
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<tr>
<td>Gray water is monitored daily Microbiological levels are not to exceed:</td>
<td></td>
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<tr>
<td>Gray water is controlled by local ordinances</td>
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<tr>
<td>Irrigation water is reused</td>
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<tr>
<td>Reused water is treated with disinfectant</td>
<td></td>
<td></td>
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<tr>
<td>Reused water is filtered</td>
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<tr>
<td>Total Coliform and E. coli are analyzed</td>
<td></td>
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<tr>
<td>Monthly</td>
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<tr>
<td>Semi-annually</td>
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<tr>
<td>Annually Results can be reviewed at: _________________________________</td>
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<tr>
<td>Corrective action taken Corrective action documents at:</td>
<td></td>
<td></td>
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<tr>
<td>Irrigation water tested for heavy metals Test results at:</td>
<td></td>
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<tr>
<td>Heavy metal tests negative</td>
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</table>

**Soil Amendments**

**Fertilization Practices**

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
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<tbody>
<tr>
<td>Inorganic fertilizers are applied Fertilizer supplier’s records are available at:</td>
<td></td>
<td></td>
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<tr>
<td>Fertilizer supplier’s records are reviewed</td>
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<td></td>
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<tr>
<td>Fertilizer supplier’s records are current</td>
<td></td>
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</tbody>
</table>
Yes No  Supplier’s records confirm compliance with state
Yes No  Animal manure is used
Yes No  Manure is composted
Yes No  Is the water used to deliver soil amendments sanitary?
Yes No  *is only properly-composted or adequately-aged manure used on the fields?
Yes No  *is aged manure applied only prior to planting?
Yes No  *Are only reputable compost suppliers used?
Yes No  *Are all compost applications documented?
Yes No  Are the supplier’s records reviewed regularly?
Yes No  *is compost stored in an appropriate manner?
Yes No  Is the crop considered before manure application?

Growers that operate their own composting operations:
Yes No  Are the proper minimum standards followed and permits obtained?
Yes No  Manure meets EPA Class A guidelines
Yes No  Manure supplier’s records are available at: ___________________________
Yes No  Manure supplier’s records are reviewed
Yes No  Manure supplier’s records are current
Yes No  Manure application occurs prior to cropping
Yes No  Manure applications are incorporated into soil
Yes No  Manure piles are left out during the season
Yes No  Municipal waste is used as manure
Yes No  Municipal waste is composted
Yes No  Municipal waste meets EPA Class A guidelines Municipal waste supplier’s records are available at: ___________________________
Yes No  Municipal waste supplier’s records are reviewed
Yes No  Municipal waste supplier’s records are current
Yes No  Municipal waste application occurs prior to cropping
Yes No  Municipal waste application is incorporated into the soil

**Personnel**

**Hand Labor Use**
Yes No  Pruning
Yes No  Thinning
Yes No  Harvest
Yes No  Other: _______________________________________________________________

**All employees**
Yes No  *Are employees properly trained in personal hygiene and the prevention of microbial contamination of produce?
Yes No  Trained in use of equipment?
Yes No  Pesticides safety?
Yes No  *Do employees feel responsible for food safety?
Yes No  Are training schedules, sanitation policies, and personal hygiene policies documented and accessible to employees?
Yes No  *Are employees with illness and open wounds prohibited from handling produce?
Yes No  *Are employees trained in proper hand-washing techniques?
Yes No  *Are restrooms adequate and available to employees?
Yes No  Are head coverings and hair restraints used as necessary?
Yes No  Do employees wear clean garments every day?
Yes No  *If gloves are used, are they used appropriately?
Yes No  Does the grower have hygiene policies in place for the fields?
Yes No  Are field workers provided a separate area for breaks and meals?
Yes No  First aid available
Yes No  Trained in emergency medical facilities and use?
Yes No  Fresh cool drinking water available?
Yes No Are individual disposable drinking cups available?
Yes No Chewing tobacco is restricted/prohibited from fields
Yes No Eating and chewing gum is restricted/prohibited from fields
Yes No Employees with rashes, cuts, etc. on their hands get first aid treatment and use gloves when working
Yes No Employees who show signs of illness are not permitted to come into contact with raw products

**Sanitary Facilities**
Yes No *Is there 1 toilet facility for every 20 workers of each sex, or fraction thereof?
Yes No *Is there 1 hand-washing facility for every 20 employees?
Yes No *Do toilets lock from inside?
Yes No *Is toilet paper held on a dispenser?
Yes No *Are toilets easily accessible, and can employees use them whenever they need to?
Yes No *Are toilet facilities maintained in a clean condition?
Yes No *Is sewage disposed of properly?
Yes No *Are portable toilets handled appropriately?
Yes No *Is drinking water provided for employees?
Yes No Are the grower’s sanitation policies documented?

