



## Guide to Identifying Hazards in Packinghouse Environments

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This document is intended to serve as a guide for growers/packers that can be used for the identification **of microbial, chemical and physical hazards** within packinghouse environments. It provides a basic diagram of the most important areas within a packinghouse, directional flow of fruits and vegetables within this location and the potential sources of contamination when handling produce inside a closed environment.

### **Important Definitions:**

**Adequate:** it refers to the necessary steps and procedures taken to maintain good practices that reduce or eliminate microbial contamination.

**Biofilm:** A slime layer formed by bacteria on a surface, which provides an environment for pathogen proliferation and food cross-contamination potentially rendering the product unsafe to eat or that may reduce the shelf life of the product during storage.

**Clean:** it refers to food or food-contact surfaces that are washed, sanitized and rinsed with potable water and that are visually free of debris, food or chemical residues, soil or dust.

**Disinfection:** it's the process where an approved chemical (Environmental Protection Agency, (EPA) label and registration number to use in direct contact with food) is used to reduce the microbial load from the surface of fruits and vegetables.

**Food-contact surfaces:** it refers to those surfaces that contact fresh fruits and vegetables, those surfaces that water, produce or any other material drain onto produce or surfaces that contact the produce during normal packinghouse operations.

**Examples** (direct contact with food): harvesting containers, conveyor belts, wash tanks, sorting tables, packing materials, utensils. **It excludes the following items** (no direct contact with food): tractors, forklifts, and pallets.

**Hazard:** The potential source of harm (ISO/IEC Guide 51). It can be of chemical, microbiological and physical origin.

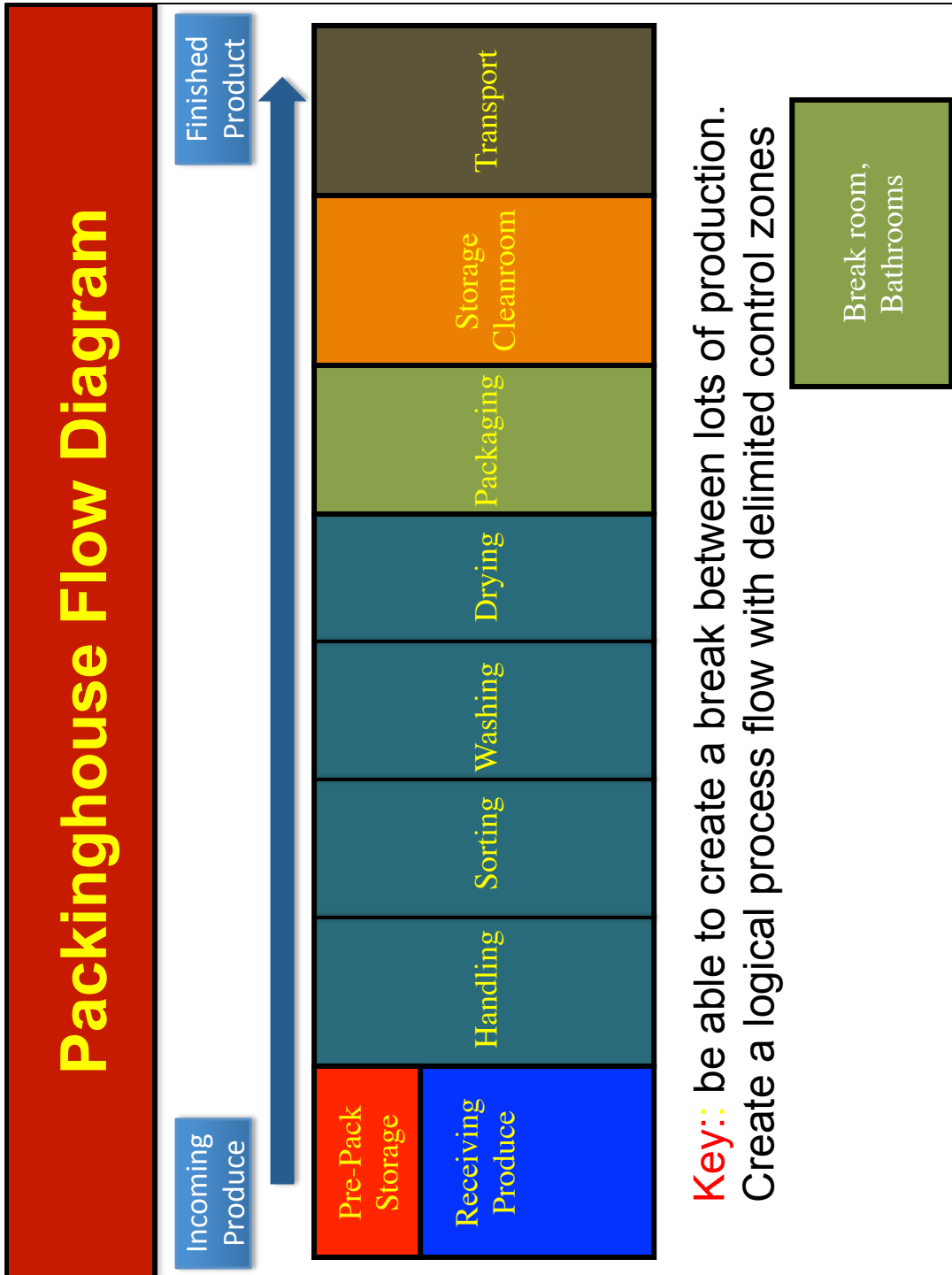
**Packinghouse Cross-contamination:** the adulteration of fruits and vegetables with any chemical or microbiological hazard during any step/process within the packinghouse so that it is no longer wholesome and safe and therefore rendering the fresh produce unsafe to eat.

