CALIFORNIA

COMMODITY SPECIFIC FOOD SAFETY GUIDELINES FOR THE PRODUCTION, HARVEST, COOLING, PACKING, STORAGE, AND TRANSPORTING OF CANTALOUPES AND OTHER NETTED MELONS

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FOREWORD

This document provides commodity specific guidance for "fresh market" (i.e., fresh and unprocessed form) varieties of *Cucumis melo* or melons known as muskmelons or rockmelons commonly found in North America recognized for their rough skin surface and veined appearance, i.e. netted melons. For the purposes of this document the term "cantaloupe" is used for netted melons and includes, but is not limited to, any melon with a netted exterior - cantaloupes, rockmelons, and muskmelons (e.g. Athenas, Galia, Hami-Gua, Harper-type, Persian, Ogen, Santa Claus, Sharlyn, etc.).

These best practices focus on the following specific operations: production, harvest, cooling, packing, storage, and shipping. While this document makes an effort to describe "best practices" for the fresh market cantaloupe industry-at-large, producers and handlers need to evaluate their own operations and assess how to integrate the program components as they are applicable to their operations. What is essential is that basic food safety program components are implemented by producers to ensure cantaloupe product safety for consumers. Regardless of the differences, cantaloupe producers, handlers, processors, shippers, and distributors agree that the following fundamental principles serve as the foundation for all food safety programs in their industry:

- All cantaloupe providers are dedicated to using risk and science-based food safety programs to preventing pathogen contamination.
- Cantaloupe providers recognize that once cantaloupes are contaminated, removing or killing pathogens is unlikely; therefore, prevention of microbial contamination at all steps from production to and through the point of sale is strongly favored over treatments to eliminate contamination after it has occurred.
- Cantaloupe providers support the documentation, implementation and verification of food safety programs that utilize risk assessment principles and risk management techniques in order to identify all plausible risks, prioritize operation-specific risks, and then take preventive action to ensure the safety of cantaloupes.
- Cantaloupe providers support and encourage routine and regularly scheduled food safety awareness training for all persons who handle cantaloupes from production through distribution. The industry also favors inspections and food safety audits as a mechanism to create awareness of industry food safety efforts and as a tool to ensure continuous improvement among handlers. Lastly, the industry also supports increased efforts to inform consumers about safe handling practices for cantaloupes.

In the sections that follow, the Best Practices were developed to address known potential food safety issues. However, it is the responsibility of individuals and companies involved in the field-to-fork fresh cantaloupe supply chain to determine what actions are appropriate in their individual operations. The potential food safety issues identified in each unit operation section are focused only on cantaloupes and may or may not apply to other specialty crops, including other types of melons. Particular recommendations that address known issues are not the only means by which the issue may be addressed. Individuals and companies are encouraged to use this document to evaluate, develop, and enhance their own food safety programs.

The document contains separate sections covering individual supply chain components.

This guidance document is intended to supplement, not replace, already established food safety program components such as Good Agricultural Practices (GAPs), current Good Manufacturing Practices (cGMPs), and Hazard Analysis and Risk-Based Preventive Control (HARPC) guidelines for the fresh fruit and vegetable industry.

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ACRONYMS AND ABBREVIATIONS

AOAC: Association of Official Analytical Chemists

BAM: Bacteriological Analytical Manual

CAFOs: Concentrated animal feeding operations

CFR: Code of Federal Regulations

CFSAN: Center for Food Safety and Applied Nutrition

CFU: Colony forming units

cGMP: Current Good Manufacturing Practices

COA: Certificate of Analysis

DL: Detection limit

FDA: Food and Drug Administration

FFDCA: Federal Food, Drug, and Cosmetic Act

GAPs: Good Agricultural Practices

GLPs: Good Laboratory Practices

HARPC: Hazard Analysis and Risk-based Preventive Control

MSDS: Material safety data sheets

MPN: Most probable number

NGO: Nongovernmental organization

NRCS: Natural Resources Conservation Service

ORP: Oxidation reduction potential

OSHA: Occupational Safety and Health Administration

PPM: Parts per million

RFR: Reportable Food Registry

RTE: Ready-to-eat

SAs: Soil amendments

SOPs: Standard Operating Procedures

SSOPs: Sanitation Standard Operating Procedures

USDA: United States Department of Agriculture

US EPA: United States Environmental Protection Agency

UV: Ultraviolet

GLOSSARY

Terms defined in this glossary represent the use of the term in the context of this particular document. These definitions may not represent the term as it may be used in a different context.

Adequate	That which is needed to accomplish the intended purpose in keeping with good practice
Biofilm	A thin layer of microorganisms enclosed in a self-produced polymetric matrix and adherent to an inert or living space.
Clean	Food or food-contact surfaces are washed and rinsed and are visually free of dust, dirt, food residues, and other debris
Co-management	An approach to conserving soil, water, air, wildlife, and other natural resources while simultaneously minimizing microbiological hazards associated with food production.
Control	(a) To manage the conditions of an operation in order to be consistent with established criteria, and (b) to follow correct procedures and meet established criteria
Control measure	Any action or activity that can be used to prevent, reduce, or eliminate a microbiological hazard
Control point	Any step at which biological, chemical or physical factors can be controlled.[1]
Cull	To remove any product that shows signs of physical damage (such as skin breaks or decay)
Current Good Manufacturing Practices	CGMP regulations that are found in 21 CFR 110 (Current Good Manufacturing Practices in Manufacturing, Processing, Packing, or Holding Human Food).
Environmental assessment	Evaluation of the growing environment, taking into consideration factors including topography, hydrology, geographical features, climatic conditions, land history, near-by land use, agricultural water, and domestic animal and wildlife presence to evaluate any safety risks that may affect the potential for melons to be contaminated. Environmental assessments may be conducted prior to planting, during production, and immediately prior to harvest.
Facilities	The buildings and other physical structures used for or in connection with the harvesting, washing sorting, storage, packaging, labeling,

[1] FDA. Hazard Analysis and Critical Control Point Principles and Application Guidelines. http://www.fda.gov/Food/FoodSafety/HazardAnalysisCriticalControlPointsHACCP/HACCPPrinciplesApplicationGuidelines/default.htm#defs

	holding, or transport of fresh produce.
Food-contact surfaces	Surfaces that contact fresh produce and those surfaces from which drainage onto the produce or onto surfaces that contact the produce may occur during the normal course of operations. "Food-contact surfaces" include equipment, such as containers and conveyor belts, which contact fresh produce, whether used in harvesting, post-harvesting, or packaging operations. "Food-contact surfaces" do not include items such as tractors, forklifts, hand trucks and pallets that are used for handling or storing large quantities of contained or packed fresh produce and that do not come into actual contact with the food.
Food safety professional	Person entrusted with management level responsibility for conducting food safety assessments before food reaches consumers; requires training or experience sufficient to establish a solid understanding of the principles of food safety as applied to agricultural production.
GAPs Guide	The guidelines set forth in the "Guide to Minimize Microbial Food Safety Hazard for Fresh Fruits and Vegetables," which was issued by the FDA in 1998.
Ground spot	The point of direct contact where melons sit directly on the soil or on top of plastic mulch. Typically the netted rind develops incompletely at this contact point and the overall rind thickness in this area is reduced.
Hazard	A biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health effect.
Human pathogen	Microorganisms capable of causing disease or injury to people.
Market withdrawal	Removal or correction of a distributed product which involves a known or suspected adulteration prior to shipment that would not be subject to legal action by the FDA or which involves no violation.[2]
Nontransporter	A person who owns food or who holds, manufactures, processes, packs, imports, receives, or distributes food for purposes other than transportation.
Packinghouse	A facility where raw agricultural commodities are handled prior to packing in

[2] http://www.fda.gov/BiologicsBloodVaccines/SafetyAvailability/Recalls/default.htm

	commercial containers, e.g., cartons, bins or totes. Handling may include one or more operations such as sorting, sizing, labeling, wrapping, trimming, or washing. .
Pest	Any animal or insect of public health importance including birds, rodents, cockroaches, and larvae that may carry pathogens that can contaminate food.
Preventive control	Scientifically- and risk based-based practices that producers or operations use to address hazards to which their products might be exposed.
Raw agricultural commodity (RAC)	Any food in its raw or natural state, including all fruits and vegetables that are washed, colored, or otherwise treated in the unpeeled natural form prior to marketing.
Ready-to-eat (RTE)	Any fruit or vegetable in its raw or natural state, including all fruits and vegetables that are washed, colored, or otherwise treated in the unpeeled natural form prior to marketing.
Recall	Removal or correction of a marketed product that the FDA considers to be in violation of the laws it administers and against which the agency would initiate legal action; may be conducted by a firm's own initiative, by FDA request, or by FDA order under statutory authority.[2]
Recirculated water	A closed water system, where water is used more than one time before it is discharged into a wastewater system.
Risk	A function of the probability of an adverse health effect and the severity of that effect, consequential to a hazard(s) in food.
Sanitize	A process that is effective in destroying or substantially reducing the numbers of microorganisms of public health concern, as well as other undesirable microorganisms.
Shed packed	Melons that are graded, sorted, sized, washed, cooled, packed, and placed onto pallets in a packing shed/packinghouse.

LIST OF APPENDICES

INTRODUCTION

Raw agricultural commodities are defined in section 201(r) of the Federal Food, Drug, and Cosmetic Act (FFDCA) as "any food in its raw or natural state, including all fruits that are washed, colored, or otherwise treated in their unpeeled natural form prior to marketing." This document covers whole, uncut cantaloupes, which are not considered to be ready-to-eat (RTE) because 1) their natural form is not altered, 2) they do not enter a processing facility, and 3) they need to be peeled and may or may not be washed before being consumed.

In 1998, the U.S. Food and Drug Administration (FDA) issued the document entitled, "Guidance for Industry: Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables." The practices outlined in this document are collectively known as Good Agricultural Practices (GAPs) and current Good Manufacturing Practices (cGMPs). GAPs provide food safety guidance on critical production steps where food safety might be compromised during the growing, harvesting, transportation, cooling, packing, and storage of fresh produce. On the other hand, cGMPs describe the methods, equipment, facilities, and controls for packing and producing processed food.

More specifically, GAP guidance documents inform fruit and vegetable growers and handlers primarily about the potential microbiological hazards associated with various aspects of the production pipeline including: land history, adjacent land use, water quality, worker hygiene, equipment sanitation, and product transportation. Physical and chemical hazards are also addressed in relation to agricultural chemical handling and storage, and the presence of physical objects such as glass or other debris contaminating fresh produce in the field. For the most part, the produce industry has proactively adopted GAPs as part of normal production operations. Indeed, many fruit and vegetable producers undergo either internal and/or external third-party audits on a seasonal basis to monitor and verify adherence to GAPs. These audit results are often shared with customers as verification of the producer's commitment to food safety and GAPs.

This guidance is consistent with the National Cantaloupe Guidance entitled, *Commodity-Specific Food Safety Guidelines for Cantaloupes and Netted Melons*, but is more specific in areas to provide metrics for California producers and handlers. Cantaloupe food safety programs whether in the field or facility should focus on preventing adulteration by microbial contamination because they are eaten raw and do not have an effective "kill step" to reduce human pathogen levels. cGMPs help to ensure that food for human consumption is safe and has been prepared, packed, and held under sanitary conditions. Parts 100-169 of Title 21 of the Code of Federal Regulations (21 CFR 100-169) prescribe the condition under which food should be processed, packed, handled, held, labeled, etc. cGMPs are regulations as set forth in 21 CFR 110. cGMPs are enforceable by law and serve as one basis for FDA inspections. In addition to the cGMPs, FDA published a "Guide to Minimize Microbial Food Safety Hazards of Fresh-cut Fruits and Vegetables" ("Fresh-cut Guide") in 2008.[3] FDA developed this guidance to complement the cGMPs and recommend more specific food safety practices relevant to handlers of fresh-cut

[3] FDA. 2008. Guidance for Industry: Guide to Minimize Microbial Food Safety Hazards of Fresh-cut Fruits and Vegetables.http://www.fda.gov/Food/GuidanceComplianceRegulatoryInformation/GuidanceDocuments/ProduceandPlanProducts/ucm064458.htm#ch8

produce. While some operations are required to operate under cGMPs, others voluntarily handle cantaloupes according to the FDA's "Fresh-cut Guide" – a means of ensuring strong preventive programs. The best practices in these guidance sections are primarily based on cGMPs and should be tailored to address the risks associated with each operation and its unique settings and practices. These guidelines are a non-exhaustive set of items that should be considered and addressed when developing an operation-specific food safety plan.

REGULATORY BACKGROUND

While the produce industry has an admirable record of providing the general public with safe, nutritious fruits and vegetables, a few highly visible food safety failures have increasingly focused the attention of consumers, consumer advocacy groups, public health organizations, government agencies and buyers on produce food safety. To address the concern, the U.S. Food and Drug Administration (FDA) promulgated a produce safety action plan in 2004 that specifically requested produce industry leadership to develop the next generation of food safety guidance for fruit and vegetable production. Since then several commodity-specific food safety guidelines have been developed to both address potential issues and to reduce the likelihood of future foodborne illness outbreak occurrences. For example, after the 2006 *E. coli* outbreak in spinach, the leafy green industry developed commodity-specific food safety guidelines in 2007, as did the tomato industry in 2008, and the green onion industry in 2010. The FDA responded by developing the Fresh-cut Guide in 2008 and drafting commodity-specific food safety guidelines for leafy greens, tomatoes, and melons in the summer of 2009 (FDA, 2009a; FDA, 2009b; FDA, 2009c).

In 2009 the U.S. House of Representatives introduced a food safety bill (H.R. 2749) that included the regulation of vegetable production and harvesting. This bill passed in July 2009 and the Senate version known as the FDA Food Safety Modernization Act, S. 510 (FSMA) passed in December 2010 and was signed into law on January 4, 2011. The FSMA states, "not later than 1 year after the date of enactment of the FDA Food Safety Modernization Act, the Secretary, shall publish a notice of proposed rulemaking to establish science-based minimum standards for the safe production and harvesting of those types of fruits and vegetables that are raw agricultural commodities for which the Secretary has determined that such standards minimize the risk of serious adverse health consequences or death."

At this time it is expected that FDA will target specific commodities for guidance beyond broad rules and will also target key practices that cut across several commodities for clarification through guidance, e.g. irrigation water sampling. FDA has specifically focused on cantaloupe food safety practices following numerous instances of *Salmonella* detection on cantaloupes over the last several years. In September 2011, the cantaloupe industry faced one of the most devastating foodborne illness incidents of the last 25 years with an outbreak of *Listeria monocytogenes* associated with cantaloupes grown in southeastern Colorado. Subsequent FDA investigations identified a number of critical food safety issues and cross-contamination risks that deserve the focus of the industry and re-examination of current guidance documents. In light of these developments pertaining to fresh produce in general and to cantaloupes specifically, the cantaloupe

industry has decided that proactive re-assessment and further standardized development of cantaloupe-specific food safety guidelines is an important step in increasing the safety and security of the U.S. cantaloupe supply chain.

PURPOSE

The purpose of this document is to provide a systematic approach to managing cantaloupe product safety in order to minimize the risk of cantaloupe-related foodborne illnesses. In the 2011 *Listeria* outbreak, cantaloupes were identified as the vehicle in the outbreak that resulted in numerous illnesses and deaths. To retain and increase consumer confidence in the safety of cantaloupes, the industry has come together to work on the development of these guidelines that when implemented will work to minimize the risks of foodborne illnesses related to cantaloupes as well as the potential for contamination related to mishandling of chemicals and the presence of foreign objects in the production and handling environments.

The issues identified in this document are based on the core elements of GAPs and cGMPs. The specific recommendations contained herein are intended for cantaloupes only. If these specific recommendations are effectively implemented this would constitute the Best Practices for a comprehensive food safety program for the production, harvest, packing, storage, and transporting of cantaloupes. When growing any type of produce, growers should comply with the FDA's "Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables" and follow the requirements established in the "Standards for the Growing, Harvesting, Packing, and Holding of Produce for Human Consumption" when it is finalized.[4]

SCOPE

This document is designed to offer food safety guidance for all companies that supply, store, and manage cantaloupes during production, harvesting, packing, and shipping operations, and does not include processing, distribution centers, retail, or foodservice (see Figure 1). It includes five sections: 1) *Common Elements of a Food Safety Programs*, 2) *Primary Production Operations*, 3) *Harvest and Field Packing Unit Operations*, 4) *Facilities* (includes packinghouse and cold storage/warehouse operations), and 5) *Transportation*.

This document pertains only to varieties of *Cucumis melo* or melons known as muskmelons or rockmelons commonly found in North America recognized for their rough skin surface and veined appearance, i.e. netted melons. For the purposes of this document the term "cantaloupe" is used for netted melons and includes, but is not limited to, any melon with a netted exterior - cantaloupes, rockmelons, and muskmelons (e.g. Athenas, Galia, Hami-Gua, Harper-type, Persian, Ogen, Santa Claus, Sharlyn, etc.). This document offers food safety guidance that is applicable for cantaloupes grown outdoors in field environments using both conventional and organic growing methods. Producers that follow organic standards are responsible for satisfying these food safety best

[4] FDA. 1998. Guidance for Industry: Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables. http://www.fda.gov/Food/GuidanceComplianceRegulatoryInformation/GuidanceDocuments/ProduceandPlanProducts/UCM064574

practices as well as their organic certification standards.

Primarily sold as an unprocessed, raw commodity, cantaloupes are manually harvested, packed in the field or in a packinghouse, and cooled as soon as possible after harvest to remove field heat. Due to harvesting by hand, quality sorting, and packing these commodities, there are numerous "touch points" early in the supply chain. Each of these "touch points" represents a potential opportunity for contamination or cross-contamination. Human pathogens that are associated with produce and cause infection and illness can be present in large numbers in the feces of humans and animals. Certain pathogens, such as *Listeria monocytogenes* are well adapted to live in soil, water, and other environmental habitats and recent fecal contamination is often not involved in their presence and potential for contamination. Therefore, food safety programs for the production and handling of cantaloupes should pay special attention to controlling, reducing, and eliminating potential sources of environmental contamination, including fecal contamination through water, soil, people, and animals (both domestic and wild).

Safe production, packing, distribution and handling of cantaloupes depend upon a myriad of factors and the diligent efforts and food safety commitment of many parties throughout the distribution chain. No single resource document can anticipate every food safety issue or provide answers to all food safety questions. The Best Practices in this document are based on current science- and risk-based knowledge and some recommendations may change as new and additional information becomes available. These guidelines primarily focus on minimizing microbial food safety hazards by providing suggested potential actions to reduce, control, or eliminate microbial contamination of cantaloupes in the field-to-fork supply chain. Guidelines for potential chemical and physical hazards are limited to mishandling and inappropriate storage of agricultural chemicals and the presence of trash and debris in close proximity to production and handling areas.

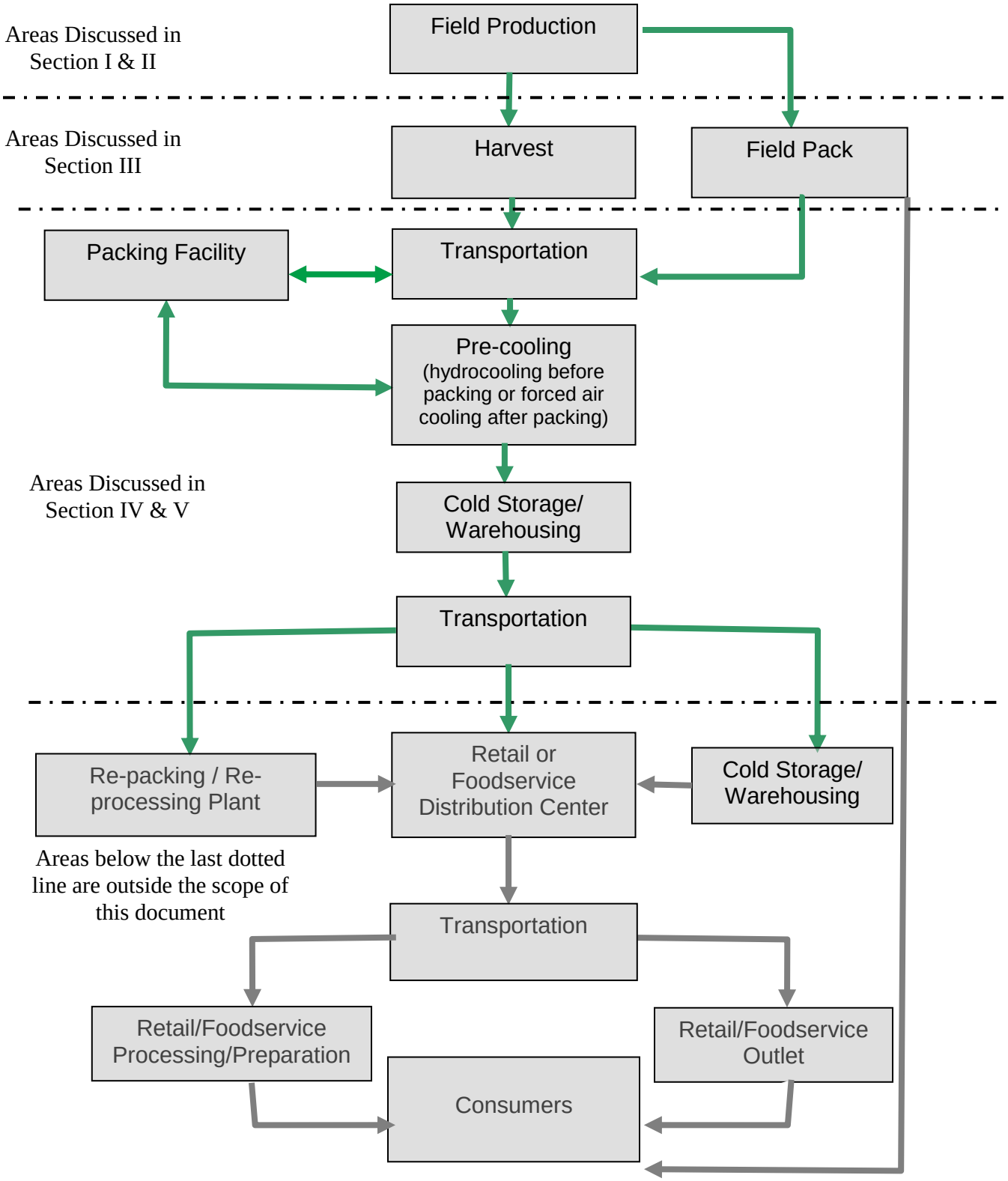
It is suggested that all companies involved in the cantaloupes' farm-to-table supply chain consider the recommendations contained within these guidelines to ensure the safe production and handling of cantaloupe products. Every effort to provide food safety education to supply chain partners should be made as well. With the commitment of each party along the supply chain to review and implement these guidelines, the produce industry is doing its part to provide a consistent, safe supply of cantaloupes to the market place.

Often cantaloupe fields may be closely associated with environmentally sensitive areas. It is recommended that growers and handlers consult with appropriate land and natural resource management agencies, many of whom are identified in Appendix G when any mitigation strategies that may impact these areas are employed. All parties involved with implementing the practices outlined in this document should be aware that these best practices or risk mitigation methods are not, in any way, meant to encourage growers to violate environmental regulations or be in conflict with or discourage co-management practices and principles.

Users are encouraged to also utilize the services of their trade associations, the Center for Produce Safety, the U.S. Food and Drug Administration, the U.S. Department of Agriculture, the U.S. Environmental Protection Agency, the Centers for Disease Control

and Prevention, and state agricultural, environmental, academic, wildlife and natural resource management agencies, and public health authorities.

FIGURE 1. GENERAL SUPPLY CHAIN FLOW FOR CANTALOUPES



SECTION I: COMMON ELEMENTS OF FOOD SAFETY PROGRAMS

1.0 ISSUE: GENERAL RECOMMENDATIONS FOR FOOD SAFETY POLICIES AND PLANS

In addition to the area-specific best practices discussed in later sections, there are best practices that are part of an effective food safety program for all companies in the cantaloupe production and handling supply chain. A critical step in developing an effective food safety program is to assess the food safety risks for an operation and develop preventative measures to control the identified risks. Awareness of common risk factors discussed in this document will enhance the safety of cantaloupes.

1.1 The Best Practices Are:

- Every company shall have a written policy signed by senior management that outlines the company's commitment to food safety, how it is implemented and how it is communicated to employees.
- Conduct a systematic risk-based hazard analysis of your company's operations from ground selection through shipment to customers.
- Prepare a written comprehensive Food Safety Plan based upon the hazard analysis. Components and practices of the plan shall include the following:
    - Develop a flow diagram of the operation.
    - Perform a hazard analysis for each phase or step in the operation.
    - Determine the critical preventive control (CPC) that can be established for an identified hazard. If a CPC cannot be established, establish control points (CPs) in a food facility environment or preventive controls (PCs) in a production environment for the identified hazards.
    - Develop parameters or critical limits around the CPCs. If CPs or PCs are established, develop parameters or limits as well.
    - Establish procedures for monitoring the PCs / CPCs and verification within the established limits.
    - Establish corrective actions to mediate any breach or violation of established parameters / limits. Establish methods to verify that corrective actions are effective.
- The hazard analysis and any accompanying hazard analysis plan shall be documented and available for review.
- If a crop production method or postharvest process is changed (e.g., updated equipment), then the plan shall be updated and revised.
- Prepare and review documentation for all the PCs / CPCs daily, including corrective actions when warranted, in accordance with the Plan.
- Each grower and handler shall designate a primary individual responsible for their operation's food safety program and staying current with developments in science-based CPCs. An alternative individual shall be assigned in the event that the primary designated individual is unavailable. Twenty-four (24)

hour contact information shall be available for these individuals in case of food safety emergencies.