**Facility Pest Control**
Yes No Identification of potential or present pests
Yes No Traps are set for identified pests
Yes No Potential nesting or hiding places are eliminated or monitored
Yes No Sliding doors are kept closed to prevent birds and pests from entering the area
Yes Yes All holes in the exterior walls are sealed
Yes No Pest control log is maintained
Pest control log is available for review at: ________________

**Packing Shed Sanitation**
Yes No Is the building designed to prevent cross-contamination?
Yes No Are bins and containers inspected regularly?
Yes No Is this schedule documented?
Yes No *Are bins and containers washed and sanitized regularly?
Yes No *Are packing shed personnel trained in minimizing microbial risk?
Yes No *Is processing water clean and sanitary?
Yes No *Is food protected from contamination by the equipment?
Yes No *equipment designed to be easily cleaned?
Yes No Are racks and forklifts inspected and cleaned regularly?
Yes No Is the garbage kept covered?
Yes No Is there a space of at least 18 inches between racks or pallets and the wall?
Yes No *Is equipment cleaned and inspected according to a schedule and standard procedure?
Yes No *Is a sanitizing step always preceded by a cleanser step?
Yes No *Are cleaning tools cleaned and sanitized regularly?
Yes No *Are cleaning tools kept separate according to their function?
Yes No Are food-grade lubricants used?
Yes No Are pests properly controlled according to a schedule and SOP?
Yes No Is environmental sanitation carried out according to a documented schedule?
Yes No Is environmental sanitation carried out according to a Standard Operating Procedure?
Yes No Are samples for testing taken properly?
Yes No *Are packaging materials stored in a sanitary manner?
Yes No Are cooling rooms and units cleaned and sanitized appropriately?
Yes No Are cooler temperatures properly maintained?
Yes No Is the outside property maintained in a clean condition?
Yes Yes *Do conditions at the loading dock minimize microbial risk?
Yes No *Are cross-contamination conditions minimized in the transport truck?
### Cleansers and Sanitizers

<table>
<thead>
<tr>
<th>Are appropriate water temperatures used for cleaning and sanitizing?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is a surface cleanser always used before a sanitizer?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Is there a method to test sanitizer concentration?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Are employees properly trained to use chemical cleansers and sanitizers?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Are all chemical hazards and risk areas clearly indicated?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Are chemicals safely stored?</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

### Sanitizers

#### Effective against

- **Gram positive bacteria** (lactics, clostridia, Bacillus, Staphylococci):
  - Chlorine: Good
  - Iodine: Best
  - Quats: Good
  - Acid-anionic: Good
- **Gram negative bacteria** (E. coli, Salmonella):
  - Chlorine: Best
  - Iodine: Good
  - Quats: Poor
  - Acid-anionic: Good
- **Yeast and molds**:
  - Chlorine: Best
  - Iodine: Good
  - Quats: Poor
  - Acid-anionic: Poor

