Arizona - California Leafy Greens Industry Food Safety Training Program

Course 2:
Cleaning and Sanitizing Harvesting Equipment

A Food Safety Training Series for the
Arizona - California Leafy Greens Industry

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LGMA
CALIFORNIA LEAFY GREEN PRODUCTS
HANDLER MARKETING AGREEMENT

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Section 1

Instructor's Guide

Section 1. Instructor's Guide

Program Introduction

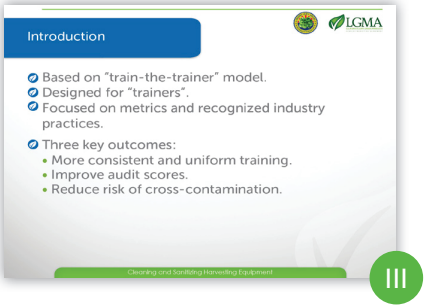
This training module, titled Cleaning and Sanitizing Harvesting Equipment, is provided by the Arizona and California Leafy Greens Marketing Agreements (LGMA).

The program is based upon the principles of the "train-the-trainer" model and was designed for primary and/or lead food safety personnel who have responsibility for training employees. Others in the target audience include sanitation supervisors, quality control personnel, extension agents, and/or industry consultants who wish to conduct field sanitation training that includes cleaning and sanitizing practices.

This program aims to ensure that cleaning and sanitizing leafy greens harvesting equipment is done in accordance with the requirements in the Arizon and California Commodity Specific Food Safety Guidelines for the Production and Harvest of Lettuce and Leafy Greens--the Metrics--which address field sanitation.

There are three key expected outcomes of this training:

1. Improvement in the consistency, quality, and uniformity of the industry's internal training for personnel.
2. Reduction in the number of citations issued for failure to comply with the Metrics.
3. Reduced risk of cross-contamination due to safer practices.



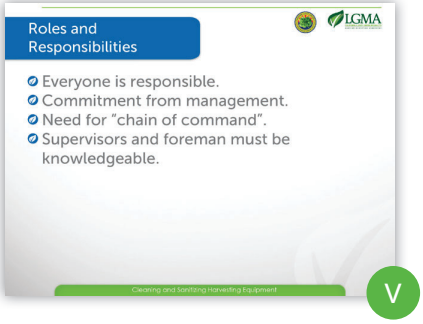
Field sanitation is one of the most important activities in the industry that helps minimize the risk of leafy greens contamination. This training course emphasizes the field sanitation requirements in the Metrics. It is essential that you thoroughly understand your company's field sanitation program and apply the information you learn today to your program.

Roles and Responsibilities

IV → V

Ensuring and promoting food safety is the responsibility of all employees within an organization. It is important that everybody, from top managers down to workers in the field, be committed to playing their role and maintaining a culture of food safety on the farm.

While all employees are both responsible and accountable for complying with all food safety standards, there must be a clearly identified "chain of command" established within the organization to provide the mechanism for accomplishing this objective. In the case of field sanitation, the food safety supervisors / foremen responsible for the field sanitation program must fully understand their program and have properly trained the members of the sanitation crew in their assigned tasks.



Scope of the Course

VI

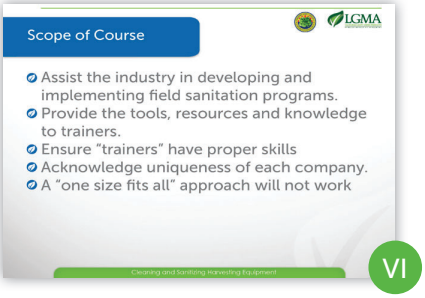
This training module focuses on teaching the proper cleaning and sanitizing of leafy greens harvesting equipment and utensils.

The Cleaning and Sanitizing Harvesting Equipment Training course has been developed to:

1. Assist the Arizona and California leafy greens industry in implementing practices for growing, harvesting, and transporting leafy greens that conform to the LGMA Metrics.

2. Provide the knowledge, tools, and resources necessary to properly train supervisors in proper cleaning and sanitizing practices.

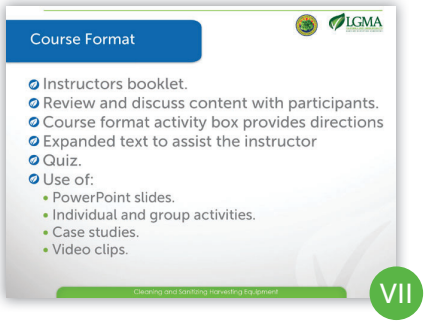
3. Ensure that leafy greens industry trainers are equipped to train other employees to perform these procedures consistently and uniformly.



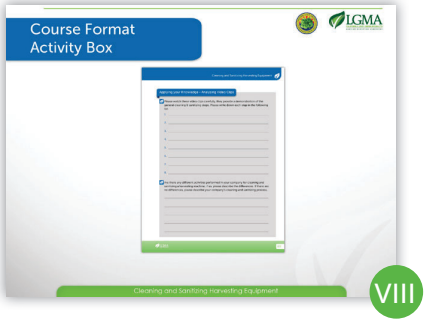
Course Format

VII → VIII

The information in this program is presented in the text narrative. There are also several activities in the program. These are included in the booklet and come with specific instructions for conducting them. The activities are designed to be conducted individually or in small groups; you can decide how best to conduct them for your groups. To help you, the suggestions for conducting these activities will be described in a Course Format Activity Box.



As you review and discuss the concepts in the narrative, you will reinforce them with the individual and group activities, discussions, case studies, and quizzes embedded in the program. These elements will help keep participants engaged as they acquire the knowledge and skills they need to properly clean and sanitize field harvesting equipment.

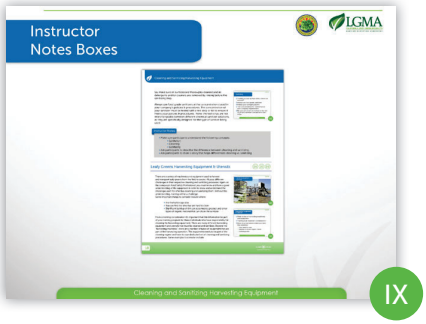


Alongside the text in this booklet are the corresponding PowerPoint slides that you will present to training participants. In some instances there is more than one slide per topic. You do not need to memorize all of the text. However, to make the training session more effective, you should become familiar with it and thoroughly understand all elements of the course.

Instructor Notes Boxes

IX

Throughout this booklet are "Instructor Notes" boxes that contain additional information intended to deepen your understanding of a topic, or to help generate discussion among participants. They may also alert you to important information that you should emphasize when teaching participants. Instructor Notes provide additional resources that help improve the training experience for you and your trainees.

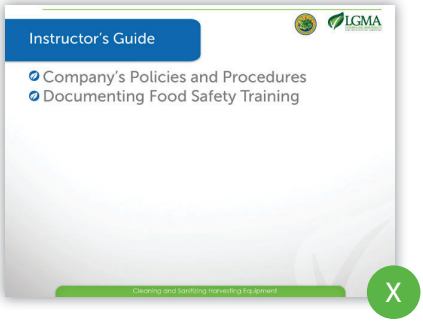


Company Policies and Procedures

X

Before conducting this training at your company, make sure that you are familiar with company policies and procedures and that what you plan to teach is consistent with these rules. We advise that whenever possible, you relate the content of this program to your company's practices.

Company policy should require that all training be documented. If a training is not documented, food safety auditors or regulatory officials will assume that it was not conducted.



Section 2

Lesson Plan

Section 2a. Introduction to the LGMA Metrics

1 → 3

Section Summary

The "Cleaning and Sanitizing Harvesting Equipment" course provides uniform sanitation training to the leafy greens industry. The program is divided in two sections: Introduction to the LGMA Metrics and Field Sanitation.

The first section introduces participants to food safety programs and provides a quick overview of the Metrics.

The second section covers two parts of the Metrics related to this cleaning and sanitizing: Field Sanitation and Equipment Facilitated Cross-Contamination.

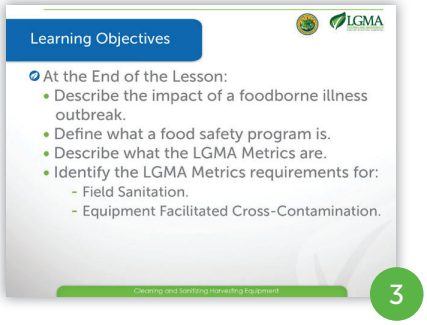
1

2

Learning Objectives

By the end of this lesson, participants will be able to:

- State the impact a foodborne outbreak can have on consumers and employees' work.
- Define what a food safety program and the Metrics are.
- Identify the Metrics requirements related to Field Sanitation.
- Identify the Metrics requirements related to Equipment Facilitated Cross-Contamination.

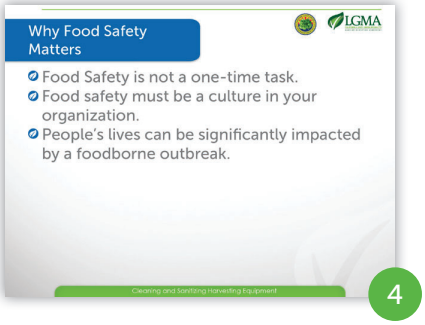


3

Why Food Safety Matters

4

Food Safety is not a one-time task; it is a culture that leafy greens farmers and shippers must establish at their companies to protect consumers and to ensure the continued success of their companies. Before learning about what we must do to keep food safe, let's take a few minutes to remember why we must keep food safe.



The following video highlights the stories of two young women whose lives were significantly impacted by the 2006 outbreak of *E. coli* 0157:H7 in spinach, and the steps the leafy greens industry has taken to help prevent such outbreaks from occurring again. We encourage you to show this video to all of your employees, to help them understand why it is so important to follow food safety rules.

Instructor Notes:

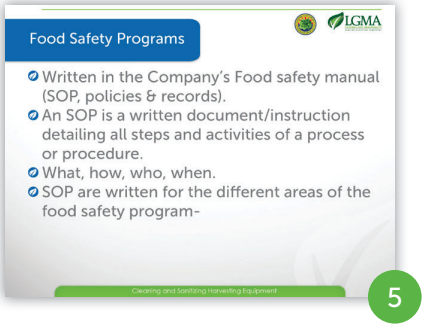
You can use the following details and questions to either personalize the introduction to the video clip, or to highlight the outcomes after showing the clip:

- Riley is 17 years old and you can see and hear how she was impacted by the outbreak.
- Riley was afraid to go into a lettuce field, and felt that she should be perceived as a "bad" person.
- What if Lauren or Riley were one of your children? How would you feel?
- Does this help you understand the personal impact of food-borne illness?

Food Safety Programs and SOPs

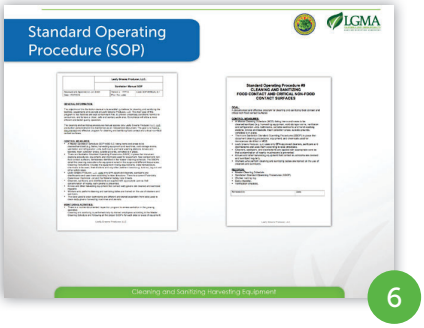
5 → 6

Your company's food safety program is written in the company's food safety manual. This manual is prepared by the Food Safety Professional and contains your company's policies, standard operating procedures (SOPs), and records.



An SOP is a detailed description of what an individual grower is going to do, how it is going to be done, who is going to do it, and when it is going to be done. The simplest definition of an SOP is: a written document outlining a company's normal operating procedure. SOPs are an integral part of a company's food safety program. They must be carried out without any deviation or modification to guarantee the desired outcome.

For each issue or area in the Metrics, your company may need to prepare a SOP outlining its standard practices.

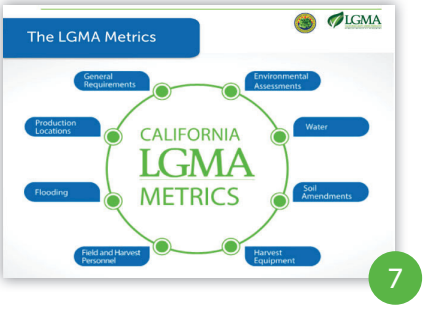


The LGMA Metrics

7 → 8

One major objective of this training program is to ensure compliance with the Metrics. It is important that your company's food safety program cover the categories in the Metrics that address field sanitation.
The Metrics are divided into the following categories:

- General Requirements
- Environmental Assessments
- Water
- Soil Amendments
- Harvest Equipment
  - Field Sanitation
  - Cross-Contamination
- Field and Harvest Personnel
- Flooding
- Production Locations



Each category includes specific recommendations which, when properly implemented at your company, constitute a Good Agricultural Practices (GAP) program for the production and harvest of lettuce and leafy greens. In the next two sections we will review two important categories of the Metrics: Field Sanitation and Cross-Contamination.

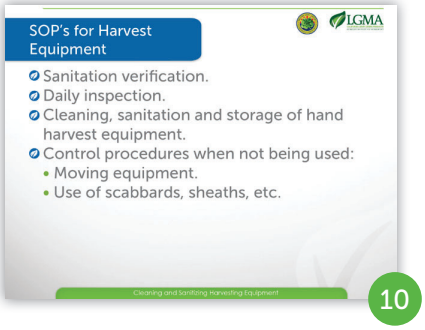
Instructor Notes:

- Explain how the Metrics were developed and the impact they have had in the leafy greens industry. If available, provide some data on the number of audits conducted each year in Arizona and California.
- Cover a few examples of some retail customers' food safety requirements. Getting employees to know some of the customer's food safety requirements will reinforce the message about the importance of food safety in the production of leafy greens.