- Every company shall have a policy that establishes corrective actions for situations that are out of compliance with the company's food safety policies or procedures. Corrective actions should be completed within 30 days and a written record shall be documented.
- Every company shall have a documented self-audit procedure. Self-audits shall be conducted at least annually by a cross-functional team based upon operational units who are knowledgeable of the Food Safety Plan. A written record of required corrective actions should be documented.
- Companies shall review their Food Safety Plan at least annually and make revisions as appropriate to their particular situation based on their operation-specific risk assessments, updated or new guidance, regulations, and / or changes to their operations (e.g., new field location not covered by existing hazard analysis, new equipment, new product formulations or new season).
- Handlers shall have up-to-date lists of growers and buyers with contact and location information on file. Growers shall have an up-to-date buyers list with contact and location information on file.
- Limit access to production areas, packing facilities and cold storage facilities to authorized employees, vendors and visitors.
- Anyone that manufactures, processes, packs, or holds cantaloupes for consumption in the U.S. is required to report when there is a reasonable probability that the use of, or exposure to, an article of food will cause serious adverse health consequences or death to humans or animals. This reporting is conducted through the FDA's Reportable Food Registry (RFR).[5] Firms that only grow fresh produce are exempt from reporting.
- Handlers must comply with the requirements of The Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (farms are exempt from the Act) including those requirements for recordkeeping (traceability), imports, and registration.[6]

Documentation List:

- ☐ A written, signed Food Safety Policy
- ☐ Hazard analysis
- ☐ A written comprehensive Food Safety Plan

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[5] FDA's Reportable Food Registry: http://www.fda.gov/Food/FoodSafety/FoodSafetyPrograms/RFR/default.htm

[6] FDA. 2009. Establishment and Maintenance of Records—FDA Actions of the Bioterrorism Act of 2002. http://www.fda.gov/Food/FoodDefense/Bioterrorism/Recordkeeping/default.htm
FDA. 2010. Food Facility Registration—FDA Actions on Bioterrorism Act of 2002 Legislation. http://www.fda.gov/Food/FoodDefense/Bioterrorism/FoodFacilityRegistration/default.htm
FDA. 2010. Prior Notice of Imported Food Shipments—FDA Actions on Bioterrorism Act of 2002 Legislation. http://www.fda.gov/Food/FoodDefense/Bioterrorism/PriorNotice/default.htm

- ☐ Contact information for primary and alternative food safety personnel
- ☐ SOP - the PCs or CPs
- ☐ Corrective action policy and logs
- ☐ Self-audit SOP
- ☐ Self-audit event records
- ☐ Grower and buyer lists

2.0 ISSUE: DOCUMENTATION AND RECORDKEEPING

As a general practice, it is important that firms involved in operations relating to cantaloupes maintain documentation and records related to operational information about the product and practices, as well as tracing information about the product. It also is important to note that subject to certain exceptions, existing FDA regulations in 21 CFR part 1, subpart J, "Establishment, Maintenance, and Availability of Records," already establish certain recordkeeping requirements on persons who manufacture, process, pack, transport, distribute, receive, hold, or import food in the U.S.[7]

2.1 Operational Records

Operational records about products and practices can be helpful to firms. First, such records help ensure consistency of production, packing, and processing operations and end-product quality and safety. They are more reliable than human memory and serve as a useful tool to identify areas where inconsistencies occur in operations and corrective actions or employee training may be needed. Furthermore, maintaining adequate documentation and records could assist in identifying patterns or rule out potential contributing factors of contamination if product should be implicated in an outbreak and is traced to a particular farm, facility or practice.

2.1.1 The Best Practices Are:

- Develop and maintain written Standard Operating Procedures (SOPs) and Sanitation Standard Operating Procedures (SSOPs) for areas such as field inspection, sanitation, handling and storage practices, facility and vehicle cleaning and sanitation, pest control, employee training programs, etc.
- Maintain records for significant activities performed, such as the Sanitary Survey of water sources, monitoring of water sources and use; water quality testing; treatment of water; equipment calibration; microbial testing; soil amendment and crop treatment applications, cleaning and sanitation of equipment, containers and vehicles; employee training; temperature control; and corrective actions taken.
- Record information such as the date and time, name of person(s) who completed the record, and the activity being monitored in the documentation.

2.2 Product Traceability

Product traceability refers to the ability to follow the movement of a food through

[7] http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?CFRPart=1&showFR=1&subpartNode=21:1.0.1.1.1.8

specified stage(s) of production, packing, processing, and distribution. Tracing information about cantaloupes facilitates tracking the physical movement from their original source through intermediate sources to their final recipient and tracking product from the final recipient back to the source. Though not a preventative measure, product tracing systems are an important element of a comprehensive food safety program and should be verified periodically for effectiveness.

2.2.1 The Best Practices Are:

- Develop and maintain standardized, clear records that can be used to enhance the ability to follow the movement of your cantaloupe products. Examples of such records include labels with product identifying information, invoices, inventory records, bills-of-lading, and shipping / receiving records. Records shall comply with Bioterrorism Act provisions; this may include packaging material records.
- Perform a trace back and trace forward exercise at least annually by facility. This exercise should achieve accurate traceability within 4 hours or as required by applicable regulation and should achieve 100% reconciliation.
- Establish a documented program with written procedures to facilitate stock recovery, market withdrawal, and recalls that includes:
    - A designated team with team members' 24-hour, seven-days-a-week contact information.
    - A mock recall exercise performed annually by facility which follows the company's written recall program.
    - 24-hour contact list of customer point persons to be called if product requires recall
    - Contact list of key regulatory officials (federal and state) that may need to be notified if a recall is warranted
- Make sure required documentation is provided when cantaloupes are imported. FDA and USDA may have different requirements for individual importing countries; consulting with a trade specialist at these regulatory bodies is the best way to ensure that the proper documentation is provided.
- Have a labeling system in place. For the purposes of product traceability, finished product shall be labeled with information that allows for effective traceability. Examples of information that may be included are:
    - Grower or Ranch ID
    - Packinghouse ID
    - Cold Storage ID
    - Shipper ID
    - Marketer ID
    - Harvest time
    - Harvest date

- Crew ID
- Lot ID
- Production date
- Production code
- Expiration date
- Quantities
- Transporter

- Any tags used in the facility should be secured to finished product containers in a manner that does not create a potential for damaged packaging materials or foreign object inclusion.

Documentation List:

- ☐ Product Tracing Records
- ☐ Recall program with contact information for recall team members, customers, regulatory officials, etc.
- ☐ Import documents
- ☐ Trace exercise records
- ☐ Mock recall exercise records

3.0 ISSUE: WORKER PERSONAL HYGIENE TRAINING AND PRACTICES

Cantaloupes may undergo significant handling by workers during production, harvest, packing, and cooling operations. Workers can contaminate fresh produce, water supplies, and other workers, and transmit human pathogens if they do not understand and follow basic hygienic principles. The importance of workers, supervisors and senior management understanding and practicing proper hygiene cannot be overemphasized. Workers should be trained regularly, in an appropriately comprehensible language, regarding food safety, and worker health and hygiene. Training programs should emphasize worker roles and responsibilities in producing a safe product, sanitation principles, and sanitary practices including appropriate and effective hand-washing, glove use if required by option or policies, health-related policies, etc. Training should be designed to help workers understand what is expected of them and why these practices are important.

3.1 The Best Practices Are: General Recommendations

- Establish a written worker practices program (e.g., a SOP) that can be used to verify worker compliance with your company's food safety policy. This program shall address operation-specific practices for workers as well as for visitors, vendors and repair/service providers.

3.2 The Best Practices Are: Training

- Every worker shall receive mandatory training in the company's food safety policy and plan, food safety procedures, sanitation, and personal hygiene appropriate to their job responsibilities at hire and thereafter at least annually.
- Training shall be documented including a general description of the subject matter, the trainer's name, the date of training, and the signatures of workers attending the training.
- Workers shall receive training in risk factor recognition and personal health reporting requirements.
- This program shall address operation-specific practices for workers as well as for visitors, third-party contractors, vendors and repair/service providers.

3.3 The Best Practices Are: Hygiene

- Workers must wash their hands before, beginning, or returning to work, after eating, smoking, using latrines, or any other activity that may cause hands to become contaminated with pathogens.
- If gloves are used, a procedure for proper glove use shall be established, followed, and documented.
    - If gloves are used, they shall be provided by the employer and not removed from the work place.
    - If gloves are reusable, they shall be washed and sanitized daily.
    - If gloves are used, they must be changed as necessary after any event that may cause gloves to become contaminated.
    - Disposable gloves shall not be permitted to be worn when using the latrine, eating, or handling unsafe or non-food grade materials.
- Workers shall not take any tools or protective garments inside the toilet facilities.
- All personal items shall be stored away from immediate areas where they may come in contact with cantaloupes or cantaloupe-contact areas. Instructions should be posted regarding this practice.
- Smoking, eating, and drinking of beverages other than water shall be restricted to designated areas equipped with covered trash receptacles.
- Workers shall be prohibited from spitting, chewing gum or tobacco and urinating or defecating any place other than the toilet facilities.

3.4 The Best Practices Are: Health

- Establish a worker, visitor, and third-party health practices program (i.e., a SOP) that addresses the following issues:
    - Workers, visitors, vendors and third-party contractors with diarrhea disease or symptoms of other infectious disease are prohibited from handling cantaloupes and contacting food contact surfaces.

- Workers, visitors and third-parties with open cuts or lesions are prohibited from handling cantaloupes and food contact surfaces without specific measures to prevent potential contamination.
- A policy for handling / disposing of cantaloupes or disposable food contact surfaces (packing materials) that have come into contact with blood or other bodily fluids. A policy for non-disposable food contact surfaces (belts, packing platforms) that have come into contact with blood or other bodily fluids.
- First aid kits, including appropriate wound coverings, shall be readily available and maintained in accordance with prevailing regulation with materials that are unexpired and kept in sanitary and usable condition.

3.5 The Best Practices Are: Toilet facilities and hand washing stations

- The toilet facilities and hand-washing stations including number and location shall be in compliance with applicable local, state, and federal regulations. (See CAL-OSHA requirements for agricultural settings and facilities)
- Evaluate the location and design of toilets and hand washing stations to maximize accessibility for use, cleaning and maintenance while minimizing the potential for the facility to serve as a source of contamination (i.e., from workers hands, leaks, spills, etc.).
- Hand washing stations must be supplied with potable running water or treated with sufficient levels of disinfectant to ensure that water meets local, state, or US EPA microbial standards for drinking water (e.g., no detected generic *E. coli*).
- Toilets and hand-washing stations shall be constructed of materials that can be readily cleaned and sanitized.
- Toilets and hand washing stations supplies (paper, soap, disposable towels, lidded or closed trash bins) shall be present in each location and properly stocked at all times.
- Instruct workers to inform the supervisor of any issues with the hand-washing or toilet units.
- Establish a response plan for leaks or spills and steps to verify effectiveness.
- All portable units shall have a tank that captures used hand wash water.
- Signage requiring hand washing after use of toilet facilities shall be visible and posted in applicable languages and/or pictures.

Documentation List:

- ☐ Training and documentation of training events including list of training topics covered; seasonal training and tailgate training sessions
- ☐ Worker attendance log for training sessions
- ☐ SOP - Worker practices
- ☐ SOP - Physical hazard prevention
- ☐ SOP - Worker health practices

□ SOP - Field toilets and hand washing stations

□ SSOP - Field toilets and hand washing stations

4.0 ISSUE: SANITATION

Sanitation programs are critical preventive controls aimed at ensuring that cantaloupes handled in the field and facilities are not contaminated with pathogens. Pathogenic microorganisms may be found on floors, drains, and equipment surfaces and components. Operators should be aware of and operate in accordance with all relevant laws and regulations that describe facility sanitation practices including the proper handling of chemicals.

Important areas of concern include any surface that comes into contact with cantaloupes, toilet facilities for employees, and control of pests. Without appropriate sanitation practices, equipment and facilities may harbor pathogens. Cleaning and sanitizing of equipment and facilities should be conducted in a manner that protects against contamination of cantaloupes, cantaloupe-contact surfaces, or packaging materials.

4.1 The Best Practices Are: Master Sanitation Schedule

- A master sanitation schedule shall be prepared and documented and clearly identify all equipment and/or equipment numbers, its cleaning frequency, and SSOPs to be followed.

4.2 The Best Practices Are: Food Contact Surfaces, Facilities and Equipment

- Food contact surfaces (e.g., mobile field pack units, grade and sort tables, harvest belts and conveyor systems, packing tables, etc.) shall be constructed of material that is easily cleanable and able to be sanitized.
- Food contact surfaces shall be cleaned and sanitized daily, after moving between ranches, or if potential contamination occurs.
- Non-food contact surfaces (e.g., field pack machines, other harvest equipment and trailers, walls, ceilings, floors, drains, mezzanines, storage areas, etc.) should be cleaned and sanitized on a routine basis.
- A pre-operative inspection of the equipment and facilities shall be conducted daily to verify that sanitation has been satisfactorily completed, the equipment is safe and ready for use, pest control measures are in place and functioning, and all food safety protocols are being followed. Use a checklist and document any corrective actions taken to address deficiencies.
- Prepare a SSOP for each piece of equipment that addresses the frequency with which it is to be cleaned (e.g., daily, weekly, monthly or seasonally) and the process to be used for cleaning (e.g., clean, wash, sanitize and rinse if necessary)
- Receptacles with a proper sanitizing solution shall be readily available to sanitize and store all hand-held tools that are not in use. Check, adjust (if necessary), and document the sanitizer concentration strength as often as necessary to assure its effectiveness.

- Use cleaning techniques that do not pose a risk of cross-contamination of product or food contact surfaces or make development of biofilms more likely (i.e., water applied to surfaces meant to stay dry).
- Verify the efficacy of the facility and equipment cleaning and sanitation methods with routine environmental testing and develop a test plan for the cleaning verification methods. Testing data shall be maintained on file.

4.3 The Best Practices Are: Toilet facilities and hand washing stations

- Establish the frequency and specific protocols of toilet and hand washing facility maintenance / sanitation including a checklist of facility supplies.
- For portable facilities, establish equipment and supply storage and control procedures when not in use.
- Establish a SOP for trash disposal at the end of the work shift.
- Maintain documentation of maintenance and sanitation schedules that demonstrates compliance with applicable worker health and safety regulations and any corrective actions for a period of 2 years.

4.4 The Best Practices Are: Training for Workers with Sanitation Duties

- Personnel with cleaning and sanitation duties shall be trained:
  - To understand the principles and methods required for effective cleaning and sanitation, especially as they relate to food safety.
  - In proper cleaning and sanitizing techniques and understand the steps outlined in the SSOP.
  - About the potential for cross-contamination from aerosols and splashing when using water to clean, especially high-pressure hoses.
  - To use, handle, and store cleaning and sanitizing chemicals safely.
  - In the proper use of cleaning equipment.
- Employee training records should be archived.

4.5 The Best Practices Are: Cleaning and Sanitizing Chemicals

- Use a secure, vented storage area for storing sanitizing chemicals and cleaning tools/equipment. This storage area shall be away from the food handling area and any storage areas for raw or finished product packaging materials.
- All chemicals used in cleaning operations shall be used and labeled in accordance with the manufacturer's instructions and in accordance with relevant federal, state, and local government regulations.
- Do not store chemicals in unlabeled secondary containers (soda bottles, milk cartons, mason jars).
- MSDS shall be kept on file for each cleaning and sanitizing chemical.

Documentation List:

- □ Master sanitation schedule
- □ Equipment SSOP
- □ Employee training records
- □ Cleaning verification records

5.0 ISSUE: EQUIPMENT CONSTRUCTION AND MAINTENANCE

Various types of equipment, both hand-held and mechanical, are used to cultivate, harvest, pack and cool cantaloupes presenting an opportunity for contamination if appropriate practices are not followed. Appropriate equipment handling and cleaning measures should be used to reduce and control the potential introduction of human pathogens. Though harvested by hand, cantaloupe harvesting and packing includes the use of many types of equipment such as clippers, mechanical conveyors, and other tools. Depending on the variety and level of maturity, hand-held cutting devices may or may not be used to assist with harvesting. Mechanical equipment used in cultivating, harvesting and packing cantaloupes should be engineered and maintained to prevent cantaloupe bruising and damage in order to reduce the possibility of contamination.

5.1 The Best Practices Are:

- A master maintenance schedule shall be prepared and documented and clearly identify all equipment and/or equipment numbers and its maintenance frequency.
- Prepare a SOP for equipment that addresses the following:
  - Inspection of all equipment prior to use to check for any equipment deficiencies or maintenance requirements.
    - Drip pans (to catch oil or other lubricants) should be in place and tightly secured.
    - Hydraulic hoses, hydraulic motors, and overhead hydraulic fittings should be tight and drip free with no indications of recent leakage.
    - Loose or damaged equipment parts should be removed or appropriately repaired immediately. No temporary remedies such as string, tape, wire, and / or cardboard should be used in repair of tools.
  - Equipment maintenance requiring the use of chemicals, oils, greases, and fuels should be conducted away from the production and handling areas.
  - Glass and brittle plastic on equipment shall be shatter-proof or covered to prevent broken fixture material from contaminating cantaloupes.
  - Periodic inspections of the condition of all hand tools and replacement of damaged tools.
    - Broken, chipped, or otherwise damaged hand tools should not be returned to use until the deficiency is corrected.

        - Maintenance of hand tools so that they are sharp and free from damage such as ragged edges.
    - Control procedures when equipment is not in use, including policy for removal of equipment from the work area or site and equipment storage.
- Equipment lubrication should be managed so as to not contaminate cantaloupes. Food grade lubricants shall be used on packing equipment where food contact may occur. Food-grade and non-food-grade lubricants are to be stored separately.
- Use equipment constructed of materials that facilitate cleaning and sanitation of the equipment's food contact surfaces (e.g., transportation tarps, conveyor belts).
    - Food contact surfaces shall be constructed of materials that can be cleaned and sanitized and will not harbor pathogens. Use of untreated or uncovered wood or other porous materials on equipment shall be avoided as they are difficult to clean and sanitize.
    - Clipping devices should be constructed of stainless steel with either plastic or stainless steel handles so that they are readily cleaned and sanitized. Wooden handles do not lend themselves to efficient sanitation and hand-held tools constructed with standard steel will not hold up to routine sanitation with most sanitizing or oxidizing agents.
    - If deceleration padding is used on harvest equipment, it shall be constructed of or covered with materials that can be cleaned and sanitized. Do not use materials that may harbor pathogens and padding design must not allow for entrapment of water and residue that will likely promote pathogen growth and biofilm formation.
    - Avoid use of hollow structures such as conveyer rollers because they may collect water and debris, and thus, harbor pathogens.

6.0 ISSUE: FLOODING

For purposes of this document, flooding is defined as the flowing or overflowing of a field with water outside of a grower's control that is reasonably likely to contain pathogens and/or other contaminants and is reasonably likely to cause adulteration of cantaloupes in that field. Pooled water (e.g., from irrigation leaks or rainfall) that is not reasonably likely to contain pathogens and/or other contaminants and is not reasonably likely to cause adulteration of cantaloupes should not be considered flooding.

If flood waters contain pathogens and/or other contaminants, cantaloupes may be contaminated if there is direct contact between flood water, or subsequently the raised soil bed, and cantaloupe. Areas that have been flooded can be separated into three groups: 1) cantaloupes that have come into contact with flood water, 2) cantaloupes that are in proximity to a flooded field but have not been contacted by flood water, and 3) production ground that was partially or completely flooded in the past before cantaloupes were planted. The considerations for each situation are described below and presented in Table I-1.

6.1 The Best Practices: General Recommendations[8]

- Prevent cross-contamination between flooded and non-flooded areas:
  - If personnel enter a field that was flooded, they should wear protective clothing such as rubber boots and rubber gloves. Discard or thoroughly clean and disinfect this clothing after use.
  - During production of non-flooded areas in close proximity to flooded areas, prohibit contact of production equipment with the flooded area (also see Section 11.0 Issue: *Equipment Facilitated Cross-Contamination*).
  - Observe appropriate turn-around buffer zones when using vehicles and equipment in close proximity to flooded areas. Create a buffer zone by placing markers that identify both the high-water line of the flooding and an interval of 30 feet beyond this line. If 30 feet is not sufficient to prevent cross-contamination while turning equipment in the field, use a greater appropriate interval. Do not harvest cantaloupes within any established buffer zones. Create a berm or other diversion to prevent subsequent runoff from buffered areas to product due to rainfall or irrigation leak.
  - Clean and sanitize any equipment that had contact with flooded areas or crops before subsequent use.
- If the borehole, even if cased and grouted with an elevated footing, or a well head is under flood water, complete a sanitary survey including water quality testing to ensure the integrity of the well before using.
- Document all flooding events and activities related to mitigating flooding events (i.e. take photographs of the area and activities).

6.2 The Best Practices Are: Cantaloupes That Have Come In Contact with Flood Waters

- FDA considers any crop that has come into contact with flood waters to be an "adulterated" commodity that cannot be sold for human consumption.[9, 10]
- See Table I-1 for criteria for cantaloupe fields that have possibly come into contact with flood waters. The Appendix B describes in more detail the process used to develop these metrics.
- Cantaloupes that are adulterated by flood waters shall be disposed of in a manner to ensure that they do not contaminate cantaloupes or other crops unaffected by flood waters.
- Take measures to prevent non-harvested fields from being gleaned for personal use or non-inspected marketing.

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[8] FDA. 2011. Guidance for Industry: Evaluating the safety of flood-affected food crops for human consumption. http://www.fda.gov/Food/GuidanceComplianceRegulatoryInformation/GuidanceDocuments/FoodDefenseandEmergencyResponse/ucm274683.htm

[9] FDA. 2009. A Notice from the Food and Drug Administration to Growers, Food Manufacturers, Food Warehouse Managers, and Transporters of Food Products About the Safety of Food Affected by Hurricanes, Flooding, and Power Outages. http://www.fda.gov/Food/FoodDefense/Emergencies/FloodsHurricanesPowerOutages/ucm112723.htm

[10] FDA. 2009. Guidance for Industry: Guide to Minimize Microbial Food Safety Hazards of Leafy Greens; Draft Guidance.

Documentation List:

- □ Flooding event – date of flooding and date when equipment are able to enter field, high water mark, photographs, etc.
- □ A pre-planting food safety assessment of formerly flooded ground
- □ Soil sampling test results

Table I-1. Flooding

For use when evidence of flooding in a cantaloupe field occurs.

Practice	Metric / Rationale
Flooding Defined	The flowing or overflowing of a field with water outside a grower's control that is reasonably likely to contain pathogens and is reasonably likely to cause adulteration of cantaloupes in that field. Additional discussion of this definition and implications for production is provided in the text portion of this document.
Handling Unharvested Cantaloupe in a Flooded Field	• Buffer and do not harvest cantaloupes within 30 ft. of the flooding. • Recommended buffer distance may be greater than 30 ft. based on risk analysis by food safety professional. • If there is flooding in the field a detailed food safety assessment should be conducted by appropriately trained food safety personnel (see Glossary) as defined in the text of this document (See Appendix E for an example food safety assessment).
Verification	• Documentation should be archived for a period of 2 years following the flooding event. Documentation may include photographs, sketched maps, or other means of delineating affected portions of cantaloupe fields.
Time Interval Before Planting Can Commence Following the Receding of Floodwaters	• Planting can commence 60 days after the flood waters have receded to the point where water is not visible in the areas that are to be planted and the soil should be at a moisture level at which the grower can get equipment into the field for preparation.[11] • Appropriate soil testing can be used to shorten this period to 30 days prior to planting. This testing should be performed in a manner that accurately represents the production field and indicates soil levels of microorganisms lower than the acceptance criteria listed below. Suitable representative samples should be collected for the entire area suspected to have been exposed to flooding. For additional guidance on appropriate soil sampling techniques, see the example soil sampling protocol in Appendix D and consult the "Soil Screening Guidance: Technical Background Document," specifically Part 4 that provides guidance for site investigations (US EPA 1996). Reputable third-party environmental consultants or laboratories provide sampling services consistent with this guidance. • Appropriate mitigation and mitigation strategies are included in the text portion of the document.
Soil Testing Criteria and Test Methods	**Target Organisms:** • *Salmonella* spp. • Enterohemorrhagic *E. coli* (EHEC) or Shiga toxin-producing *E. coli* (STEC) • Generic *E. coli* **Acceptance Criteria:** • *Salmonella* spp.: Negative or < DL (<1/100 grams) • Enterohemorrhagic *E. coli* (EHEC) or Shiga toxin-producing *E. coli* (STEC): Negative or < DL (<1/100 grams)

[11] Soil moisture test results can also be used to demonstrate moisture levels. Methods typically used by growers to determine soil moisture content include, but are not limited to, tensiometers, electric resistance blocks, oven drying analysis, or other methods that are measurable and repeatable. The grower should have historical information available regarding typical moisture content of the soil so there is comparison data available if it is needed.

	• Generic *E. coli*: < 10 MPN/g **Recommended Test Methods (1 sample per 400 square feet of flooded area)**: • *Salmonella* spp.: U.S. EPA Method 1682 • Generic *E. coli*, Enterohemorrhagic *E. coli* (EHEC) or Shiga toxin-producing *E. coli* (STEC): Any laboratory validated method for soil sampling. • Other U.S. EPA, FDA, or AOAC-accredited methods may be used as appropriate.
Rationale	• The basis for the 30 foot distance is the turn-around distance for production equipment to prevent cross-contamination of non-flooded ground or crops in the fields.

SECTION II: PRIMARY PRODUCTION OPERATIONS

INTRODUCTION

This section addresses best practices specific for production of cantaloupes from land assessment before cultivation to harvest. Additional relevant best practices regarding company food safety policies and plans, worker training and personal hygiene, sanitation, equipment facilitated cross-contamination, flooding, and documentation and recordkeeping are located in Section I: *Common Elements of Food Safety Programs*.

7.0 ISSUE: ENVIRONMENTAL RISK ASSESSMENTS

This section addresses the assessments of environmental conditions that should be completed:

- Prior to the first seasonal planting
- Within one week prior to harvesting

These environmental risk assessments are intended to identify any food safety issues related to cantaloupe fields and production, adjacent land uses that might impact safety, or natural events that might occur between planting and harvest that might compromise safety, e.g. fecal contamination, flooding, etc. (see Table II-1). For example, prior to planting, a grower should consider production site location and include an evaluation of the slope and the potential for runoff from nearby fields, the flood risk as well as hydrological features of nearby sites in relation to the production site. The proximity of high risk production sites, such as animal production facilities, hazardous waste sites and waste treatment facilities, should be evaluated for the potential to contaminate cantaloupe production fields with microbial or other environmental hazards via, for example, run-off, fecal material, aerosols or organic waste." FDA recommends conducting environmental assessments on the topography, land history, risk of flooding, adjacent land use, and domestic animal and wildlife presence associated with the production environment, using the concepts that are outlined in the GAPs Guide (to the extent that any of these environmental factors are present).

Cantaloupes are generally grown in warm weather conditions. Wet or humid conditions favor human pathogen persistence and would likely pose a greater risk for amplification, though we do see evidence of some pathogen persistence in dry or arid conditions, e.g. *Salmonella*. It is also important to consider that drier climates may present other problems such as requirements for additional water that may increase the potential for introduction of human pathogens. Heavy rains in certain areas may also cause cantaloupes to be exposed to contaminated soil due to rain splashing. It is important to tailor practices and procedures designed to promote food safety to the unique environment in which cantaloupes are produced. Each grower or handler should take into account the growing environment when performing a risk assessment.

