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*.

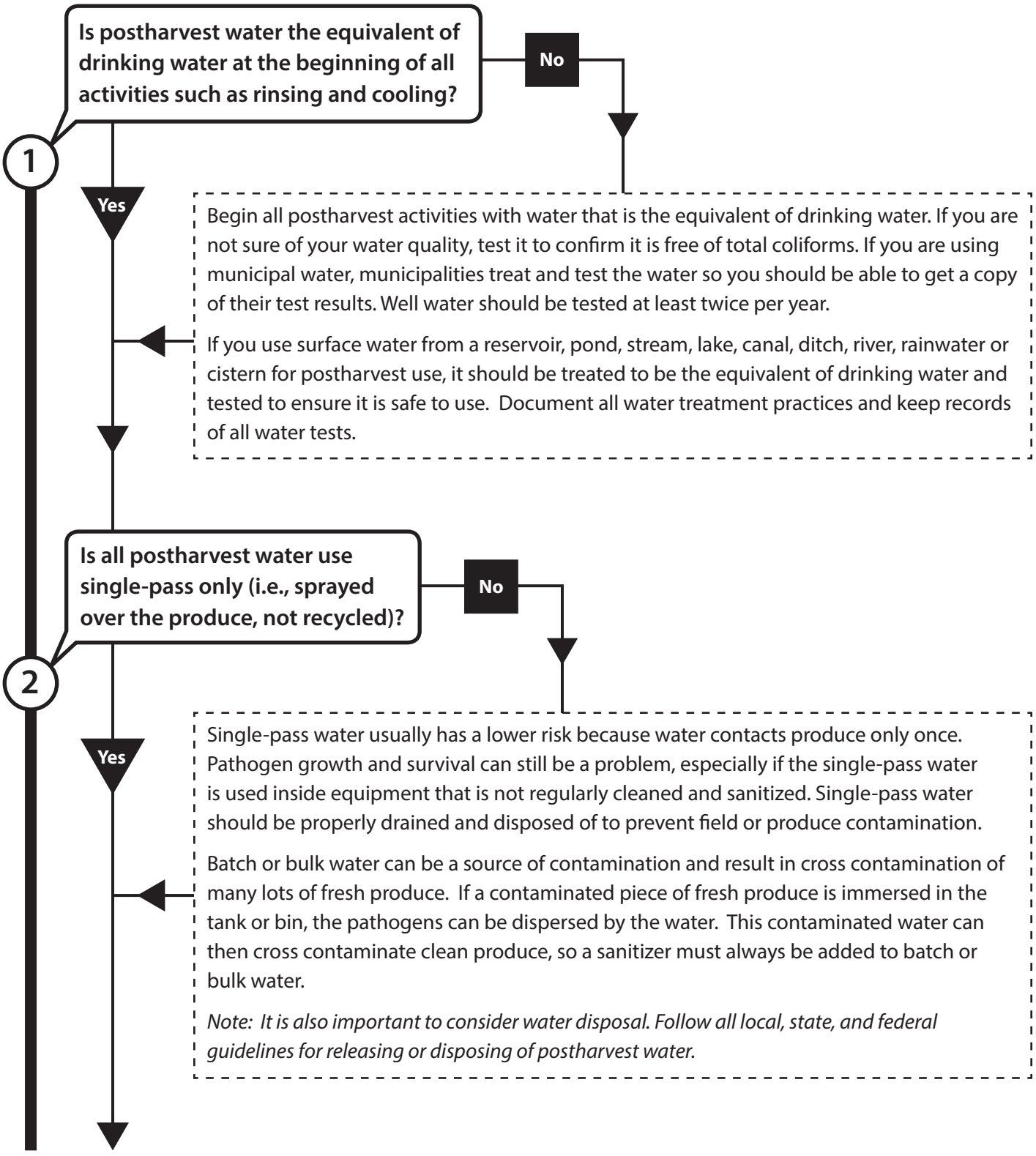
Document all postharvest activities

Records should to 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.