Field Sanitation & Equipment Facilitated Cross-Contamination

9 → 12

This section in the metrics addresses SOPs for various types of equipment used for harvesting lettuce/leafy greens. Machine harvesting has become increasingly prevalent and provides opportunity for increased surface contact exposure.

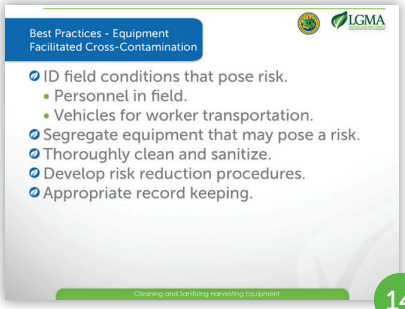


Equipment Facilitated Cross-Contamination

13 → 14

The second area relevant to field sanitation is Equipment Facilitated Cross-Contamination. When farm equipment has had direct contact with raw untreated manure, untreated compost, waters of unknown quality, animals, or other potential human pathogen reservoirs, it may be a source of cross contamination. Such equipment should not be used in areas where it may contact edible portions of lettuce and/or leafy greens until it is properly cleaned and sanitized.

13



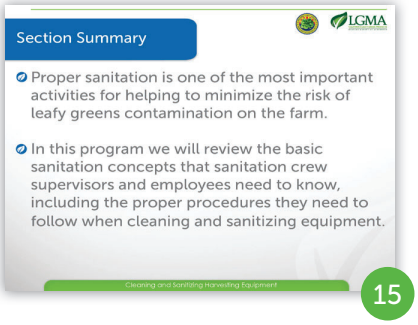
14

Section 2b. Field Sanitation

15 → 16

Section Summary

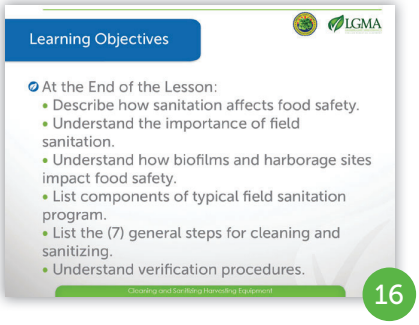
Proper sanitation is one of the most important activities for helping to minimize the risk of leafy greens contamination on the farm. This section of the program is designed to communicate basic sanitation concepts to sanitation crew supervisors and employees. The instructor will explain and demonstrate the proper procedures to follow when cleaning and sanitizing equipment.



Learning Objectives

By the end of this section, participants will be able to:

- Describe how sanitation directly affects the safety of leafy greens.
- Understand the importance of proper cleaning and sanitizing.
- Understand how biofilms and harborage sites impact food safety.
- List the different components of a typical sanitation program.
- List the seven general steps for cleaning and sanitizing harvesting equipment.
- Understand sanitation verification procedures.



Microorganisms

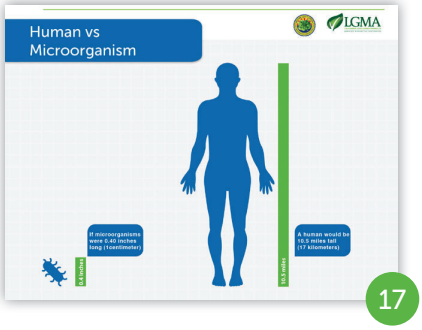
17 → 19

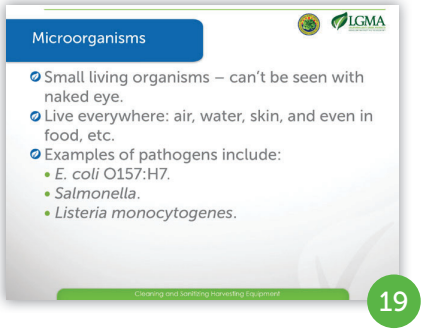
Microorganisms, or microbes, are living organisms so small that they can only be seen through a microscope. To put that in context, if microorganisms were 0.40 inches long (1 centimeter), then an average man would be 10.5 miles tall (17 kilometers).

There are microorganisms everywhere: in the air, water, soil, on skin, and even in food. Most microorganisms will not harm us, but there are several that, if present, could make us sick.

The microorganisms that can make us sick are called human pathogens. Human pathogens are undesirable in leafy greens. Examples of pathogens include:

- *E.coli* O157:H7
- *Salmonella*
- *Listeria monocytogenes*





Instructor Notes:

- Note that testing for *Listeria monocytogenes* is not currently required under LGMA.
- Emphasize that it can take very few organisms to cause illness. For example, as few as 10 cells of *E. coli* O157:H7 can make someone sick. This is why thorough cleaning and sanitizing is important.

Instructor Notes - The 2011 Cantaloupe Story

The following example illustrates how poor sanitation resulted in a deadly outbreak of *Listeria monocytogenes*, a dangerous human pathogen.

In 2011, 147 people from 28 states got sick after eating cantaloupe contaminated with *Listeria monocytogenes*. The outbreak made national news and was highly publicized. When it was declared over, thirty-three people had died and one pregnant woman had a miscarriage.

The Food and Drug Administration (FDA) worked closely with the Centers for Disease Control and Prevention (CDC), the companies involved, and public health authorities in states where illnesses occurred to determine the source(s) of contamination. Laboratory testing by the FDA identified *Listeria monocyogenes* strains in samples from packing equipment and cataloupes at a Colorado farm's packing facility.

The company issued a recall of its cantaloupes after they were linked to the outbreak. The FDA determined that the outbreak may have been caused, among other things, by the use of unsanitary equipment. This is an example of how not following proper field sanitation practices can result in a major foodborne illness outbreak.

Sources:
http://www.cdc.gov/listeria/outbreaks/cantaloupes-jensen-farms/120811/
http://www.cdc.gov/listeria/outbreaks/cantaloupes-jensen-farms/082712/index.html

Cross-Contamination

20 → 21

Cross-contamination is the transfer of harmful substances or microbes (contaminants) from something DIRTY to something CLEAN. Leafy greens can be contaminated by using dirty equipment or from poor employee sanitary practices. Proper sanitation helps minimize the risk of cross-contamination with microorganisms that cause spoilage or illness.

In the field, there is always potential for cross contamination. This can occur when produce comes in contact with dirty equipment surfaces, utensils or other sources of contamination. Cross contamination from harvesting equipment can contribute to foodborne illness.

Look out for conditions that can lead to cross contamination of leafy greens, and work to prevent them. Harvesting machines, tractors, trailers and any other equipment and utensils used in daily harvest operation must be visually inspected daily before work begins and periodically throughout the work day (e.g.: during breaks, when equipment has been moved from one location to another, etc.) This slide illustrates how microorganism can get into a surface and then contaminate leafy greens.

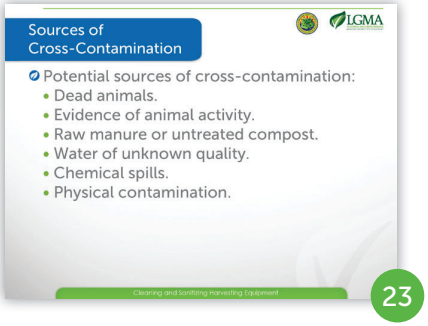
Sources of Cross-Contamination

22 → 23

Sources of contamination exist in and around fields, on field access roads, in equipment yards, etc. It is important to visually monitor equipment regularly to make sure it does not become a source of contamination. Some potential contaminants are:

- Dead animals in or near around the field
- Evidence of animal activity in and around the field
- Feces
- Raw manure and untreated compost
- Waters of unknown quality
- Chemical spills
- Physical contamination including metal, glass and trash

Equipment that becomes contaminated from any of these sources must be cleaned and sanitized in accordance with the Metrics before it is used to harvest leafy greens.



Instructor Notes:

- Emphasize that microorganisms can't be seen with the naked eye.
- Ask participants or each group to share potential real life situations they have encountered in the field that may lead to cross-contamination.

What is Sanitation?

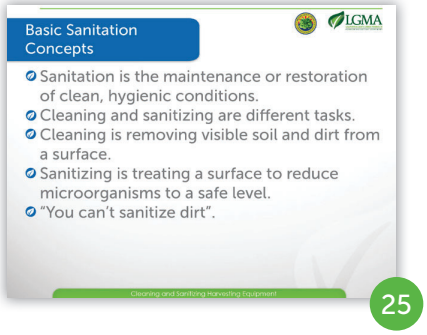
24 → 25

Sanitation is the maintenance or restoration of clean, hygienic conditions. In leafy greens production, sanitation programs are needed to eliminate microorganisms that can cause food spoilage or illness.

Sanitation programs include cleaning and sanitizing steps. Cleaning and sanitizing are two different activities with two different objectives. It is important to make the distinction, as one without the other results in a process that does not work.

Key Concepts

1. Cleaning refers to the physical removal of visible and invisible soil and dirt from food-contact and non-food contact surfaces.
2. Sanitizing is the treatment of a surface to reduce the number of disease-causing microorganisms to safe levels.
3. "You can't sanitize dirt:" harvesting equipment must be cleaned before it can be properly sanitized. The next two sections will review these concepts in more detail.



Cleaning

26 → 27

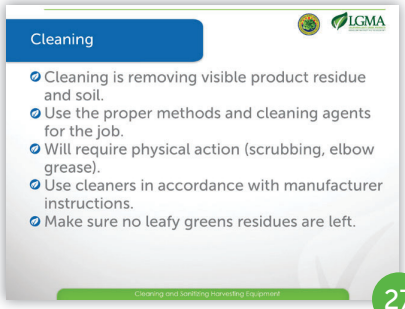
Cleaning is the removal of all soil, dust, and debris from a surface. Soil provides the nutrients for microorganisms to grow. It can originate from the food or from the field (dirt, dust, grease, animal hazards, etc.)

Cleaning removes product residue and visible soil from food-contact and non-contact food surfaces, so that sanitization can occur. Most often, the cleaning process will require physical action (i.e., scrubbing, elbow grease) to ensure that the surfaces are clean. During this step, a specified cleaner (or detergent) is applied and used according to the manufacturer's directions. These directions may include cleaner type, concentration, contact time and temperature.

The cleaner helps remove grime through the interaction of detergent and soil. After cleaning, no leafy greens residues should remain in any part of the harvesting equipment or utensil.

The cleaning method and the chemical agents used will depend on the type of soil generated. The Food Safety Professional will be responsible for determining the procedures and chemicals that will be used.

26



27

Sanitizing

28 → 29

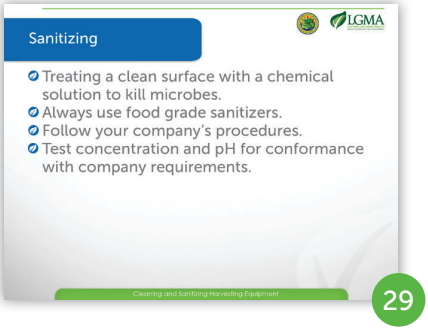
During the sanitizing process, a clean surface is treated with a chemical sanitizer to reduce the number of microorganisms to safe levels.

All surfaces should be thoroughly cleaned and all detergents and/or cleaners rinsed off before the sanitizing step.

Remember, you cannot sanitize a dirty surface: dirt and debris will prevent the sanitizer from doing its job.

28

Always sanitize using food-grade sanitizers at the concentration stated in your company's policies & procedures. The concentration of your sanitizer must be tested with the appropriate test strip to ensure that it is in line with company procedures. Note that test strips are designed to be used with specific types of sanitizers. A test strip can only be used with the chemical sanitizer it is designed for.



Instructor Notes:

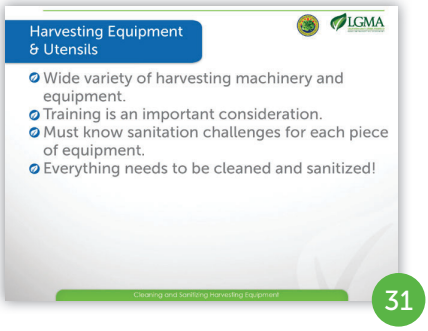
- Make sure participants understand the following concepts:
  - Sanitation
  - Cleaning
  - Sanitizing
- Ask participants to describe the difference between cleaning and sanitizing.
- Ask participants to share a story that helps differentiate between cleaning and sanitizing.

Leafy Greens Harvesting Equipment & Utensils

30 → 32

Various machinery, equipment and utensils are used to harvest and transport leafy greens from the field to cooler: all pose different challenges in their respective cleaning and sanitizing processes. As the company's Food Safety Professional, you must know the equipment well in order to understand the challenges to effectively cleaning and sanitizing each one. Without this understanding, training others to do the job correctly will be a challenge.

In addition to "harvesting machines", there are other types of equipment that are part of the the harvesting operation. Everything needs to be part of the cleaning regime and have its own dedicated set of cleaning and sanitizing procedures. Some examples of equipment to consider are:



Types of Harvesting Machines

- Field packed – romaine hearts
- Field packed – wrapped head lettuce
- Bulk – lettuce and romaine
- Bulk – cabbage
- Mower – spring mix and spinach

Other Equipment Used in Harvesting Operations

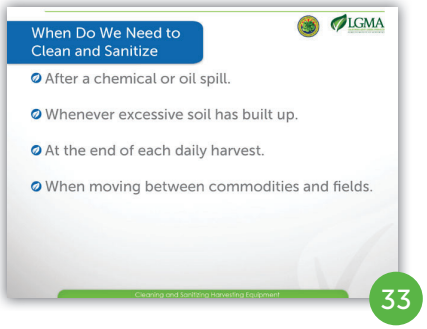
- Trailers
- Tractor
- Trucks
- Totes

When Do We Need to Clean and Sanitize?