Cantaloupes are generally grown in rural areas that may have adjacent wetlands, wildlands parks and/or other areas where animals may be present. Some animal species are known to be potential carriers of various human pathogens (Fenlon 1985; Gorski et al. 2011; Jay et al. 2007; Keene et al. 1997; LeJeune et al. 2008; Perz et al. 2001). Uncertainties in the literature about which wildlife species might be the most likely to contaminate fields as well as difficulty excluding some types of animals from fields (i.e.,

birds, reptiles) has led to the recommendation that if crop damage from animals or fecal contamination is detected, measures should be taken to prevent the harvest of any potentially contaminated cantaloupes. In addition, extensive development in certain farming communities has also created situations with urban encroachment and unintentional access by domestic animals, livestock, and human activity, which may also pose varying degrees of risk and should be considered when assessing risks. It is possible that some land uses may be of greater concern than others when located near production fields. Appendix C provides additional information to assist in assessing risks and developing mitigation strategies related to adjacent land use.

7.1 The Best Practices Are: Pre-planting Assessment

- Prior to the first seasonal planting perform a written environmental risk assessment of the production field, adjacent land and surrounding area. Focus these assessments on evaluating the production area and water sources for contamination by animals, flooding or other potential sources of contamination.
    - Assessment of Cantaloupe Fields
        - Before planting, monitor and assess all cantaloupe fields and water sources for evidence of obvious animal intrusion and actual fecal contamination. If the designated food safety professional deems that there is the potential for microbial contamination in cantaloupe production areas due to fecal contamination, a food safety assessment must be performed to determine the risk level as well as to evaluate potential strategies to control or reduce the introduction of human pathogens. See Table II-1 and Figure 2 for numerical criteria and guidance applicable to addressing fecal contamination when it is found. Document any fecal contamination during pre-planting periods and corrective actions taken.
        - When developing strategies to reduce the risk associated with feces in the production area, it is recommended that mitigations are designed to minimize adverse impacts to the environment.
        - Producers are advised to check for local, state, and federal laws and regulations that protect riparian habitat and wetland areas, restrict removal of vegetation or habitat, or restrict construction of wildlife deterrent fences in riparian areas or wildlife corridors.
        - Growers are encouraged to contact the relevant agencies (e.g., the Regional Water Quality Control Board, and state and federal fish and wildlife agencies) to confirm the details of these recommendations. In addition, growers may wish to consult with their state or regional Natural Resources Conservation Service (NRCS) offices to evaluate the food safety risks associated with wildlife, livestock, domestic animals and other adjacent land uses as well as develop and document strategies to control or reduce the introduction of human pathogens through animals for each cantaloupe field. Appendix G provides contact information for resource agencies.

- Evaluate the risk to subsequent cantaloupe production on production acreage that has experienced recent post-harvest grazing with or by domesticated animals.
- Pooled water (e.g., a seasonal lake from rainfall, irrigation leaks, irrigation overflow detention ditches, etc.) may attract animals and should be considered as part of any land use evaluation.

- Assessment of Adjacent Land Use
  - Evaluate all land and waterways adjacent to cantaloupe fields for potential sources of human pathogens. These sources include, but are not limited to septic drain fields, manure storage, compost production and storage, Concentrated Animal Feeding Operations (CAFOs), grazing / open range areas, livestock feeding facilities, surface water, sanitary facilities, and composting operations (see Table II-1 for further detail, and Appendix C for information to assist in developing mitigation strategies related to potential hazards from adjacent land use). Be aware of topographical features of the production area, water sources, and surrounding areas when evaluating the opportunity for runoff and/or leaching from these potential sources, and maximize distances between production area / water sources and potential contamination sources. If any adjacent land uses potentially pose a risk of contamination to the production area or water sources, see Table II-1 for guidance and potential corrective actions. Additionally, appropriate land and/or natural resource management agency personnel (see Appendix G) can provide assistance in addressing land use issues.
  - Control risks associated with encroachment by urban development. Risks may include, but are not limited to, domestic animal fecal contamination of production fields and equipment and septic tank leaching.
  - Evaluate and implement practices to reduce the potential for windborne soil including soil from roads adjacent to fields, aerosols from spray application of SAs, water, or other media that may be a source of contamination to come into direct contact with cantaloupes. Such practices may include (but are not limited to) berms, windbreaks, diversion ditches, and vegetated filter strips.
  - Be aware of runoff from adjacent properties and its proximity to cantaloupe fields, packinghouses, etc.
  - The location of any adjacent land uses that may be of potential risk should be documented.
  - Fencing, vegetation removal, and destruction of habitat may result in adverse impacts to the environment. Potential adverse impacts include loss of habitat to beneficial insects and pollinators; wildlife loss; increased discharges of sediment and other pollutants resulting from the loss of vegetative filtering; and increased air quality impacts if bare soil is exposed to wind. It is recommended that producers check for local, state, and federal laws and regulations that protect riparian habitat and wetland areas, restrict removal of vegetation or habitat, or regulate wildlife

deterrence measures, including hazing, harassment, lethal and non-lethal removal, etc.

- Assessment of Historical Land Use
  - To the degree practical, determine and document the historical land uses for cantaloupe production fields and any potential issues from these uses that might impact food safety (e.g., hazardous waste sites, heavy metal pesticides such as lead arsenate, landfills).
- Assessment of Flooding
  - Evaluate all cantaloupe fields for evidence of flooding. If any evidence is found, follow procedures identified in Section 6.0 *Flooding*.

7.2 The Best Practices are: Pre-Harvest Assessment

- Within one week prior to harvesting, conduct a follow-up environmental risk assessment based on the pre-planting assessment. Focus this assessment on any changes that may have occurred in the field and to water sources and the surrounding areas since the pre-planting assessment.
- Evaluate and monitor crop damage by animals or fecal contamination in cantaloupe fields as is appropriate based on the location of your cantaloupe fields. If damaged crops or fecal material are present, take corrective action in accordance with the recommendations in Table II-1.

Documentation List:

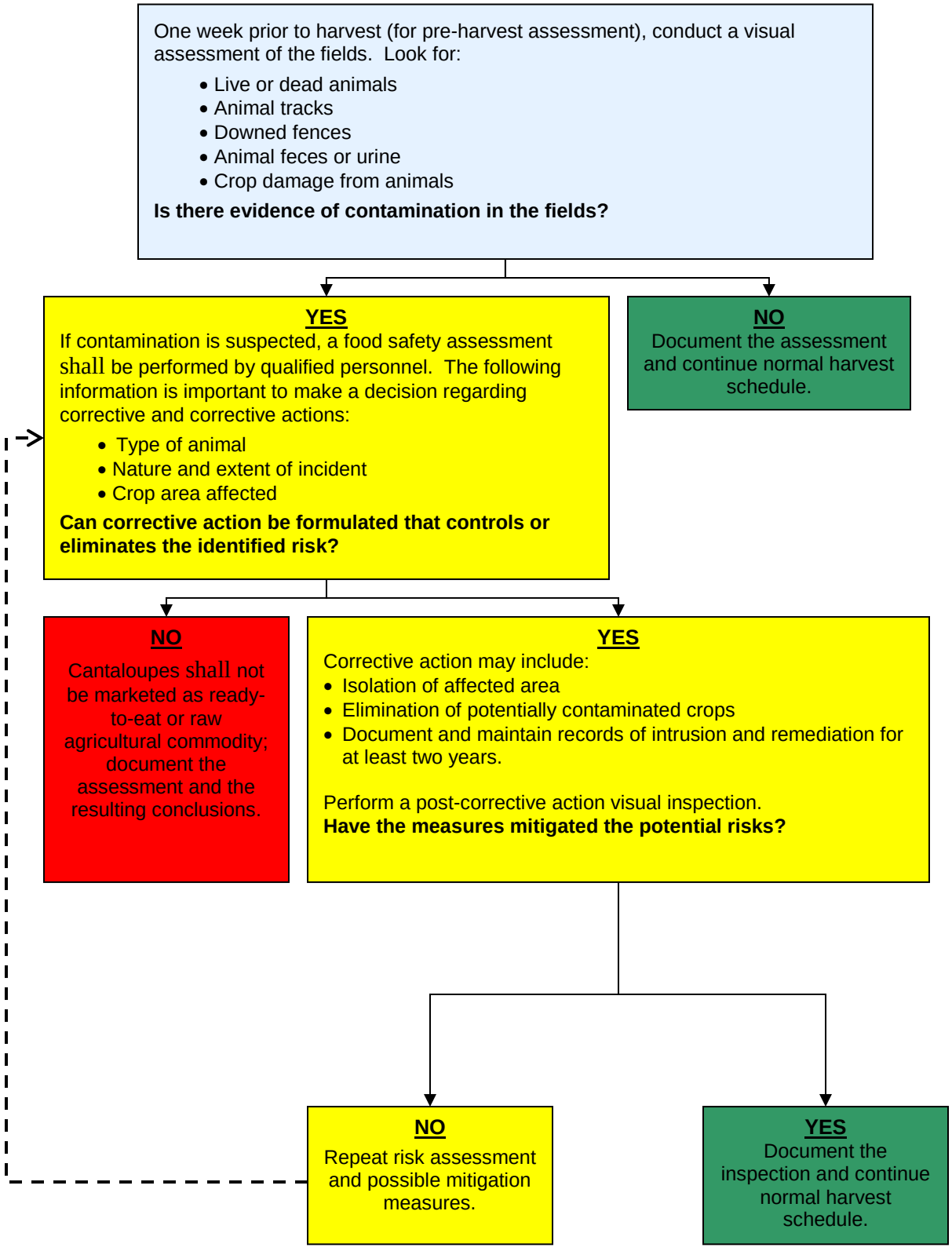
- ☐ Pre-plant environmental assessment
- ☐ Corrective actions report
- ☐ Pre-harvest environmental assessment

Table II-1. Field Management – Risk Assessment of Environmental Conditions

Issue	Risk Assessment Considerations	Corrective Actions
Fecal contamination	Frequency • There shall be a periodic monitoring plan in place for cantaloupe production fields. • There shall be pre-planting and pre-harvest assessments. Variables • Observation of animals in the field • Downed fences • Animal tracks in the field • Animal feces or urine in the field • Crop damage (trampled, eaten plants) in the field	• If there is crop damage from animals or fecal contamination in the field, the field shall undergo a food safety assessment by appropriately trained food safety personnel (see Glossary: food safety professional) prior to harvest, as defined in the text of this document. The extent of the assessment should be determined by the extent of plant damage from animals and fecal contamination (i.e., a few plants eaten in a field would result in a less detailed assessment compared to evidence of a herd of deer that has repeatedly eaten in the field). • In developing corrective actions, it is recommended that producers consult with wildlife and / or domestic animal experts as appropriate. • If corrective actions, such as no harvest buffers, cannot be formulated to control or eliminate the identified risk, do not harvest the crop and destroy the block. • Equipment used to destroy the cantaloupes should be cleaned and sanitized upon exiting the field. • Prior to taking action that may affect natural resources, growers should check local, state, and federal laws and regulations that protect riparian habitat and wetland areas, restrict removal of vegetation or habitat, or restrict construction of wildlife deterrent fences in riparian areas or wildlife corridors. In addition, it is important to assess the overall impact a corrective action might have on food safety – e.g., elimination of a predator may favor the prey which is more capable of transmitting a pathogen. • Food safety assessments and corrective actions shall be documented and available for verification for a period of 2 years.
	Please see Figure 2. Decision Tree for Conducting Pre-Harvest Assessments. **Monitoring** Conduct periodic monitoring for pre-planting and pre-harvest assessments. Evaluate and document any crop damage from animals or fecal matter in cantaloupe fields and production environments. **Pre-Harvest Assessment**	

Issue	Risk Assessment Considerations	Corrective Actions
	Conduct the Pre-Harvest assessment not more than 1 week prior to harvest. If fecal contamination is discovered before harvest operations: • Do not harvest any cantaloupes that have come into direct contact with fecal material. • Conduct a food safety assessment using qualified personnel. Do not harvest cantaloupes found within a minimum five-foot radius buffer distance from the spot of the contamination unless corrective actions are taken that adequately control the risk. The food safety professional can increase this buffer distance if deemed appropriate. • Remove fecal material from the field and dispose of properly. If crop damage from animals is found in a cantaloupe field without evidence of fecal deposits: • Conduct a visual food safety risk assessment to determine if there is contamination. Establish appropriate buffers and do not harvest crop within the buffered area. Document the food safety risk assessment and any corrective action taken. • If it is likely that an irrigation or rain event occurred when fecal matter was present, reassess and consider extending established buffers and do not harvest crop within the buffered area. Document the food safety risk assessment and any corrective actions taken. **Verification** • Archive documentation for a period of 2 years following the intrusion event. Documentation may include photographs, sketched maps, or other means of delineating affected portions of cantaloupe fields. **Rationale** • The basis of these guidelines is qualitative assessment of the relative risk from a variety of intrusions. Fecal material is the primary food safety risk factor; crop damage may indicate risk of undetected fecal contamination. Because it is difficult to develop quantitative metrics for these types of risks, a food safety assessment is considered appropriate for this issue. • Appendix B describes in detail the process used to develop these metrics.	
Field and Water Source Adjacent Land Use (e.g., raw manure piles/lagoons, livestock, landfills, sewage treatment, chemical plants, etc.)	In evaluating risk from physical, chemical, and microbiological hazards to cantaloupe fields and water sources, factors to consider include: • Topography – potential contaminants may be uphill or downhill from cantaloupe fields • Opportunity for water run off through or from a potential contamination source • Presence of fencing and other physical barriers such as: o Berms and ditches to divert runoff o Covering on pile to prevent wind dispersion o Vegetated strips to filter potential contaminants • Opportunity for transfer of foreign material to fields • Pooled water from rainfall that may attract animals	• If possible, move potential hazard (e.g. manure piles, livestock) to a location that does not pose a risk to a mature cantaloupe crop. • Erect barriers (e.g. diversion ditches, fences, storage pits, windbreaks, etc.) or buffers (e.g. sod strips, grass waterways, etc.) to prevent contamination from run off or wind dispersion of potential hazard

Figure 2. Decision Tree for Conducting Pre-Harvest Assessment of the Risk of Fecal Contamination



8.0 ISSUE: WATER

Water can be a source or transference vehicle for microbial or chemical cross-contamination. Therefore, it is critical to conduct a thorough hazard assessment that evaluates the cantaloupe (e.g., exterior, stem), sources of water to be used, and delivery methods to determine if the quality of the water to be used for irrigation, pesticide dilution and application, or equipment sanitation on the farm is of sufficient quality for its intended use. It is important to consider the source of the water along with its intended use. Care should be taken to ensure that cantaloupes are not inadvertently contaminated by the use of water not ideally suited for the intended purpose.

The water source may also dictate different risk management measures or strategies. From a potential risk perspective, water sourced from surface water (e.g., a river or an irrigation canal) represents a very different entity than water sourced from a well. For example, for water sourced from a well, inspection of the well head and periodic microbial testing of the water would be a reasonable management strategy. Microbial testing of flowing water systems is primarily designed to establish baseline information on the ability of these systems to deliver water of acceptable quality. As part of a water quality management program, analysis of microbial testing data over time provides valuable information on trends in microbial levels that may be related to environmental conditions or that may indicate the occurrence or existence of a contaminating source or event. When testing data indicates unusual microbial levels, the Sanitary Survey (Appendix A) may be used to evaluate the water system.

When water is sourced from a canal, it is recommended that risk management strategies focus on keeping the laterals within the boundaries of the production area free from the accumulation of debris and other potential sources of contamination. These strategies should be in place and should include inspections and corrective action protocols. A management program for water quality verification should include documentation of any testing results as well as any preventive or corrective actions taken to reduce or eliminate potential contamination.

8.1 The Best Practices Are:

- A water system description shall be prepared. This description can use maps, photographs, drawings, or other means to communicate the location of permanent fixtures and the flow of the water system (including any water captured for re-use). Permanent fixtures include wells, gates, reservoirs, valves, returns, and other above ground features that make up a complete irrigation system. The direction of water flow shall be clearly indicated on each map. If feasible, include underground piping or conveyances. This map is to be used to facilitate physical water system inspections as described in the Sanitary Survey (Appendix A) for the purpose of identifying conditions that may result in the contamination of cantaloupe crops.
- Establish a water management plan as part of your Food Safety Plan that includes preventative controls, monitoring and verification procedures, corrective actions and documentation.

- Perform a Sanitary Survey (Appendix A) prior to use of water in agricultural operations.
- Use irrigation water and other water in production that meets or does not exceed the acceptance criteria outlined in Table II-2.[12]
- Avoid the use of overhead irrigation systems after fruit set has occurred that results in water directly contacting the outer surface of the cantaloupe rind, and in doing so increase the risk of contamination. For all irrigation types, care should be taken to minimize cantaloupe contact with moist soil that results in the creation of ground spots where internalization of bacteria can take place (Parnell et al 2005).
- If water quality microbial tests are at levels that exceed the acceptance criteria set forth in Table II-2, follow recommendations for corrective actions as outlined in the Table and in Figures 3A and 3B.
- Have a written procedure for water testing that includes frequency of sampling, who is taking the samples, where the sample is taken, the volume of the sample, how the sample is collected, type of test and acceptance criteria. For guidelines see Table II-2.
    - Test water as close to the point-of-use as practical, and if microbial levels are above specific action levels, take appropriate corrective actions.
    - Retain documentation of all test results and / or Certificates of Analysis available for inspection for a period of at least 2 years.

[12] Water quality criteria are based on US EPA recreational and drinking water quality. These standards are being used because there are no federal agricultural water quality standards. For further information, please see Appendix B, Technical Basis for Metrics.

Table II-2. Water Use

Use	Metric	Rationale / Corrective Actions
PRE-HARVEST **Foliar Applications** (overhead sprinkler irrigation, pesticides / fungicide application, etc.)	**Target Organism:** generic *E. coli*. **Sampling Procedure:** A minimum of 1 L sample aseptically collected at the point of use, mixed and poured into laboratory-supplied vials;* e.g., for point of use - one sample at lateral gate per water source for irrigation, water tap for pesticides. Water utilized in preseason irrigation operations may be tested and utilized. **Sampling Frequency:** Collect and test one sample per water source prior to use if >60 days since last test of the water source. Collect additional samples no less than 18 hr. apart and at least monthly during use from points within the distribution system. **Municipal & Well Exemption:** For wells and municipal water sources, if generic *E. coli* levels are below detection limits for five consecutive samples, the sampling frequency may be decreased to once every six months and the recommendations for 60 and 30 day sampling are waived. This exemption is void if there is a significant source or distribution system change.	For any given water source (municipal, well, reclaimed water, reservoir or other surface water), collect samples for microbial testing as close to the point of use as practical (as determined by the sampler using sampling methods to ensure the integrity of the sample as prescribed in this table) where the water contacts cantaloupes, so as to test both the water source and the water distribution system. In a closed water system (meaning no connection to the outside) water samples may be collected from any point within the system, but are still preferred as close to point of use as practical. Only one sample per month per distribution system is recommended under these metrics unless a system has qualified for an exemption. If there are multiple potential point-of-use sampling points in a distribution system, then samples should be taken from different point-of-use locations each subsequent month (randomize or rotate sample locations). Use of the indicator organism, generic *E. coli* as the target organism is based on the US EPA's recreational water quality standards as well as drinking water standards (requires tests for *E. coli* when public water systems test positive for total coliforms) (US EPA, 1974; US EPA, 1986; US EPA 2003). Water for pre-harvest, direct use shall meet or exceed microbial standards for recreational water, based on a rolling geometric mean of the five most recent samples. If the water source has not been tested in the past 60 days, the first water sample should be tested prior to use, to avoid using a contaminated water source. After the first sample is shown to be within acceptance criteria, subsequent samples should be collected no less frequently than monthly at points of use within the distribution system. Ideally, pre-harvest water should not contain generic *E. coli*, but low levels do not necessarily indicate that the water is unsafe. Investigation and / or corrective action should be taken when test results are higher than normal or indicate an upward trend, but do not exceed the acceptance criteria. Investigation and corrective action should be taken when acceptance criteria are exceeded. **Corrective Actions:** If the rolling geometric mean (n=5) or any one sample exceeds the acceptance criteria, then the water shall not be used whereby the cantaloupes are contacted by water until corrective actions have been completed and generic *E. coli* levels are within acceptance criteria. • Conduct a Sanitary Survey of water source and distribution system to determine if a contamination source is evident and can be eliminated. Eliminate identified contamination source(s). • For wells, perform a Sanitary Survey and / or treat as described in Appendix A. • Retest the water after conducting the Sanitary Survey and / or taking corrective actions to determine if it meets the outlined microbial acceptance criteria for this use. This sample should represent the

	Test Method: FDA BAM method or any US EPA-approved or AOAC-validated method for quantitative monitoring of water for generic *E. coli.* **Acceptance Criteria for Water:** **≤126 MPN (or CFU) /100 mL** † (rolling geometric mean n=5) and **≤235 MPN/100 mL** for any single sample. † For the purposes of water testing, MPN and CFU should be considered equivalent.	conditions of the original water system. If feasible, collect this sample as close as practical to the original sampling point. A more aggressive sampling program (i.e., sampling once per week instead of once per month) should be instituted if an explanation for the exceedence is not readily apparent. This type of sampling program should also be instituted if an upward trend is noted in normal sampling results. • **Optional* – After fruit has set, retain an additional two laboratory-supplied 1L samples of the original water that can be tested for pathogens. When the water tests exceed the acceptance criteria analyze the retained samples for pathogens. If pathogens are present, DO NOT harvest cantaloupes for human consumption. **Records**: Information requirements: Each water sample and analysis should record: the type of water (canal, reservoir, well, etc.) date, time, field location of the sample, and exact location in the water system and the method of analysis and detection limit. Records of the analysis of source water may be provided by municipalities, irrigation districts or other water providers. All test results and corrective actions should be documented and available for verification from the grower / handler who is the responsible party for a period of 2 years.
PREHARVEST Non-Foliar Applications Whereby Edible Portions of the Crop are **NOT** Contacted by Water (*e.g.*, furrow or drip irrigation, dust abatement water; if water is not used in the vicinity of produce, then testing is not necessary)	**Target Organism, Sampling Procedure, Sampling Frequency Test Method and Municipal Well Exemption:** as described for foliar application. **Acceptance Criteria:** **≤235 MPN /100 mL** (rolling geometric mean n=5) and **≤576 MPN /100 mL** for any single sample.	Testing and corrective actions for preharvest water that does not come in direct contact with edible portions of the crop are the same as for direct contact water, but acceptance criteria are less stringent because of the reduced risk of contact of the edible portion with contamination from water. Acceptance criteria here are derived from U.S. EPA recreational water standards.