**Sanitation:** it's the process where an approved chemical (EPA label and registration number to use in direct contact food contact surfaces) is used to reduce or eliminate the microbial load from the surface of food-contact surfaces.

**Risk:** The combination of the probability of occurrence of harm and the severity of that harm (ISO/IEC Guide 51).

**H1 lubricants:** - Lubricants that could have incidental food contact. They may be used on food-processing equipment, on gaskets or seals of tanks, and for machine parts and equipment in locations where the lubricated part is potentially exposed to food. **HT-1** specifically refers to heat transfer oils that may have incidental food contact.

## Packinghouse Flow Diagram



<p><b>Receiving</b></p>	<p>Microbial, chemical and physical hazards will mainly originate at this stage within the handling and packing of fresh fruits and vegetables. Addressing the potential sources of this contamination at this stage will significantly reduce the hazards at the packinghouse.</p> <p><b><u>Hazards to look for:</u></b>  Incoming product may arrive with some type of contamination</p> <ol style="list-style-type: none"> <li>1. Look for direct cross-contamination from other products, other items being shipped on the same truck. Indicators: <ul style="list-style-type: none"> <li>- Direct contact between raw ag commodities and non-food items.</li> <li>- Between commodities (some may be destined for processing, not meant to be ready-to-eat without a cooking step).</li> <li>- Chemicals transported on same truck separate/protected from what you've purchased.</li> <li>- Standing water/moisture/dripping from refer condenser where pathogens may persist.</li> <li>- Physical hazards like uncovered lights or trucks with broken wood items.</li> </ul> </li> <li>2. The supplies/products themselves have visual indicators of contamination (leaking, broken containers).</li> <li>3. If packing for another producer/repacking ensure that incoming product meets your specifications (Good Agricultural Practices (GAPs), GAP audit, etc.) and that the supplier has documentation to support.</li> </ol>
<p><b>Pre-pack storage Including Pre-Cooling Steps.</b></p>	<p>Once fruits and vegetables have been received some require cooling before sorting, washing, and packing the finished product, while others could be stored at room temperature or refrigeration while they await shipment or further processing.</p> <p><b><u>Hazards to look for:</u></b></p> <ul style="list-style-type: none"> <li>- Standing water, fruit and vegetable residues, soil and packing debris.</li> <li>- Transportation origin (field vs packinghouse).</li> <li>- Forced air-cooling (air quality, covers, pallets, ceiling, jacks, forklifts).</li> <li>- Flow of food in and out of the storage area.</li> <li>- Mixing of raw with washed product, <u>seconds or culls</u> that will be diverted to different markets (processing, direct sales, animal feed).</li> <li>- Packaging cross contamination during storage.</li> <li>- Door curtains, walkways, drip pans/shields.</li> <li>- Pest management.</li> <li>- Mixing of chemical storage with fruits and vegetables.</li> <li>- Water quality if hydro-cooling or ice is used.</li> <li>- Utensils used to handle ice.</li> <li>- Waste management.</li> <li>- Floor/wall junctions difficult to clean/sanitize (coving).</li> </ul>
<p><b>Handling and Sorting</b></p>	<p>Handling and sorting of produce is a labor-intensive operation where direct contact with hands and food contact surfaces may impact the overall safety of produce.</p>