33

It is very important that harvesting equipment be sanitized whenever it may have become contaminated, such as after a chemical or oil spill, and whenever excessive soil has built up.

Keep in mind that food-contact surfaces on harvest equipment must also be cleaned and sanitized at the end of each daily harvest or when moving between commodities and fields to help prevent any potential cross-contamination between products.



Components to Clean

34 → 35

The differences in design, construction, and materials used in harvesting equipment and its components should be reflected in the cleaning and sanitizing procedures. You should consider different procedures for the different equipment components.

The following are some of the "components" that need to be considered when cleaning and sanitizing harvesting equipment:

- Packing tables
- Transfer and conveyor belts
- Belt rollers

- Hydraulics, including overhead fittings, hoses, motors and pistons
- Drip pans
- Water tanks mounted on tractors
- Main water supply
- Bearings and gear boxes
- Harvesting machine framework

Instructor Notes:

- Ask groups to think of other components and how each component can contribute to problems. Then have them present specific instances they have encountered and addressed.

Food-Contact Surfaces

36 → 44

Food-contact surfaces are surfaces or areas that may come in direct contact with exposed leafy greens. Some examples are: conveyor belts, table tops, working tables, elevators, and knives. Food-contact surfaces are more likely than other surfaces to be sources of cross-contamination. Special care must be placed into cleaning and sanitizing these areas.

These slides show some examples of food-contact surfaces in different types of equipment.

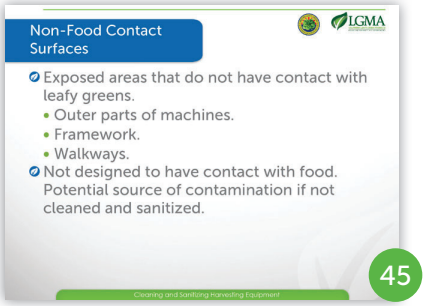
Non-Food Contact Surfaces

45 → 51

Non-food-contact surfaces such as outer parts of machines, framework, walkaways, etc. are exposed areas that do not have contact with leafy greens. Although they were not designed to have contact with food, they can still become a source of contamination. We need to be aware of these areas, and clean and sanitize them properly on a regular basis.

It is important to clean non-food contact surfaces in the equipment to prevent the accumulation of debris and crop residue. The accumulation of these materials may create a good environment for the growth of microorganisms.

These slides show a few examples of non-food contact surfaces in different types of equipment.



Applying your Knowledge - Food-Contact & Non-Food Contact Surfaces

Select a harvesting machine that you are familiar with and list 3-5 of its food-contact surfaces. Then list 3-5 of its non-food-contact surfaces.

Instructor: *When participants have completed the activity, have them discuss their answers with the group. Ask for a volunteer to read his/her answers out loud.*

Food Contact Surfaces

1. _____

2. _____

3. _____

4. _____

5. _____

Non-Food Contact Surfaces

1. _____

2. _____

3. _____

4. _____

5. _____

Harborage Sites

52 → 67

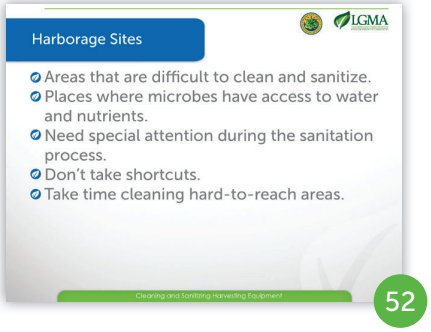
A harborage site is an area on a piece of equipment that is difficult to clean and sanitize. Dirt, product, and other types of organic material can accumulate in these areas providing nutrients and water for microbes and making them ideal areas for bacteria to grow.

When combined with other factors, like time and temperature, that allow for bacterial growth, these sites can be particularly dangerous. They need special attention during cleaning and sanitizing; do not take shortcuts and always take your time cleaning the hard-to-reach areas of equipment.

Field equipment has many places that can become harborage sites for microorganisms. Harborage sites include:

- Ledges
- Conveyor belts
- Equipment seams
- Temporary repairs
- Welds

The following slides show potential harborage sites in several locations of the equipment. Let's go over each one of them and identify the potential harborage sites.



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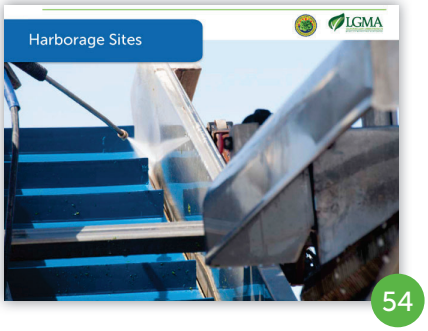

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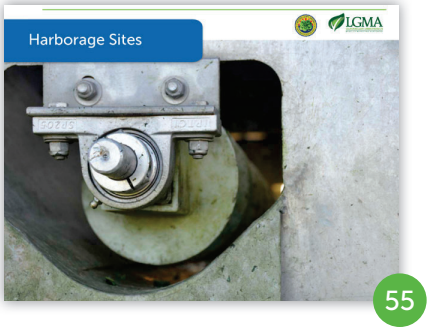

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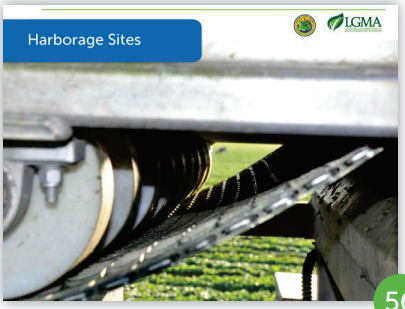
Instructor Notes:

- This is a good opportunity to show the participants potential harborage sites in different parts of equipment. As you go through each slide, ask each group to discuss and identify the potential harborage site(s) on that equipment.
- Ask each group to share with the class how the harborage sites they identified can be cleaned and sanitized effectively.



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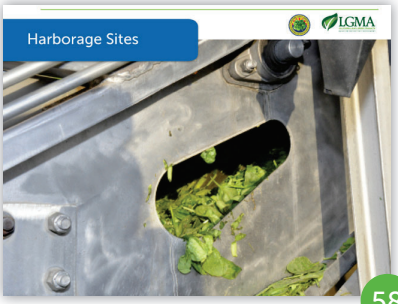

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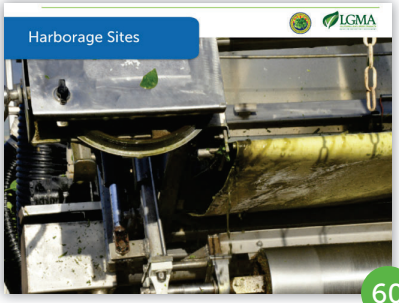

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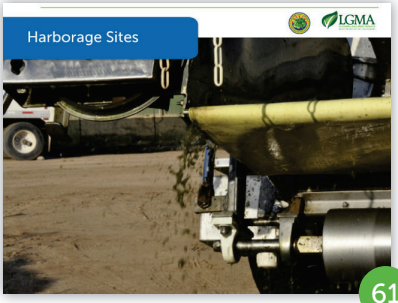

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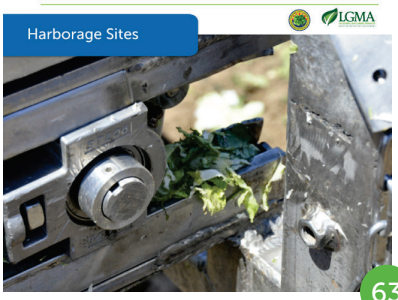

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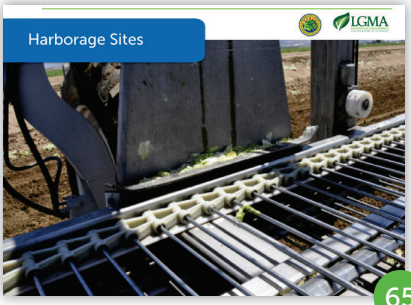

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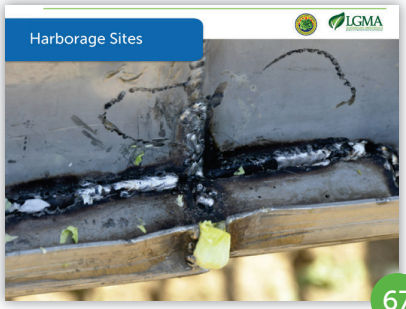


67

Applying your Knowledge - Harborage Sites Discussion

Write down 3-5 specific areas in one of your company's harvesting machines that may be potential harborage sites.

1. _____

2. _____

3. _____

4. _____

5. _____

Why is it important to properly clean & sanitize potential harborage sites on equipment?

_____

_____

_____

_____

_____

_____

_____

_____

Instructor: *When participants have completed the activity, discuss their answers as a class.*

Applying your Knowledge - Identifying FCS, Non-FCS & Harborage Sites

The following picture shows a harvesting machine that has just been properly cleaned and sanitized. In groups, have participants identify 3 Food Contact Surfaces and label them "FCS." Next, have them write "Non-FCS" on 3 Non-Food Contact Surfaces that they think are close to the exposed product when the machine is working, and that could become sources of cross- contamination. Finally, the groups should identify potential Harborage Sites and label them "HS."

When the groups are finished, have them share their findings with the class.

Biofilms

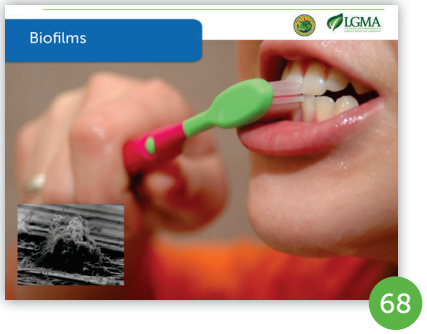
68 → 69

A biofilm is a community of microorganisms held together in a film. The microorganisms produce this film, which acts as a structure that houses and protects them from the environment.

Biofilms form on surfaces that have not been cleaned and sanitized properly. In leafy greens harvesting equipment they are associated with food-contact surfaces and harborage sites, but they are also a common occurrence in our everyday lives.

An excellent example of a biofilm is the scum/plaque that builds up on your teeth. Even after brushing, bacteria remain in the warm and moist environment of your mouth. If you brush your teeth at night, by morning the bacteria will have built up a film on the surface of the teeth. The formation of a film in a glass of milk is another example of biofilm formation. This film is a combination of bacteria and the byproducts they form.

The same sort of film can build up on harvesting equipment surfaces and lead to product contamination. Regular cleaning and sanitizing are the best ways to combat biofilm formation and leafy greens contamination. Scrub the food contact surfaces on harvesting machines well to avoid biofilm formation.



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69

Instructor Notes - More on Biofilms

Biofilms are the aggregation of microorganisms that attach themselves to a surface by excreting a sticky substance. This substance protects the microorganisms from outside stressors and provides anchor points for other microorganisms and colonies to attach themselves to the surface.

Porous, wet, and hard-to-reach surfaces on harvesting machines are the perfect environment for microorganisms to grow and form colonies. As the colonies grow, microorganisms produce more of the adhesive substance to protect them from cleaning chemicals and sanitizers.

Biofilms are an area of concern when it comes to cleaning and sanitizing harvesting machines and equipment. If not cleaned properly, the water and leafy greens debris can become a source of nutrition for the microorganisms in the biofilm, contributing to their growth.

Because of this, it is very important to prevent the formation of biofilms in harvesting machines by properly cleaning and sanitizing them. The best way to remove them and prevent their formation is to thoroughly scrub the equipment when cleaning, giving special attention to harborage sites.

Applying your Knowledge - Quiz

Instructions
Circle the best answer to each question. There is only 1 right answer per question.

Instructor: *When participants have completed the activity, have them discuss their answers with the group. Ask for a volunteer to read his/her answers out loud.*

1. What is sanitation?
   a) Sanitation is the maintenance or restoration of clean, hygienic conditions that help prevent foodborne illnesses.
   b) Keeping things clean.
   c) The physical removal of visible and invisible soil.
   d) The treatment of a surface to reduce the number of microorganisms to a safe level.

2. Which of the following statement is NOT TRUE about the cleaning process?
   a) It may require physical action.
   b) It focuses on the need to remove organic matter and visible soil from food-contact surfaces.
   c) The use of a detergent is not part of the cleaning process; scrubbing is all that is needed to clean equipment.
   d) A surface must be cleaned before it can be sanitized.

3. What is the aim of a sanitation program?
   a) To clean the equipment so that it can operate better and more efficiently.
   b) To remove visible soil from food-contact surfaces.
   c) To eliminate microorganisms that cause disease and spoilage.
   d) To remove grime through the interaction of detergent and soil.

4. What is a food contact surface?
   a) Any surface or area that may come in direct contact with exposed leafy greens.
   b) Exposed areas that do not have contact with leafy greens.
   c) An area that is difficult to clean and sanitize effectively
   d) A surface with an accumulation of microorganisms in a hard-to-remove structure.

5. What is a biofilm?
   a) Any surface or area that may come in direct contact with exposed leafy greens.
   b) A food contact surface that has not been properly cleaned and sanitized.
   c) An area that is difficult to clean and sanitize effectively
   d) The accumulation of microorganisms stuck on a surface in a hard-to-remove structure.