Figure 3A. Decision Tree for PRE-HARVEST WATER USE – Foliar applications (e.g., overhead irrigation, pesticide / fungicide applications)

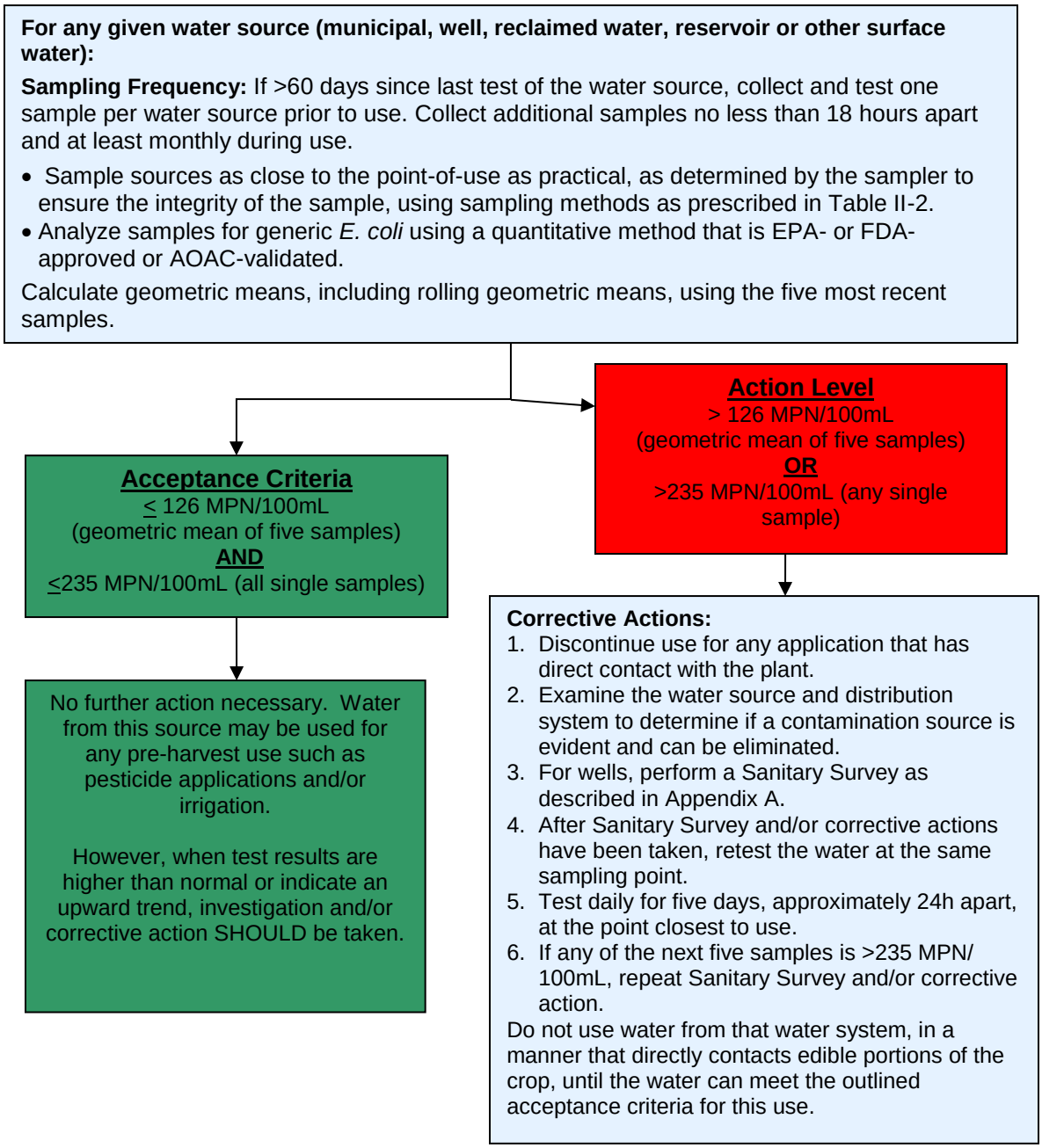
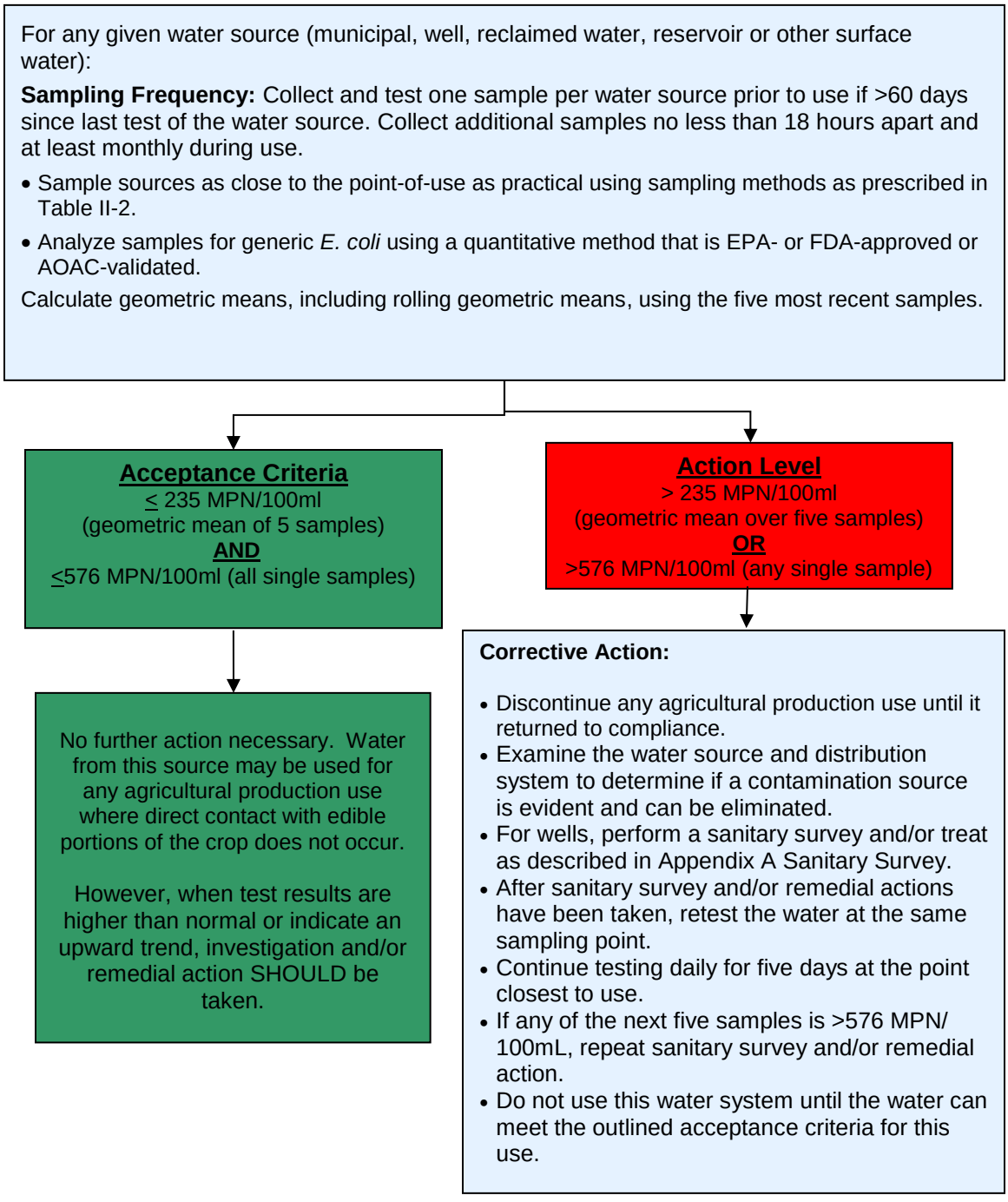


Figure 3B. Decision Tree for PRE-HARVEST WATER USE – Non-foliar applications whereby edible portions of the crop are NOT contacted by water (e.g. furrow or drip irrigation, dust abatement water)



8.2 Other Considerations for Water

- Evaluate irrigation methods (e.g., drip irrigation, overhead sprinkler, and furrow) for their potential to introduce, support, or promote the growth of human pathogens on cantaloupes. Consider such factors as the potential for the development of ground spots, depositing soil on the crop, free moisture on plant surfaces, and the presence of pooled or standing water that attracts animals.
- When water from various sources is combined, ensure all water sources meet the water quality metrics described in Table II-2.
- Storm events have considerable impact on surface waters. Bacterial loads in surface water are generally much higher than normal after a storm event, and caution should be exercised when using surface water for irrigation.
- Cantaloupes should not come in contact with ater pooled from irrigation, rainfall or storm events.
- Use procedures for storing irrigation pipes and drip tape that reduce or eliminate potential pest infestations. Develop procedures to provide for microbiologically safe use of irrigation pipes and drip tape if a pest infestation does occur.
- Reclaimed water must be subject to applicable state and federal regulations and standards. Use of this water for agricultural purposes should meet the most stringent standard as defined by state and federal regulations or Table II-2 of this document.
- If water sample results and analysis are provided by a water district or provider, they may be utilized as records of water source testing for verification and validation audits.

Documentation List:

- □ Water system description
- □ A water management plan including validation of water disinfection system
- □ SOP - Water testing
- □ Water test results that describe the methods used for analysis
- □ Water disinfectant monitoring logs

9.0 ISSUE: SOIL AMENDMENTS

Soil Amendments (SAs) are commonly (but not always) incorporated prior to planting into agricultural soils used for cantaloupe production to add organic and inorganic nutrients to the soil as well as to reduce soil compaction. Human pathogens may persist in animal manures for weeks or even months (Fukushima et al. 1999; Kudva et al. 1998). Some studies of human pathogens conducted in cultivated-field vegetable production models point towards a rapid initial die-off from high pathogen populations but often maintain a characteristic and prolonged low level pathogen survival (Hutchison et al. 2004; Islam et al. 2004a; Islam et al 2005; Nicholson et al. 2004). Proper composting of animal manures via thermal treatment will reduce the risk of potential human pathogen survival. However, the persistence of many human pathogens in agricultural soils depends on many factors (e.g., soil type, crop, soil moisture, relative humidity, UV index, cultivation practices, stress-adaption, etc.) and the effects of these factors are under extensive investigation (Jiang et al. 2003; Islam et al. 2004a; Islam et al. 2004b; Singh et

al. 2010). Field soil contaminated with human pathogens may provide a means of cantaloupe contamination.

9.1 The Best Practices Are:

- DO NOT USE raw manure, biosolids, or apply SAs that contain poultry carcasses, un-composted or incompletely composted animal manure and/or green waste, or non-thermally treated animal manure to fields which will be used for cantaloupe production.
- Verify by documentation from the compost supplier that they follow a validated method that ensures the killing of pathogens and meets regulatory requirements. California regulatory requirements outline validated processes dictating critical times and temperatures for different composting methods (see Table II-3 and Appendix F for details). New research findings suggest that rapid achievement of critical temperatures may also be important factors in pathogen die-off. Numerical criteria and guidance for compost and SAs used in cantaloupe production fields are provided in Table II-3 and Decision Trees (Figures 4A and 4B). The Technical Basis for Metrics (Appendix B) describes in more detail the process used to develop these metrics.
- Any SA that does not contain animal manure, biosolids, or incompletely composted animal manure and/or green waste shall have a certificate (e.g., ingredient list, statement of identity, letter of guaranty) from the producer or seller demonstrating that it is manure-free. The certificate shall be available for verification before application and should be saved and available for inspection for 2 years.
- Prior to application, obtain documentation demonstrating that SAs have been tested for target organisms according to the criteria outlined in Table II-3.
- Implement management plans (e.g., timing of applications, storage location, source and quality, transport) that significantly reduce the likelihood that SAs being used contain human pathogens.
- Follow the recommended time interval between SA application and time to harvest as provided in Table II-3.
- Implement practices that control, reduce or eliminate likely contamination of cantaloupe fields in close proximity to on-farm stacking of manure.
- Use SA application techniques that control, reduce, or eliminate likely contamination of surface water and / or crops being grown in adjacent fields.
- Compost suppliers should provide cantaloupe producers with the SOPs they use to prevent cross-contamination of finished compost with raw materials through equipment, runoff, animal vectors, or wind.
- Compost operations supplying compost to cantaloupe crops shall maintain temperature monitoring and turning records for at least 2 years, and growers shall obtain proof that this documentation exists. This applies to composting

operations regulated under Title 14 of California Code of Regulations (CCR) as well as smaller operations that do not fall under CCR Title 14.[13]

- Retain documentation of all processes and test results by lot (at the supplier) and / or Certificates of Analysis available for inspection for a period of at least 2 years.

Documentation List:

- ☐ Product spec sheets
- ☐ Composted SA process verification paperwork (e.g. COA, test results, etc.)
- ☐ On-farm compost processing records
- ☐ SA application dates
- ☐ Copy of any required applicator's license
- ☐ SOP - Cleaning of SA application equipment

[13] CCR. Title 14, Chapter 3.1 http://www.calrecycle.ca.gov/Laws/Regulations/title14/default.htm#Chapter3_1

Table II-3. Soil Amendments (SAs)

Amendment	Metric / Rationale
Raw Manure, Biosolids, SAs Containing Poultry Carcasses, Incompletely Composted Green Waste or Animal Manure (see composted manure process definition below)	**DO NOT USE OR APPLY** raw manure, biosolids, or SAs that contain poultry carcasses, un-composted, incompletely composted green waste, incompletely composted or non-thermally treated (e.g., heated) animal manure to fields which will be used for cantaloupe production. If these materials have been applied to a field, wait 12 months prior to harvest.
Composted SAs (containing animal manure or animal products)	**Please see Figure 4A: Decision Tree for Use of Composted SAs.** **Composting Process Validation:** Enclosed or within-vessel composting: • Active compost shall maintain a minimum of 131°F for 3 days. Windrow composting: • Active compost shall maintain aerobic conditions and a minimum of 131°F for 15 days or longer, with a minimum of five turnings during this period. Aerated static pile composting: • Active compost shall be covered with 6 to 12 inches of insulating materials and maintain a minimum of 131°F for 3 days at the surface and a positive gradient of at least 10°F at a depth of 3 ft. **Target Organisms:** • Fecal coliforms • *Salmonella* spp. • *E coli* O157:H7 **Acceptance Criteria:** • Fecal coliforms: <100 MPN/gram • *Salmonella* spp.: Negative or < DL (<1/100 grams) • *E coli* O157:H7: Negative or < DL (<1/100 grams) **Recommended Test Methods:** • Fecal coliforms: 9 tube MPN • *Salmonella* spp.: US EPA Method 1682 • *E. coli* O157:H7: Any laboratory validated method for compost sampling. • Other US EPA, FDA, or AOAC-accredited methods may be used as appropriate.

Amendment	Metric / Rationale
	Sampling Plan: • A composite sample shall be representative and random and obtained as described in the California state regulations (see Appendix F). • Sample may be taken by the supplier if trained by the testing laboratory. • Laboratory should be certified / accredited for microbial testing by an appropriate process authority. **Testing Frequency:** • Each lot before application to cantaloupe production fields. A lot is defined as a unit of production equal to or less than 5,000 cubic yards. **Application Interval:** • Must be applied >45 days before harvest. **Documentation:** • All test results and / or Certificates of Analysis shall be documented and available for verification from the grower (the responsible party) for a period of 2 years. **Rationale:** • The microbial metrics and validated processes are from California state regulations for composting operations (CCR Title 14 - Chapter 3.1 - Article 7), with the addition of testing for *E. coli* O157:H7 as microbe of particular concern. A more stringent level of fecal coliform was also included to provide necessary assurance for pathogen die-off and to compensate for the limitations of sampling and testing to detect pathogens, if they are present. The 45-day application interval was deemed appropriate as an additional precaution along with the requirements to produce composted SAs via validated methods and to test the composted SA for fecal coliforms and select pathogens. Raw manure should be composted with an approved process and pass testing requirements before an application.

Amendment	Metric / Rationale
SAs Containing Animal Manure that has Been Physically Heat Treated or Processed by Other Equivalent Methods	• Any process applied to a soil amendment containing animal manure shall be validated to assure that the process is capable of reducing pathogens of human health significance to acceptable levels. **Target Organism:** • Fecal coliforms • *Salmonella* spp. • Enterohemorrhagic *E. coli* **Acceptance Criteria:** • Fecal coliforms: < 1 MPN/gram • *Salmonella* spp.: Negative or < DL (<1/100 grams) • Enterohemorrhagic *E. coli*: Negative or < DL (<1/100 grams) **Recommended Test Methods:** • Fecal coliforms: 9 tube MPN • *Salmonella* spp.: US EPA Method 1682 • Enterohemorrhagic *E. coli*: Any laboratory validated method for testing SAs. • Other US EPA, FDA, or AOAC-accredited methods may be used as appropriate. **Sampling Plan:** • Extract at least 12 equal volume samples (identify12 separate locations from which to collect the sub-sample, in case of bagged product 12 individual bags). • Sample may be taken by the supplier if trained by the testing laboratory or state authority. • Laboratory should be certified / accredited by annual review of laboratory protocols based on GLPs by recognized NGO. **Testing Frequency:** • Each lot before application to cantaloupe fields. • In lieu of the above sampling plan recommendation, a Certificate of Process Validation issued by a recognized process authority can be substituted. This certificate will attest to the process validity as determined by either a documented (included with Certificate) inoculated pack study of the standard process or microbial inactivation calculations of organisms of significant risk (included with Certificate) as outlined in FDA CFSAN publication "Kinetics of Microbial Inactivation for Alternative Food Processing Technologies. Overarching Principles: Kinetics and Pathogens of Concern for All Technologies."

Amendment	Metric / Rationale
	Application Interval: • If the physical heat treatment process used to inactivate human pathogens of significant public health concern is validated and the soil amendment produced meets the microbial acceptance criteria outlined above, then no time interval is needed between application and harvest. • If the physical heat treatment process used to inactivate human pathogens of significant public health concern is not validated, but the soil amendment produced meets microbial acceptance criteria outlined above, then a >45-day interval between application and harvest is required. **Documentation** • Cantaloupe growers should keep the following documentation for a 2 year period: o Any SA test results and / or Certificates of Analysis shall be available for verification from the grower who is the responsible party o A copy of the SA supplier's operation validation certificate issued by a process authority • The documentation shall be available for verification before application and maintained for at least 2 years. **Rationale:** • The microbial metrics and validated processes are from California state regulations for composting operations (CCR Title 14 - Chapter 3.1 - Article 7), with the addition of testing for Enterohemorrhagic *E. coli* as the microbe of particular concern. A more stringent level of fecal coliform was also included to address the much more controlled nature of SAs produced in this manner. The above suggested application interval was deemed appropriate due to the specified multiple hurdle risk reduction approach outlined. Raw manure should be composted with an approved process and pass testing requirements before application. • FDA has established the validity of D-values and Z-values for key pathogens of concern in foods. This method of process validation is currently acceptable to U.S. regulators. Alternatively, results of an inoculated test pack utilizing the specific process and a validated strain or surrogate is also an acceptable validation of the lethality of the process.
SAs Not Containing Animal Manure	• Any SA that DOES NOT contain animal manure shall have documentation that it is manure-free. • The documentation shall be available for verification before application. • If there is documentation that the amendment does not contain manure or animal products then no additional testing is required, and no application interval is necessary • Any test results and / or Certificate of Analysis shall be available for verification from the grower who is the responsible party for a period of 2 years.

Figure 4A. Decision Tree for Composted Soil Amendments (SAs)

If raw (un-composted) manure has been directly applied to the field in the past, a one-year waiting period should be observed before planting any variety of cantaloupes.

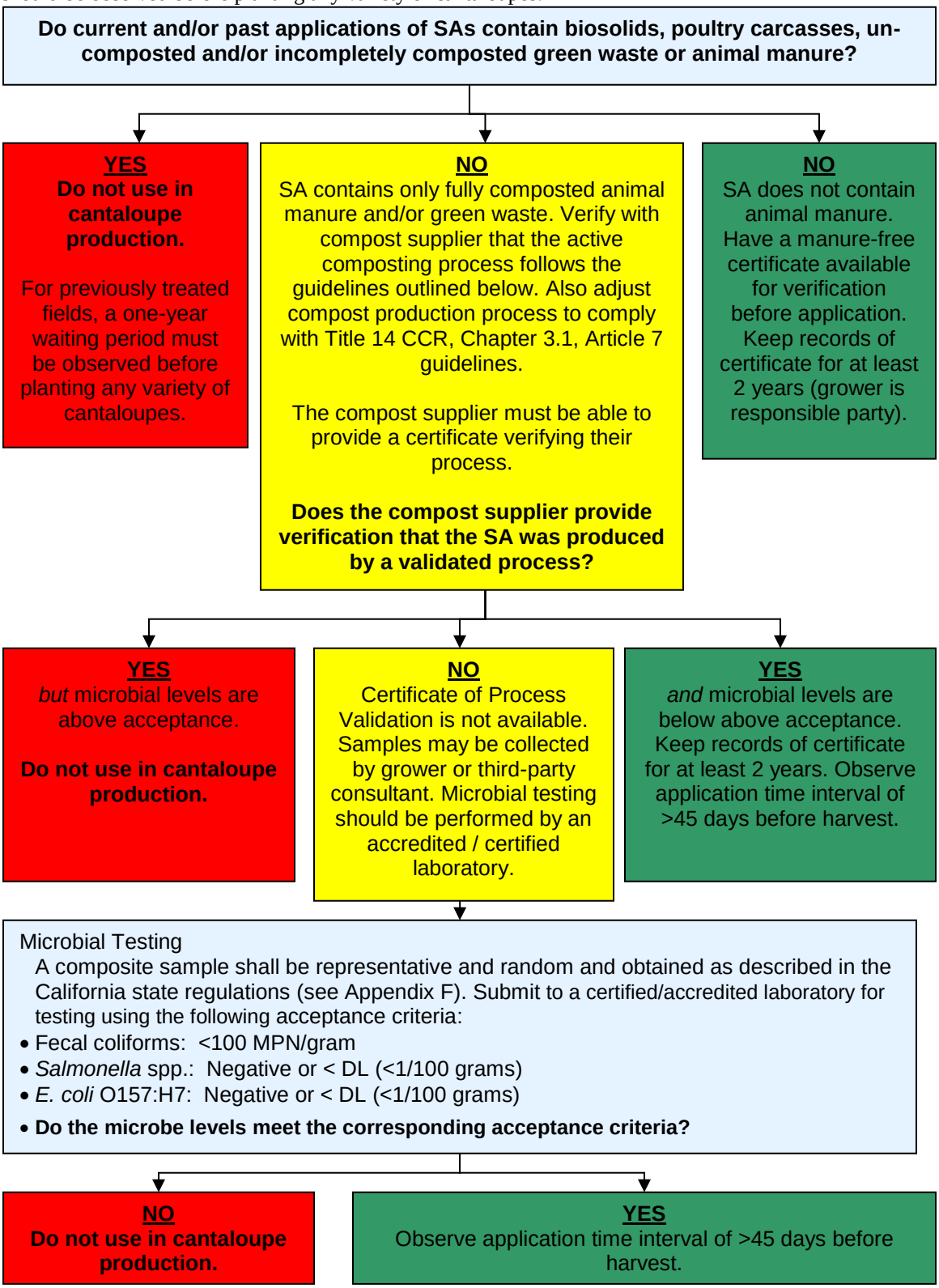
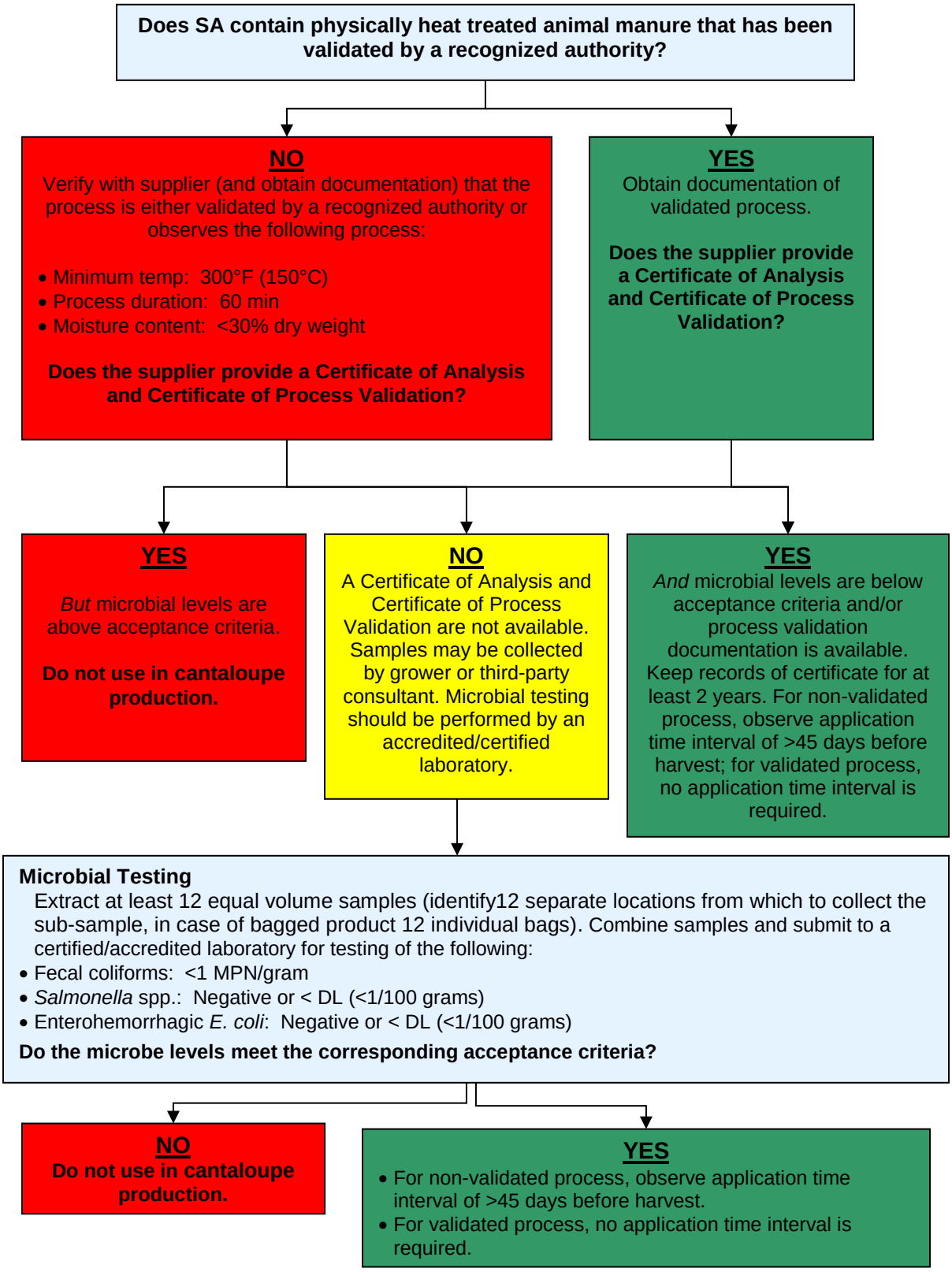


Figure 4B. Decision Tree for Physically Heat Treated Animal Manure Containing Soil Amendments (SAs)



10.0 ISSUE: NONSYNTHETIC CROP TREATMENTS

Nonsynthetic crop treatments are commonly applied post-emergence for pest and disease control, greening, and to provide organic and inorganic nutrients to the plant during the growth cycle. For the purposes of this document, they are defined as any crop treatment that contains animal manure, an animal product, and / or an animal by-product that is reasonably likely to contain human pathogens or promote multiplication of bacterial pathogens in water, soil, or on fruit. Due to the potential for human pathogen contamination, these treatments should only be used under conditions that minimize the risk of cantaloupe contamination.

10.1 The Best Practices Are:

- DO NOT USE crop treatments that contain raw manure for cantaloupe production.
- Retain documentation of supplier(s), all test results and process validation records and have available for inspection for a period of at least 2 years.
- Implement management plans (e.g., timing of applications, storage location, source and quality, transport) that assure to the greatest degree practicable that the use of crop treatments does not pose a risk of contamination.
- Verify that the time and temperature process or other process (acidification, lime treatment, etc.) used to manufacture the crop treatment reduces, controls, or eliminates the potential for human pathogens being carried in the composted materials, as applicable to regulatory requirements.
- Follow the recommended time interval between the crop treatment application and time to harvest as provided in Table II-4.
- Implement practices that control, reduce, or eliminate likely contamination of cantaloupe fields that may be in close proximity to on-farm storage of crop treatments.
- Use crop treatment application techniques that control, reduce, or eliminate the likely contamination of surface water and / or crops being grown in adjacent fields.
- See Table II-4 and Decision Tree (Figure 5) for numerical criteria and guidance for nonsynthetic crop treatments used in cantaloupe production fields.