	<p><b><u>Hazards to look for:</u></b></p> <ul style="list-style-type: none"> <li>- Cleanliness of hands and outer garments.</li> <li>- Glove use and glove storage.</li> <li>- Management and storage of garments.</li> <li>- Materials used in contact surfaces: porous, leachates (cooper), reactive with acids, fatigue, flexure, abrasion, and absorption of surfaces.</li> <li>- Hard to clean and sanitize food contact surfaces.</li> <li>- Niches for pathogens in and on rollers, belts, sponges, welds.</li> <li>- Chemicals from cleaning and sanitation of food contact surfaces.</li> <li>- Debris within drains, sorting tables, containers, conveyer belts, forklift, jacks and food contact surfaces.</li> <li>- Separation, storage and movement of “low quality” produce.</li> <li>- Type of lubricants (all <b>H1</b> if it comes into incidental contact with food).</li> </ul>
<p><b>Washing and Drying</b></p>	<p>Washing, disinfection and drying of produce depends mainly on the type of product being handled. Hazards associated to these operations depend on the type of equipment and chemicals being used, the origin of the crop and whether the process requires dry or wet cleaning. <u>When using disinfectants, it is important to control water turbidity and the pH and concentration of the chemical solution</u> (factsheet FS-EGR1B-(7-14)).</p> <p><b><u>Hazards to look for:</u></b></p> <ul style="list-style-type: none"> <li>- Microbial water quality.</li> <li>- Type of chemical disinfectant.</li> <li>- Microbial load and soil debris within produce.</li> <li>- Chemical residues from disinfectants or pesticides.</li> <li>- Materials used as food contact surfaces.</li> <li>- Air quality.</li> <li>- Lubricants (<b>H1</b> allowed).</li> <li>- Cross-contamination: brushes, conveyer belts, rollers, drip shields, drains, panel-operator buttons, tubing, utensils, dust overhead lights.</li> <li>- Stagnant water, sharp corners and metal to metal contact.</li> </ul>
<p><b>Packaging</b></p>	<p>This process varies with type, purpose and end user and includes a number of different packing methods including: bulk, by unit with or without plastic cover, in cartons, waxed boxes, plastic and wood bins, etc. However, all are considered food contact surfaces and therefore capable of rendering the product unsafe for eating.</p> <p><b><u>Hazards to look for:</u></b></p> <ul style="list-style-type: none"> <li>- Storage conditions of packing materials (humidity, debris, pest management).</li> <li>- Food grade inks and packing materials.</li> <li>- Cross contamination from weight stations and scales, dirty hands, conveyer belts, packaging tables, dust from overhead lights, drip pans/shields, storage containers, jacks, forklifts, lubricants (<b>H1, HT1</b> allowed), brushes, brooms, cleaning cloths.</li> <li>- Re-use of packing material exposed to previous packing events.</li> </ul>
<p><b>Palletizing</b></p>	<p>Palletizing materials include wood pallets, corrugated boxes, plastic containers (e.g., bins, trays), stretch wrap, cardboard/corrugated slip-sheets, cardboard</p>

	<p>corner boards, poly shrouds, banding tape, among other materials used for holding, storing and shipping product</p> <p><b><u>Hazards to look for:</u></b></p> <ol style="list-style-type: none"> <li>1. Wood splinters, loose staples, chipped plastic edges, other physical material from the pallets, boxes, and containers.</li> <li>2. Allergen risk due to mixing product types.</li> <li>3. Cross contamination between raw/final product and dirty/contaminated materials.</li> </ol> <p><b><u>Palletizing best practices:</u></b></p> <ol style="list-style-type: none"> <li>1. All pallet materials should be in good condition by visual inspection (or preferably new at start of season).</li> <li>2. All pallet materials should be maintained in clean operational condition, according to Standard Operating Procedures (SOPs).</li> <li>3. All pallet materials should be stored in a secure, clean location</li> <li>4. Use clean/inspected pallets to keep finished product off the floor before shipping.</li> <li>5. Maintain a perimeter between pallet materials and walls to facilitate visual inspection of pest control and sanitation</li> </ol>
<p><b>Storage</b></p>	<p><b><u>Hazards to look for (similar to pre-pack storage):</u></b></p> <ul style="list-style-type: none"> <li>- Standing water, fruit and vegetable residues, soil and packing debris</li> <li>- Transportation origin field vs packinghouse.</li> <li>- Forced air-cooling (air quality, covers, pallets, ceiling, jacks, forklifts).</li> <li>- Flow of finished product in and out of the storage area.</li> <li>- Mixing of raw with washed product, <u>seconds or culls</u>.</li> <li>- Packaging cross contamination during storage.</li> <li>- Door curtains, walkways, drip pans/shields.</li> <li>- Pest management.</li> <li>- Mixing of chemical storage with fruits and vegetables.</li> <li>- Waste management.</li> <li>- Floor/wall junctions difficult to clean/sanitize (coving).</li> </ul>
<p><b>Shipping</b></p>	<p>All shipped product should have a standardized, easily traceable written record (e.g., invoice), which includes information about the specific product (lot code, date packed, destination location, variety, etc.)</p> <p><b><u>Hazards to look for:</u></b></p> <ol style="list-style-type: none"> <li>1. Wood, metal, debris, other materials that shouldn't be in/with-finished product.</li> <li>2. Residues (cross contamination from previous cargo, or improper cleaning/sanitizing of transport vehicle).</li> <li>3. Microorganisms (cross contamination during loading, transport, and unloading).</li> <li>4. Temperature abuse of product; keep refrigerated.</li> </ol> <p><i>Never load product into a transport vehicle with off odors, especially masking smells (e.g., coffee)</i></p>