Sanitation Programs in the Leafy Greens Industry

70 → 71

All leafy greens companies have sanitation programs in place. A comprehensive sanitation program does not only address the cleaning and sanitizing of harvesting machines and equipment, but is comprised of multiple components that establish the range of procedures and processes for sanitation.

A typical sanitation program includes, but is not limited to, the following components:

- Master cleaning schedule
- Sanitation standard operating procedures (SSOPs)
- Monitoring of cleaning and sanitizing activities
- Verification activities
- Corrective actions
- Records

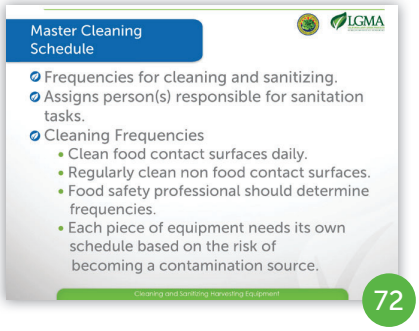
For LGMA members, company sanitation programs must at minimum comply with the LGMA Metrics.

Master Cleaning Schedule - What Should be Cleaned & Sanitized

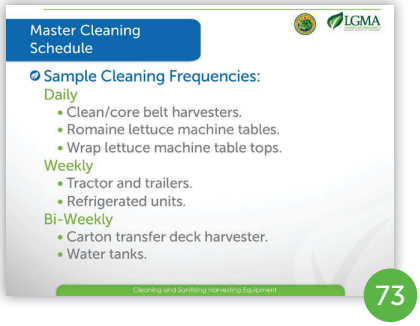
72 → 84

The company's sanitation program should include a master cleaning schedule. This schedule details how frequently all harvesting equipment and utensils should be cleaned, and who is responsible for executing and supervising cleaning tasks.

There are some areas on harvesting equipment where special emphasis should be placed. Food-contact surfaces should be cleaned and sanitized at least daily, or more often, as necessary. Non-food-contact surfaces must be cleaned regularly to maintain sanitary conditions. It is the company's responsibility to establish the master cleaning schedule, SOPs, SSOPs, etc., based on the cleaning and sanitizing challenges presented by the types of equipment being used.



Each piece of harvesting equipment should have its own cleaning schedule: the cleaning frequency should be based on the risk that the machine or utensil poses as a contamination source. For instance, equipment like tractors and trailers do not normally directly contact produce. They do not need to be cleaned on a daily basis-,-rather, cleaning them once every two weeks should be adequate.



The following are some examples of cleaning and sanitizing schedules from different LGMA members. They can provide guidelines to assist in developing an effective cleaning and sanitizing program:

- Clean/Core Belt Harvesters – Daily.
- Romaine Lettuce Machine Table Tops - Daily.
- Wrap Lettuce Machine Table Tops -Daily if covered with plastic liner.
- Tractor and trailers- Weekly.
- Refrigerated units – Weekly.
- Carton Transfer Deck Harvester – 2 times per month.
- Water Tanks – 2 times per month.

The following slides show different types of harvesting equipment and utensils that must be cleaned and sanitized on a regular basis.

Instructor Notes:

- Ask participants to discuss in groups some of the cleaning frequencies for equipment included in their companies' master cleaning schedules.
- Ask groups to discuss amongst themselves what kinds of challenges they have encountered in complying with the cleaning frequencies in their companies' master cleaning schedules.

Sanitation Standard Operating Procedures (SSOPs)

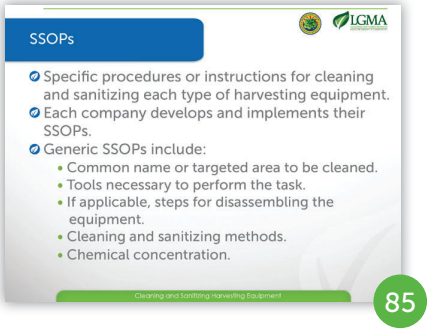
85 → 87

As part of the sanitation program, leafy greens companies must develop, implement and maintain sanitation standard operating procedures or SSOPs.

An SSOP is a kind of SOP that focuses on sanitation. SSOPs provide detailed instructions on how each harvesting machine or utensil should be cleaned and sanitized to prevent contamination.

Similar to SOPs, they include:

- Common names of equipment or targeted areas to be cleaned.
- Tools necessary to perform the task.
- If applicable, steps for disassembling the area or equipment.
- Cleaning and sanitizing method.
- The concentrations of chemicals required for cleaning and sanitizing.



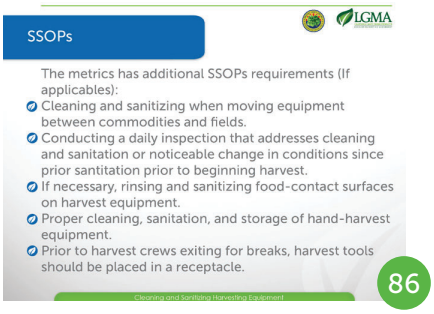
SSOPs, like other SOPs, should be carried out without any deviation or modification to guarantee the desired outcome.

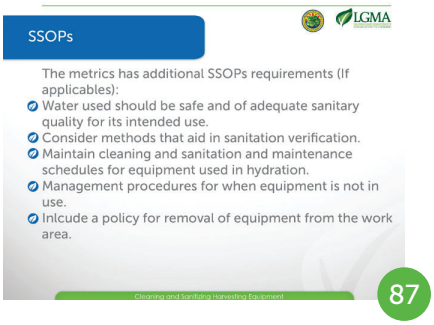
Instructor Notes:

- Close the discussion by reminding participants of the following concept: WHAT, HOW, WHO, and WHEN. An SOP it is a basic description of WHAT an individual ranch is going to do, HOW it is going to be done, WHO is going to do it, and WHEN they are going to do it.
- This is also important for audits: auditors will review your SSOPs and then verify that your field procedures match what is written down.

In addition, the metrics has a few additional requirements that some SSOPs need to Address (If applicable):

- Cleaning and sanitizing when moving equipment between commodities and fields.
- Conducting a daily inspection that addresses cleaning and sanitation or noticeable change in conditions since prior sanitation prior to beginning harvest, and if necessary, rinsing and sanitizing food-contact surfaces on harvest equipment (i.e., accumulation of dirt, debris, dust, droppings, etc.).
- Proper cleaning, sanitation, and storage of hand-harvest equipment such a knives, and scythes.
- Prior to harvest crews exiting for breaks, harvest tools should be placed in a receptacle.
- Water used should be safe and of adequate sanitary quality for its intended use.
- Consider methods that aid in sanitation verification.
- Maintain cleaning and sanitation, and maintenance schedules for equipment used in hydration.
- Management procedures for when equipment is not in use (i.e., end of season).
- Include a policy for removal of equipment from the work area (i.e., containers, scabbards, sheathes or other harvest equipment).





Monitoring

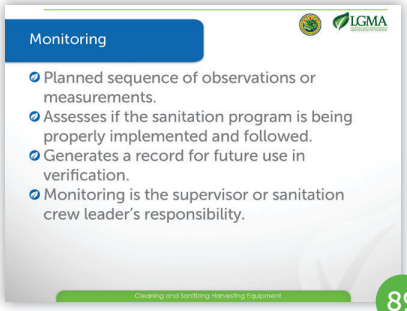
88 → 89

Monitoring is another component of a sanitation program: it is a planned sequence of observations or measurements that assess whether the program is being properly implemented.

Monitoring is the sanitation crew leader or the supervisor's responsibility. The individual(s) responsible for observing cleaning crews should spend time on the field supervising the cleaning crew's work. They should pay attention to the hard to clean areas of the machines and make sure the harborage sites have been properly cleaned and sanitized. They should also closely monitor all of the food contact surfaces and make sure that the chemical concentrations stated in SSOPs are used at all times.

The Food Safety Professional is responsible for reviewing and monitoring records, and for making sure this activity is performed in accordance with written procedures.

88



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Verification

90 → 91

Verification allows companies to check the effectiveness of their cleaning and sanitizing practices. There following are 3 common verification methods:

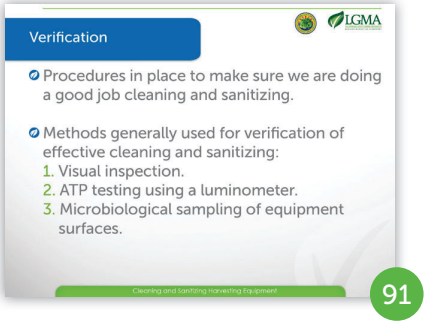
1. Visual inspection, to verify that there is no visible dirt or debris.

2. ATP testing with a luminometer. ATP stands for adenosine triphosphate, a molecule that serves as a primary source of energy to living cells. The more bacteria on a surface, the more ATP is present. Luminometers measure ATP by measuring the light given off when it reacts with a special enzyme. During testing, a surface is swabbed, and the swab placed in an enzyme solution. The swab and enzyme are placed in the luminometer, which measures the light given off and gives results within seconds.

90

3. Microbiological sampling of equipment surfaces: This method provides a count of microbes on a given surface. This is very accurate, however, the results are not provided instantly. The samples are taken at a predetermined frequency according to company's sampling plan and then sent to a laboratory. Results are sent back after few days.

Do not verify your own work. If you perform the activity, your supervisor must verify it.



Instructor Notes:

- Describe in detail a typical verification program used in the industry. You can also mention the process of sampling equipment and getting results back from the lab. Also describe how it gets decided which equipment will be sampled.
- Ask groups to discuss the verification programs at their companies.

Applying your Knowledge - Using ATP to Verify Cleaning & Sanitizing

The purpose of this activity is to demonstrate the use of a luminometer and/or verification swabs to verify the effectiveness of cleaning & sanitizing on a food contact surface.

Materials

- Computer
- Projector/screen
- ATP tester/Luminometer (Optional)
- Glucose-protein Swabs (Optional)

Introduction

The cleanliness of a surface can be assessed in few seconds using an ATP tester/ luminometer or a glucose-protein verification swab. Let's review a couple of videos to find out more on how these tools work and how to use them.

Instructor: *Play the ATP testing – Luminometer video followed by the Verification Swabs video. Once the video has ended discuss with participants if they use any of these tools on their farms. Tell participants that this test must be done on a surface that has been normally cleaned, sanitized and then air-dried. It is important to NOT apply EXTRA sanitizer in an equipment surface before running the test on them.*

Optional Activity:

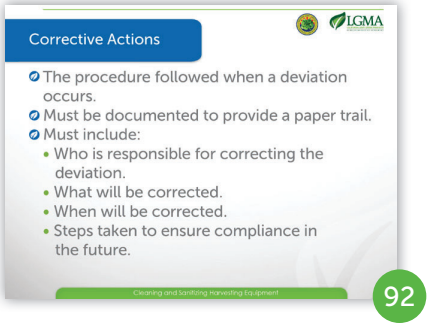
If you have access to a ATP tester/Luminometer and/or Glucose-protein Swabs, you may perform a quick test on a volunteer's hands or a dirty surface. You may use this activity to illustrate how the company's specific device or tests are done.

Closing Remarks

Proper cleaning and sanitizing procedures on the equipment will reduce the number of bacteria on them, therefore, there will be a decrease in the relative light units. The objective of having these tool is to verify that the sanitation process is properly done. The goal of your company and your team is to reach low numbers of the relative light units when the test is conducted and to always keep these numbers low. The same applies for the swabs, the swabs detect the presence of proteins and sugars normally found on food such as leafy greens. If they are found on a surface, then this surface was not cleaned properly. Color changing verification swabs should always stay clear after testing a clean surface.

Corrective Actions

92



A corrective action is the procedure followed when a deviation from an SOP or an SSOP occurs. If a corrective action is taken, you must document it and include it as part of your sanitation checklist or in the ranch's general corrective action checklist.

This documentation is important: it shows that action was taken to correct mistakes in implementing the sanitation program, and to prevent these mistakes from compromising the safety of leafy greens products.

The following is an example of a corrective action:

If an equipment or utensil does not meet the preestablished company's cleaning and sanitizing standards or criteria, it will need to be declared unfit to use in the field and the company's cleaning and sanitizing procedures must be carried out again and the equipment re-inspected.

A corrective action plan outlines how a corrective action will be completed. The plan must outline:

- Who is responsible for initiating the corrective actions.
- The records that must be maintained.
- Who is responsible for oversight.

Applying your Knowledge - Corrective Actions Case Study

Instructions
Using your experience and the information you have learned, write down an appropriate corrective action for the following situation.

Instructor: *When everyone is done, ask for volunteers to read their answers out loud and discuss the participants' answers with the group.*

Your company's sanitation crew cleaned and sanitized eight harvesting machines the last night. The crew was two men short and rushed the cleaning and sanitizing process. They did not do a through inspection of the equipment after they were done since it was too dark to accurately inspect the equipment. Just before starting the harvesting crew a foreman discovered detergent/soap residues on two harvesting machines food contact surfaces.

_____

_____

_____

_____

_____

_____

_____

Documentation and Record Keeping

93 → 96

A record is a document, generally in the form of a checklist or log, that provides evidence that a program is in place and that specific tasks are being completed. Auditors look for evidence that the company's sanitation program is being implemented consistently--checklists and logs provide this evidence.

Documentation and records are critical components of a sanitation program: they should not be overlooked or performed haphazardly. Individuals responsible for filling records have a big responsibility. The Food Safety Professional must take the time to review and verify periodically the accuracy of records.