Documentation List:

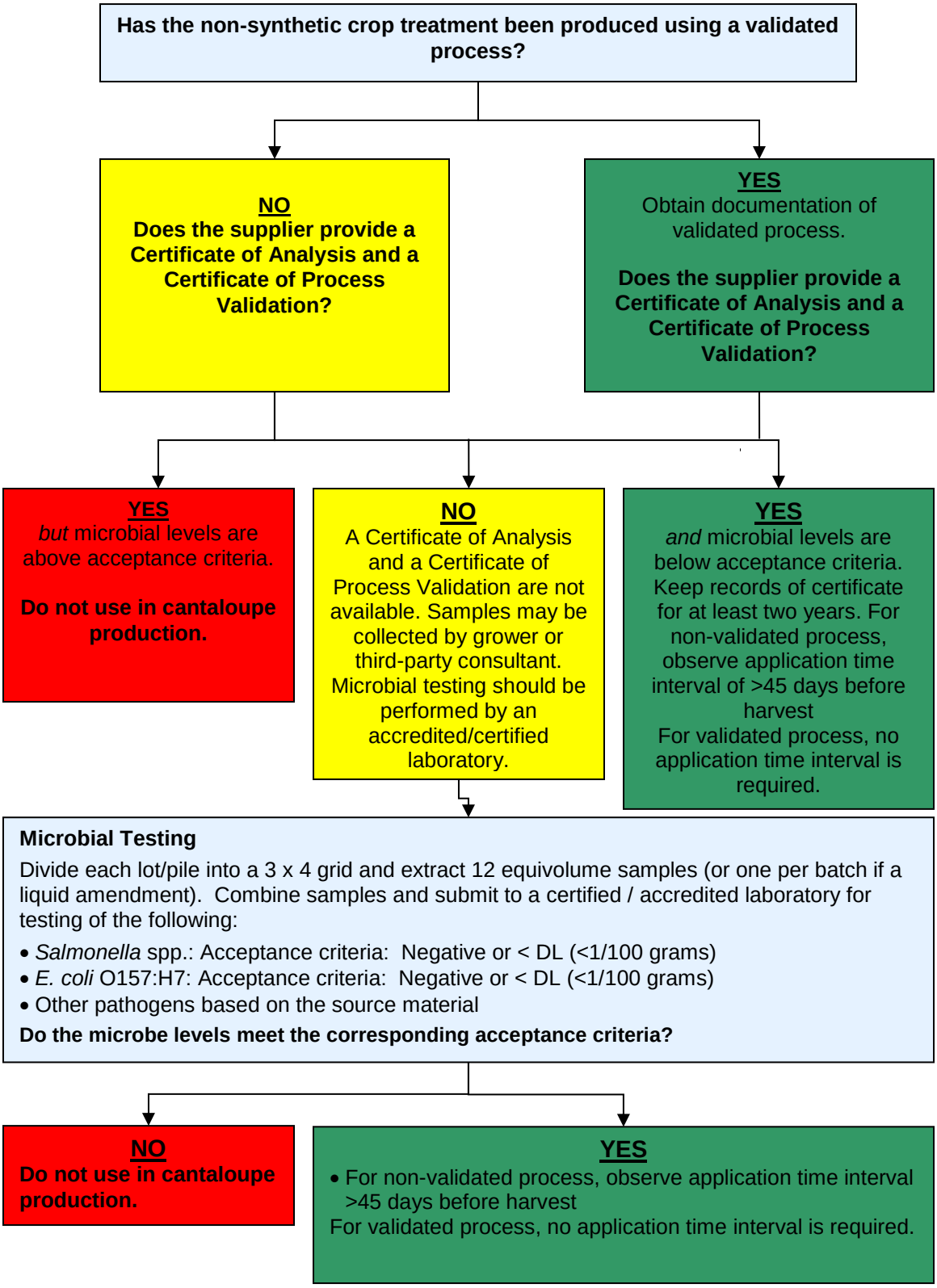
- ☐ Product spec sheets
- ☐ Composted SA process verification paperwork (e.g. COA, test results, etc.)
- ☐ On-farm processing records
- ☐ SA application dates
- ☐ Copy of any required applicator's license
- ☐ SOP - cleaning of SA application equipment

Table II-4. Nonsynthetic Crop Treatments

Treatment	Metric / Rationale
Any crop treatment that contains animal manure, an animal product, and / or an animal by-product that is reasonably likely to contain human pathogens. Examples include (but not limited to): • Compost teas • Fish emulsions • Fish meal • Blood meal • "Bio-fertilizers" commonly used for pest control, greening, disease control, fertilizing • Lime (COA needed to assure contaminant control in mined and packaged material) Suppliers of these products must disclose on labels, Certificates of Analysis, or other companion paperwork whether the product contains any animal manure or products.	**Nonsynthetic crop treatments that contain animal products or animal manure that have not been physically heat treated or processed by other equivalent methods shall NOT be directly applied to cantaloupes.** **Please see Figure 5: Decision Tree for Use of Nonsynthetic Crop Treatments.** **Process Validation** • The physical, chemical, and / or biological treatment process used to render the crop treatment safe for application to crops shall be validated. **Target Organism:** • *Salmonella* spp. • *E. coli* O157:H7 • Other pathogens appropriate for the source material. **Acceptance Criteria (at point of use):** • *Salmonella* spp.: Negative or < DL (<1/100 grams) • *E. coli* O157:H7: Negative or < DL (<1/100 grams) **Recommended Test Methods:** • *Salmonella* spp.*:* US EPA Method 1682 • *E. coli* O157:H7: Any laboratory validated method for the non-synthetic material to be tested. • Other US EPA, FDA, or AOAC-accredited methods may be used as appropriate. **Sampling Plan:** • If solid, 12 point sampling plan composite sample, or if liquid, one sample per batch (if liquid-based, then crop treatment shall meet water quality acceptance levels as described in Table II-2) • Sample may be taken by the supplier if trained by the testing laboratory. • Laboratory should be certified / accredited by annual review of laboratory protocols based on GLPs by recognized NGO. **Testing Frequency:** • Each lot before application to cantaloupe fields.

Treatment	Metric / Rationale
	Application Interval: • If the physical, chemical, and / or biological treatment process used to render the crop treatment safe for application to cantaloupes is validated and meets that microbial acceptance criteria outlined above, no time interval is needed between application and harvest. • If the physical, chemical, and / or biological treatment process used to render the crop treatment safe for application to cantaloupes is not validated yet meets the microbial acceptance criteria outlined above, a 45-day time interval between application and harvest is recommended. **Documentation:** • All test results and / or Certificates of Analysis shall be documented and available from the grower for verification for a period of 2 years. The grower is the responsible party for maintaining the appropriate records. **Rationale:** • The microbial metric for *Salmonella* spp. is from California state regulations for composting operations (CCR Title 14 - Chapter 3.1 - Article 7), with the addition of testing for *E. coli* O157:H7 as the microbe of particular concern. The above suggested application interval was deemed appropriate due to the specified multiple hurdle risk reduction approach outlined. Any nonsynthetic crop treatment that contains animal manure shall use only fully composted manure that meets the requirements outlined in Table II-3 before application to soils or directly to cantaloupes. • **Appendix B** describes in detail the process used to develop these metrics.

Figure 5. Decision Tree for Nonsynthetic Crop Treatments That Contain Animal Products



11.0 ISSUE: EQUIPMENT FACILITATED CROSS-CONTAMINATION

When farm equipment has had direct contact with raw untreated manure, untreated compost, waters of unknown quality, animal carcasses, crops that have been damaged by animals, fecal contamination or other potential human pathogen reservoirs, it may be a source of cross-contamination. Such equipment shall not be used in cantaloupe fields or in areas where it may contact cantaloupes until it has been cleaned and sanitized.

11.1 The Best Practices Are:

- Identify any operations that may pose a risk for equipment facilitated cross-contamination of cantaloupe. These include vehicles and farm equipment utilized in the fields, vehicles used to transport workers, as well as many other possibilities.
- Maintain appropriate records related to equipment cleaning and possible cross-contamination issues for a period of 2 years.

Documentation List:

- □ SSOP - Equipment used in high-risk operations
- □ Cross-contamination event log

12.0 ISSUE: CROP PROTECTION CHEMICALS

Production of safe cantaloupes requires an environment free of chemical contamination. The inappropriate use, handling and storage of crop protection chemicals may result in a chemical hazard. All federal, state and local regulations must be adhered to.

12.1 The Best Practices Are:

- Crop protection chemicals used are registered with the US EPA, state, and local for use on cantaloupes, and comply with any state or local regulations.
- Crop protection chemicals shall be applied by trained, licensed or certified pesticide personnel as required by regulation.
- Crop protection chemicals shall be used in accordance with label directions, including application rates, worker protection standards, personal protection equipment, container disposal, storage, and all requirements specified for the chemical or compound.
- Retain documentation of all crop protection chemicals for at least 2 years.
- Maintain files of up-to-date MSDS for all crop protection chemicals.

Documentation List:

- □ Copies of product labels and product spec sheets
- □ Ag chemical application dates
- □ Copy of required applicator's license

SECTION III: HARVEST AND FIELD PACKING UNIT OPERATIONS

INTRODUCTION

This section addresses best practices specific for harvest and field packing of cantaloupes. Additional relevant best practices regarding company food safety policies and plans, worker training and personal hygiene, sanitation, equipment facilitated cross-contamination, flooding, and documentation and recordkeeping are located in Section I: *Common Elements of Food Safety Programs*.

13.0 ISSUE: ENVIRONMENTAL RISK ASSESSMENTS

This section addresses the assessment of environmental conditions that should be completed during harvest operations. Environmental risk assessments are intended to identify any food safety issues related to cantaloupe fields, adjacent land uses that might impact safety, or natural events that might occur at the time of harvest that might compromise safety, e.g. fecal contamination, flooding, etc. (see Table III-1). Cantaloupes are generally grown in rural areas that may have adjacent wetlands, wildlands parks and/or other areas where animals may be present. Some animal species are known to be potential carriers of various human pathogens (Fenlon 1985; Gorski et al. 2011; Jay et al. 2007; Keene et al. 1997; LeJeune et al. 2008; Perz et al. 2001). Uncertainties in the literature about which wildlife species might be the most likely to contaminate fields as well as difficulty excluding some types of animals from fields (i.e., birds, reptiles) has led to the recommendation that if crop damage from animals or fecal contamination is detected, measures should be taken to prevent the harvest of any potentially contaminated cantaloupes. In addition, extensive development in certain farming communities has also created situations with urban encroachment and unintentional access by domestic animals, livestock, and human activity, which may also pose varying degrees of risk and should be considered when assessing risks. It is important to tailor practices and procedures designed to promote food safety to the unique environment in which cantaloupes are produced. Each grower or handler should take into account the growing environment when performing a risk assessment.

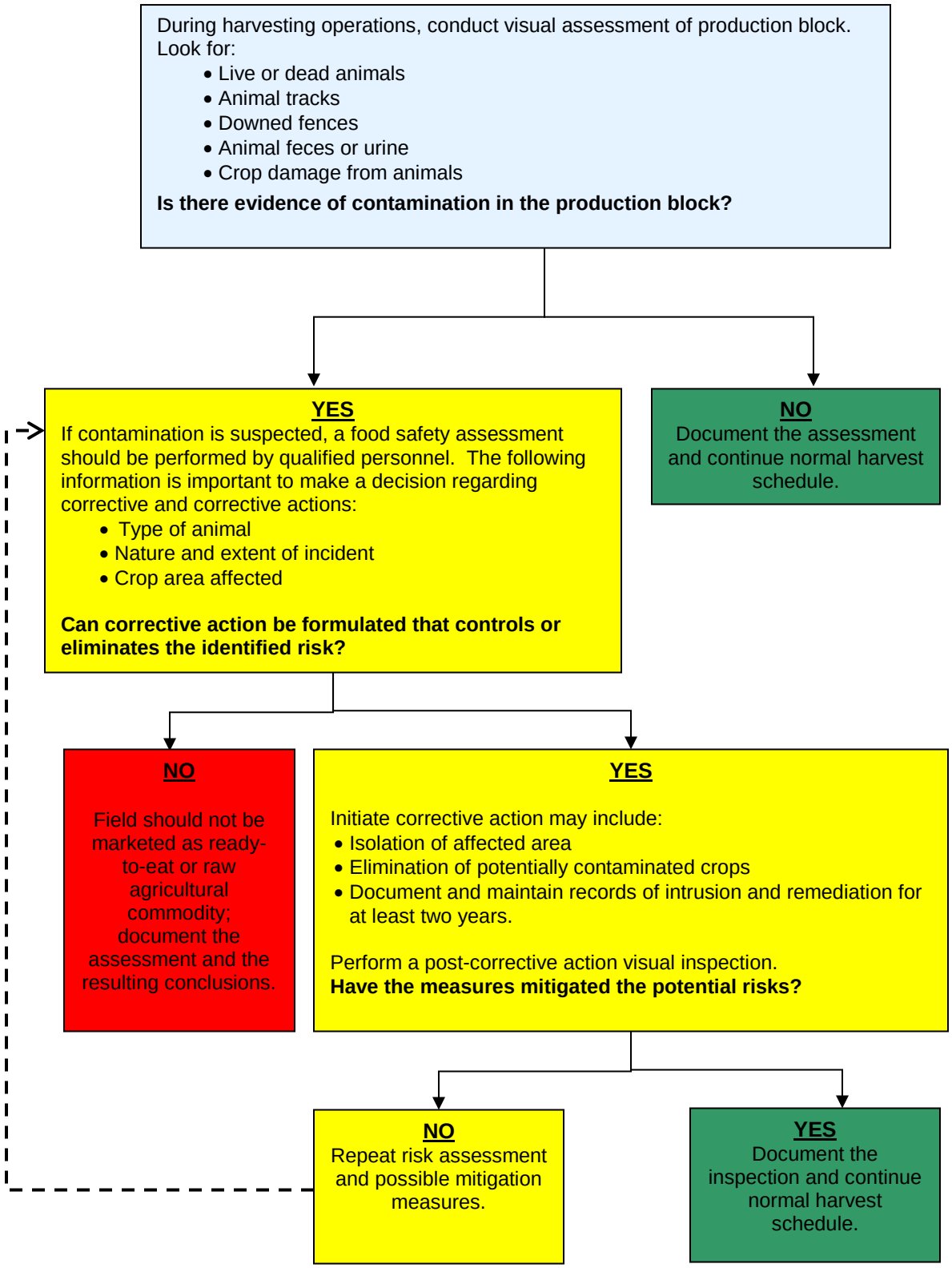
13.1 The Best Practices Are: Harvest Assessment

- During harvest operations, assess cantaloupe fields, water sources and surrounding area and document any of the following observations:
    - Any changes that may have occurred since the pre-harvest assessment.
    - Evidence of crop damage from animals and fecal contamination. Additional information is provided in Table III-1 and Figure 6.
    - Evidence of open and/or unsecured chemicals.
    - Any other factor that might increase the risk of microbial contamination.

Table III-1. Harvest Environmental Risk Assessment

Issue	Corrective Actions
Evidence of Fecal Contamination Variables • Observation of animals in the field • Downed fences • Animal tracks in the field • Animal feces or urine in the field • Crop damage (trampled, eaten plants) in the field	If fecal material, crop damage, or animals are observed in the field during harvest operations: • Stop harvest operations in affected areas. • Initiate an intensified block assessment for evidence of further contamination and take appropriate actions per the aforementioned actions. • If evidence of crop damage from animals is discovered during harvest operations and equipment has been potentially contaminated by contaminated product or feces, clean and sanitize the equipment before resuming harvest operations. • Before resuming harvest operations, all workers should wash and sanitize their hands / gloves and any clothing that came in contact with feces • If contamination is discovered in harvest containers such as bins / totes, discard and destroy the harvested cantaloupes that had contact with the contaminated containers, and clean and sanitize the container before reuse.
Allowable Harvest Distance from Flooding	• Buffer and do not harvest cantaloupes within 30 ft. of the flooding. • Recommended buffer distance may be greater than 30 ft. based on risk analysis by food safety professional. • If there is evidence of flooding, the field should undergo a detailed food safety assessment by appropriately trained food safety personnel (see Glossary) prior to harvest, as defined in the text of this document (See Appendix E for an example food safety assessment).
Verification	• Archive documentation for a period of 2 years following the contamination event. Documentation may include photographs, sketched maps, or other means of delineating affected portions of cantaloupe fields.
Rationale	• The basis of the guidelines related to fecal contamination is qualitative assessment of the relative risk from a variety of intrusions. Fecal material is the primary food safety risk factor; crop damage may indicate risk of undetected fecal contamination. Because it is difficult to develop quantitative metrics for these types of risks, a food safety assessment is considered appropriate for this issue. • **Appendix B** describes in detail the process used to develop the flood-related metrics.

Figure 6. Decision Tree for Conducting Harvest Assessment of the Risk of Fecal Contamination



14.0 ISSUE: HARVEST

Cantaloupe harvest is usually based on the stage of maturity as judged by the formation of an abscission zone between the vine and the cantaloupe. This characteristic of cantaloupe maturity is commonly called "slip," and most cantaloupes are harvested between ¾ and full slip. Cantaloupe stem scars may provide a potential route for entry of human pathogens to the cantaloupe's edible flesh. As cantaloupes mature and ripen, they have a greater propensity to allow for the survival and multiplication of human pathogens on their surface (Ukuku 2002).

Best practices for worker training and personal hygiene, equipment, equipment facilitated cross-contamination, and documentation and recordkeeping are located in Section I: *Common Elements of Food Safety Programs*. Best practices for containers are addressed below in Section 17.0 *Issue: Harvest and Field Packing Containers*.

14.1 The Best Practices Are: General Recommendations

- Prior to harvest, an individual shall be designated as responsible for harvesting food safety. This person should be available when cantaloupes are being harvested.
- When a field is to be harvested more than once, develop practices and procedures to protect against the introduction of pathogens (for best practices see below).
- As harvest time approaches, schedule irrigation so as to avoid exposing the plants to excessive mud and soil.
- Train harvest employees to recognize and not harvest melons that have mechanical damage or possible contamination from previous harvest operations or from animal activities.

15.0 ISSUE: FIELD PACKING OPERATIONS

Cantaloupes are often packed directly in the field after harvest. Field packing includes any practice that involves grading, sorting, cleaning, or packing of cantaloupes into containers for commerce while in the field. Product contact containers and tools may be a source of microbiological, chemical or physical contamination if they are not handled and stored in a sanitary manner.

Best practices for worker training and personal hygiene, equipment, equipment facilitated cross-contamination, and documentation and recordkeeping are located in Section I: *Common Elements of Food Safety Programs*. Best practices for containers are addressed below in Section 17.0 *Issue: Harvest and Field Packing Containers*.

15.1 The Best Practices Are:

- Establish a procedure for inspecting and accepting or rejecting cantaloupes.
- Exclude damaged or decayed cantaloupes and discard in a manner that does not attract insects.
- Discard foreign objects and debris in an appropriate location.

- Remove loose soil from product prior to packing.
- To the degree feasible, minimize holding time for cantaloupe prior to cooling operations.
- Any surface that touches harvested cantaloupes shall be considered a food contact surface and shall be treated in a manner so as to not be a source of contamination. For more on food contact surfaces, see equipment cleaning and sanitation best practices in 4.2 *The Best Practices Are: Food Contact Surfaces, Facilities and Equipment*
- Establish a SOP to ensure that all essential field information is appropriately maintained and transferred to downstream operations for recordkeeping.

Documentation List:

- □ SOP - Worker hygienic practices
- □ SOP - Packing materials handling and storage

16.0 ISSUE: WATER USED DURING HARVEST AND FIELD PACKING

Water can be a source or transference vehicle for microbial or chemical cross-contamination. Therefore, it is critical to conduct a thorough hazard assessment that evaluates the cantaloupe (e.g., exterior, stem), sources of water to be used, and delivery methods to determine if the quality of the water to be used during harvest and field packing is of sufficient quality for its intended use. It is important to consider the source of the water along with its intended use. Care should be taken to ensure that cantaloupes are not inadvertently contaminated by the use of water not ideally suited for the intended purpose.

16.1 The Best Practices Are:

- Establish a water management plan as part of your Food Safety Plan that includes preventive controls, monitoring and verification procedures, corrective actions and documentation.
- Use water in harvest and field packing operations that meets or does not exceed the acceptance criteria outlined in Table III-2.
- If water quality microbial tests are at levels that exceed the acceptance criteria set forth in Table III-2, follow recommendations for corrective actions as outlined in the table and in Figure 7.
- Have a written procedure for water testing that includes frequency of sampling, who is taking the samples, where the sample is taken, the volume of the sample, how the sample is collected, type of test and acceptance criteria. For guidelines see Table III-2.
    - Test water as close to the point-of-use as practical, and if microbial levels are above specific action levels, take appropriate corrective actions.
    - Retain documentation of all test results and / or Certificates of Analysis available for inspection for a period of at least 2 years.

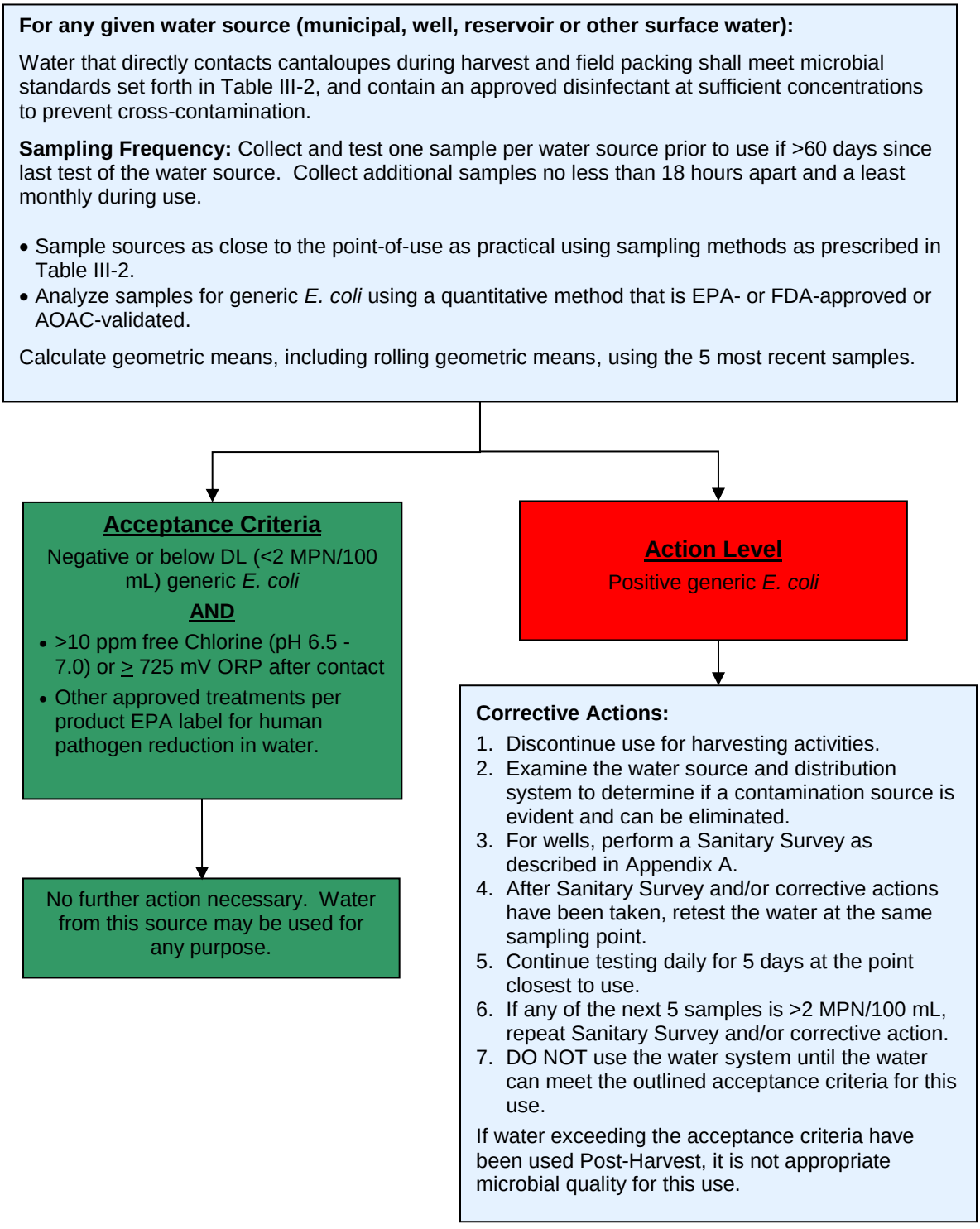
- Water used on cantaloupes or food contact surfaces during harvest and packing activities must have sufficient levels of disinfectant so as not to result in adulteration of the product by cross-contamination as specified in Table III-2.
- If a chlorine-based disinfectant is used, the active disinfectant level shall be measured and documented (i.e., measure free chlorine and not total chlorine). Continuous monitoring of disinfectant levels is preferred.
- Follow manufacturer's directions for mixing of disinfectant chemicals to obtain effective concentrations; a manufacturer's suggested or allowable level in washing and cooling water shall not be exceeded.

Table III-2. Water Use During Harvest and Field Packing

Use	Metric	Rationale / Corrective Actions
Direct Product Contact or Food Contact Surfaces	**<u>Microbial Testing</u>** **Target Organism:** Generic *E. coli* **Sampling Procedure:** A minimum of 1 L sample collected aseptically at the point of use **Sampling Frequency:** Collect and test one sample per water source prior to use if >60 days since last test of the water source. Collect additional samples at intervals of no less than 18 hours and at least monthly during use. **Municipal & Well Exemption:** For wells and municipal water sources, if *generic E. coli* levels are below detection limits for five consecutive samples, the sampling frequency may be decreased to once every six months and the recommendations for 60 and 30 day sampling are waived. This exemption is void if there is a significant source or distribution system change. **Test Method:** FDA BAM method or any US EPA-approved or AOAC-validated method for quantitative monitoring of water for *generic E. coli.* **Acceptance Criteria:**	For any given water source (e.g. municipal, well), collect samples for microbial testing as close to the point of use as practical (as determined by the sampler to ensure the integrity of the sample) using sampling methods as prescribed in this table where the water contacts cantaloupes, so as to test both the water source and the water distribution system. Only one sample per month per distribution system is recommended under these metrics. If there are multiple potential point-of-use sampling points in a distribution system, then samples should be taken from different point-of-use locations each subsequent month (randomize or rotate sample locations). Water that directly contacts harvested cantaloupes or is used on food contact surfaces such as equipment or utensils, shall come from a source that meets the Maximum Contaminant Level Goal of zero or no detection for *generic E. coli* in drinking water as specified by US EPA and once in use, contain an approved disinfectant at sufficient concentration 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 and Recirculated Water Systems** • Single pass use – Water shall have non-detectable levels of generic *E. coli* and sufficient disinfectant to ensure water has no detectable generic *E. coli* (minimally 10 ppm chlorine). • Recirculated use – Water shall have non-detectable levels of generic *E. coli* and sufficient disinfectant to ensure returned water has no detectable generic *E. coli* (minimally 10 ppm chlorine). * Single pass and recirculated water treated with chlorine-based disinfectants shall be tested for free chlorine concentration (ppm) and pH <u>OR</u> for oxidation reduction potential (mV). The selected method should be verified periodically with the alternative process verification method <u>AND</u> by ensuring that established microbial acceptance criterion for water is being met. **Corrective Actions**: If any one sample exceeds the acceptance criteria, then the water shall not be used for this purpose unless appropriate disinfectants have been added or until corrective actions have been completed and generic *E. coli* levels are within acceptance criteria: • Conduct a sanitary survey of the water source and distribution system to determine if a contamination source is evident and can be eliminated. Eliminate identified contamination source(s) if applicable. • For wells, perform a sanitary survey and / or treat as described in the sanitary survey (Appendix A).

