Postharvest Water Overview

Postharvest water includes any water that contacts fresh produce at or after harvest. This includes water used for rinsing, washing, cooling, waxing, icing, or moving fruits and vegetables. Postharvest water use may be a necessary part of fruit and vegetable production, but it is also a potential source of contamination. Understanding the risks associated with postharvest water use and how to minimize them are important for produce safety.

The key things you need to do to ensure the safety of postharvest water are to:

1. Start with water that is the equivalent of drinking water.
2. Add a sanitizer to all postharvest water.
3. Change bulk/batch tank water when dirty.
4. Make sure water is at the appropriate temperature to avoid infiltration.
5. Clean and sanitize tanks/bins daily, making sure to reduce or eliminate pooled water.
6. Document all postharvest activities.

Start with water that is the equivalent of drinking water

Only use water that is the equivalent of drinking water (i.e., potable) to begin all postharvest activities. Water quality should be verified through testing. Water testing can be done by the farm or by the municipality or water supplier, but the water must be tested to know its quality. Contaminated water can contaminate produce, so starting with clean water is essential. If you are using a surface water source, you will need to treat the water and regularly test it to make sure the treatment process is working.

Add a sanitizer to all postharvest water

Postharvest water, even if it is potable at the start, may become contaminated by produce that contacts the water. Adding a sanitizer does not clean each individual piece of produce, but prevents cross contamination from the water to the produce and limits the build-up of pathogens in the water. It is critical to add a sanitizer to all batch/bulk water where many pieces of produce are submerged in the same water because the risk of cross contamination is highest at this step.

Single pass water is less of a risk, but it is recommended that sanitizer still be added to the water. If single pass water is used inside equipment, a sanitizer should be added to prevent the formation of biofilms and pathogen growth inside the equipment.

A number of chemical and non-chemical sanitizers are available such as chlorine, chlorine dioxide, peracetic acid, hydrogen peroxide, ozone, and UV light. The choice of water treatment depends on the application, the type of product, and what is allowed by your customer or certifying group.

Always consider worker and environmental safety when choosing sanitizers. Remember to follow label directions and use proper personal protection equipment (PPE) when handling and mixing sanitizers. Levels of chemicals should be routinely monitored to ensure there is an appropriate amount to effectively reduce risks. Furthermore, some sanitizers, such as chlorine, are most active at a specific pH, so you will need to monitor the sanitizer levels and the water pH. Seek out expert technical advice before investing in a sanitation system or if you have questions.

Change bulk/batch tank water when dirty

Anything added to the batch/bulk tank water can introduce contamination. Leaves, stems, dirt, and even harvest containers submerged in the water, can contaminate the water and reduce the effectiveness of sanitizers. To reduce food safety risks, bulk/batch water should be changed frequently or filtered. One way to monitor water quality is by measuring turbidity. This can be done through the use of a turbidity meter or by developing other water clarity
standards based on measurable observations. Establishing water quality standards for your postharvest water will guide decisions about when to change water. Resources are provided at the end of this summary to help you decide what is right for your farm.

Make sure water is at the appropriate temperature to avoid infiltration

Some vegetables and fruits, especially tomatoes, apples, and cantaloupes, are susceptible to water infiltration when the pulp temperature of the fruit is warmer than the water into which it is submerged. If the produce is warmer than the water, it may create a vacuum inside the produce and cause water to be taken up into the fruit. If that water is contaminated, the produce can be contaminated both inside and outside. To reduce the risk of infiltration, keep batch/bulk water the same temperature or less than 10°F warmer than the pulp temperature and avoid deep tanks (deep submersion = higher pressure = higher infiltration rates).

Clean and sanitize tanks/bins/washers daily

Making sure tanks/bins/washers are clean will reduce the risks of cross contamination. When daily cleaning and sanitizing is not possible, such as complicated equipment that requires disassembling, another schedule should be established to reduce pathogen and dirt build-up inside the equipment. Develop a policy and SOP that includes step-by-step instructions for cleaning and sanitizing, including what needs to be cleaned, how often it is to be cleaned, and the process for cleaning it. Your cleaning SOP should be specific and identify what items, parts, drains, hoses, and other equipment need to be cleaned. Remember to include instructions on how to eliminate or reduce standing water in the tanks/bins/washers because standing water provides the opportunity for pathogens, such as Listeria monocytogenes, to become established and persist. After cleaning and sanitizing tanks/bins/washers, all drip trays should be drained and any pooled water in the equipment should be removed as best as possible.