The most common sanitation checklists include daily sanitation checklists, monthly/quarterly sanitation checklists, daily ATP tests for food-contact surfaces and non-food contact surfaces, and pre-operational sanitation inspection logs.

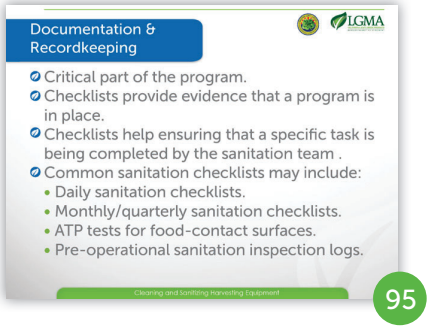
Below are some good documentation practices to follow:

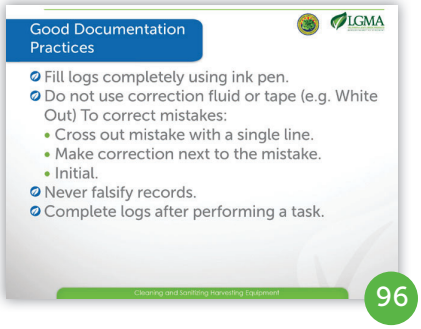
- Fill out logs completely using an ink pen.
- If you make a mistake, do not use correction fluid or tape (e.g.: White Out), and do not scratch it out or write over it. Instead, cross out the mistake with a single line and initial it. Make any corrections next to it.
- Never falsify records. Data falsification may result in a:
  - Flagrant violation issued by the LGMA
  - Loss of audit privileges from the USDA
  - Automatic failure of an audit, if a third-party audit.
- Complete each log when the task is performed.

It is very important to properly complete and sign records. If you do not understand something or have a question, ask your supervisor immediately.

Records must be reviewed, dated, and signed by a supervisor or another responsible party within a reasonable time after the records are made. FDA guidance suggests this review be made within a week, but time can be lessened or increased on occasion.

The company's documentation control SOPs will designate the maximum amount of days that is necessary for this review, make sure that you always follow your company's SOP.





Applying your Knowledge - Overview of a Company's Sanitation Program

Write down a simple cleaning & sanitizing schedule for 5 pieces of equipment that you are familiar with.

Equipment:_____ Frequency:_____

Equipment:_____ Frequency:_____

Equipment:_____ Frequency:_____

Equipment:_____ Frequency:_____

Equipment:_____ Frequency:_____

List some of the components that make up a basic sanitation program.

1. _____
2. _____
3. _____
4. _____

What are some verification activities in your company's program? What are some of the corrective actions that you are aware of?

_____

_____

_____

_____

Instructor: *Have participants discuss their answers with the group. Ask for volunteers to read their answers out loud.*

General Steps for Cleaning and Sanitizing

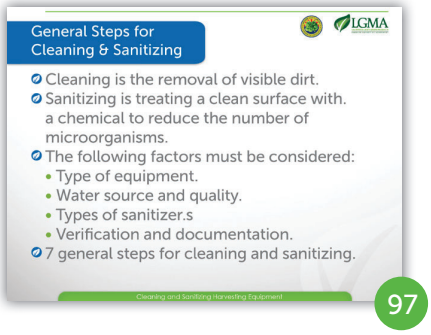
97 → 100

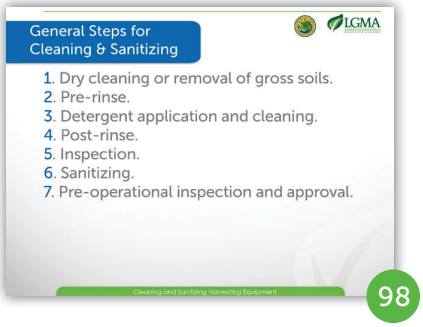
Now that we have covered the basic concepts related to cleaning and sanitizing, let us learn the basic steps for performing these tasks.

Although each utensil or piece of equipment has its own specific cleaning and sanitizing procedure, most procedures follow the 7 general steps below:

1. Dry cleaning or removal of gross soils
2. Pre-rinse
3. Detergent application and cleaning
4. Post-rinse
5. Inspection
6. Sanitizing
7. Pre-operational inspection and approval

Let's review each of the steps in detail.





Instructor Notes:

- Even though the basic steps and procedures for cleaning and sanitizing harvesting equipment are similar, you must also consider the types of equipment involved, water source and quality, types of sanitizers used, verification and documentation.
- Ask some volunteers to describe how many steps are in their companies' cleaning and sanitizing procedures for harvesting equipment.

1. Dry Cleaning or Removal of Gross Soils

101 → 103

During this step we need to remove any visible soil to prepare the surfaces for cleaning. We will need to remove soil, product debris, and waste from the equipment and the cleaning area and properly dispose of them. Cover or remove all packaging materials from the area. There should be no exposed packaging materials when cleaning and sanitizing take place. Equipment may require some preparation or disassembly before it can be cleaned and sanitized. The following are some common preparation steps:

- Take equipment to a designated area for cleaning and sanitizing.
- Loosen belts, rollers, or movable parts of equipment to clean top and bottom surfaces.
- If necessary, disassemble the equipment and place the parts in designated areas, boxes, pallets, or racks before cleaning. Do not place parts on the ground.
- If needed activate conveyers to remove trapped food debris.
- Wipe excess grease and oils from machinery to prevent them from becoming a source of chemical contamination.
- Compressed air or other tools can be used to aid in removal of debris.
- Remember to cover water-sensitive parts and electrical boards of equipment with plastic.
- Rinse food-contact surfaces like tables or cutting boards to remove any remaining soil.

101

102

103

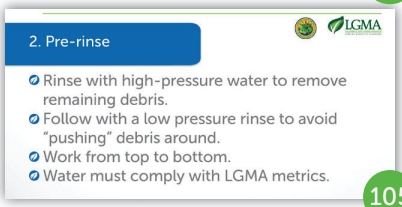
2. Pre-rinse

104 → 106

The equipment is rinsed from top to bottom with water to remove any remaining debris. At this point, lift belts to rinse all upper and lower surfaces. Remember to rinse food contact surfaces and non-food contact surfaces with enough water, but beware of splashing, especially when using a high-pressure washer. Avoid creating puddles and mud.

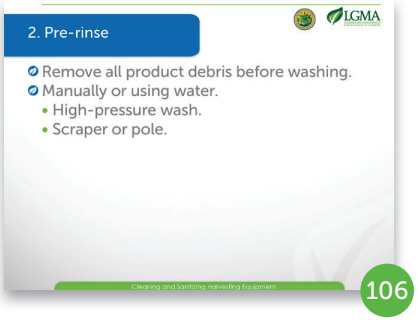
Pay special attention to conveyor-belts, transporters, moving parts of equipment and hard to reach areas or "harborage sites". For some equipment, you may need the help of a scraper or pole. When using a high-pressure hose, make sure debris is removed from the machine, and not just being pushed from one side of the machine to the other.

104



105

You may need to rinse with a low-pressure hose after high-pressuring the machine to ensure that all debris is removed.



3. Detergent Application and Cleaning

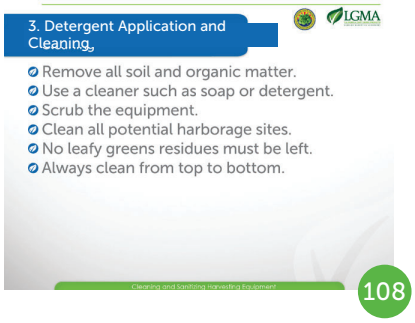
107 → 108

In this step we focus on the removal of any remaining soils and dirt to get rid of organic matter so that sanitation can occur. To start, we need to prepare the specified cleaning solution according to the manufacturer´s instructions and the company's SSOP.

When applying detergent to the equipment, make sure that all food contact surfaces, and adjacent surfaces are covered. Remember that cleaning is the removal of all visible soil and dirt from a surface. The goal of cleaning is to remove organic matter from food-contact surfaces so that sanitization can occur.

The cleaning process should include: conveyer lines, hollow parts, boards, tables, bands, undersides and hard to clean areas. Apply physical action and run automated belts. Scrub all equipment parts to remove soil and dirt. Always clean from top to bottom.

Give special attention and effort to cleaning harborage sites: after cleaning, no leafy greens residues should remain on any part of the harvesting machine or utensil. Lastly, do not allow the cleaning solutions and foams to dry while you are scrubbing or before rinsing.



4. Post-rinse

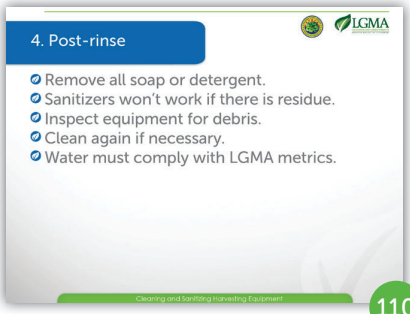
109 → 110

During the post-rinsing step, rinse surfaces that have been cleaned with clean water to remove all soap or detergent. It is important to rinse thoroughly to remove all detergent, soil, residues, and/or plant debris that may dilute or inactivate sanitizers.

Rinse from top to bottom and carefully rinse underneath belts, conveyors, and frames. Remember to run belts or conveyors to rinse them thoroughly. Avoid spraying and splashing dirt, detergent, or debris onto clean equipment. All detergent residues need to be removed, along with any soil and debris that remain on the harvesting machine. Remember the water used for cleaning and sanitizing must have the quality outlined in the LGMA Metrics.

Finally, visually inspect the equipment surfaces to make sure there are no residues you may have missed. If you find any residue on the equipment, you will need to clean and rinse these areas again.

109



110

5. Inspection

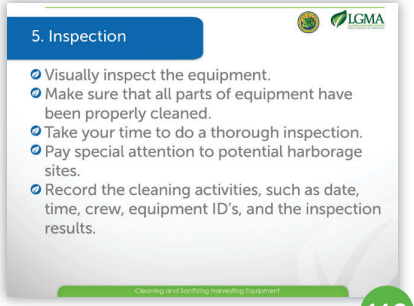
111 → 112

After rinsing and before storing the cleaning utensils, the sanitation crew leader must visually inspect the equipment. It is important to inspect all parts of equipment to make sure that they have been properly cleaned. Take your time to do a thorough inspection, paying special attention to potential harborage sites to make sure they were properly cleaned, and, if necessary, have the sanitation crew reclean the equipment. During this inspection, avoid touching food-contact surfaces.

Record the cleaning activities, such as date, time, crew, equipment ID's, and the inspection results.

Reassemble the equipment, conveyors and any other parts removed during cleaning. Avoid touching food-contact surfaces when reassembling equipment. Also avoid reassembling equipment where it may be exposed to splashes, dust, or other potential sources of contamination. In some instances you may need to sanitize and rinse equipment again after reassembly.

111



112

You can now return cleaning equipment, tools and supplies to their designated area.

The equipment is ready for transport if moving between fields or changing commodities. If this is the end of harvest operations for the day, the best practice is to sanitize the equipment right after it was cleaned.

6. Sanitizing

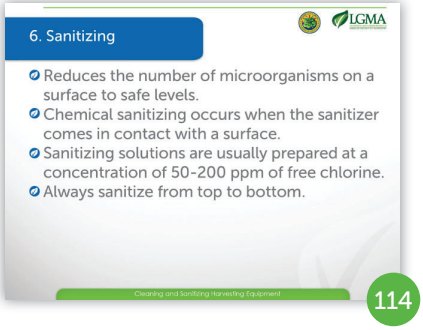
113 → 114

Chemical sanitizing occurs when an approved sanitizer comes in contact with the different surfaces of a utensil or machine. During this step, a CLEAN surface is treated with a sanitizer to reduce the number of microorganisms to safe levels.

Prepare the appropriate sanitizing solution to the concentration stated in your SSOPs or in the manufacturer's directions. Spray or immerse the equipment/utensil (both food-contact and non-food-contact surfaces) in the sanitizing solution and allow to sit for the instructed time. If spraying, work from top to bottom.

Remember, dirty or soapy surfaces cannot be sanitized: the soil and dirt will prevent the sanitizer from doing its job. Rinse all parts of the harvesting machines and utensils thoroughly before sanitizing to remove dirt, detergents, or cleaners.

Depending on the concentration and the type of sanitizer you use, equipment may need to air-dry or be rinsed again, although most companies SSOPs call for the use of air drying. Once you finish, return the sanitizing chemicals and the tools used to their assigned locations and complete the sanitation records and logs.



Instructor Notes:

Emphasize the following points when teaching this section:

- Rinsing with potable water or water meeting quality requirements in the LGMA metrics when used for re-hydration or rinsing food contact surfaces will not sanitize a surface. You need a sanitizing solution at the appropriate concentration.
- Most chlorine or quat sanitizing solutions in the food industry are prepared at a concentration of 50 to no more than 200 ppm. Peracetic acid is generally used at 80-120 ppm. Your Food Safety Professional will evaluate your operation and decide what is an appropriate concentration for your company's needs.
- For a sanitizer to be effective, it needs to be at the appropriate concentration and sit on utensils/equipment for the manufacturer-recommended contact time.

Name of Sanitizer	Commonly Used Concentration
Chlorine	50-200 ppm
Quats	50-200 ppm
Peracetic Acid	80-120 ppm

7. Pre-operational Inspection

115 → 116

During the pre-operational inspection and approval of the equipment for harvesting, you must visually inspect the equipment to confirm that cleaning and sanitation procedures have been completed. If needed, any soiled areas must be re-cleaned. Remember to follow the good handling practices and PPE requirements. Perform any additional sanitizing steps according to your company SSOP's and document any corrective actions you may need to take. If a piece of equipment represents a food safety risk DO NOT put it back in service.