	Negative or Below DL for All Samples	• Retest the water at the same sampling point after conducting the sanitary survey and / or taking corrective actions to determine if it meets the outlined microbial acceptance criteria for this use. For example, if a water sample for water used to clean food contact surfaces has detectable generic *E. coli*, STOP using that water system, examine the distribution line, source the inlet as described in the sanitary survey (Appendix A), and retest from the same point of use. Continue testing daily for five days at the point closest to use, and do not use the water system until it consistently delivers water that is safe, sanitary, and meets the acceptance criteria outlined in this table. If any of the five samples taken during the intensive sampling period after corrective actions have detectable generic *E. coli*, repeat corrective actions and DO NOT use that water system until the source of contamination can be corrected. **Records**: All test results and corrective actions shall be documented and available for verification from the user of the water for a period of 2 years.
	<u>Physical / Chemical Testing</u> **Target Variable:** Water disinfectant (e.g. chlorine-based compounds or other disinfectants) **Water Disinfecting Criteria:** • US EPA-**approved disinfecting treatments** per product label for human pathogen reduction in water and used in accordance with a water system-specific protocol that has been validated to show that active disinfectant is present. • **Chlorine-based disinfectants** <u>≥</u>10 ppm free chlorine after application and pH 6.5 – 7.0 • ORP <u>≥</u> 725 mV* **Testing Procedure:** • Chemical reaction based colorimetric test, or • Ion specific probe, or • ORP,* or • Other as recommended by disinfectant supplier. **Testing Frequency:** Continuous monitoring (preferred) with periodic verification by titration OR routine monitoring if the system can be shown to have a low degree of variation.	

Figure 7. Water Use for Direct Contact with Cantaloupes or Food Contact Surfaces



17.0 ISSUE: HARVEST AND FIELD PACKING CONTAINERS

In California, cantaloupes are harvested and field-packed before being transported to a customer or harvested in bulk containers before being transported to a packinghouse. Product containers, packaging materials, and pallets may be a source of microbial contamination if they are not handled and stored in a sanitary manner. In addition, the reuse of product containers poses a risk of cross-contamination if containers have not been properly cleaned and sanitized.

17.1 The Best Practices Are:

- Establish a SOP for inspecting all incoming finished product packing materials and shipping containers to ensure that they are in sanitary condition and suitable for use. The inspection procedure should also include an inspection of vehicles that transport these containers to ensure no foreign material, pests, or pest contamination exists.
- Field containers shall be distinguishable from finished product containers (e.g., by color, design, or label). Field containers shall be used, maintained, and inventoried separately from finished product containers.
- Prepare a SOP for harvest and field packing containers that addresses the following:
    - Daily inspection of all containers used in harvesting and field packing prior to use to check for any containers deficiencies or maintenance requirements.
    - Periodic inspections of container condition and replacement of damaged containers.
- Prepare a SOP for the handling and storage of product containers that addresses the following:
    - Overnight storage. All containers and packaging materials shall be stored in a clean environment with appropriate perimeters and covered so as to mitigate contamination by rodents, birds, wind-blown dirt, or chemical sprays. Storage areas shall have a pest control program.
    - Contact with the ground including instructions not to stack soiled bins/boxes/RPCs on top of each other if the bottom has had direct contact with soil unless a protective barrier (e.g., lid, liner, cover, etc.) is used to separate the containers.
    - If liners or other barriers are used, precautions shall be taken to prevent them from becoming a source of contamination.
    - Proper container assembly (boxes, RPC, bin, etc.)
    - Damaged and/or potentially contaminated containers. Any product containers that are identified as potentially contaminated and not suitable for use shall be discarded.
    - Use of containers only as intended.

- Prohibit the re-use of single-use containers (e.g. corrugated boxes) for the field packing of cantaloupes.
- Properly label finished product containers used in field packing operations with information for traceability.
- Prepare a SSOP for reusable containers that addresses the following:
    - Cleaning frequency, sanitizer type and concentration, and specific cleaning procedure.
    - Cleaning before subsequent usage.
    - Cleaning of containers that come into direct contact with soil between uses.
    - Cleaning and sanitation in a manner that will not contaminate cantaloupes or other equipment.
    - Documentation of cleaning activities shall include the concentration of sanitizer used, date and time of cleaning, and the initials of the employee performing the task.
    - Verify the efficacy of container cleaning and sanitation methods and develop a test plan for the cleaning verification methods.
- Establish a pallet inspection and repair program (SOP). Pallets used with post-harvest and finished product containers should be in good condition (i.e., free from loose pieces such as nails or staples) and not used for production and harvesting activities. Damaged wood pallets should not be used.

Documentation List:

- ☐ SOP containers used in harvesting and field packing operations
- ☐ SSOP for reusable containers
- ☐ SOP for container cleaning verification methods
- ☐ SOP for container handling and storage
- ☐ SOP for pallet inspection and repair program

SECTION IV: FACILITIES

INTRODUCTION

This section addresses best practices specific for facilities used for packing, cooling and storage/holding of cantaloupes. Additional relevant best practices regarding company food safety policies and plans, worker training and personal hygiene, sanitation, and documentation and recordkeeping are located in Section I: *Common Elements of Food Safety Programs*.

19.0 ISSUE: FACILITY CONSTRUCTION, DESIGN AND MAINTENANCE

A well designed and managed facility and its corresponding food safety program can reduce the risk of microbial contamination. The needs of each facility may vary due to location, environment, the volume of cantaloupes handled, local requirements, and many other variables. Although there may be multiple strategies for effectively dealing with individual hazards, the overall goal of an effective packinghouse food safety program is to minimize risk of contamination.

Although packing, cooling and cold storage facilities are not considered to be manufacturing or processing facilities, these guidelines encourage facilities that pack and cool cantaloupes to follow the requirements for buildings and grounds, packing and holding of foods, equipment and utensils, toilet facilities and controls, and sanitary operations as provided for under 21 CFR Part 110, as appropriate to the facility. Facilities that are used seasonally may be dormant between uses leaving them susceptible to pest infestations and microbial contamination. Physical design, product flow, construction materials, facility traffic, and airflow can play a role in direct contamination and cross-contamination of cantaloupes. Facilities and staging areas should be designed to facilitate maintenance and good sanitation practices so that the potential for contamination may be controlled throughout receiving, cooling, packing, and holding of cantaloupes.

19.1 The Best Practices Are: Facility Grounds

The grounds around the packinghouse shall be kept in a condition that will control, reduce, or eliminate the risk of food contamination. Grounds maintenance includes, but is not limited to:

- Properly store equipment, remove litter and waste, and cut weeds or grass around the buildings or structures that may constitute an attractant, breeding place, or harborage for pests.
- Maintain roads, yards, and parking lots so that they do not constitute a source of contamination in areas where cantaloupes are exposed. Roads should be paved or otherwise managed to prevent dust.
- Evaluate adjacent land use to ensure that it does not pose a significant risk of product contamination.
- Operate systems for waste treatment and disposal in an adequate manner so that they do not constitute a source of contamination in areas where cantaloupes are exposed.

19.2 The Best Practices Are: General Recommendations

Facilities and equipment used in the cooling and packing of cantaloupes shall be designed, constructed and maintained to facilitate cleaning and sanitization. Forced air cooling facilities should be designed and constructed to provide optimal air flow and to facilitate cleaning and sanitization. Buildings, fixtures, and equipment should be maintained in a sanitary condition and should be kept in repair sufficient to prevent food from becoming adulterated.

- Conduct and document a risk assessment of your facilities that addresses areas of potential risk. If applicable, the following items should be considered in your assessment:
    - The building structure is managed such that potential cross contamination from pests can be controlled.
    - Air intakes are not located near potential sources of contamination.
    - To provide adequate drainage and prevent accumulation of water, floors are sloped to drains, and kept in good repair.
    - Floor drains are designed to be accessible for cleaning and capable of preventing pest entry.
    - Food contact surfaces are constructed of materials that are readily cleaned and sanitized and do not serve as harborage of microbial pathogens.
    - Avoid use of hollow structures such as table legs, conveyer rollers, and racks because they may collect water and debris, and thus, harbor pathogens.
    - Sufficiently elevate food contact surface above the floor to prevent contamination from floor splashes.
    - Raw and finished product storage areas are separated to reduce the potential for cross-contamination.
    - Lights are equipped with shatter-proof light bulbs or have similar protective coverings to prevent broken fixture material from contaminating cantaloupes.
    - Overhead equipment, structures or fixtures, walls, pipelines, etc. should be designed to avoid condensation that has the potential to be a contamination source.
    - Facility water systems are equipped with back-flow prevention devices to prevent potential contamination of the water supply. Test backflow prevention devices at least annually.
    - Waste water collection areas are designed to prevent product and equipment contamination.
    - Provide a designated area not in a food handling area for employees, visitors and third parties to store personal items.

19.3 The Best Practices Are: Pest Control

- All pesticides, traps, bait, and chemicals used in facilities must be acceptable for use in and around a food packing facility and used in accordance with local, state, and federal regulations.
    - Permit the use of insecticides or rodenticides inside the facility only under precautions and restrictions that will protect against the contamination of food, food-contact surfaces, and food-packaging materials.
    - These materials must only be used by properly trained and accredited personnel. A record of use should be kept available for inspection along with the appropriate applicators licenses and documentation. Applicators should also show records of training, continuing education, etc.
    - If rodent traps are deployed around the inside of the facility and bait stations along the outside perimeter of the facility, detailed maps demonstrating the location of each trap and bait station must be available for review. Routinely inspect traps and bait stations and document any corrective actions taken (e.g., cleaning out traps, replacing damaged traps).
- If pest control is performed internally or by a third-party pest control company, a copy of the applicator's license, any chemicals used, MSDS, and a schedule of the applicator's activities and actions should be maintained and available for review.
- An inspection buffer must be maintained on both the inside and outside perimeters of the physical facility (e.g., pallets, raw product and equipment may not be stored flush against the wall of the facility).

19.4 The Best Practices Are: Cooling and Cold Storage

- Humidifiers should be designed to supply clean, homogeneous humidity in the chamber.
- Cooling systems' condensation units should drain directly into drainage systems. Emptying of this water into floor drains should be prohibited.

20.0 ISSUE: FACILITY SANITARY OPERATIONS

Contamination by location and / or flow of humans, product, equipment, and air can be prevented by adequate food safety controls, operating practices, and facility design. A facility should be designed so that cantaloupes arriving from the field never cross paths with, or are commingled with, finished product. Operators should be aware of and operate in accordance with all relevant laws and regulations that describe facility sanitation practices. [14, 15]

[14] OSHA. Sanitation 1910.141
http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9790
[15] Code of Federal Regulations, Title 21, Part 110 – Current Good Manufacturing Practice in Manufacturing, Packing, or Holding Human Food. http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=fe4d3406434fbb5824f74776dadefb66&rgn=div5&view=text&node=21:2.0.1.1.10&idno=21

20.1 The Best Practices Are: General Recommendations

- Each facility shall have a flow diagram of the operation and should perform a hazard analysis for the operation. This analysis shall be documented and available for review. If the operator changes the process (e.g., updated equipment), then the analysis must be updated and revised.
- Cantaloupes must not come into contact with the floor or any other non-food contact surface. Cantaloupes that fall on the floor must be discarded.
- Floors should have proper drainage to avoid water build-up and reduce the potential for cross-contamination.
- Protect food contact surfaces from contact with non-potable water.
- Condensation provides conditions optimal for microbial growth and may potentially serve as a source of cross-contamination. In the event that condensation forms in the facility, develop a management plan to ensure that it does not pose a risk of contamination to cantaloupes and food contact surfaces.
- Appropriate measures must be taken for waste water disposal.
- Garbage should be placed in appropriate receptacles and removed from the facility on a regularly scheduled basis.
- Clearly designate receptacles for their intended use (e.g., trash, recyclable materials or product that might be re-worked). Train employees to recognize and use material receptacles appropriately.
- Clearly designate all tools to denote those tools that are only used for food contact and those that are used for general cleaning and may contact non-food contact surfaces.
- Store old, unused equipment in a manner that does not present a food safety hazard.

20.2 The Best Practices Are: Cooling and Cold Storage

- Stack crates/bins in a manner that allows for uniform air flow and distribution.
- All equipment used to control environmental conditions such as temperature and humidity shall be maintained and calibrated on a routine basis. Calibration activities must be documented.

21.0 ISSUE: RECEIVING

When cantaloupes are delivered from the field to the facility they should undergo an inspection process prior to receiving at the facility. During receiving it is critical that all essential field information is appropriately maintained and transferred to downstream operations for recordkeeping.

21.1 The Best Practices Are: General Recommendations

- Establish a procedure for inspecting and accepting or rejecting incoming loads of cantaloupes.

- Reduce the temperature of the cantaloupe as soon as feasible after receiving.
- Ensure that incoming documentation provides sufficient information to facilitate product traceability and establish a SOP to maintain that documentation.

22.0 ISSUE: UNLOADING OPERATIONS

When cantaloupes are received at the packing or cooling facility, they are typically unloaded from field bins, open flatbed wagons, or gondolas by dry dump or dumping/immersing into water-filled tanks. In dumping operations there is potential for cantaloupe-to-cantaloupe, food contact surface-to-cantaloupe, and cantaloupe-to-water-to-cantaloupe cross contamination.

22.1 The Best Practices Are:

- Unloading operations are conducted in a manner that minimizes, reduces, or eliminates the potential for cross-contamination
- If gondolas/trailers/wagons are immersed in water, ensure water quality is maintained (as outlined in Table IV-1) due to the potential for product cross contamination from dirt and debris on the gondolas/trailer/wagon exterior.
- If wet dump stations are used, water quality must meet the criteria outlined in Table IV-1. Dump tank water must have sufficient water disinfectant present and the levels monitored as described in Table IV-1.

23.0 ISSUE: COOLING FIELD CANTALOUPES

Field packed cantaloupes are typically cooled by forced-air cooling or by use of a chilled water drench or flume immersion. Cantaloupe cooling with water, if done correctly may reduce microbial loads on the outside surface of cantaloupes by 2-3 logs CFU (Park and Beuchat, 1999; Rodgers et al., 2004). Microbial reduction on cantaloupe surfaces is dependent on disinfectant concentration and contact time. However, it must be remembered that human pathogens once present on the surface of a cantaloupe cannot be completely eliminated by washing (Parnell et al., 2005). Soaking cantaloupes in aqueous solutions containing wash water disinfectants for very long periods of time is not an effective means of eliminating surface microbial contamination of the cantaloupe rind and may actually aid in the infiltration of human pathogens into the edible portions by creating an infiltration driving force. Cantaloupe cooling water may also be a significant source of microbial cross contamination if there is insufficient water disinfectant present. Also because cantaloupe cooling water is colder than the cantaloupes, infiltration of small amounts of cooling water may enter cantaloupes through the stem scar and rind. (Richards and Beuchat, 2004). Forced-air cooling operations may also spread product contamination if forced air cooling equipment is not cleaned and sanitized regularly.

23.1 The Best Practices Are:

- If cold water is used to cool cantaloupes it shall be of sufficient microbial quality for its intended purpose (Table IV-1).
- If cantaloupe cooling water is re-circulated, water disinfectant shall be present at sufficient levels and the levels monitored to reduce the potential risk of cross

contamination (Table IV-1). If cantaloupes are fully submerged in water as a means of cooling, they are more likely to have cooling water infiltration into the cantaloupes and consideration should be given to cooling water quality variables such as pH, organic load, turbidity, product through-put capacity, etc. to assure that the wash water disinfectant of choice is effective in reducing the potential for water-to-cantaloupe cross contamination. (See Suslow (1997) and Suslow (2001) for details.)

- Single pass or one use cooling water of sufficient quality for this intended purpose may also be used to cool product, but the use of a water disinfectant must be present at sufficient levels and the levels monitored to reduce the potential risk of cross contamination.
- When recirculating water, procedures must be established to determine when and how often water should be refreshed or completely changed out.
- If wash water is used to cool cantaloupes, equipment must be cleaned and sanitized on a regular basis to assure that the potential for cross contamination is minimized.
- If forced-air cooling is used to cool cantaloupes, equipment must be cleaned and sanitized on a regular basis to assure that the potential for cross contamination is minimized.

24.0 ISSUE: FACILITY WATER USE

Assuring the microbial quality of water used in packing, pre-cooling and cooling operations is critical as water provides a means for spreading contamination to and among product. Facilities may utilize water for unloading, washing, pre-cooling, cleaning and sanitation as well as other purposes. Water may be single-use or recirculated. If water is used in a facility, water quality is critical for preventing potential cross-contamination. Studies have shown that pathogens in water can adhere to and infiltrate cantaloupes (Richards, 2004; Ukuku, 2002). When used appropriately with water of adequate quality, disinfectants help minimize growth of microorganisms in the wash water and the subsequent cross contamination of the product. The effectiveness of a disinfectant and the amount that should be used depends on the type of product and the treatment conditions, such as water temperature, acidity (pH), water hardness, contact time, amount and rate of product throughput, water to product ratio, amount of organic material, and the resistance of pathogens to the particular disinfectant. For a list of chemicals that may be safely used to wash fruits and vegetables, see 21 CFR 173.315.[16]

24.1 The Best Practices Are: Water Quality

- Establish a water management plan as part of your Food Safety Plan that includes preventative controls, monitoring and verification procedures, corrective actions and documentation.

[16]FDA. 2009. CFR - Code of Federal Regulations Title 21.
http://www.accessdata.fda.gov/SCRIPTs/cdrh/cfdocs/cfcfr/CFRSearch.cfm?fr=173.315&SearchTerm=chemicals

- The source of water used in packing operations that directly contacts cantaloupes must meet US EPA microbial standards for total coliforms in drinking water.
    - The water source must be tested as specified in Table IV-1. If a municipal water source is used, microbial water quality information from the respective municipal water authority may be obtained and archived if it is reported as total coliforms. Periodically test water quality at point of use to verify the facility water distribution system.
    - Develop an action plan in case municipal water authorities issue a water quality alert or warning such as "boil water warning." Document and archive any warning or alerts issued by the water authority as well as corrective actions taken by your firm to address this issue.
- Water used on cantaloupes or food contact surfaces in the packinghouse must have sufficient levels of disinfectant so as not to result in adulteration of the product by cross-contamination as specified in Table IV-1. Include pH measurement in appropriate records and documentation.
- If a chlorine-based disinfectant is used, measure and document the active disinfectant level (i.e., measure free chlorine and not total chlorine). Continuous monitoring of disinfectant levels is preferred.
- Follow manufacturer's directions for mixing of disinfectant chemicals to obtain effective concentrations; a manufacturer's suggested or allowable level in washing and cooling water shall not be exceeded.
- All instrumentation used to measure and monitor disinfectants shall be well maintained and calibrated daily. Disinfectant measurements and equipment calibrations must be documented.
- The person monitoring the water disinfectant levels should know when to add disinfectant based on values obtained.
- Any other substance (e.g., processing aids or organic acids for pH control) used to treat the wash water shall be approved by the US EPA or FDA for use in the manner that it is applied and monitored to verify correct concentration. Monitoring activities should be documented.
- If filtering devices are used, they must be maintained in a sanitary condition to minimize the buildup of organic material in recirculated wash water.
- When recirculating water, procedures must be established to determine when and how often water should be refreshed or completely changed out.
- Appropriate measures must be taken for waste water disposal.

Table IV-1. Facility Water Use

Use	Metric	Rationale / Corrective Actions
Direct Product Contact or Food Contact Surfaces	**<u>Microbial Testing</u>** **Target Organism:** Total coliforms **Sampling Procedure:** A minimum of 1 L sample collected aseptically at the point of use **Sampling Frequency:** One sample per water source should be collected and tested prior to use if >60 days since last test of the water source. Additional samples should be collected at intervals of no less than 18 hours and at least monthly during use. **Municipal & Well Exemption:** For wells and municipal water sources, if total coliform levels are below detection limits for five consecutive samples, the sampling frequency may be decreased to once every six months and the recommendations for 60 and 30 day sampling are waived. This exemption is void if there is a significant source or distribution system change. **Test Method:** FDA BAM method or any US EPA-approved or AOAC-validated method for quantitative monitoring of water for total coliforms. **Acceptance Criteria:** **Negative or Below DL for All Samples**	For any given water source (e.g. municipal, well), samples for microbial testing should be taken as close to the point of use as practical (as determined by the sampler to ensure the integrity of the sample) using sampling methods as prescribed in this table where the water contacts cantaloupes, so as to test both the water source and the water distribution system. Only one sample per month per distribution system is recommended under these metrics. If there are multiple potential point-of-use sampling points in a distribution system, then samples should be taken from different point-of-use locations each subsequent month (randomize or rotate sample locations). Water that directly contacts harvested cantaloupes or is used on food contact surfaces such as equipment or utensils, should come from a source that meets the Maximum Contaminant Level Goal of zero or no detection for total coliforms in drinking water as specified by US EPA and once in use, contain an approved disinfectant at sufficient concentration to prevent cross-contamination. Microbial or physical / chemical testing should be performed, as appropriate to the specific operation, to demonstrate that acceptance criteria have been met. **Single Pass and Recirculated Water Systems** • Single pass use – Water should have non-detectable levels of total coliform and sufficient disinfectant to ensure water has no detectable total coliform (minimally 10 ppm chlorine). • Recirculated use – Water should have non-detectable levels of total coliform and sufficient disinfectant to ensure returned water has no detectable total coliform (minimally 10 ppm chlorine). * Single pass and recirculated water treated with chlorine-based disinfectants should be tested for free chlorine concentration (ppm) and pH <u>OR</u> for oxidation reduction potential (mV). The selected method should be verified periodically with the alternative process verification method <u>AND</u> by ensuring that established microbial acceptance criterion for water is being met. **Corrective Actions**: If any one sample exceeds the acceptance criteria, then the water should not be used for this purpose unless appropriate disinfectants have been added or until corrective actions have been completed and total coliform levels are within acceptance criteria: • Conduct a Sanitary Survey of the water source and distribution system to determine if a contamination source is evident and can be eliminated. Eliminate identified contamination source(s) if applicable. • For wells, perform a Sanitary Survey and / or treat as described in the Sanitary Survey (Appendix A). • Retest the water at the same sampling point after conducting the Sanitary Survey and / or taking

		corrective actions to determine if it meets the outlined microbial acceptance criteria for this use.
	<u>Physical / Chemical Testing</u> **Target Variable:** Water disinfectant (e.g. chlorine-based compounds or other disinfectants) **Water Disinfecting Acceptance Criteria:** • US EPA-**approved disinfecting treatments** per product label for human pathogen reduction in water and used in accordance with a water system-specific protocol that has been validated to show that active disinfectant is present. • **Chlorine-based disinfectants** <u>≥</u>10 ppm free chlorine after application and pH 6.5 – 7.0 • ORP <u>≥</u> 725 mV* **Testing Procedure:** • Chemical reaction based colorimetric test, or • Ion specific probe, or • ORP,* or • Other as recommended by disinfectant supplier. **Testing Frequency:** Continuous monitoring (preferred) with periodic verification by titration OR routine monitoring if the system can be shown to have a low degree of variation.	For example, if a water sample for water used to clean food contact surfaces has detectable total coliforms, STOP using that water system, examine the distribution line, source the inlet as described in the Sanitary Survey (Appendix A), and retest from the same point of use. Continue testing daily for five days at the point closest to use, and do not use the water system until it consistently delivers water that is safe, sanitary, and meets the acceptance criteria outlined in this table. If any of the five samples taken during the intensive sampling period after corrective actions have detectable total coliforms, repeat corrective actions and DO NOT use that water system until the source of contamination can be corrected. **Records**: All test results and corrective actions should be documented and available for verification from the user of the water for a period of 2 years.

25.0 ISSUE: POST-HARVEST PRODUCT CONTAINERS, PACKAGING MATERIALS, FINISHED PRODUCT CONTAINERS AND PALLETS

During packing operations, cantaloupes may be packed for shipping in bulk or packaged in market-ready packaging. Post-harvest product containers, packaging materials, finished product containers, and pallets may be a source of microbial contamination if they are not handled and stored in a sanitary manner. In addition, the reuse of containers and pallets that previously may have been used for other products provides the potential for cross-contamination if they have not been transported and stored in a sanitary manner. Finally, pallets used to transport empty containers, packing materials, and finished product should be kept clean and in good condition.

25.1 The Best Practices Are: Post-Harvest Product Containers

- Post-Harvest product containers are distinguishable from field containers (e.g., by color, design, or label). Field containers must be used, maintained, and inventoried separately from post-harvest product containers.
- Use product contact containers that are constructed of or covered or sleeved with materials that can be readily cleaned and sanitized.
- Store post-harvest containers in a manner that protects against pest infestations, dust and debris.
- Develop SSOPs for cleaning and sanitizing reused post-harvest product containers. Topics addressed shall include (but are not limited to):
    - Cleaning frequency, sanitizer type and concentration, and specific cleaning procedure.
    - Documentation that includes the concentration of sanitizer used, date and time of cleaning, and the initials of the employee performing the task.

25.2 The Best Practices Are: Finished Product Containers, Packaging Materials, Pallets

- Establish a SOP for inspecting all incoming finished product packing materials and shipping containers to ensure that they are in sanitary condition and suitable for use. The inspection procedure should also include an inspection of vehicles that transport these containers to ensure no foreign material, pests, or pest contamination exists.
- Measures should be taken to protect finished product containers and packaging materials from wind-blown dirt, chemical sprays, birds, rodents or other pests.
- The storage area or carton yard shall be kept clean and shall be included in the facility pest control program.
- Maintain a perimeter to facilitate inspection, cleaning, and pest control devices in the storage area.
- Discard any finished product containers and packaging materials that are identified as potentially contaminated and not suitable for use in storing food products.
- Finished product containers shall be labeled appropriately for traceability purposes.

26.0 ISSUE: COLD STORAGE AND WAREHOUSING

Cold storage and warehouse facilities are often the last area that house cantaloupes before they are shipped to the next point of the supply chain. The conditions and sanitation programs of these facilities are critical in maintaining the integrity of the finished product before it exits the facility.

26.1 The Best Practices Are:

- Finished cantaloupes must be stored and warehoused under conditions that will protect them against physical, chemical, and microbial contamination as well as against deterioration of the product and the container.
- Cantaloupes must be stored at appropriate temperatures according to industry standards.
- Refrigeration units shall be inspected on a regular basis and kept in good operating condition.
- Temperature monitoring devices shall be placed in the warmest area of the refrigerator unit and calibrated on a regular basis.
- Condensate / water from evaporator-type refrigeration systems should be contained in catchments designed to assure that it does not become a source of contamination. Water from refrigeration catchments should be drained and disposed of away from product and product contact surfaces.
- The storage area shall be included in the facility's master cleaning schedule and pest control program.
- Forklifts and other pallet moving equipment shall be included in the master sanitation schedule and cleaned on a regular basis.