Personal protective equipment (PPE) and other necessary equipment should be specified in the SOPs. Use of photographs, drawings, and color-coding schemes is encouraged to aid workers in understanding exactly what needs to be done. SOPs should also be written in the language of the workers who use them. More information about cleaning and sanitation practices is available in the Sanitation and Postharvest Handling Decision Tree.

Document all postharvest activities

Records should be kept of all postharvest water management and sanitation activities. Document the amount of sanitizer used, monitoring steps, how often water is changed in flumes/tanks, pulp and water temperatures, when equipment is cleaned, and any other activities that are part of postharvest water management. All activities should be outlined in your written farm food safety plan. Detailed SOPs and log sheets should be developed to ensure activities are done properly and documented. Sample SOPs and log sheets are provided within this decision tree.

Resources


The information in the template food safety plan, SOPs, and recordkeeping logs are examples you can use. They are not intended to be used directly. Tailor each to fit your farm operation and practices. These documents are guidance for risk reduction and for educational use only. These documents are not regulatory and are not intended to be used as audit metrics. These documents are subject to change without notice based on the best available science.
Postharvest Water Decision Tree

1. Is postharvest water the equivalent of drinking water at the beginning of all activities such as rinsing and cooling?
   - Yes: Begin all postharvest activities with water that is the equivalent of drinking water. If you are not sure of your water quality, test it to confirm it is free of total coliforms. If you are using municipal water, municipalities treat and test the water so you should be able to get a copy of their test results. Well water should be tested at least twice per year.
   - No: If you use surface water from a reservoir, pond, stream, lake, canal, ditch, river, rainwater or cistern for postharvest use, it should be treated to be the equivalent of drinking water and tested to ensure it is safe to use. Document all water treatment practices and keep records of all water tests.

2. Is all postharvest water use single-pass only (i.e., sprayed over the produce, not recycled)?
   - Yes: Single-pass water usually has a lower risk because water contacts produce only once. Pathogen growth and survival can still be a problem, especially if the single-pass water is used inside equipment that is not regularly cleaned and sanitized. Single-pass water should be properly drained and disposed of to prevent field or produce contamination.
   - No: Batch or bulk water can be a source of contamination and result in cross contamination of many lots of fresh produce. If a contaminated piece of fresh produce is immersed in the tank or bin, the pathogens can be dispersed by the water. This contaminated water can then cross contaminate clean produce, so a sanitizer must always be added to batch or bulk water.
     
     Note: It is also important to consider water disposal. Follow all local, state, and federal guidelines for releasing or disposing of postharvest water.
Sanitizer levels must be monitored to make sure the levels are effective at reducing the presence of microorganisms in the water. The primary purpose of the sanitizer is not to clean the produce, but to prevent cross contamination from the water to produce. Always follow the label recommendations and only use sanitizer approved for your specific crop. Monitor sanitizer levels frequently to be sure they are effective at reducing cross contamination risks. If you are certified organic, check with your certifier to make sure you are using an approved sanitizer for your produce.

A sanitizer should be added to all postharvest water to reduce cross contamination and minimize potential transfer of pathogens to fresh produce. Sanitizers are critically important when using postharvest water in dump tanks, wash bins, or other batch water systems.

There are many sanitizers that can be used for postharvest water. Pick the sanitizer that is best for your operation and the produce you grow. Make sure to follow the label recommendations and only use sanitizer approved for your specific crop. Monitor sanitizer levels frequently to be sure they are effective at reducing cross contamination risks. If you are certified organic, check with your certifier to make sure you are using an approved sanitizer for your produce.