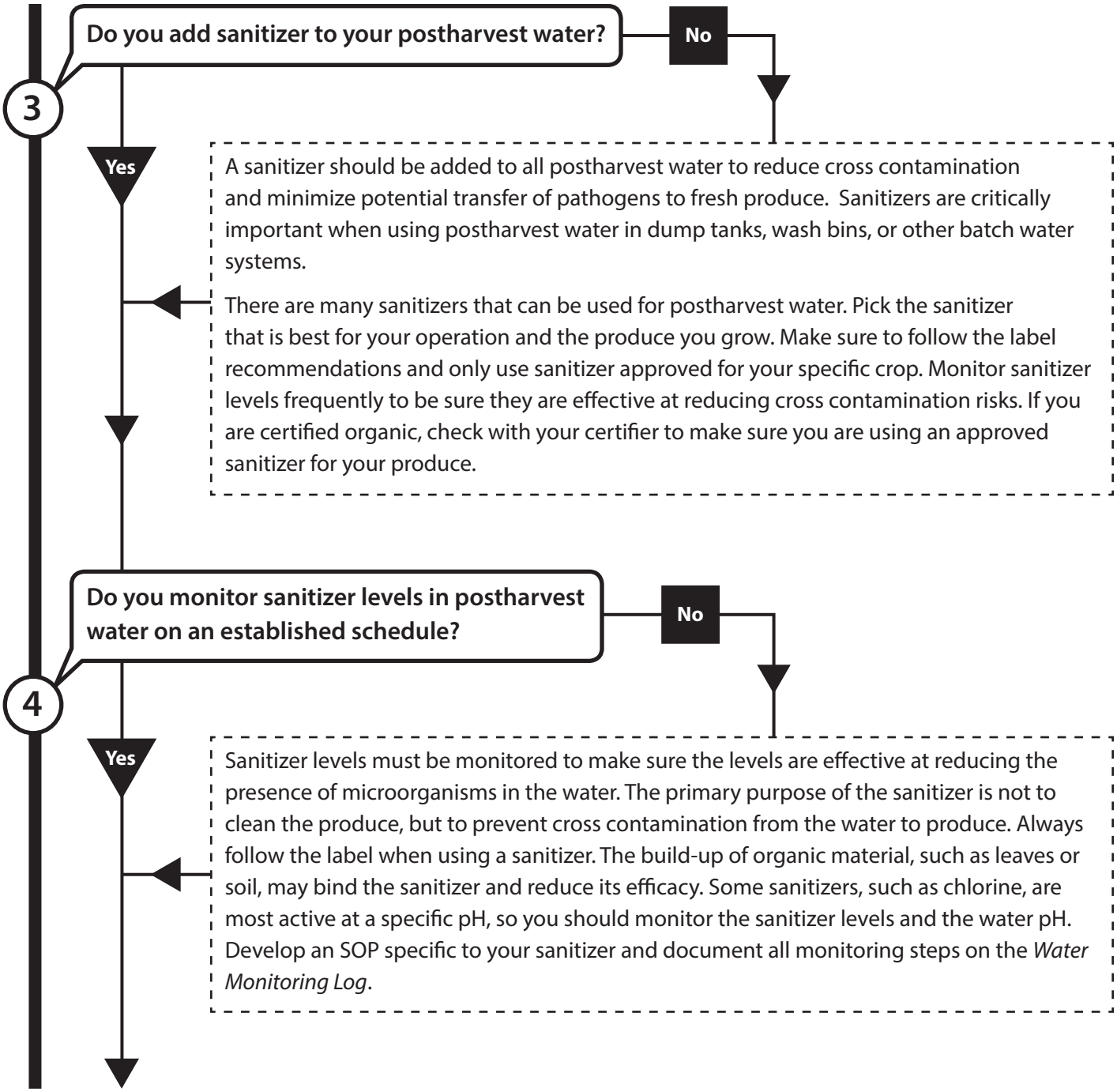
Resources

Suslow, T.V. 2012. *Top FAQs about Produce Wash Water Management for Small Scale and Direct Market Farms*. Presentation at Center for Produce Safety Annual Meeting 2013. https://cps.ucdavis.edu/amass/documents/document/106/FINAL%20CPS%20Webinar%20Slides%209.21.2012_Updated.pdf