SECTION V: TRANSPORTATION

27.0 ISSUE: TRANSPORTATION

Conditions under which cantaloupes are transported may provide opportunities for microbial contamination. Cantaloupes may be transported by numerous modes of transportation that may or may not be refrigerated. Transportation of cantaloupes should be managed to reduce, control, or eliminate the risk of contamination.

27.1 The Best Practices Are: General Recommendations

- Prepare a SOP for loading and unloading procedures that addresses the following:
    - Inspection of transport trailers to verify that food safety needs are being met. Items that may be evaluated include (but are not limited to) the trailer condition, overall cleanliness, good structural condition, etc.
    - Procedures to assure that prior loads hauled in transport trailers do not potentially contaminate cantaloupes during transport.
    - Air-ride suspensions should be used to minimize fruit injury in transit and create abrasions or openings for pathogen internalization and growth
- The vehicle operator should have a written sanitation procedure (type and frequency of cleaning and sanitizers) for cleaning transport vehicles and schedule / log of cleaning activity.
- Perform periodic maintenance and inspections on transport vehicles (e.g., inspect for any evidence of fluid leaks). Document findings and actions taken to fix the problem. Do not use equipment that is actively leaking fluids in transporting cantaloupes.
- If cantaloupes are covered during transport, materials used to cover cantaloupes should be in good condition with established procedures for cleaning and sanitizing them.
- Load and unload in a manner that minimizes damage and contamination.
- Verify that refrigerated units are operating, appropriately cooled and capable of maintaining desired temperatures prior to loading cantaloupes. Obtain documentation from operator that appropriate temperatures are maintained for the particular cantaloupe being transported.

28.0 DETAILED BACKGROUND GUIDANCE INFORMATION AND RESOURCES

"Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables," U.S. Food and Drug Administration, 1998. (http://www.fda.gov/Food/GuidanceComplianceRegulatoryInformation/GuidanceDocuments/ProduceandPlanProducts/ucm064574.htm)

"Guide to Minimize Microbial Food Safety Hazards for Fresh-cut Fruits and Vegetables," U.S. Food and Drug Administration, 2008. (http://www.fda.gov/food/guidancecomplianceregulatoryinformation/guidancedocuments/produceandplanproducts/ucm064458.htm)

"Guide to Traceback of Fresh Fruit and Vegetables Implicated in Epidemiological Investigations," U.S. Food and Drug Administration, 2001. (http://www.fda.gov/downloads/ICECI/Inspections/InspectionGuides/ucm109502.doc)

Current Good Manufacturing Practice in Manufacturing, Processing, Packing, or Holding Human Food, Code of Federal Regulations, Title 21, Part 110. (http://www.accessdata.fda.gov/SCRIPTs/cdrh/cfdocs/cfcfr/CFRSearch.cfm?CFRPart=110)

The Produce Traceability Initiative: http://www.producetraceability.org/

"Food Safety Guidelines for the Fresh-Cut Produce Industry," United Fresh Produce Association, 2001. (http://www2.unitedfresh.org/forms/store/ProductFormPublic/)

"Fresh-cut Produce Handling Guidelines," United Fresh Produce Association, 2001. (http://www2.unitedfresh.org/forms/store/ProductFormPublic/)

"Food Safety Auditing Guidelines: Core Elements of Good Agricultural Practices for Fresh Fruits and Vegetables." United Fresh Produce Association, 2001. (http://www2.unitedfresh.org/forms/store/ProductFormPublic/)

"Food Safety Begins on the Farm: A Grower Self Assessment of Food Safety Risks," National GAPs Program Cornell University, 2003. (http://www.gaps.cornell.edu/farmassessmentws.html)

"Guide to Federal Food Safety and Security Inspections: Guidance on Preparing for and Successfully Directing Regulatory Inspections by FDA and other Food Authorities," United Fresh Produce Association, 2005. (http://www2.unitedfresh.org/forms/store/ProductFormPublic/)

"Food Security Guidelines and Questionnaire for Fresh Fruits and Vegetables," United Fresh Produce Association, 2001. (http://www2.unitedfresh.org/forms/store/ProductFormPublic/)

Bioterrorism Act of 2002.

(http://www.fda.gov/RegulatoryInformation/Legislation/ucm148797.htm)

Food Facility Registration

(http://www.fda.gov/Food/FoodDefense/Bioterrorism/FoodFacilityRegistration/default.htm)

Prior notice of imported food shipments
(http://www.fda.gov/Food/FoodDefense/Bioterrorism/PriorNotice/default.htm)

Reportable Food Registry
(http://www.fda.gov/Food/FoodSafety/FoodSafetyPrograms/RFR/default.htm)

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APPENDICES

FOR THE

CALIFORNIA

Commodity Specific Food Safety Guidelines for
the Production, Harvest, Cooling, Packing, Storage, and Transporting
of Cantaloupes and Other Netted Melons

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FORWARD

These appendices are resources created to supplement the *California Commodity Specific Food Safety Guidelines for the Production, Harvest, Cooling, Packing, Storage, and Transporting of Cantaloupes and Other Netted Melons.*

APPENDIX A: SANITARY SURVEY AND REMEDIATION GUIDELINES FOR WATER RESOURCES

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1.0 INTRODUCTION

The Sanitary Survey and Remediation Guidelines described below are to be used as follow-up to situations encountered while using the *California Commodity Specific Food Safety Guidelines for the Production, Harvest, Cooling, Packing, Storage, and Transporting of Cantaloupes and Other Netted Melons*. This report provides an action plan when a water sample taken closest to the point-of-use has levels of generic *E. coli* (production) or total coliforms (packinghouse or processing facility) above acceptance criteria.

For purposes of this report:

- A sanitary survey is an inspection of the entire water system, including water source, facilities, and equipment, for the purpose of identifying conditions that may result in contamination.
- Remediation guidelines describe corrective actions corresponding to the conditions observed in the sanitary survey.

A sanitary survey of water systems should also be conducted periodically to prevent contamination. Sanitary surveys:

- Reduce the risk of waterborne disease.
- Provide an opportunity to enhance your knowledge of your water system.
- Identify and document system deficiencies.

This document prescribes a sanitary survey be performed prior to the start of the growing season on water supplies and distribution systems used in the production of fresh herbs. There are also some remediation approaches in this document that require that a Sanitary Survey be performed such as when source water used in packing and processing facilities exceeds the acceptance criteria for total coliforms. In addition, a sanitary survey is a useful tool for packing and processing facilities in managing their food safety and HACCP programs.

In the Production and Harvest Unit Operations section, Figures 3A and 3B have certain "red-box" situations when water samples taken closest to the point-of-use result in generic *E. coli* levels above an action level. In these situations, a sanitary survey is initiated to determine any potential sources of contamination. In general, when conducting a sanitary survey the reliability, quality, and vulnerability of your water system are being investigated. To get started:

While irrigating cantaloupe production areas, irrigation water tests are above acceptance criteria (this situation brings you to a red box in a decision tree in Figure 3A or 3B). Continue the investigative process as stated in the blue-box instructions in the decision tree:

1. Perform a generic *E. coli* test on a water sample taken at or as close to the source as possible. This result of this test will help to determine where the source of the contamination might reside. Depending on the results of this test, additional tests may be used to further narrow the exact location of the contamination entering the distribution system.
2. Initiate a sanitary survey of your water system:
    - Begin the sanitary survey process at the water source and continue surveying the water system between the water source and the site of the positive sample.
    - For specific water sources, follow the guidelines for conducting Sanitary Surveys and corresponding remediation outlined below.

1.1 Water sources

Whenever possible the sanitary survey should begin at the water system source as this is the first opportunity for controlling microbial contaminants. When investigating your water system source, you should identify the characteristics and activities that may lead to microbial contamination.

1.1.1 Wells

1.1.1.1 Sanitary Survey and Remediation Guidelines for Wells

Sanitary surveys of wells should focus on the integrity (meaning the state of repair) of the well components and the condition of the area surrounding the well. Inspect your wellhead on a regular basis and keep records of inspections and repairs. Issues to consider when surveying the surrounding area are:

Proximity to:

- Livestock – including animal burial grounds, feedlots, manure pits/lagoons
- Sewers and septic systems
- Irrigation systems

Tables 1 and 2 below provide guidelines for doing surveys of a well's components and the condition of the surrounding area.

TABLE 1. Survey of Well Components

Well component	Survey Guidelines	Remediation guidelines
Well casing	Listen for water running down into the well. If you can hear water, there could be a crack or hole in the casing. If you can move the casing by pushing against it, you may also have a problem with the integrity of the casing. Well casing should extend at least 18 inches above the ground.	*Contact a well contractor or other trained individual for well casing repair or construction of a new well.
Annular space (The space between two well casings or between the casing and the wall of the drilled hole.)	The annular space of the well should have a minimum of 25 feet of sealing material.	*Contact a contractor or other trained individual for correction of a deficient annular space seal or construction of a new well.
Well cap or seal	Well should be completely sealed against surface water, insects, or other foreign matter. Look for holes, missing plugs, leaking water. If artesian flow install appropriate check valve.	Replace any missing plugs and seal any openings, gaps or cracks. *Contact a well contractor or other trained individual to install a new cap and/or wellhead gasket.
Well vent	Check the cleanliness & integrity of the well vent screen. Look for tears or holes.	Vents must be covered with a screen. Replaced damaged vent screen.
Concrete well pad	Look for cracks that would allow water to enter well casing.	Seal cracks or re-pour a new concrete pad. Ground should slope away from well so that surface water cannot collect near the well.
Well pump	Make sure pump is operating properly; check for corrosion.	Clean, repair or replace pump
*Many California counties' Departments of Environmental Health have listings of licensed contractors. Information taken from *A Guide For The Private Well Owner, Santa Clara Valley Water District, County of Santa Clara, Department of Environmental Health* and *Preparing for a Sanitary Survey: Information to Help Small Water Systems, WA State Dept of Health, DOH Pub.#331-238.*		

TABLE 2. Survey of the Area Surrounding the Well

Issue	Survey Guidelines		Remediation guidelines
Cleanliness	Look for debris.		Manually remove debris.
Gradient	There is standing water around the well or water draining toward the well. Well is downstream from a potential contaminant source.		Re-grade around the well so the ground slopes away from your well. Move either the well or potential contaminant source.
Potential contaminant source	Minimum horizontal distance from:		
	Any sewer	50 ft.	Move potential contaminant source to meet the minimum guidelines.
	Watertight septic tank or subsurface sewage leaching field	100 ft.	
	Cesspool or seepage pit	150 ft.	
	Animal enclosure	100 ft.	
Information taken from *DWR – Southern District Water Well Standards, Part II, Section 8* and *A Guide For The Private Well Owner, Santa Clara Valley Water District, County of Santa Clara, Department of Environmental Health*			

1.1.1.2 Remediation: Well Disinfection

If generic *E. coli* (production) or total coliforms (packinghouse or processing facility) level in well water sample is above corresponding action levels, wells must be disinfected in order to remove the contamination. Follow the disinfection steps outlined below and keep records of when, why and how disinfection was done.

TABLE 3. Disinfection steps:

Steps	Detailed Disinfection Instructions	Step Summary
1.	A chlorine solution containing at least 50 mg/l (or ppm - parts per million) available chlorine, is added to the well. If bringing the well back into service quickly is desired (such as when wells have been repaired or when a pump has been repaired or replaced), the solution should contain at least 100 mg/l available chlorine.	Using Tables A-F to make a 50 ppm (mg/L) chlorine solution and add it to the well.
2.	To prevent contamination of the well during disinfection, first clean the work area around the top of the well. Remove grease and mineral deposits from accessible parts of the well head and flush the outside surfaces with chlorine solution (1/2 cup of laundry bleach in 5 gal of water). Turn off the pump. Remove the cap or the well plug on the rubber seal. There are many	Clean surrounding area & disinfect well head. Turn off the pump. Remove well cap. Wash sides of well casing, pump

Steps	Detailed Disinfection Instructions	Step Summary
	types of well caps and plugs. If you have questions, you should contact a licensed well driller. If you have a submersible pump, you may also want to contact a licensed well driller for advice on disinfection procedures. Wash the pump column, drop pipe, or anything inserted into the well with chlorine solution. Try to coat the sides of the casing as you pour. NOTE: To prevent later corrosion, thoroughly flush sensitive pump parts such as wiring with fresh water after disinfection process is completed.	column, and anything inserted into the well with chlorine solution.
3.	After it has been placed into position, turn the pump on and off several times so as to thoroughly mix the disinfectant with the water in the well. Repeat this procedure **3-5x** at 1-hour intervals. Test for the presence of chlorine in well discharge with a residual chlorine test; if chlorine is not detected, the disinfection process should be repeated. NOTE: Inexpensive color comparator residual chlorine test kits can be purchased from most large department stores and swimming pool supply companies.	Mix well water by turning pump on and off several times until discharge tests positive for residual chlorine. Repeat 3-**5x** at 1 hr. intervals.
4.	The well shall be allowed to stand without pumping for 24 hours.	Let pump/well rest for 24 hours.
5.	The waste water shall then be pumped to land and contained. Avoid all water conveyance features such as swales, ditches, canals, creeks or streams. Do not allow overland flow to reach surface waters. Pump until presence of chlorine is not detectable. The absence of chlorine is best determined by testing for available chlorine residual (Inexpensive color comparator residual chlorine test kits can be purchased from most large department stores and swimming pool supply companies.). NOTE: Heavily chlorinated water should not be discharged into any plumbing system that utilizes individual sewage disposal systems (septic tanks). Such strong disinfectants could neutralize the bacteria needed to stabilize the sewage and also could damage the soil adsorption system.	Pump water to a safe waste location until chlorine is no longer detected.
6.	A bacteriological sample shall be taken and submitted to a laboratory for examination. For individual wells, technical advice regarding the collection of bacteriological samples may be obtained from your local health departments or from the laboratories that will examine the sample.	Take a water sample using sanitary techniques and submit it to a lab for testing.

Steps	Detailed Disinfection Instructions	Step Summary
	If no technical assistance is available, use the following procedure: Use a new sterile sample collection container (it can be a collection bag i.e. Whirl-Pak®) preferably a bottle provided by the laboratory to ensure the integrity of the sample, but Before sampling ensure that the sample container is properly labeled with location, date, and time of sampling. It is extremely important that nothing except the water to be analyzed come in contact with the inside of the bottle or the cap; the water must not be allowed to flow over an object (such as the hands) and into the container while it is being filled. If the water is collected from a sample tap, turn on the tap and allow the water to flow for 2 or 3 minutes before collecting the sample. Do not rinse the sample container. The sample should be delivered to the laboratory as soon as possible and in no case more than 30 hours after its collection. It is recommended to chill samples in an ice chest or refrigerator immediately after collection. During delivery, the sample should be kept as cool as possible. Do not freeze samples. U.S EPA recommends holding water samples below 50°F during transit when testing for total coliforms; however, there is evidence this is also valid for *E.coli*.	
7.	Testing should be performed and results interpreted. Testing for total coliforms is currently approved by U.S. EPA to verify drinking water disinfection with "zero" as the Maximum Contaminant Level Goal (MCLG). If the laboratory analysis indicates microbial contamination, the disinfection procedure should be repeated. Depending on the level of contamination, it may be necessary to use a higher concentration chlorine solution and re-test the water. If repeated attempts to disinfect the well are unsuccessful, a detailed investigation to determine the cause of the contamination should be undertaken.	If testing shows microbial levels are still above acceptable action levels, repeat the disinfection process.
Information taken from *DWR –Southern District, Water Well Standards, Appendix C*.		

1.1.2 Surface Water in Canals, Laterals, and Ditches

1.1.2.1 Sanitary Survey and Remediation Guidelines for Surface Water

Sanitary surveys of canals, laterals, and ditches should focus on the integrity of surrounding bank systems focusing on potential point source and non-point source confluences (e.g. drainage into these systems). Inspections should occur on a regular basis. Keep records of the date of inspection and any observations made.

TABLE 4. Guidelines for Assessment of Surface Water

Issues	Survey Guidelines	Remediation guidelines
Evidence of animal intrusion around the water source	Look for evidence of animal intrusion (observed animal in canal, fecal deposits, or animal carcasses).	Remove animal debris; if animal intrusion is a regular occurrence, investigate the potential cause for intrusion and re-test the source.
Contaminating waters	Look for dirty/contaminated water that may be draining into the canal.	Redirect contaminating water with diversion dikes, gradients, inlet/outlet control structures, etc.
Cleanliness	Look for trash and debris accumulation.	Remove and dispose of items away from water.

1.1.2.2 Remediation by Disinfection

Management of microbial contamination in flowing water is difficult. If water source is not from a managed irrigation district, disinfection is not an option. If water source is from a managed irrigation district, contact the irrigation district manager. It may also be possible to treat (disinfect) water between pump and filter or after filter.

1.1.3 Well Reservoirs

1.1.3.1 Sanitary Survey and Remediation Guidelines for Well Reservoirs

Sanitary surveys of well reservoirs should focus on the condition of the source water, the integrity of the reservoir's surrounding bank system, and potential for contamination from both point source (e.g. animal feces) and non-point sources (e.g. influent). Inspections should occur on a regular basis. Keep records of the date of inspection and any observations made.

TABLE 5. Guidelines for Assessment of Well Reservoirs

Issues	Survey Guidelines	Remediation guidelines
Contaminated well (source) water	Biannual or pre-production testing of source or well water as described in *Decision Tree for Well Head* reveals contamination.	Options: • Drain reservoir and allow to dry. Disinfect connection system before refilling reservoir with disinfected well water. • Treat water as it is taken from the reservoir.

Evidence of animal intrusion around the water source	Look for evidence of animal intrusion (observed animal in reservoir, fecal deposits, carcasses, etc.).	Remove animal debris. If animal intrusion is a regular occurrence consider isolating reservoir with fences.
Contaminating influent	Look for dirty/contaminated water that may be draining into reservoir. Caution should be exercised when back-flushing filtration systems so that this water does not return directly to the source.	Redirect water with diversion dikes, gradients, drainage pipes, inlet control structures, etc. A managed grassed buffer zone around reservoir (but not on banks) helps prevent contamination.
Overflow pipe	Observe whether opening is clean and free of weeds and debris.	Cover opening with a mesh screen.

1.2 Irrigation Systems

Contamination of irrigation systems can be avoided with proper maintenance and storage. Documented inspections should occur on a routine basis, and additionally when microbial levels of irrigation water are above acceptable levels.

1.2.1 Sanitary Survey for Irrigation Systems

- Mechanical components (Clark 1996; Benham 2002)
  - Check primary and secondary filtration equipment for cleanliness and proper function.
  - Check for leaks on seals, gaskets, and fittings.
- Water lines
  - Check water lines for visual evidence of microbial growth (Clark 1996).
    - white stringy slime
    - red filamentous sludge
  - For drip irrigation systems, use of chlorination treatment is advised if water source is not chlorinated.[17]
    - Because bacteria can grow in filters, inject chlorine upstream from filter units.
    - Chlorine may be injected continuously (at concentration of 1-2 ppm) or as a shock treatment (at concentrations of 10-30 ppm).
    - A general formula for calculating the amount of chlorine for injection is: (Clark 1996; see footnote for an example) [18]

      IR = Q x C x 0.006/S

      Where IR = injection rate (gal/hr.); Q = irrigation system flow rate

[2] Example: A grower wishes to use household bleach (NaOC at 5.25% active chlorine) to achieve a 3 ppm chlorine level at the injection point. The flow rate of his irrigation system is 90 gal/min. IR = 90 gal/min x 3 ppm x 0.006/5.25 = 0.31 gallon per hour. At an irrigation flow rate of 90 gal/min, the grower is pumping: 90 gal/min x 60 min = 5400 gal/hr. The goal is to inject 0.31 gallon of bleach into 5400 gallons of water each hour that injection occurs. If the injector is set for a 300:1 ratio, it will inject 5400/300 or 18 gal/hr. Then, 0.31 gallon of bleach should be added to 18 gallons of water in the stock solution. Note: be careful to use the same time units (hours) when calculating the injection rate.

(gal/min); C = the desired chlorine concentration (ppm); and S = strength of chlorine solution used (percent).

- Chlorine materials commonly used and their corresponding strength (S)
  - Sodium hypochlorite (household bleach): 5.25 – 15%
  - Calcium hypochlorite (dry): 65 – 70%
  - Chlorine gas: 100%
- It may be necessary to lower the pH during chlorination to increase the effectiveness of the microbial action.[19]
  - pH should be $\leq$ 7.0
  - acid and chlorine should be added to the system 2 – 3 feet apart
  - never combine chlorine and acid in the same container

- Establish a documented regular maintenance schedule of inspection and flushing.

1.3 Water Holding Tanks

The water holding tank site should be well maintained and properly graded. The tank should be located away from livestock and septic systems.

1.3.1 Sanitary Survey for Water Holding Tank

- Area around the tank:
  - Whether it is on the ground or elevated, the base of the tank should be visible
  - Should be clean and free of debris and weeds
- On a routine basis inspect each water holding tank to ensure:
  - Structural soundness (interior and exterior damage or rust)
  - No vegetation is growing on tank
  - Access hatch lids are properly gasketed and secured
  - If vents are present, they should be adequately screened with a corrosion resistant material
  - The overflow and drain pipes are screened and have proper air gaps
- Tanks should be cleaned and sanitized on a routine basis.

1.3.2 Remediation: Disinfection

If water in a holding tank tests positive for generic *E. coli*, contact a water system contractor or other trained individual to clean and disinfect the tank.

1.4 Water Distribution System

Since almost all of the distribution system components are underground, a map of your water distribution system would be helpful. If however, a map is not available, check exposed components for any vulnerability to contaminants. Signs of damaged underground components may include unexplained erosion or patches of lush green grass.

[19] Note: Chlorine in solution exists as hypochlorus acid (HOC) and hypochlorite (OC-). HOC is 40-80x more effective at killing microorganisms than OC- and water with a lower pH increases the amount of HOC. [1]

1.4.1 Cross Connections

As part of the Sanitary Survey, check for cross connections in your water system. The EPA defines a cross connection as an actual or potential physical connection between a water system and another water source of unknown or questionable quality. For example, agricultural water systems should not be cross-connected with human or animal waste systems. Water systems intended to convey untreated human or animal waste should be separated from conveyances utilized to deliver agricultural water.

Any physical connection between agricultural water systems and systems with unknown water quality could allow water of questionable quality to backflow into the agricultural water system. An unintentional, potential cross connection can occur in places where proper air gaps between water surfaces and water sources are not maintained and therefore allow flow reversals. An example of an unintentional cross connection is a hose with one end attached to a water line and the other end lying in a tub of water, a fountain base, or a fish pond.

TABLE 6. Sanitary Survey of Distribution System

Issues	Remediation Guidelines
There are cross-connections in the plumbing system.	Make sure that your plumbing is not connected to another source of water that may be contaminated (e.g. a defunct community water system, animal waste system).
There is not adequate back-flow protection.	Install a back-flow prevention device on every outdoor faucet (available at most hardware and plumbing supply stores).
There are dead-end or unused water lines connected to your plumbing system.	Flush lines regularly or remove any used lines or sections of the water system.
There are abandoned or inactive wells on my property.	When no longer in use, wells must be destroyed to prevent them from functioning as a vertical conduit for contaminants.

2.0 SUMMARY AND CONCLUSIONS

- Have your entire water system checked annually by a licensed contractor or other trained individual, and as required in the decision trees in the *California Commodity Specific Food Safety Guidelines for the Production, Harvest, Cooling, Packing, Storage, and Transporting of Cantaloupes and Other Netted Melons*.
- Keep detailed records every time a sanitary survey is conducted. Documentation should include:
    - Date
    - A description of the condition of the water system
    - Location and description of problem areas and the corresponding repairs and/or resolutions.

3.0 REFERENCES

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How to use tables in Appendices 1:1 - 1:5

Step 1: Determine the pipe diameter of your well in inches.

Step 2: Determine the well depth (or pipe length) of your well in feet (The company that constructed the well should be able to provide you with the well depth if you do not have it in your records).

Step 3: Determine the water level of your well in feet from the top of the well.

Step 4: Subtract the water level from the well depth to determine the length of pipe containing water (ft.).

Step 5: Using the table for the particular disinfectant product listed on the next 5 pages, match your pipe diameter with your calculated length of pipe containing water to determine the amount of disinfectant (e.g., 70% calcium hypochlorite) required (Example – If you have a well that has a pipe diameter of 6 inches and a length of pipe containing water that is 60 ft., you would use 0.84 oz. or 23.8 grams of (70%) calcium hypochlorite).

Step 6: Decide what concentration of chlorine is required for the well disinfection. If you want to use a 50 mg/L chlorine solution, use the number that you derived in the table. If you want a **100 mg/L chlorine solution,** use the number that you derived in the table **multiplied by 2**. If you want a **200 mg/L chlorine solution,** use the number that you derived in the table **multiplied by 4**.

Step 7: **NOTE** – If you are going to weigh out the disinfectant product in **grams, use the second Table on each page – these numbers are metric**.

Appendix 1.1: Conversion table for calculating the amount of (65%) Calcium Hypochlorite required to dose specific well volumes at 50 mg/L.