#### Affects on

- **Corrosive**
  - Chlorine: Mod-High
  - Iodine: Mod-Low
  - Quats: Low
  - Acid-anionic: High
- **Affect by hard water**
  - Chlorine: No
  - Iodine: Slightly
  - Quats: Yes
  - Acid-anionic: Slightly
- **Skin irritant**
  - Chlorine: Yes, >100 ppm
  - Iodine: Not all levels
  - Quats: No
  - Acid-anionic: Yes
- **Maximum level permitted by FDA based on type without rinse**
  - Chlorine: 200 ppm
  - Iodine: 25 ppm
  - Quats: 200 ppm
  - Acid-anionic: 200-400 ppm
- **AFFECTED BY ORGANIC MATERIAL**
  - Chlorine: High
  - Iodine: Moderate
  - Quats: Low
  - Acid-anionic: Moderate
- **Cost**
  - Chlorine: Low
  - Iodine: Low
  - Quats: High
  - Acid-anionic: High
- **Stability**
  - Chlorine: Low
  - Iodine: Varies with temperature
  - Quats: High
  - Acid-anionic: High
- **Leaves active residue**
  - Chlorine: No
  - Iodine: Yes
  - Quats: Yes
  - Acid-anionic: Yes
- **Incompatible with**
  - Chlorine: Phenols, amines, soft metal
  - Iodine: Starch, silver,
  - Quats: Anionic wetting agents
  - Acid-anionic: Cationic surfactants, alkaline cleaners
- **Activity**
  - Chlorine: Fast
  - Iodine: Fast
  - Quats: Fast
  - Acid-anionic: Fast
- **Penetration**
  - Chlorine: Poor
  - Iodine: Good
  - Quats: Excellent
  - Acid-anionic: Good
# Packing Shed Sample Daily Pre-Inspection Log

(Include initial by individual performing inspection)

<table>
<thead>
<tr>
<th>Week of:___________________</th>
<th>Mon</th>
<th>Tues</th>
<th>Wed</th>
<th>Thur</th>
<th>Fri</th>
<th>Sat</th>
<th>Sun</th>
</tr>
</thead>
</table>

## Receiving Area
- Floors swept and clean of trash, debris and broken equipment
- Area is free of rodents and rodent droppings
- Walls and ceilings are clean and free of debris and cobwebs
- Trash cans are clean and emptied
- Doors are sealed properly, with no gaps

## Warehouse
- Floors swept and clean of trash, debris and broken equipment
- Walls, ceilings, pipelines and fans are clean and free of debris and cobwebs
- Cooler perimeter is free of debris and rodent droppings

## Product Storage Room
- Floors swept and clean of trash, debris and broken equipment
- Walls, ceilings, pipelines and fans are clean and free of debris and cobwebs
- Cooler perimeter is free of debris and rodent droppings

## Packing Material Storage
- Floors swept and clean of trash, debris and broken equipment
- Walls, ceilings, pipelines and fans are clean and free of debris and cobwebs
- Sanitation equipment is cleaned and properly stored
- Employee gloves, personal belongings and personal tools are properly stored

## Sanitation Supply Area
- Floors swept and clean of trash, debris and broken equipment
- Walls, ceilings, pipelines and fans are clean and free of debris and cobwebs
- Sanitation equipment is cleaned and properly stored
- Employee gloves, personal belongings and personal tools are properly stored

## Maintenance Room
- Floors swept and clean of trash, debris and broken equipment
- Walls, ceilings, pipelines and fans are clean and free of debris and cobwebs
- Sanitation equipment is cleaned and properly stored
- Employee gloves, personal belongings and personal tools are properly stored