Applying your Knowledge - Analyzing Video Clips

Your instructor will now present a short video clip that demonstrates the seven general cleaning & sanitizing steps. Write down each step below as you watch.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

Are there any different activities performed in your company for cleaning and sanitizing a harvesting machine? If so, please describe the differences. If there are no differences, please describe your company's cleaning and sanitizing process.

_____

_____

_____

_____

_____

Instructor: *After participants have completed the activity, have them discuss their answers with the group. Ask for a volunteer to read his/her answers out loud.*

Applying your Knowledge - Understanding Cleaning & Sanitizing Steps

In the following pages there are seven pictures representing each of the general steps for cleaning and sanitizing equipment. In your own words, describe what happens in each step of the process and why it is important to follow that step according to your company's Sanitation Standard Operating Procedure (SSOP).

Instructor: *When participants have completed the activity, have them share their answers with the class.*

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

5. _____

_____

6. _____

_____

7. _____

_____

_____

Applying your Knowledge - Understanding Cleaning & Sanitizing Steps

Dry Clean

Pre-Rinse

Detergent Application

Post-Rinse

Inspection

Sanitizing

Pre-Operational Inspection

Water Quality

To ensure that sanitation procedures work as intended, it is very important that you consider the quality of the water you will be using for these practices. Water from an unknown source or with high microbial content can contaminate equipment instead of aiding in its sanitation.

All water utilized in cleaning and sanitizing of equipment must meet harvest water acceptance criteria Established in Table 2G of the LGMA Metrics document.

Always use water from a known source that meets LGMA Metrics acceptance criteria when performing sanitation activities.

TABLE 2G. HARVEST DIRECT PRODUCT CONTACT, HARVEST FOOD-CONTACT SURFACES AND HAND WASH WATER (ON-FARM PRACTICES ONLY) - SEE FIGURE 6

Metric	Rationale /Remedial Actions
Water Type **Municipal, Well (Type A) and Reverse Osmosis** **Microbial Testing** **Target Organism:** Generic *E. coli*. **Sampling Procedure:** Prior to use, a 100 mL sample collected aseptically at the water source. **Sampling Frequency:** One sample per water source shall be collected and tested prior to use if >60 days since last test of the water source. Additional samples shall be collected at intervals of no less than 18 hours and at least monthly during use. **Municipal & Well Exemption:** If generic *E. coli* are below detection limits for five consecutive samples, the requirements for 60 days and monthly sampling are waived, and the sampling frequency may be decreased to no less than once every 180 days. This exemption is void if there is a significant water source or distribution system change. Reverse Osmosis Systems: No less than one sample per month per system is required. **Test Method:** Any FDA allowed method [2] **Acceptance Criteria:** Negative or below DL for all samples	Water used during harvest operations that directly contacts edible portions of harvested crop, used on food-contact surfaces such as equipment or utensils, or water used for hand washing, shall be sourced from municipal, well (Type A) or reverse osmosis water sources. Testing must be conducted to demonstrate that this water meets the Maximum Contaminant Level Goal for generic *E. coli* as specified by U.S. EPA or contain an approved disinfection method at sufficient concentration or of sufficient wavelength to prevent cross-contamination. Microbial or physical/chemical testing shall be performed, as appropriate to the specific operation, to demonstrate that acceptance criteria have been met. **Single Pass vs. Multiple Pass Systems** • Single pass use – Water must have non-detectable levels of *E. coli* or breakpoint disinfectant present at point of entry • Multi-pass use – Water must have non-detectable levels of *E. coli* and/or sufficient disinfectant to ensure multi-pass water has no detectable *E. coli* (e.g. minimally 1 ppm for chlorine). **Remedial Actions**: Develop an SOP that determines what corrective actions will be required when harvest water does not meet acceptance criteria. If any single sample exceeds the acceptance criteria, then DO NOT USE THE WATER until remedial actions have been completed and generic *E. coli* or disinfectant levels are within acceptance criteria: • Conduct an agricultural water system assessment of water source and distribution system to determine if a contamination source is evident and can be eliminated. Eliminate identified contamination source(s) and/or treat with appropriate disinfectants. • For wells, perform an agricultural water system assessment and/or treat as described in Appendix A. • Retest the water at the same sampling point after conducting the agricultural water assessment for water
Physical/Chemical Testing **Target Variable:** Water disinfectant (e.g., chlorine or other disinfectant compound, UV transmittance). **Multi Pass Water Acceptance Criteria:** Chlorine ≥ 1 ppm free chlorine after application and pH 5.5 – 7.5Other approved treatments per product EPA label for human pathogen reduction in water. **Testing Procedure:** • Chemical reaction-based colorimetric test (i.e. test strips), or • Ion-specific probe, or UV transmittance • Other as recommended by disinfectant supplier. **Testing Frequency:** • Prior to first use on day of harvest. • During harvest, samples shall be taken at routine intervals (i.e. hourly, breaks, lunch, etc.) as determine by historical data showing typical degree of variation.	used for harvest and/or taking remedial actions to determine if it meets the outlined microbial acceptance criteria for this use. For example, if the water intended for use on food-contact surfaces has detectable *E. coli*, DO NOT USE THE WATER. Examine the distribution line and source inlet as described in Appendix A and retest from the same point of use. If physical/chemical testing criteria are not being met for single or multi-pass water, take remedial actions per SOP, retest the water to determine if it meets the outlined acceptance criteria. After corrective actions have been implemented and verified the water may be used for harvest operations and hand wash water.
Records: All test results and remedial actions shall be documented and available for verification from the user of the water for a period of two years.	

Arizona LGMA FOOD SAFETY PRACTICES | METRICS
Version 14 | Accepted - August 10, 2021

Periodic Equipment Cleaning - PEC

117 → 119

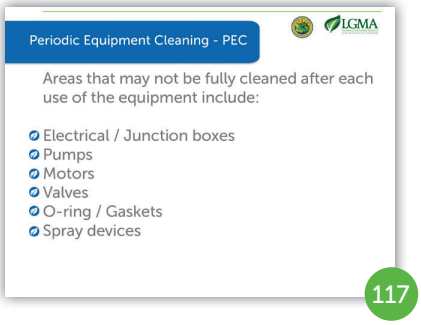
Our sanitation program is designed to control all sanitation-related activities. Periodic Equipment Cleaning is an essential part of the sanitation program intended to address the cleaning and sanitation of niche areas that may not be fully cleaned after each use of the equipment for various reasons. Some examples of these areas include:

- Electrical / Junction boxes
- Pumps
- Motors
- Valves
- O-rings / Gaskets
- Spray devices

These areas can become potential harborage sites if not properly cleaned. It is possible that these areas may not be cleaned and sanitized during normal sanitation operations because they are too difficult or require special equipment to disassemble, cannot have contact with flowing water, are in difficult to reach parts of equipment and/or do not normally represent a risk to food safety because they are located away from food contact surfaces.

None the less, these areas and pieces of equipment can still become a source of contamination if left unattended for too long. As such they will still require some sanitation activities, even if these are done less frequently, as long as they are done in a scheduled and appropriate manner.

Keeping a Periodic Equipment Cleaning schedule and documentation as part of your sanitation program, will help you manage and track all sanitation tasks that are not normally performed as part of your routine cleaning procedure. This Periodic Equipment Cleaning program needs to address any potential sanitation gaps in your regular cleaning and sanitizing activities.



Labeling, Storage, and Use of Chemical Products

120 → 121

When working with cleaners and sanitizers, remember that they are chemical substances and can be dangerous if not handled properly.

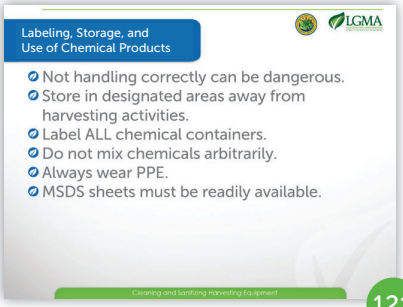
Labeling and Storage. Chemicals should be stored in designated areas, away from leafy greens. They should be kept in closed, labeled containers that prevent spills or leaks. Never put chemicals in food containers.

All cleaners and sanitizers, whether in use or in storage, must be clearly labeled. Smaller containers must also be labeled with the name of their contents. To preventing cross-contamination, some companies use color-coded labels for types of chemicals to indicate their use.

Materials Safety Data Sheets (MSDS) must be readily available for every chemical used in your operation.

Use. Know how each chemical works, and do not combine them randomly. Combining chemicals can be very dangerous. For example, chlorine gas, a toxic vapor, is created when chlorine is mixed with acid solutions. Only mix chemicals as stated in SOPs and manufacturer's directions, and use all the appropriate Personal Protective Equipment (PPE) when working with them.

120



121

Cleaners

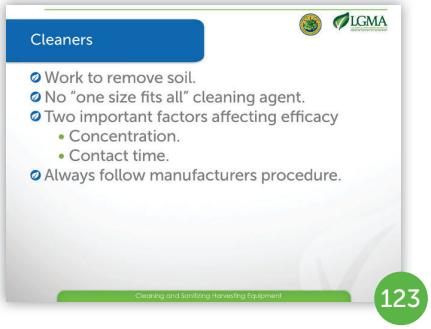
122 → 123

There is no one-size-fits-all cleaning agent; each one is designed especially for specific types of dirt. Each cleaner works best for specific types of dirt, on specific types of materials, or under specific conditions (pH, water temperature, etc.). Most companies use detergents as cleaning agents. They act by wetting, foaming and penetrating into cracks and scratches to remove soils. There are two main factors that affect the efficacy of a cleaner: concentration and contact time.

Concentration. Each cleaning agent is designed to work at a certain concentration. It is your job to ALWAYS use the appropriate concentration and the type of cleaner that has been assigned for the task at hand.

122

Lastly, using more cleaner is not necessarily better: this may leave residue on food-contact surfaces that could contaminate the product.



Contact time. This is the amount of time that detergents or foams need to be exposed to a surface to effectively clean it. For instance, if your company SSOP states that a cleaner must be left on equipment for 5 minutes, you must leave it on the equipment for the full 5 minutes. Do not try to speed up the cleaning process by reducing the contact time, but do not let cleaning agents dry on the equipment. Follow the time guidelines described in SOPs and manufacturers' instructions.

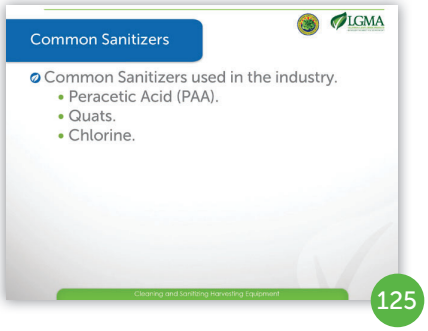
Common Sanitizers & Working Conditions

124 → 126

Peracetic acid, chlorine, and quaternary ammonium compounds (quats) are some of the most commonly used sanitizers in the leafy greens industry. Like cleaners, each sanitizer works best under specific conditions. Choosing the appropriate sanitizer for a task depends on many factors, including the type of machine or utensil that will be sanitized, the hardness and pH of the water, the application tools available, and the cost of the sanitizer.

There are five important elements to look out for when working with sanitizers:

- Organic material
- Concentration
- Temperature
- pH
- Contact time



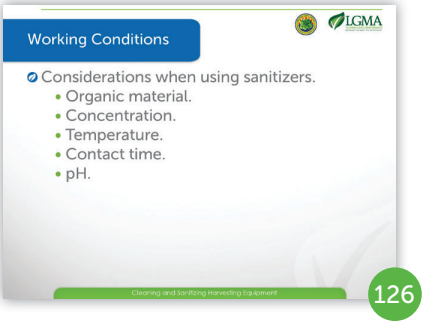
Organic material. The presence of organic material such as leafy greens residues decreases the effectiveness of chlorine sanitizing solutions. Sanitizers should only be used on clean surfaces.

Concentration. Mix sanitizers to the proper concentration to ensure maximum effectiveness. Too little sanitizer will not effectively reduce microbes, and too much can leave toxic residue. After mixing, use a test strip to verify that the sanitizing solution is at the concentration stated in your company SSOPs.

Temperature. The temperature of a sanitizing solution can influence the effectiveness of the sanitizer. Make sure that sanitizers are mixed to the temperature stated in company SSOPs.

Contact Time. Like cleaners, sanitizers must be left on surfaces long enough to kill the microorganisms on them. Make sure the sanitizer has contact with all surfaces of the harvesting machine or utensil, including harborage sites, for as long as prescribed in the manufacturer's directions.

pH. All sanitizers have an optimum pH or pH range at which they are most effective. Quaternary ammonium compounds are effective over a wide pH range, while chlorine has a limited optimum range. In the following sections we will discuss peracetic acid, quaternary ammonium, and chlorine sanitizers in more detail.