Sanitizer levels must be monitored to make sure the levels are effective at reducing the presence of microorganisms in the water. The primary purpose of the sanitizer is not to clean the produce, but to prevent cross contamination from the water to produce. Always follow the label when using a sanitizer. The build-up of organic material, such as leaves or soil, may bind the sanitizer and reduce its efficacy. Some sanitizers, such as chlorine, are most active at a specific pH, so you should monitor the sanitizer levels and the water pH. Develop an SOP specific to your sanitizer and document all monitoring steps on the Water Monitoring Log.
Postharvest Water Decision Tree

5. Do you change your filter or bulk/bin/tank water when your water quality monitoring indicates it is dirty?
   - No
   - Yes

   To reduce risks associated with bulk/bin/tank water, change water or filter when your water quality monitoring system indicates it is dirty. Changing the water may depend on the sanitizer because some sanitizers are more sensitive to the presence of organic material. You should create a policy and SOP describing how and when to change water. Document all water changing activities including water monitoring on a Water Monitoring Log.

6. Do you monitor the temperature of your postharvest water?
   - No
   - Yes

   Some fresh produce commodities are susceptible to infiltration when immersed in water that is colder than the pulp temperature. Infiltration is the passage of water from the bulk/bin/tank water into fresh produce, usually caused by a temperature differential larger than 10°F, where the water is cooler than the produce. If that water is contaminated, microorganisms could enter the produce with the water. Tomatoes, cantaloupes, and apples are some crops susceptible to infiltration. Monitor pulp temperature and water temperature to make sure the water temperature is less than 10°F warmer than the pulp temperature, and document on a Water Monitoring Log.

7. Do you clean and sanitize your postharvest equipment including tanks, bins, and washers on a standardized schedule?
   - No
   - Yes

   Tanks, bins, and washers should be cleaned and sanitized to reduce the risk of biofilm formation and the risk of cross contamination. Develop a policy that includes an SOP with step-by-step instructions for cleaning and sanitizing, including which detergents, sanitizers, and tools should be used, how often to clean the equipment, and what needs to be cleaned such as hoses, brushes, and conveyor belts. Document all cleaning and sanitation activities on the Cleaning and Sanitizing Log. For more information on cleaning, see the Sanitation and Postharvest Handling Decision Tree.
Pathogens, such as *Listeria monocytogenes*, can become established and persist in areas with standing water. At the end of each day, check the equipment, including drip pans, to make sure water has drained properly and is not pooling. Workers should be instructed on how to reduce and eliminate standing water and why it is important.

Records should be kept of all postharvest water management and sanitation activities, such as:

- Water tests that document the water is the equivalent of drinking water
- Steps taken to monitor postharvest water such as water temperature, turbidity, and pH
- Actions taken to reduce risks such as changing postharvest water and cleaning tanks, bins and washers

SOPs and logs should be developed to make sure activities are done properly and documented. Your postharvest water management policy should be detailed in your farm food safety plan.
Purpose
Describes the process for changing postharvest water in a bulk produce washing tank, bin, or container, including how often the water should be changed and how to monitor turbidity to assure it is being changed often enough to reduce food safety risks. Frequently changing postharvest water reduces the risk of pathogen build up in the water and minimizes the risk of fresh produce cross contamination.

Scope
This SOP covers the bulk tanks that are use for fresh produce washing in the main packing shed.

Responsibilities
The farm owner is responsible for determining the frequency of water changes based on what commodity is being cooled or washed, the volume of produce being run, the size of washing bins, sanitizers used, and other factors such as turbidity.

The packinghouse manager is responsible for making sure that the water is monitored and changed according to the farm policy.

Materials
- Bulk tank, bin, or container
- Water
- Water Monitoring log
- Cleaning and Sanitation log
- Detergent [add name here]
- Cleaning brush
- Sanitizer [add name here]

Procedure
All procedures must be tailored to the type of tank/bin, the amount of water used, access to drains, and water source.

1. Empty the tank/bin. Use an outlet hose to direct the emptying water directly into a drain or to an area away from the postharvest handling or produce growing areas.
2. Rinse the tank/bin with clean, potable water.

3. Add detergent and scrub tank/bin with a cleaning brush to remove any dirt stuck to the walls or floor of the water container.