	<p><b><u>Shipping best practices:</u></b></p> <ol style="list-style-type: none"> <li>1. All shipping material (e.g., pallets, boxes) should be clearly labeled</li> <li>2. All shipped product should have traceability records (one step forward, one step back)</li> <li>3. Transport vehicles should be visually inspected and or cleaned/sanitized before product is loaded so they do not become a source of contamination</li> <li>4. Farms should have clear, written SOPs for loading, unloading and transporting product (i.e., protocol for corrective actions if transport vehicles are <u>not</u> clean/sanitary, e.g., contaminated from prior load by raw animal products, garbage/refuse)</li> <li>5. Transport vehicles should be refrigerated and temperature monitored often to control/minimize temperature abuse (<u>refrigeration temperatures minimize most pathogenic microorganisms' growth</u>)</li> </ol>
<p><b>Overall infrastructure</b></p>	<p>The overall structure of the facility and equipment should be design with hygienic design in mind. There are a number of factors influencing hygiene within the packinghouse. These include:</p> <ul style="list-style-type: none"> <li>- Installation and layout</li> <li>- Plant environment</li> <li>- Equipment design</li> <li>- Process design</li> <li>- Process operation</li> <li>- Process control</li> <li>- Storage and distribution</li> </ul> <p><b><u>Other important aspects</u></b></p> <ul style="list-style-type: none"> <li>- Equipment should be self-emptying and draining.</li> <li>- Avoid dead spaces where product may accumulate.</li> <li>- Equipment should protect product from external contamination where practical.</li> <li>- Easily cleanable.</li> <li>- Recognize suitable materials of construction for food processing equipment.</li> <li>- Identify suitable maintenance requirements for food processing equipment construction materials.</li> </ul> <p><b><u>Hazards to look for:</u></b></p> <ul style="list-style-type: none"> <li>- Dust from overhead lights.</li> <li>- Drip pans/shields.</li> <li>- Glass from overhead lights.</li> <li>- Harboring of pests.</li> <li>- Wall, ceiling and floor materials (porous, difficult to clean/sanitize, stagnant water).</li> <li>- Poor separation between receiving, storing, washing and packing areas.</li> </ul>
<p><b>Cleaning and Sanitizing</b></p>	<p><i>Always use cleaning and sanitizing/disinfecting agents (for food/food contact surfaces) that are approved for fruit and vegetable use (EPA registration number).</i></p> <p><i>Always use water of good microbial quality (zero generic E. coli)</i></p>

**Hazards to look for:**

1. Debris from product or packing-line (e.g., organic matter, metal shavings, rocks, etc.)
2. Residues from cleaning/sanitizer products or pest prevention programs, allergen risk from product cross over.
3. Microorganisms from (e.g., bacteria, viruses, parasites, formation of biofilms) contaminated material, product, contact surfaces, etc.

**Cleaning and Sanitizing Best Practices:**

1. Select an appropriate cleaner for your operation, such as detergents, solvent cleaners, acid cleaners, abrasive cleaners, etc.
2. Sanitizing agents work best on cleaned and rinsed surfaces.
3. Select an appropriate sanitizer for your operation, such as hot water (>165°F), chlorine (e.g., bleach), chlorine dioxide, peracetic acid (e.g., SaniDate), ozone, quaternary ammonia, etc.
4. Adequate cleaning and sanitizing is a multi-step process (the following steps outline key cleaning and sanitizing processes).
  - a. Pre-clean: scrape and rinse to remove loose food.
  - b. Wash: use detergent or other solution to remove stuck food.
  - c. Rinse: remove food and detergent or other solution used to wash.
  - d. Sanitize: kill attached surviving microorganisms (e.g., bacteria, viruses).
  - e. Dry: air, fan, clean wipe (often times sanitizers work more effectively with longer contact time; check bottle instructions).

**References**

- ISO/IEC Guide 51: 2014, Safety Aspects-Guidelines for their inclusion in Standards. [http://www.iso.org/iso/iso\\_catalogue/catalogue\\_tc/catalogue\\_detail.htm?csnumber=53940](http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=53940)
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- USDA- Food Safety Audit, 2015. California Cantaloupe Advisory Board Audit Verification Checklist-Packinghouse/Cooler. [http://www.californiacantaloupes.com/sites/default/files/CCAB%20Regular%20Packinghouse-Cooler%20Checklist%20-%20V4%20150506\\_0.pdf](http://www.californiacantaloupes.com/sites/default/files/CCAB%20Regular%20Packinghouse-Cooler%20Checklist%20-%20V4%20150506_0.pdf)