## Restrooms
- Floors swept and clean of trash, debris and broken equipment
| Sinks, toilets and urinals are clean and in working order |  |  |  |  |
| Mirrors are clean and unbroken |  |  |  |  |
| Soap and hand towels dispensers are full and working properly |  |  |  |  |
| Trash cans are emptied and clean |  |  |  |  |
| Toilet tissue, soap and hand towels are in dispensers ONLY |  |  |  |  |
| Floor drains are clear and clean |  |  |  |  |
| **Rest Area** |  |  |  |  |
| Trash cans are clean and emptied |  |  |  |  |
| Tables are clear and clean |  |  |  |  |
| Floors are clean and free of trash |  |  |  |  |
| The area is free of rodents |  |  |  |  |
| Walls, ceilings, pipelines and fans are clean and free of debris and cobwebs |  |  |  |  |
| **Building exterior** |  |  |  |  |
| Parking lot is clean and free of trash |  |  |  |  |
| Parking lot is free of rodents and rodent droppings |  |  |  |  |
| Grounds are clean and free of trash and cigarette butts |  |  |  |  |
| Dumpster area is clean and free of trash |  |  |  |  |
| Dumpster is not leaking |  |  |  |  |
| There are no areas of standing water near the facility |  |  |  |  |
| The dock area is free of trash and bird activity |  |  |  |  |
| **Packing Area** |  |  |  |  |
| Floors swept and clean of trash, debris and broken equipment |  |  |  |  |
| Walls, ceilings, pipelines and fans are clean and free of debris and cobwebs |  |  |  |  |
| Drainage system is clean and free of debris |  |  |  |  |
| Equipment is clean and sanitized, free of debris |  |  |  |  |
| Equipment is free of excessive lubrication and temporary repairs |  |  |  |  |
| Trash cans are emptied and clean |  |  |  |  |
| No personal belongings are in the area |  |  |  |  |
| Lighting has an intact bulb shield |  |  |  |  |
| **Box Make Up Area** |  |  |  |  |
| Floors swept and clean of trash, debris and broken equipment |  |  |  |  |
| Walls, ceilings, pipelines and fans are clean and free of debris and cobwebs |  |  |  |  |
| Drainage system is clean and free of debris |  |  |  |  |
| Equipment is free of excessive lubrication and temporary repairs |  |  |  |  |
| Equipment is free of excessive lubrication and temporary repairs |  |  |  |  |
| Trash cans are emptied and clean |  |  |  |  |
| No personal belongings are in the area |  |  |  |  |
Lighting has an intact bulb shield

**Holding Area**
- Floors swept and clean of trash, debris and broken equipment
- Walls, ceilings, pipelines and fans are clean and free of debris and cobwebs

**Cold Room**
- Floors swept and clean of trash, debris and broken equipment
- Walls, ceilings, pipelines and fans are clean and free of debris and cobwebs
- Perimeter is free of rodents and rodent droppings

**SUPERVISOR VERIFICATION**

<table>
<thead>
<tr>
<th>Signature:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A supervisor should be notified of any problems seen during inspection. Problems should be corrected immediately.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Corrective Action Required</th>
<th>Name of Supervisor Notified</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

**Documentation**

Are Standard Operating Procedures (SOPs), policies and schedules documented and kept where employees have access to them?

A daily, weekly or monthly log such as shown above for the packing shed should be developed for the field production phase as well.

**SOPs and schedules should be available for cleaning and sanitizing:**
- Yes No Ceilings, overhead lamps and pipes
- Yes No Drains
- Yes No Forklift
- Yes No Waste hopper
- Yes No Boxes bins, etc.
- Yes No Waxing equipment
- Yes No Conveyors and belts
- Yes No Cooling units
- Yes No Facility floors and walls
- Yes No Wash tanks and immersion tanks
- Yes No Warehouse and other storage rooms
- Yes No Packing materials
- Yes No Restrooms
- Yes No Water tanks for washing and drinking (refill)
- Yes No Hand tools
- Yes No Farm equipment

**SOPs and schedules should be available for the following tasks:**
- Yes No Stocking paper towels, toilet paper, drinking cups
- Yes No Container inspection
- Yes No Testing water quality
- Yes No Changing postharvest water (dump tanks, cooling, etc.)
Yes No Sewage disposal  
Yes No Container inspection  
Yes No Pest control

**Schedules should be available for the following tasks:**  
Yes No Review of manure-supplier records

**Logs should be maintained for the following operations:**  
Yes No Wash water (include disinfectant concentration, pH)  
Yes No Immersion wash (include disinfectant concentration, oxidation-reduction potential, pH, temperature)  
Yes No Master sanitation schedule  
Yes No Daily pre-inspection log

**The following must be documented:**  
Yes No Manure application (supplier, lot number, composition)  
Yes No Land history (physical description of the soil, crop history, soil amendment history)  
Yes No Field and shed sanitation policies  
Yes No Personal hygiene policies  
Yes No Training schedule  
Yes No Medical leave and reporting policy

**Documentation (Record of Due Diligence):**  
The only recourse a grower or shipper has in his defense in the event of a food safety violation charge is his records showing he did everything possible to insure a safe product is being produced and shipped to consumers. Remember if it is not documented and recorded it did not occur!

**Acknowledgement:**  
The above information found in this appendix was taken from the UC GAPs Primer developed by Dr. Trevor Suslow of the Vegetable Crops Department of the University of California @ Davis.