Good Agricultural Practices (GAPs) help improve produce quality and safety. Producers also use standard cleaning and sanitizing practices to reduce sources of microbial contamination on their products.

This publication focuses on the best cleaning and sanitizing practices for food products and food contact surfaces. It includes a resource list plus a sample form for monitoring sanitizer effectiveness and a sample cleaning schedule.

Washing, rinsing, and sanitizing may appear to increase costs but they enhance product quality and offer these benefits:

- Soil and particles that can cause decay or spoilage are removed.
- Microorganisms that cause foodborne illness can be eliminated or reduced to a safe level.
- Clean produce is more visually appealing to customers.
- Product shelf life increases when spoilage organisms are removed.

Using good sanitation practices during production, harvesting, and packaging can help reduce the risk of microbial contamination of fresh produce. Soil, fertilizers, harvesting equipment, water, workers, or animals such as livestock, pets, and pests can be sources of harmful microorganisms that cause foodborne illness. Surfaces that come in contact with produce must be washed, rinsed, and sanitized regularly. Employees need to understand and use appropriate food handling practices.

**Food Contact Surfaces**

Any surface that comes in contact with food, either directly or indirectly, is a food contact surface. Examples include preparation tables, spinners, food bags, and cartons for transporting produce. Food contact surfaces should be smooth to allow for easy and effective cleaning. Rough surfaces, such as wood, can harbor dirt and microorganisms. Stainless steel tables and counters are commonly used in foodservice and processing facilities due to durability and ease of cleaning.

Other surfaces that can come into contact with product include containers for harvesting and transportation, tables in packing areas, bags and other packaging materials, conveyors, processing equipment, employee aprons, outerwear, and gloves. Hands also may come into contact with the food. For more information about food handling practices, see “On-farm Food Safety: Guide to Food Handling” (PM 1974b).

**Cleaning**

Cleaning means removing soil and residues from food contact surfaces. This is usually a two-step process of washing with soap or detergent followed by rinsing with clean potable (safe to drink) water. Rinsing surfaces thoroughly is important so that any detergent residue is removed. Because many detergents can degrade produce, products also can be cleaned just by using potable water at room temperature. Under certain conditions, microorganisms (bacteria, yeasts, and molds) can form invisible films (biofilms) on surfaces. Biofilms can be difficult to remove and usually require cleaners as well as sanitizers.

**Sanitizing**

Sanitizing is the process of treating a food contact surface with a sanitizing solution that will kill most microorganisms or reduce them to a non-harmful level. For sanitizers to be effective, surfaces must first be cleaned because soil and soap residues can make the sanitizing solution less effective.

- **Sanitizing** is a process that reduces the contamination level of a food product contact surface by 99.999 percent in 30 seconds.

- **Sanitizer** is a chemical compound designed to kill microorganisms. Chlorine bleach and quaternary ammonium compounds (quats) are commonly used sanitizers for food contact surfaces. Chlorine, quats, and hydrogen peroxide, at proper concentrations, can be used for food contact surfaces.
Sanitizing solution is the mixture of a specific amount of a sanitizer with potable water according to the directions given by the manufacturer to create the proper concentration. Sanitizing solutions gradually lose effectiveness over time. As the solution is continually exposed to air or debris, reactions cause some of the chemical to dissipate. The best way to check whether a sanitizing solution is effective is to use a test strip. Sanitizing solutions should be made and checked at least daily. They also should be recorded.

Choosing a Sanitizer
Producers should select a sanitizer based on the following characteristics. Sanitizers should be safe and leave no harmful residues on produce, stable and non-corrosive, and safe to workers and the environment.

Several types of sanitizer are available for product and/or food contact surfaces: chlorine, quaternary ammonium, and other commercial sanitizers such as ProSan™. Chlorine and hydrogen peroxide are commonly used for products because they are readily available and cost effective. For a complete list of approved sanitizers for products and food contact surfaces, check with state regulatory agencies or the Environmental Protection Agency (http://www.epa.gov).

Sanitizers may have multiple uses. For example, chlorine can be used on fresh produce or on food contact surfaces, depending on the concentration. Room temperature water should be used to minimize chlorine loss.

How the cleaning and sanitizing process works

1. Washing helps loosen soils and other organic material from the surface. Detergent also helps break the adhesion of microorganisms to the surface.

2. Rinsing removes loosened soil and detergent from the surface. This step is important because organic material and detergent can bind up sanitizer making it less effective.

3. Applying the sanitizer to clean surfaces actually provides a “kill” step for reducing the number of microorganisms. The surface is not completely free of microorganisms but the number is greatly reduced.

Guidelines for preparing chlorine sanitizer solutions

<table>
<thead>
<tr>
<th>Amount of chlorine bleach per gallon of room temperature water</th>
<th>Approximate concentration (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 teaspoon</td>
<td>65</td>
</tr>
<tr>
<td>1 tablespoon</td>
<td>200</td>
</tr>
<tr>
<td>1 fluid ounce</td>
<td>400</td>
</tr>
<tr>
<td>1/2 cup</td>
<td>800</td>
</tr>
<tr>
<td>1 cup</td>
<td>1600</td>
</tr>
<tr>
<td>1 cup</td>
<td>3200</td>
</tr>
</tbody>
</table>


1. Assuming 5.25% sodium hypochlorite in chlorine bleach
2. ppm = parts per million
The proportion of sanitizer to water must be accurate to make sure the solution will be effective. A common recipe for a sanitizing solution is 1 tablespoon household bleach (non-scented) per 1 gallon room temperature water. This will result in a solution of 200 parts per million (ppm), which is acceptable for products. Sanitizing solution for surfaces should be 50 ppm.