4. Empty the detergent and wash water into an appropriate drain.

5. Rinse again with clean, potable water to rinse off all the detergent.

6. Refill the container to the desired volume using clean, potable water.

7. Add sanitizer to the water. Follow the SOP for adding sanitizer to the water to make sure you reach the level that is effective for reducing food safety risks. Wear appropriate protective clothing (e.g., gloves, apron, eye wear).

8. Document on the log sheet when the water was changed, the tank/bin was cleaned, and when the new batch of water was mixed with sanitizer. Be sure to document the level of sanitizer before returning to produce washing/cooling. Include any actions taken to adjust the water such as changing the pH or temperature.

9. Put away any chemicals, including detergent and sanitizer, tools, or materials used while changing the water and store protective equipment in the appropriate location.

10. Resume washing/cooling produce.

11. At the end of each day, empty the tank/bin, then clean and sanitize it (rinse if necessary). Allow the tank/bin to air dry. If the containers are outdoors and can be moved, transfer them inside where they are protected from bird or rodent activity.
# Sample Water Monitoring Log

Please see the food safety plan for overall water treatment procedures.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Water pH</th>
<th>Water Temperature</th>
<th>Pulp Temperature (if applicable)</th>
<th>Turbidity</th>
<th>Sanitizer (name &amp; rate)</th>
<th>Water Changed (yes or no)</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/14/13</td>
<td>8:35 am</td>
<td>7.0</td>
<td>65° F</td>
<td>50° F</td>
<td>25 NTU</td>
<td>NaOCl 75 ppm</td>
<td>No</td>
<td>EAB</td>
</tr>
</tbody>
</table>

Reviewed by: ___________________________ Title: ___________________________ Date: ___________________________
**Sample Cleaning and Sanitizing Log**

**Name of operation:** _______________________________________________________________________________________________

Please see the food safety plan for overall processing/packing line water control procedures.

<table>
<thead>
<tr>
<th>Date</th>
<th>Contact Surfaces</th>
<th>Dump Tank</th>
<th>Flume</th>
<th>Cleaned By (initials)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cleaned (✓)</td>
<td>Sanitized (✓)</td>
<td>Cleaned (✓)</td>
<td>Sanitized (✓)</td>
</tr>
<tr>
<td>10/11/13</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reviewed by: ______________________________________________________  Title: ____________________________  Date: ____________________________
Template Language for Postharvest Water Section of a Farm Food Safety Plan

Risk Assessment
Fresh produce can become contaminated by water used during and after harvest. Our farm has put practices into place to reduce risks associated with postharvest water use, including standards for water at the beginning of use and practices to reduce risks during use.

Actions to Reduce Risks
All water used in postharvest handling is the equivalent of drinking water, or potable, at the beginning of all operations.

Copies of the municipal water test results are kept on file [add location here]. Wells that supply water for postharvest activities are tested twice per year, found to be absent of total coliforms, and test results are kept on file [add location here].

Our farm grows and packs [list crops here]. Our produce is rinsed in a dump tank, so we add a sanitizer [name here] to our postharvest water. The label, MSDS, and other emergency information are kept on file [add location here].

We monitor our water throughout the day when in use (at least every 3 hours). We record:

- Date and time water quality was checked
- Temperature of water
- Temperature of the fruit pulp
- Water pH
- Turbidity
- Sanitizer level in the water

The temperature of the water in the dump tank is monitored at the same time the disinfectant concentration is measured. The water temperature is maintained so that it is within 10 degrees Fahrenheit or less warmer than the produce.

Dump tank water is changed [insert how often here or NTU turbidity level that would lead to a water change] and sanitizer levels are maintained at [insert level here, e.g., 150 ppm].

Tank/bins/washers are cleaned and sanitized according to our farm’s SOPs including the removal of debris and damaged produce. Cleaning happens at the end of each day or as needed. This is recorded on the Cleaning and Sanitation Log.

Instruments used to measure temperature, pH, turbidity, sanitizer levels, or other critical measurements for water quality are properly calibrated [enter frequency here] to maintain accuracy.