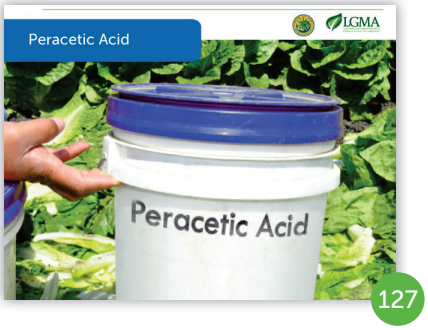
Peracetic Acid

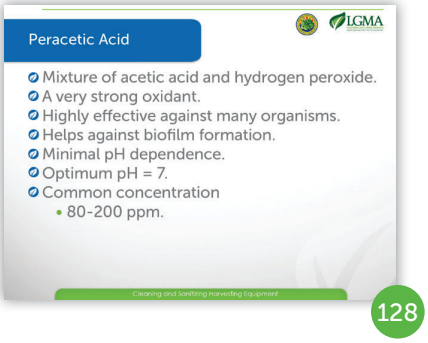
127 → 128

A peracetic acid (PAA) solution is a mixture of acetic acid and hydrogen peroxide. Peracetic acid has a higher oxidation potential than chlorine-based compounds, which makes it effective against all types of microorganisms including molds and spores. Peracetic acid is especially useful for preventing biofilm formation on equipment.

Peracetic acid is most effective at pH 7; its effectiveness is reduced at pH of 8.5. Its efficacy is not temperature dependent, so solutions can be applied cool or warm.

Peracetic acid degradation products are non-toxic and can easily dissolve in water. It should never be mixed with chlorine: this creates a toxic gas.





Instructor Notes:

- We advise physically presenting the sanitizers used at your company to participants as you teach this section. You may also find it helpful to describe the concentrations that are used for each one, and the situations under which each concentration is appropriate.

Quaternary Ammonium Compounds

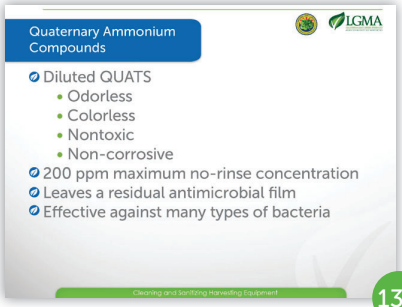
129 → 130

Diluted Quaternary Ammonium Compounds or "QUATS" are odorless, colorless, and nontoxic. Quats are also noncorrosive; they are less affected by pH and organic material than chlorine; kill many types of bacteria, including *Listeria;* and leave a residual antimicrobial film.

The FDA allows quats at a maximum no rinse concentration of 200 ppm on food contact surfaces.

Always read labels to determine the proper concentration and contact time for your intended surface.

129



130

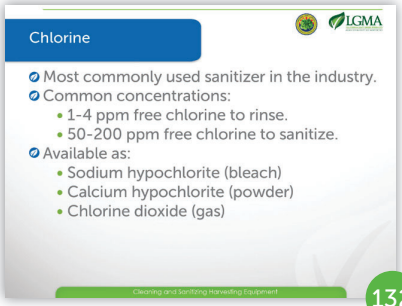
Chlorine

131 → 132

Chlorine based sanitizers are the most commonly used sanitizers in the leafy greens industry. Chlorine is available as sodium hypochlorite (bleach), calcium hypochlorites (powder), powdered organic chlorine, or as chlorine dioxide. Hypochlorites are the most active chlorine compounds.

In the food industry, chlorine sanitizing solutions are generally prepared to a concentration between 50 and 200 ppm. Water used for rinsing usually contains 1 to 4 ppm of free chlorine. The FDA allows a maximum no-rinse concentration of 200 ppm.

131



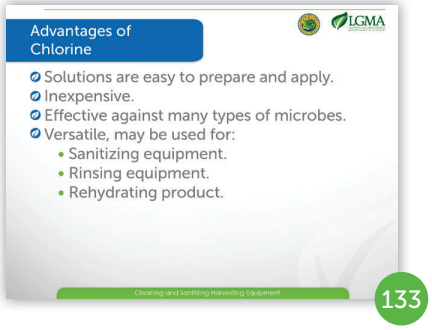
132

Chlorine (cont.)

133 → 134

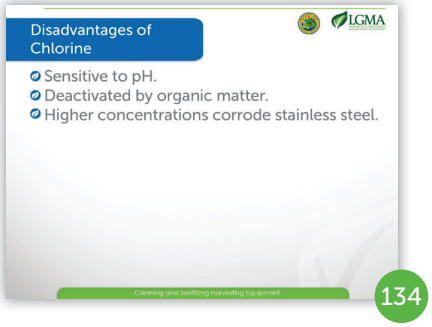
Chlorine has many advantages as a sanitizer:

- Overall, chlorine sanitizing solutions are easy to prepare and apply.
- Chlorine sanitizers are inexpensive.
- It kills many different types of microbes and works well in hard or soft water.
- It is versatile: chlorine can be used to disinfect water for various activities. Solutions containing 1 to 4 ppm of free chlorine are prepared and used for different activities such as rinsing equipment or produce.



Chlorine also has a few disadvantages when compared to other sanitizers.

- Is sensitive to pH.
- Can be inactivated by organic matter.
- Is corrosive to stainless steel at high concentrations or temperatures.
- Can be irritating to skin, eyes, and nasal passages.



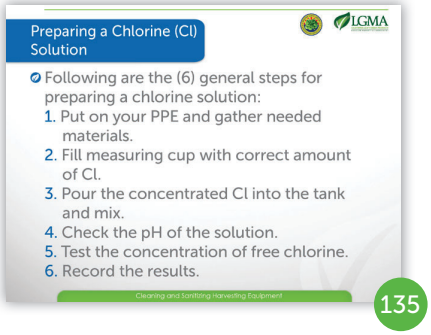
Preparing a Chlorine Solution

135 → 142

Although chlorine sanitizing solutions are easy to prepare, a clear understanding of the process is necessary to ensure that the solutions contain the right amount of free chlorine. The general steps for preparing a chlorine sanitizing solution are listed below. This will make a solution with about 100ppm of free chlorine.

Step 1. Put on your personal protective equipment and gather the following materials:

- Measuring cup
- Sodium hypochlorite (5% or 12.5%)
- pH test strips
- Free chlorine test strips
- Water that meets LGMA acceptance criteria



Step 2. Using the table on page 60, find the volume of solution you want to prepare. Look in the column with the concentration of sodium hypochlorite you are using, and find the amount to add to your water. Using the measuring cup, pour out the appropriate amount of sodium hypochlorite.

Step 3. Pour the sodium hypochlorite in the water tank and mix.

Step 4. Check the pH of the solution. Remember that chlorine is most effective at a pH between 6.5-7.5; this is also the pH range required by the LGMA. There is a section on pH measurement later in the lesson.

Step 5. Check the amount of free chlorine in the solution. Dip a free chlorine test strip in the solution for about 10 seconds, and then compare its color with the color chart included on the strip container. Verify that your solution contains the desired concentration of free chlorine.

Step 6. Record the result. Write the result in the corresponding log. If it isn't documented, it didn't happen.

This procedure can be used to prepare solutions for sanitizing food contact surfaces, tools, gloves, other protective gear, and knife dip buckets. Foremen are required to confirm that these solutions are prepared properly. They should be trained on the proper preparation of sanitizing solutions, including pH and clorine level testing and documentation.

Note: These instructions pertain to mixing the solution in large batches. However, the procedure is scalable, and can be used to mix small batches for sanitizing knives, gloves, etc.

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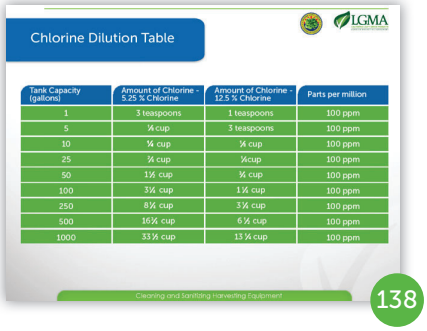

Tank Capacity (gallons)	Amount of Chlorine - 5.25 % Chlorine	Amount of Chlorine - 12.5 % Chlorine	Parts per million
1	3 teaspoons	1 teaspoons	100 ppm
5	¼ cup	3 teaspoons	100 ppm
10	½ cup	¼ cup	100 ppm
25	¼ cup	¼cup	100 ppm
50	1¼ cup	½ cup	100 ppm
100	3¼ cup	1¼ cup	100 ppm
250	8¼ cup	3¼ cup	100 ppm
500	16¼ cup	6 ½ cup	100 ppm
1000	33 ½ cup	13 ½ cup	100 ppm

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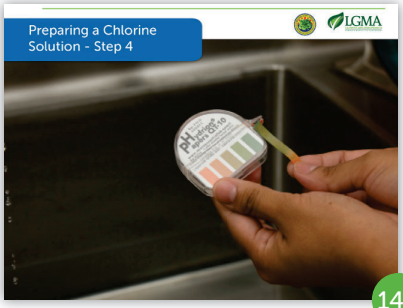

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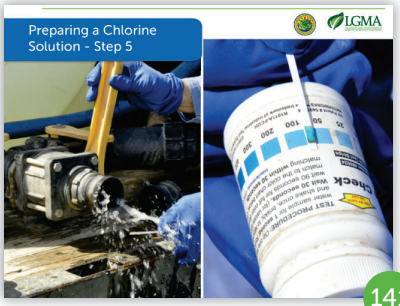

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Chlorine Dilution Table

Tank Capacity (gallons)	Amount of Chlorine - 5.25% Chlorine	Amount of Chlorine - 12.5% Chlorine	Parts per million
1	3 teaspoons	1 teaspoons	100 ppm
5	⅛ cup	3 teaspoons	100 ppm
10	¼ cup	⅛ cup	100 ppm
25	¾ cup	¼cup	100 ppm
50	1½ cup	¾ cup	100 ppm
100	3¼ cup	1¼ cup	100 ppm
250	8¼ cup	3¼ cup	100 ppm
500	16¾ cup	6 ½ cup	100 ppm
1000	33½ cup	13 ¼ cup	100 ppm

Applying your Knowledge - Testing a Sanitizer Conc. Using Testing Strips

The purpose of this activity is to help trainees learn how to test a sanitizer concentration using testing strips.

Introductory Remarks

- It is very important for sanitizing solutions to be at an appropriate concentration. If the concentration is too low, the sanitizer will not do its job of killing microorganisms. If it is too high, it can become a source of chemical contamination. This is why we test sanitizing solution concentrations before using them. Let's watch a quick video on how this is done.

Materials

- Computer
- Projector/screen
- 1 cup, jars, or bucket (Optional)
- Water (Optional)
- A sanitizer (i.e. chlorine, QUAT, PAA. etc.) (Optional)
- Test strips (Optional)

Instructor: *Play the Testing a Sanitizer Concentration Using Testing Strips video. Once the video has ended discuss with participants. Remind participants about the importance of measuring the strength of sanitizing solutions.*

Optional Activity

If you would like participants to practice testing a sanitizer solution using test strips, prepare a container with a sanitizing solution at a concentration between 50 and 200 ppm before starting the training session. If the company requires that the concentration be monitored, bring a blank log for record keeping purposes during the demonstration. Provide each person with a free chlorine test strips and ask them to test the solution's concentration and to record it on the log.

Closing Remarks

Finish the discussion by reminding employees that everyone should follow the company's policies when it comes to sanitizer solutions. Remember, more is not better, since residue may be left on the food-contact surfaces and may become a source of chemical contamination to leafy greens. If they are not sure what to do, employees should contact their supervisor immediately.

Total Chlorine vs Free Chlorine

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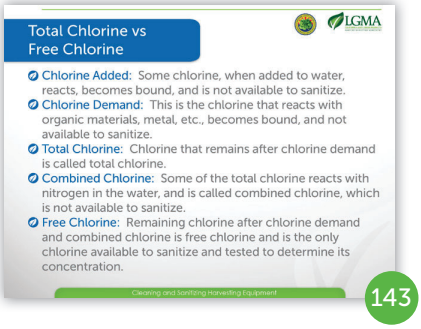
When chlorine is added to water to prepare a sanitizing solution, some of it reacts with compounds (organic materials and metals) present in the water. This reaction is known as the "chlorine demand" of water. The chlorine that reacts is not available for sanitizing.

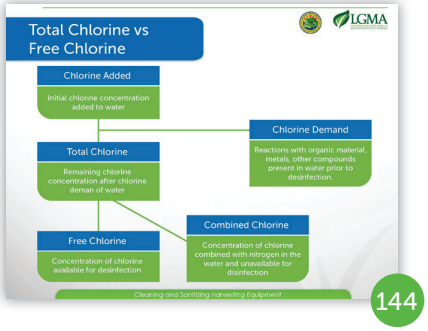
The chlorine that remains after the chlorine demand is called "total chlorine."

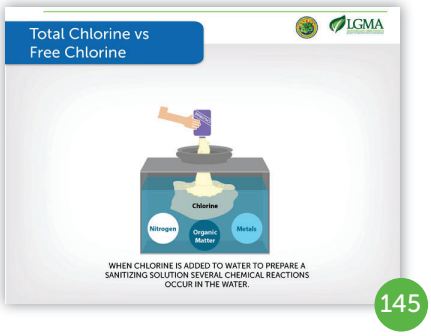
Some of this total chlorine then reacts with nitrogen in the water. The chlorine bound to nitrogen is known as "combined chlorine." Combined chlorine is also unavailable for sanitizing.

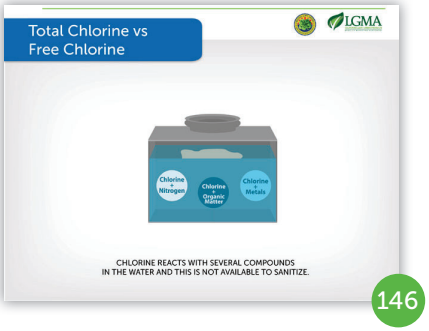
The chlorine that remains after the chlorine demand and after the reaction with nitrates is called "free chlorine." Only free chlorine is available for sanitizing; this is what you test for.