Chlorine bleach can be purchased in several concentrations. Check the manufacturer’s label to see the concentration. A typical concentration is 5.25%. A higher concentration of sodium hypochlorite (the active ingredient in bleach) will require less bleach to make the same solution. Water quality can significantly impact the effectiveness of the sanitizer solution. Most solutions will require more sanitizer when used with “hard” water. Check the concentration of the solution using a test strip to adjust the amount of sanitizer to reach the appropriate concentration for the intended use.

Hydrogen peroxide is another common sanitizer for products. It should be used as a 2-5% solution and can normally be purchased as 3% solution. Using a stronger solution can possibly damage produce. Research has shown that adding ½ cup acid such as acetic, citric, or lactic acid to 1 gallon of hydrogen peroxide solution can significantly improve the effectiveness of the 3% solution.

**Set up Cleaning and Sanitizing Schedules**

The key to effective cleaning and sanitizing is making these practices part of normal operations. Equipment should be cleaned from top to bottom to avoid re-soiling already cleaned surfaces. In general, four questions need to be answered.

1. **What** should be cleaned?
2. **How** should each piece of equipment or food contact surface be cleaned and sanitized?
3. **When** should equipment be cleaned? Daily, weekly, as needed?
4. **Who** is responsible? Is a specific person or a position responsible for each cleaning task? Who will check to make sure the list is done according to schedule?

Many steps can be easily overlooked during cleaning. Action items in the schedule should be incorporated into the regular duties of employees. Employees should initial the form to document that the task is completed. Regular cleaning reduces the build-up of microorganisms.

### Sample Sanitizing Schedule

<table>
<thead>
<tr>
<th>Area</th>
<th>Cleaning Frequency</th>
<th>Cleaning and Sanitizing Method</th>
<th>Person Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation table in Packaging area</td>
<td>Beginning of the day and between packaging different products</td>
<td>1. Remove debris accumulation using clean cloth and soapy water. 2. Rinse table top with clean water. 3. Sanitize with clean cloth and chlorine sanitizer solution of 50 ppm.</td>
<td>Bill / 11-1-2004</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Sample Chemical Sanitizer Monitoring Form

<table>
<thead>
<tr>
<th>Date</th>
<th>Initials</th>
<th>Test Strip Result</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/01/04</td>
<td>DH</td>
<td>Chlorine 50 ppm—OK</td>
<td>Surfaces</td>
</tr>
<tr>
<td>11/01/04</td>
<td>DH</td>
<td>Chlorine 200 ppm—OK</td>
<td>Product</td>
</tr>
</tbody>
</table>

**Directions:**

1. Complete this form daily.
2. Record date, your initials, and test strip result.
3. Indicate whether the test strip turned the appropriate color to meet the sanitizer concentration standard. The result is either “OK” or “CHANGED.” If the solution is changed, indicate corrective action on the form.
4. If the sanitizer solution is redone, log the new concentration on the form.

**Sanitizer Standards:**

- Chlorine = 50 (surfaces) to 200 ppm (product)
- Quaternary ammonium = 200 ppm (product)
- Hydrogen peroxide = 300 ppm (product)

Visit [www.iowahaccp.iastate.edu](http://www.iowahaccp.iastate.edu) for sample cleaning procedures and schedules.
Summary
Cleaning and sanitizing are part of an overall food safety plan to provide the safest and best quality produce to customers. Checklists, standard procedures, and schedules are typically the best ways to communicate information to employees and document that proper cleaning and sanitizing practices are followed.

References and Resources
More information about general produce food safety, GAPs, and food safety plans is available at the following Web sites.

Local Foods: From Farm to Foodservice, Hotel, Restaurant, and Institution Management Extension, Iowa State University
http://www.extension.iastate.edu/hrim/localfoods/

Foodborne Illness Education Information Center, USDA/FDA

Good Agricultural Practices Project, Cornell University
http://www.gaps.cornell.edu

Good Agricultural Practices, New England Extension Food Safety Consortium
http://www.hort.uconn.edu/IPM/foodsafety/index.htm

Guidelines for the use of chlorine bleach as a sanitizer in food processing operations, (Publication FAPC#116), W. McGlynn, Oklahoma State University Cooperative Extension
http://osuextra.okstate.edu/pdfs/FAPC-116web.pdf

Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables, Center for Food Safety and Applied Nutrition (CFSAN), U.S. Food and Drug Administration
http://vm.cfsan.fda.gov/~dms/prodguid.html

HACCP: Hazard Analysis Critical Control Point Information Center, Iowa State University Extension
http://www.iowahaccp.iastate.edu/sections/farmfoodsafety.cfm?action=resources

ISU Extension publications
http://www.extension.iastate.edu/pubs

Vegetable Research and Information Center, University of California Cooperative Extension
http://vric.ucdavis.edu

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