Postharvest Water Decision Tree



Postharvest Water Decision Tree



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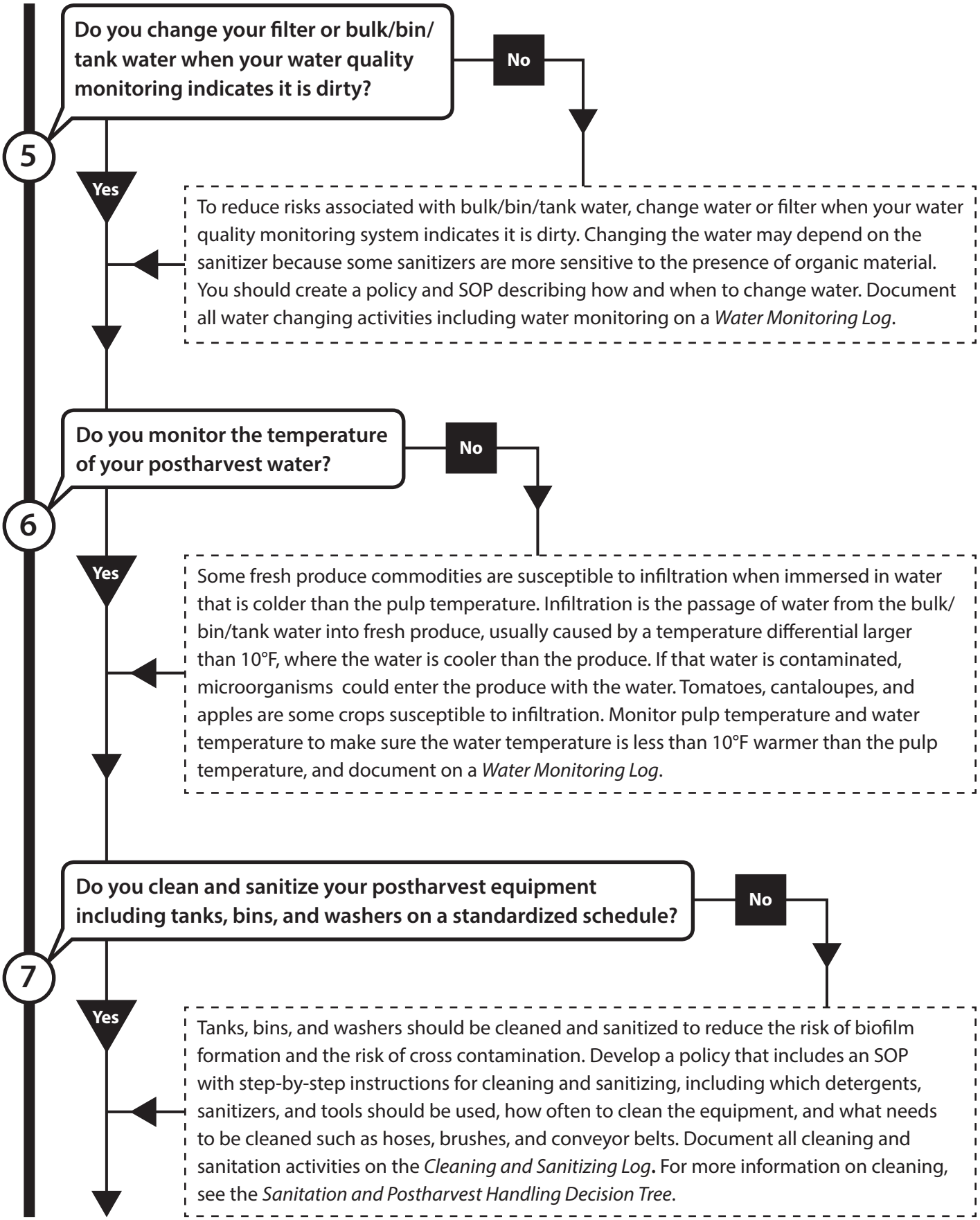
Postharvest Water Decision Tree



Postharvest Water Decision Tree

8 **Do you reduce and eliminate standing water in your packing area?**

No

Yes

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.

9 **Do you keep records of all your postharvest water management and sanitation activities?**

No

Yes

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.

Finished

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Sample SOP: Changing Postharvest Water in a Bulk Tank, Bin, or Container

Revision: 7.0
Date: 07/16/2014

1—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.

2—Scope

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

3—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.

4—Materials

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

5—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

Name of operation: _____

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

Date	**Time**	**Water pH**	**Water Temperature**	**Pulp Temperature (if applicable)**	**Turbidity**	**Sanitizer (name & rate)**	**Water Changed** (yes or no)	**Initials**
10/14/13	*8:35 am*	*7.0*	*65° F*	*50° F*	*25 NTU*	*NaOCl 75 ppm*	*No*	*EAB*

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.

Date	Cleaning List (check each)								Cleaned By (initials)
	Contact Surfaces		Dump Tank		Flume				
	Cleaned (√)	Sanitized (√)	Cleaned (√)	Sanitized (√)	Cleaned (√)	Sanitized (√)	Cleaned (√)	Sanitized (√)	
10/11/13	√	√							*EAB*

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.