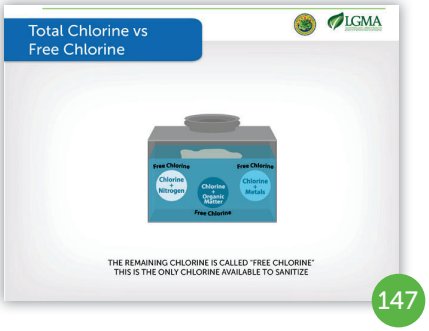
To summarize: added chlorine - chlorine demand - combined chlorine = free chlorine











Applying your Knowledge - Case Studies

Instructions
Using the information you have learned, write down what should have been done in each of the following situations.

Instructor: *When everyone is done, ask for volunteers to read their answers out loud and discuss the participants' answers with the group.*

1. Rocio is the sanitation crew supervisor for a leafy greens growing, harvesting, and shipping company. One day she had to leave work for a personal errand and knew that she wouldn't be able to return in time to complete the final sanitation inspection of the harvesting machine. Knowing she would be late and that the machine would be needed as soon as possible, she filled out the inspection record in advance, recording that every part of the machine was clean. Since no one was there to thoroughly inspect the equipment after sanitation, the sanitation crew only cleaned the visibly dirty parts of the machine and didn't bother to use any sanitizer. What is the problem with this situation? What should have Rocio done? What should have the sanitation crew done? How can we prevent something like this happening in our operation?

2. Miguel is the sanitation crew supervisor at a leafy greens operation. One day he was monitoring the crew cleaning a harvesting machine in the field when he noticed that the water tank was almost empty. The crew was nearly finished with the cleaning step and returning to the appropriate water source to refill the tank would take 30 minutes to an hour. He didn't want to go back to the storage building, refill the tank and then have to come all the way back out to the field. He told the crew to skip the rinsing step and instead use the sanitizing solution to remove the foam from the machine. The machine was then air dried, and the crew left a few minutes before the harvesting crew arrived to start using the machine in the field. What is the problem with this situation? What should have Miguel done? What should have the sanitation crew done? How can we prevent something like this happening in our operation?

Applying your Knowledge - Case Studies

3. Hugo works as part of a sanitation crew. As part of his job, he is in charge of cleaning and sanitizing the harvesting machine. Today he was in a hurry to finish his duties before the World Cup soccer match started, but the machine was very dirty with dried mud and cleaning the machine was making him late. He had removed most of the visible mud by pre-rinsing the equipment, but the foam cleaner he was to use needed to be in contact with the equipment for 15 minutes to work properly. He didn't want to wait for the full 15 minutes and miss the first part of the match, so he doubled the concentration of the foam and only waited five minutes before rinsing the machine. What is the problem with this situation? What should have Hugo done? How can we prevent something like this happening in our operation?

4. Edwin is part of a sanitation crew at a leafy greens operation. Today he finished cleaning and sanitizing the harvesting equipment on time and was filling out inspection paperwork while the machine finished air-drying. Adrian, the harvesting crew manager, got to the field and was in a hurry to start harvesting because they had a big order to fill. Since the harvesting machine was already clean and just needed air drying, Edwin handed the keys over to Adrian and told him to just make sure the machine was dry before using it. After Edwin left, Adrian had his harvesting crew use a damp towel from his truck to finish drying off the equipment so it could be used as quickly as possible. The harvesting crew was then able to get an early start and even got to go home earlier than planned. What is the problem with this situation? What should have Edwin and Adrian done? How can we prevent something like this happening in our operation?

Applying your Knowledge - Case Studies

5. Jose is the driver for a leafy greens operation. One day he received a call from a sanitation crew employee just as he was leaving the ranch to go to the bank. The crew had run out of foam/detergent to clean the spinach harvesting equipment and needed him to bring more from the supply depot. Jose was in a hurry because the bank closed at 4, so he told the crew they could use the same detergent they use to clean the offices to clean the harvesting machines. He explained how he had used it once to clean his truck, and it had worked really well to remove the mud. He said that he would bring the new foam/detergent tomorrow, but for now the crew should just use the other detergent. What is the problem with this situation? What should have Jose done? What should have the sanitation crew done? How can we prevent something like this happening in our operation?

6. Angelica works at a leafy greens facility as part of a sanitation crew. While she works, she likes to fill out the sanitation records with pencil and then later, once she is finished, she goes over them with a pen, since that's how she was told to turn them in. Her documents are generally messy and disorganized but legible. What is the problem with this situation? What should Angelica do instead?

Applying your Knowledge - Case Studies

7. Marcelo and his crew do a very good job cleaning and sanitizing the field pack harvesting machine so there is no need for supervision from the food safety professional. They follow all the SSOP instructions and do a thorough visual verification of the machine to not miss anything and to make sure everything is clean. However, they have issues filling out the required documentation: sloppy records, missing the ranch locations and time of the activity, filling out records in advance, etc. Additionally, the crew supervisor just signs the paperwork without carefully looking at these issues. This requires the food safety professional to spend twice as much time reviewing the sanitation paperwork. How would you approach this issue? What would you tell the crew and the supervisor?

8. Edgar works on a sanitation crew at a leafy greens operation. Today he has been assigned the task of preparing the chemical solutions because Iris, who usually does this task, is on vacation. Iris instructed Edgar to just add two bottle capfuls of the chlorine with the yellow label to a bucket full of water and then check the concentration using test strips. She also reminded Edgar to write down the exact concentration on the record and that it should be between 50 and 100 ppm. When Edgar opened the chemical closet, he couldn't find the bottle for chlorine with the yellow label, but he did find one with a green label that also said chlorine. He then proceeded to fill the bucket all the way up to the top. Once full, Edgar poured the chlorine into the bottle's cap and used it to measure two bottle capfuls of chlorine. He then checked the concentration by placing the test strip in the solution and compared it against the colored chart on the plastic container. It looked to be somewhere between the colors for 50 and 100 ppm so he wrote down 75 ppm on the record and proceeded to take the solution out for use during the day's sanitation activities. What is the problem with this situation? What should have Iris done? What should have Edgar done? How can we prevent something like this happening in our operation?

Applying your Knowledge - Case Studies

9. Iris is still on vacation, so today Damian is in charge of preparing the detergent solution. During his training he was taught exactly which chemicals to use, how to prepare them properly, and how to check for concentration. Damian prepared all the chemicals at the designated area perfectly but halfway through the cleaning process, the crew ran out of detergent and so he needed to prepare more. Damian had been prepared for this and had enough chemicals and supplies in the truck to mix more but would need additional water. The machine they were washing was parked close to a pump used to pump water from the river to irrigate the crops. Damian opened the valve and filled the buckets with water from the pumping station. He then proceeded to prepare the chemicals and finish the cleaning procedure. Since they were so close to the pumping station, they also used that water to rinse off the detergent after scrubbing the machines. What is the problem with this situation? What should have Iris done? What should have Damian done? How can we prevent something like this happening in our operation?

Applying your Knowledge - Case Studies

10. Ana is the food safety professional at a leafy greens operation. Today she had to leave the field for a few minutes to run some company errands, so she left her phone number with David the foreman in case anything came up. When she was away, she received an emergency phone call from David in the field, telling her that the fluid line on one of the machines had broken and spilled machine oil all over the machine. She instructed David to make sure it was repaired and then to clean and sanitize the machine before using it again. A couple of hours later Ana got back to the field and the machine was up and running; it had already been sanitized, and the crew was about to start harvesting. Before they could start, Ana asked to take a closer look at what had happened. As David was explaining, Ana noticed that while the tabletops and the top of the conveyor belt looked clean, the underside was still dripping dark and oily water. Upon closer inspection, the inside rollers of the conveyor were stained black as were some of the machine frames on the underside. As she asked how all of this had happened, she noticed that some leafy greens in that area were stained with oil, as were a few product containers on pallets nearby. What is the problem with this situation? What should Ana do? What should have David done? How can we prevent something like this happening in our operation?

Applying your Knowledge - Case Studies

11. Luis is the food safety professional at a leafy green harvesting operation. Today they have a big audit and also a big shipment to harvest and deliver. The crew has already been working for the better part of an hour when the auditor arrives at the field. He asks Luis some questions about the water used to rinse and cool the romaine lettuce heads. Luis explains that they use clean water that has been treated to contain 5 ppm of chlorine. He explains that the foreman is in charge of this task and does it every day before harvesting starts. The auditor asks Luis if he could please show him how they check to make sure that the chlorine concentration is adequate, so Luis proceeds to check it using a test strip. After comparing the test strip to the color chart, Luis finds that they are using water without any free chlorine. The foreman admits that they are using water left over from the night before and that he had checked the concentration last night to make sure it was still good. What is the problem with this situation? What should Luis do? What should have the foreman done? How can we prevent something like this happening in our operation?

Lesson Sumary - What is my Job?

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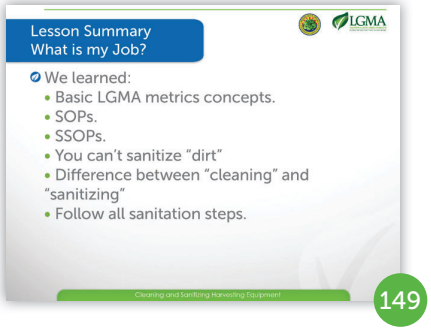
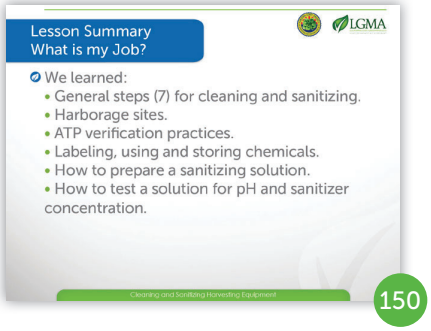
Before we close, let's summarize what we covered in this course. We learned:

- The basic field sanitation concepts included in the metrics.
- The components of a sanitation program.
- That SSOPs (Standard Sanitation Operating Procedures) detail the cleaning and sanitizing procedures that need to be carried out in the field.
- The importance of good sanitation and the difference between cleaning and sanitizing.
- That "you can't sanitize dirt." A surface must be cleaned before it is sanitized.
- To follow all steps included in the company's SSOPs; each step is required for correct sanitation. Do not take sanitation shortcuts. While shortcuts may make your job go faster, they compromise the safety of leafy greens we harvest.
- The importance of paying extra attention to harborage sites. These sites may need a little extra effort to properly clean and sanitize, since they are the most likely places for microorganisms to hide and grow.
- How to verify with ATP if a food contact surface is clean.
- Basic concepts for labeling, using, and storing chemicals.
- How to prepare a sanitizing solution and test its concentration using testing strips.
- To ask supervisors when we have questions, and to alert them to any sanitation lapses.





Instructor Notes:

- Closing Remarks: This is the end of our discussion about sanitation in the leafy greens industry. Are there any questions? Thank you for coming. Please make sure you have signed the attendance sheet.

Glossary

Active Harvest Area: Area of immediate-easy access to raw product and/or product contact surfaces or substances.

Adenosine tri-phosphate (ATP): A high energy phosphate molecule required to provide energy for cellular function.

Biofilms: The accumulation of microorganisms on a surface. This accumulation often happens in a hard-to-remove structure of bacterial origin.

Cleaning: Refers to the physical removal of visible and invisible soil and dirt from food-contact and non-food contact surfaces.

Company: Entity for which work is being done, for example: grower or shipper.

Corrective actions: Procedures followed when a deviation from an SOP or an SSOP occurs.

Cross-Contamination: The transfer of microorganisms, such as bacteria and viruses, from one place to another.

E. coli: *Escherichia coli* is a common bacteria that lives in the lower intestines of animals (including humans) and is generally not harmful. It is frequently used as an indicator of fecal contamination, but can be found in nature from non-fecal sources.

EPA: United States Environmental Protection Agency.

First Aid Kit: A first aid kit compliant with OSHA and CAL/OSHA Safety Order 3459.

FDA: United States Food and Drug Administration.

Food Safety Personnel: Person trained in basic food safety principals and/or working under the auspices of a food safety professional.

Food Safety Professional: Person entrusted with management level responsibility for conducting food safety assessments before food reaches consumers; requires documented training in scientific principles and a solid understanding of the principles of food safety as applied to agricultural production.

GAP's: Good Agricultural Practices.

GHP's: Good Harvesting Practices.

Harborage Site: An area on a piece of equipment that is difficult to clean and sanitize effectively. These are places where microbes have access to nutrients and water, making them ideal areas for bacteria to grow.

Glossary

Monitoring: A planned sequence of observations or measurements to assess whether the sanitation program is being adequately implemented and it is used to produce an accurate record for future use in verification.

MSDS: Material Safety Data Sheets.

Parts per Million: Usually describes the concentration of something in water or soil; one particle of a given substance for every 999,999 other particles.

Pathogen: A disease causing agent such as a virus, parasite, or bacteria.

Sanitation: Maintenance or restoration of clean, hygienic conditions; it includes cleaning and sanitizing.

Sanitation Standard Operating Procedures (SSOPs): SSOPs are written documents developed by the Food Safety Professional. They have the detailed procedures on how each item should be cleaned and sanitized to prevent contamination.

Sanitizing: The treatment of a surface to reduce the number of disease-causing microorganisms to safe levels. FDA's definition of "sanitizing" is to eliminate 99.9% of the bacteria present.

Standard Operating Procedure (SOP): A written document/instruction detailing all steps and activities of a process or procedure.

Acknowledgments

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