Table A

(65%) Calcium Hypochlorite (Dry Weight in ounces)	Length of Pipe Containing Water (ft.)																		
Pipe Diameter (inches)	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10
2	0.17	0.16	0.15	0.14	0.13	0.13	0.12	0.11	0.10	0.09	0.08	0.08	0.07	0.06	0.05	0.04	0.03	0.03	0.02
4	0.67	0.64	0.60	0.57	0.54	0.50	0.47	0.44	0.40	0.37	0.34	0.30	0.27	0.23	0.20	0.17	0.13	0.10	0.07
6	1.51	1.43	1.36	1.28	1.21	1.13	1.06	0.98	0.91	0.83	0.75	0.68	0.60	0.53	0.45	0.38	0.30	0.23	0.15
8	2.68	2.55	2.41	2.28	2.15	2.01	1.88	1.74	1.61	1.48	1.34	1.21	1.07	0.94	0.80	0.67	0.54	0.40	0.27
10	4.19	3.98	3.77	3.56	3.35	3.14	2.93	2.72	2.51	2.30	2.10	1.89	1.68	1.47	1.26	1.05	0.84	0.63	0.42
12	6.03	5.73	5.43	5.13	4.83	4.53	4.22	3.92	3.62	3.32	3.02	2.72	2.41	2.11	1.81	1.51	1.21	0.91	0.60
16	10.73	10.19	9.66	9.12	8.58	8.05	7.51	6.97	6.44	5.90	5.36	4.83	4.29	3.75	3.22	2.68	2.15	1.61	1.07
20	16.76	15.92	15.09	14.25	13.41	12.57	11.73	10.90	10.06	9.22	8.38	7.54	6.71	5.87	5.03	4.19	3.35	2.51	1.68
24	24.14	22.93	21.72	20.52	19.31	18.10	16.90	15.69	14.48	13.28	12.07	10.86	9.66	8.45	7.24	6.03	4.83	3.62	2.41

Table B

(65%) Calcium Hypochlorite (Dry Weight in grams)	Length of Pipe Containing Water (ft.)																		
Pipe Diameter (inches)	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10
2	4.8	4.5	4.3	4.0	3.8	3.6	3.3	3.1	2.9	2.6	2.4	2.1	1.9	1.7	1.4	1.2	1.0	0.7	0.5
4	19.0	18.1	17.1	16.2	15.2	14.3	13.3	12.4	11.4	10.5	9.5	8.6	7.6	6.7	5.7	4.8	3.8	2.9	1.9
6	42.8	40.6	38.5	36.4	34.2	32.1	29.9	27.8	25.7	23.5	21.4	19.2	17.1	15.0	12.8	10.7	8.6	6.4	4.3
8	76.0	72.2	68.4	64.6	60.8	57.0	53.2	49.4	45.6	41.8	38.0	34.2	30.4	26.6	22.8	19.0	15.2	11.4	7.6
10	118.8	112.9	106.9	101.0	95.0	89.1	83.2	77.2	71.3	65.3	59.4	53.5	47.5	41.6	35.6	29.7	23.8	17.8	11.9
12	171.1	162.5	154.0	145.4	136.9	128.3	119.8	111.2	102.6	94.1	85.5	77.0	68.4	59.9	51.3	42.8	34.2	25.7	17.1
16	304.1	288.9	273.7	258.5	243.3	228.1	212.9	197.7	182.5	167.3	152.1	136.9	121.7	106.4	91.2	76.0	60.8	45.6	30.4
20	475.2	451.5	427.7	403.9	380.2	356.4	332.7	308.9	285.1	261.4	237.6	213.8	190.1	166.3	142.6	118.8	95.0	71.3	47.5
24	684.3	650.1	615.9	581.7	547.4	513.2	479.0	444.8	410.6	376.4	342.2	307.9	273.7	239.5	205.3	171.1	136.9	102.6	68.4

Appendix 1.2: Conversion table for calculating the amount of (70%) Calcium Hypochlorite required to dose specific well volumes at 50 mg/L.

Table C

(70%) Calcium Hypochlorite (Dry Weight in ounces)	Length of Pipe Containing Water (ft.)																		
Pipe Diameter (inches)	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10
2	0.16	0.15	0.14	0.13	0.12	0.12	0.11	0.10	0.09	0.09	0.08	0.07	0.06	0.05	0.05	0.04	0.03	0.02	0.02
4	0.62	0.59	0.56	0.53	0.50	0.47	0.44	0.40	0.37	0.34	0.31	0.28	0.25	0.22	0.19	0.16	0.12	0.09	0.06
6	1.40	1.33	1.26	1.19	1.12	1.05	0.98	0.91	0.84	0.77	0.70	0.63	0.56	0.49	0.42	0.35	0.28	0.21	0.14
8	2.49	2.37	2.24	2.12	1.99	1.87	1.74	1.62	1.49	1.37	1.25	1.12	1.00	0.87	0.75	0.62	0.50	0.37	0.25
10	3.89	3.70	3.50	3.31	3.11	2.92	2.72	2.53	2.33	2.14	1.95	1.75	1.56	1.36	1.17	0.97	0.78	0.58	0.39
12	5.60	5.32	5.04	4.76	4.48	4.20	3.92	3.64	3.36	3.08	2.80	2.52	2.24	1.96	1.68	1.40	1.12	0.84	0.56
16	9.96	9.46	8.97	8.47	7.97	7.47	6.97	6.48	5.98	5.48	4.98	4.48	3.98	3.49	2.99	2.49	1.99	1.49	1.00
20	15.57	14.79	14.01	13.23	12.45	11.67	10.90	10.12	9.34	8.56	7.78	7.00	6.23	5.45	4.67	3.89	3.11	2.33	1.56
24	22.41	21.29	20.17	19.05	17.93	16.81	15.69	14.57	13.45	12.33	11.21	10.09	8.97	7.84	6.72	5.60	4.48	3.36	2.24

Table D

(70%) Calcium Hypochlorite (Dry Weight in grams)	Length of Pipe Containing Water (ft.)																		
Pipe Diameter (inches)	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10
2	4.4	4.2	4.0	3.8	3.5	3.3	3.1	2.9	2.6	2.4	2.2	2.0	1.8	1.5	1.3	1.1	0.9	0.7	0.4
4	17.7	16.8	15.9	15.0	14.1	13.2	12.4	11.5	10.6	9.7	8.8	7.9	7.1	6.2	5.3	4.4	3.5	2.6	1.8
6	39.7	37.7	35.7	33.8	31.8	29.8	27.8	25.8	23.8	21.8	19.9	17.9	15.9	13.9	11.9	9.9	7.9	6.0	4.0
8	70.6	67.1	63.5	60.0	56.5	53.0	49.4	45.9	42.4	38.8	35.3	31.8	28.2	24.7	21.2	17.7	14.1	10.6	7.1
10	110.3	104.8	99.3	93.8	88.3	82.7	77.2	71.7	66.2	60.7	55.2	49.6	44.1	38.6	33.1	27.6	22.1	16.5	11.0
12	158.9	150.9	143.0	135.0	127.1	119.1	111.2	103.3	95.3	87.4	79.4	71.5	63.5	55.6	47.7	39.7	31.8	23.8	15.9
16	282.4	268.3	254.2	240.1	225.9	211.8	197.7	183.6	169.4	155.3	141.2	127.1	113.0	98.8	84.7	70.6	56.5	42.4	28.2
20	441.3	419.2	397.1	375.1	353.0	331.0	308.9	286.8	264.8	242.7	220.6	198.6	176.5	154.4	132.4	110.3	88.3	66.2	44.1
24	635.4	603.7	571.9	540.1	508.3	476.6	444.8	413.0	381.3	349.5	317.7	285.9	254.2	222.4	190.6	158.9	127.1	95.3	63.5

Appendix 1.3: Conversion table for calculating the amount of (25%) Chloride of Lime required to dose specific well volumes at 50 mg/L.

Table E

(25%) Chloride of Lime (Dry Weight in ounces)	Length of Pipe Containing Water (ft.)																		
Pipe Diameter (inches)	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10
2	0.44	0.41	0.39	0.37	0.35	0.33	0.31	0.28	0.26	0.24	0.22	0.20	0.17	0.15	0.13	0.11	0.09	0.07	0.04
4	1.74	1.66	1.57	1.48	1.39	1.31	1.22	1.13	1.05	0.96	0.87	0.78	0.70	0.61	0.52	0.44	0.35	0.26	0.17
6	3.92	3.73	3.53	3.33	3.14	2.94	2.75	2.55	2.35	2.16	1.96	1.77	1.57	1.37	1.18	0.98	0.78	0.59	0.39
8	6.97	6.62	6.28	5.93	5.58	5.23	4.88	4.53	4.18	3.84	3.49	3.14	2.79	2.44	2.09	1.74	1.39	1.05	0.70
10	10.90	10.35	9.81	9.26	8.72	8.17	7.63	7.08	6.54	5.99	5.45	4.90	4.36	3.81	3.27	2.72	2.18	1.63	1.09
12	15.69	14.91	14.12	13.34	12.55	11.77	10.98	10.20	9.41	8.63	7.84	7.06	6.28	5.49	4.71	3.92	3.14	2.35	1.57
16	27.89	26.50	25.10	23.71	22.31	20.92	19.53	18.13	16.74	15.34	13.95	12.55	11.16	9.76	8.37	6.97	5.58	4.18	2.79
20	43.58	41.40	39.22	37.05	34.87	32.69	30.51	28.33	26.15	23.97	21.79	19.61	17.43	15.25	13.07	10.90	8.72	6.54	4.36
24	62.76	59.62	56.48	53.35	50.21	47.07	43.93	40.79	37.66	34.52	31.38	28.24	25.10	21.97	18.83	15.69	12.55	9.41	6.28

Table F

(25%) Chloride of Lime (Dry Weight in grams)	Length of Pipe Containing Water (ft.)																		
Pipe Diameter (inches)	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10
2	12.4	11.7	11.1	10.5	9.9	9.3	8.6	8.0	7.4	6.8	6.2	5.6	4.9	4.3	3.7	3.1	2.5	1.9	1.2
4	49.4	47.0	44.5	42.0	39.5	37.1	34.6	32.1	29.7	27.2	24.7	22.2	19.8	17.3	14.8	12.4	9.9	7.4	4.9
6	111.2	105.6	100.1	94.5	89.0	83.4	77.8	72.3	66.7	61.2	55.6	50.0	44.5	38.9	33.4	27.8	22.2	16.7	11.1
8	197.7	187.8	177.9	168.0	158.2	148.3	138.4	128.5	118.6	108.7	98.8	89.0	79.1	69.2	59.3	49.4	39.5	29.7	19.8
10	308.9	293.4	278.0	262.6	247.1	231.7	216.2	200.8	185.3	169.9	154.4	139.0	123.6	108.1	92.7	77.2	61.8	46.3	30.9
12	444.8	422.6	400.3	378.1	355.8	333.6	311.4	289.1	266.9	244.6	222.4	200.2	177.9	155.7	133.4	111.2	89.0	66.7	44.5
16	790.8	751.2	711.7	672.1	632.6	593.1	553.5	514.0	474.5	434.9	395.4	355.8	316.3	276.8	237.2	197.7	158.2	118.6	79.1
20	1235.6	1173.8	1112.0	1050.2	988.4	926.7	864.9	803.1	741.3	679.6	617.8	556.0	494.2	432.4	370.7	308.9	247.1	185.3	123.6
24	1779.2	1690.2	1601.3	1512.3	1423.4	1334.4	1245.4	1156.5	1067.5	978.6	889.6	800.6	711.7	622.7	533.8	444.8	355.8	266.9	177.9

Appendix 1.4: Conversion table for calculating the amount of (12.5%) Sodium Hypochlorite required to dose specific well volumes at 50 mg/L.

Table H

(12.5 %) Sodium Hypochlorite (Liquid Measure in milliliters) — Length of Pipe Containing Water (ft)

Pipe Diameter (inches)	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10
2	24.7	23.5	22.2	21.0	19.8	18.5	17.3	16.1	14.8	13.6	12.4	11.1	9.9	8.6	7.4	6.2	4.9	3.7	2.5
4	98.8	93.9	89.0	84.0	79.1	74.1	69.2	64.2	59.3	54.4	49.4	44.5	39.5	34.6	29.7	24.7	19.8	14.8	9.9
6	222.4	211.3	200.2	189.0	177.9	166.8	155.7	144.6	133.4	122.3	111.2	100.1	89.0	77.8	66.7	55.6	44.5	33.4	22.2
8	395.4	375.6	355.8	336.1	316.3	296.5	276.8	257.0	237.2	217.5	197.7	177.9	158.2	138.4	118.6	98.8	79.1	59.3	39.5
10	617.8	586.9	556.0	525.1	494.2	463.3	432.4	401.6	370.7	339.8	308.9	278.0	247.1	216.2	185.3	154.4	123.6	92.7	61.8
12	889.6	845.1	800.6	756.2	711.7	667.2	622.7	578.2	533.8	489.3	444.8	400.3	355.8	311.4	266.9	222.4	177.9	133.4	89.0
16	1581.5	1502.4	1423.4	1344.3	1265.2	1186.1	1107.1	1028.0	948.9	869.8	790.8	711.7	632.6	553.5	474.5	395.4	316.3	237.2	158.2
20	2471.1	2347.6	2224.0	2100.4	1976.9	1853.3	1729.8	1606.2	1482.7	1359.1	1235.6	1112.0	988.4	864.9	741.3	617.8	494.2	370.7	247.1
24	3558.4	3380.5	3202.6	3024.6	2846.7	2668.8	2490.9	2313.0	2135.0	1957.1	1779.2	1601.3	1423.4	1245.4	1067.5	889.6	711.7	533.8	355.8

Table G

(12.5%) Sodium Hypochlorite (Liquid Measure in fluid ounces) — Length of Pipe Containing Water (ft.)

Pipe Diameter (inches)	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10
2	0.84	0.79	0.75	0.71	0.67	0.63	0.58	0.54	0.50	0.46	0.42	0.38	0.33	0.29	0.25	0.21	0.17	0.13	0.08
4	3.34	3.18	3.01	2.84	2.67	2.51	2.34	2.17	2.01	1.84	1.67	1.50	1.34	1.17	1.00	0.84	0.67	0.50	0.33
6	7.52	7.14	6.77	6.39	6.02	5.64	5.26	4.89	4.51	4.14	3.76	3.38	3.01	2.63	2.26	1.88	1.50	1.13	0.75
8	13.37	12.70	12.03	11.36	10.70	10.03	9.36	8.69	8.02	7.35	6.68	6.02	5.35	4.68	4.01	3.34	2.67	2.01	1.34
10	20.89	19.85	18.80	17.76	16.71	15.67	14.62	13.58	12.53	11.49	10.44	9.40	8.36	7.31	6.27	5.22	4.18	3.13	2.09
12	30.08	28.58	27.07	25.57	24.06	22.56	21.06	19.55	18.05	16.54	15.04	13.54	12.03	10.53	9.02	7.52	6.02	4.51	3.01
16	53.48	50.80	48.13	45.46	42.78	40.11	37.43	34.76	32.09	29.41	26.74	24.06	21.39	18.72	16.04	13.37	10.70	8.02	5.35
20	83.56	79.38	75.20	71.02	66.85	62.67	58.49	54.31	50.14	45.96	41.78	37.60	33.42	29.25	25.07	20.89	16.71	12.53	8.36
24	120.32	114.31	108.29	102.28	96.26	90.24	84.23	78.21	72.19	66.18	60.16	54.15	48.13	42.11	36.10	30.08	24.06	18.05	12.03

Appendix 1.5: Conversion table for calculating the amount of (5.25%) Sodium Hypochlorite required to dose specific well volumes at 50 mg/L.

Table I

(5.25%) Sodium Hypochlorite (Liquid Measure in fluid ounces) — Length of Pipe Containing Water (ft.)

Pipe Diameter (inches)	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10
2	1.99	1.89	1.79	1.69	1.59	1.49	1.39	1.29	1.19	1.09	0.99	0.90	0.80	0.70	0.60	0.50	0.40	0.30	0.20
4	7.96	7.56	7.16	6.76	6.37	5.97	5.57	5.17	4.77	4.38	3.98	3.58	3.18	2.79	2.39	1.99	1.59	1.19	0.80
6	17.91	17.01	16.11	15.22	14.32	13.43	12.53	11.64	10.74	9.85	8.95	8.06	7.16	6.27	5.37	4.48	3.58	2.69	1.79
8	31.83	30.24	28.65	27.06	25.47	23.87	22.28	20.69	19.10	17.51	15.92	14.32	12.73	11.14	9.55	7.96	6.37	4.77	3.18
10	49.74	47.25	44.76	42.28	39.79	37.30	34.82	32.33	29.84	27.36	24.87	22.38	19.89	17.41	14.92	12.43	9.95	7.46	4.97
12	71.62	68.04	64.46	60.88	57.30	53.72	50.14	46.55	42.97	39.39	35.81	32.23	28.65	25.07	21.49	17.91	14.32	10.74	7.16
16	127.33	120.96	114.59	108.23	101.86	95.50	89.13	82.76	76.40	70.03	63.66	57.30	50.93	44.56	38.20	31.83	25.47	19.10	12.73
20	198.95	189.00	179.05	169.11	159.16	149.21	139.26	129.32	119.37	109.42	99.47	89.53	79.58	69.63	59.68	49.74	39.79	29.84	19.89
24	286.49	272.16	257.84	243.51	229.19	214.86	200.54	186.22	171.89	157.57	143.24	128.92	114.59	100.27	85.95	71.62	57.30	42.97	28.65

Table J

(5.25%) Sodium Hypochlorite (Liquid Measure in milliliters) — Length of Pipe Containing Water (ft.)

Pipe Diameter (inches)	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10
2	58.8	55.9	53.0	50.0	47.1	44.1	41.2	38.2	35.3	32.4	29.4	26.5	23.5	20.6	17.7	14.7	11.8	8.8	5.9
4	235.3	223.6	211.8	200.0	188.3	176.5	164.7	153.0	141.2	129.4	117.7	105.9	94.1	82.4	70.6	58.8	47.1	35.3	23.5
6	529.5	503.0	476.6	450.1	423.6	397.1	370.7	344.2	317.7	291.2	264.8	238.3	211.8	185.3	158.9	132.4	105.9	79.4	53.0
8	941.4	894.3	847.2	800.2	753.1	706.0	659.0	611.9	564.8	517.8	470.7	423.6	376.6	329.5	282.4	235.3	188.3	141.2	94.1
10	1470.9	1397.4	1323.8	1250.3	1176.7	1103.2	1029.6	956.1	882.5	809.0	735.5	661.9	588.4	514.8	441.3	367.7	294.2	220.6	147.1
12	2118.1	2012.2	1906.3	1800.4	1694.5	1588.6	1482.7	1376.8	1270.9	1165.0	1059.0	953.1	847.2	741.3	635.4	529.5	423.6	317.7	211.8
16	3765.5	3577.2	3389.0	3200.7	3012.4	2824.1	2635.9	2447.6	2259.3	2071.0	1882.8	1694.5	1506.2	1317.9	1129.7	941.4	753.1	564.8	376.6
20	5883.6	5589.4	5295.2	5001.1	4706.9	4412.7	4118.5	3824.3	3530.2	3236.0	2941.8	2647.6	2353.4	2059.3	1765.1	1470.9	1176.7	882.5	588.4
24	8472.4	8048.8	7625.2	7201.5	6777.9	6354.3	5930.7	5507.1	5083.4	4659.8	4236.2	3812.6	3389.0	2965.3	2541.7	2118.1	1694.5	1270.9	847.2

APPENDIX B: TECHNICAL BASIS DOCUMENT

TABLE OF CONTENTS

1.0 INTRODUCTION

This document serves as a supplementary source of information to the *California Commodity Specific Food Safety Guidelines for the Production, Harvest, Cooling, Packing, Storage, and Transporting of Cantaloupes and Other Netted Melons* (Cantaloupe Guide). The document established measurable best practices and guidelines ("metrics") for a variety of process areas judged to be potential contributors to the risk of microbial contamination. The intent of this document is to provide the basis and rationale for the choice of metrics used in the recommended best practices. Some metrics for cantaloupes are based on the metrics for green onions and/or lettuce and leafy greens. In those cases, text from the Technical Basis Documents for commodity specific food safety guidelines for lettuce and leafy greens (Leafy Greens Guide) and/or green onions (Green Onions Guide) are provided for context.

In all of these commodity-specific guidelines, a three-tier approach was used to identify appropriate metrics:

1. A literature review was conducted to establish whether a scientifically valid basis for establishing a metric has been published.
2. If the literature review did not identify published scientific support for an appropriate metric, existing standards or metrics supported by authoritative or regulatory bodies were adopted.
3. If neither scientific studies nor existing standards or metrics from authoritative bodies supported adoption of a specific metric, consensus among industry representatives and/or other stakeholders was sought.

The following sections provide explanations of the processes and rationale for derivation of the metrics.

2.0 WATER SOURCES AND USES

2.1 Primary Production, Harvest and Field Packing Unit Operations

Metrics for water sources used in agricultural applications must consider (1) which microorganisms to test for and the test methods, (2) action levels to apply, and (3) appropriate responses. An ideal test method would detect all pathogenic organisms present; however, this is not scientifically or economically feasible for many reasons:

- Concentrations of pathogenic microbes can vary widely in fecal matter. Hence, if testing focuses on specific pathogens at the exclusion of others, the presence of fecal contamination may not be detected even if significant contamination is present (Ashbolt *et al.* 2001; World Health Organization 2008). While continuous monitoring or daily testing might more reliably detect these microbes, this approach is economically unfeasible.
- Existing test methods may not be able to detect the wide variety of pathogenic organisms that might contaminate water (World Health Organization 2008). Even if water is routinely tested for the more common pathogenic organisms, this does not guarantee other pathogens are not present.

Given the statements above, and guidance and/or comments from various regulatory agencies (US EPA 1986; California Department of Health Services (CDHS) and California Department of Food and Agriculture (CDFA 2006; US FDA 2006)), use of an "indicator" microbe was determined to be the most effective and efficient testing approach. Testing for generic *E. coli* is considered the best available indicator for fecal contamination of a water source in an agricultural production environment. Generic *E. coli* is generally non-pathogenic; thus, using this as an indicator organism results in action levels that are not necessarily health risk-based. Although increasing levels of generic *E. coli* in a water source are likely to correlate with increasing health risk, "bright line" levels of generic *E. coli* above which health risks are unacceptable cannot rationally be established. Action levels based on generic *E. coli* concentrations should not be considered as separating "safe" or "unsafe" levels—they should only be considered as indicators of fecal contamination or increasing bacteriological densities.

To set generic *E. coli* action levels for water used in agricultural applications, it was decided that it was not possible to use one set of levels for all uses. For instance, water that is used for foliar applications should likely have more stringent standards than water that is used for non-foliar applications. In order to address this issue, use-specific standards for production and harvest operations were created for two uses determined to be most critical to the safety of cantaloupes during these operations:

- Pre-harvest foliar applications.
- Pre-harvest non-foliar applications (e.g. furrow or drip irrigation, dust abatement water).
- Harvest and field packing applications

For the pre-harvest use category, a rolling average and single sample maximum metric was set (see Table II-2 and Figures 3A and 3B). These metrics were based on water quality standards developed by the US EPA in their risk assessment of *E. coli* in recreational waters (US EPA 1986; 2003). To protect against unacceptable risk of waterborne diseases, US EPA determined that the geometric mean of *E. coli* in recreational water systems should not exceed 126 MPN *E. coli*/100 mL. In addition to this geometric mean value, they also determined single sample maximum values for various beach-use types. These single sample maximums are based on certain confidence levels of the geometric mean value of 126 MPN. For a "Designated Beach," U.S. EPA used the 70% confidence level, which is a value of 235 MPN/100 mL. These two guidelines were used to establish action levels for pre-harvest water uses. All pre-harvest water used for foliar applications must meet the geometric mean requirement of 126 MPN/100 mL and a single sample maximum of 235 MPN/100 mL. Pre-harvest water used for non-foliar applications must meet the geometric mean requirement of 235 MPN/100 mL and a single sample maximum of 576 MPN/100 mL. The use of these values is bolstered by the adoption of the 126 MPN/100 mL geometric mean by the state of Arizona as its irrigation water quality standard.

For harvest and field packing applications, it was determined that stringent requirements should be met for direct contact with product and food contact surfaces due to the potential high-risk for cross-contamination, especially when the cantaloupes go directly to customers with no additional steps taken to remove or reduce potential contamination. Hence, the metric for this standard has been set at the US EPA's Maximum Contaminant Level Goal for *E. coli* in drinking water, which

is zero or no detection and the detection limit is currently 2 MPN/100 mL.

A complete list of the various action levels is outlined in Table III-2 in the Cantaloupe Guide, while a decision tree explaining water use is shown in Figure III-2.

During development of the Leafy Greens Guide – as the first commodity-specific food safety guidelines to use acceptance criteria – appropriate locations for water testing were evaluated. Initially, testing the "source" of the water was thought to be most appropriate. However, several stakeholders commented that testing at the source may miss contamination introduced into the distribution systems (US FDA 2006). Hence, this guidance document follows the Leafy Greens Guide in specifying testing as close to the point-of-use as possible. If water is found to be above action levels at this location, then additional testing and the initiation of a sanitary survey are required.

Acceptable methods for testing water are similar to the methods in the Leafy Greens Guide. Since the creation of the Leafy Greens Guide in 2007, newer technologies approved by the US EPA and validated by the AOAC have been developed to provide more rapid results than the MPN methods such as described in the FDA's Bacteriological Analytical Manual. The Leafy Greens Guide has recently been revised to allow for the use of these newer technologies, and these changes have been incorporated into the Cantaloupe Guide. However, unlike the Leafy Greens and Green Onions Guides, the Cantaloupe Guide does not allow for presence/absence testing. Because presence/absence test methods are not quantitative, they do not represent the "best practices" for preventing potential microbial contamination.

2.2 Facilities Section

For post-harvest water use in a packing, pre-cooling and cooling facility, it was determined that source water must meet US EPA's drinking water microbiological standards. Hence, the metric for this standard has been set at the US EPA's Maximum Contaminant Level Goal for total coliforms in drinking water, which is zero or no detection and the detection limit is currently 2 MPN/100 mL. Guidelines for continuous monitoring of disinfectant in product washing systems are also provided in the *California Commodity Specific Food Safety Guidelines for the Production, Harvest, Cooling, Packing, Storage, and Transporting of Cantaloupes and Other Netted Melons,* Table IV-1 to facilitate meeting this standard.

3.0 SOIL AMENDMENTS

Considerably more guidance exists for establishing metrics for soil amendments (SAs) than water sources. Many regulatory bodies have set guidelines for production of soil amendments as well as acceptable levels of microbial organisms in finished products. A complete list of the metrics is provided in Table II-3 and II-4 of the Cantaloupe Guide, and decision trees are found in Figures 4A, 4B and 5.

3.1 Manure

The application of manure to cantaloupe production fields is thought to be a high risk practice, and industry discussions have centered on completely disallowing this practice.
The decision to disallow this practice is similar to other commodity groups such as leafy greens.

The National Organic Program guidance allows an application-to-harvest interval of 120 days (USDA 2002). However, the California cantaloupe industry working group determined that the 120 day period was not acceptable, given the long survival period of bacteria in raw manure (over 120 days in some references), and that raw manure should not be used in the production of cantaloupes. However, in order not to completely restrict the use of land that has at some point had raw manure applied, a one-year waiting period prior to planting was considered appropriate.

3.2 Composted Soil Amendments

Due to the existence of California state regulations regarding the production of compost (CCR Title 14 - Chapter 3.1 - Article 7), these guidelines were essentially adopted "as is" for the Cantaloupe Guide, with the addition of *E. coli* O157:H7 testing as an additional safeguard as was done for food safety guidance for leafy greens, green onions, and fresh culinary herbs. These guidelines largely rely upon fecal coliforms as the indicator pathogens.

A three hurdle process was considered to be sufficient for safe application of composted SAs to cantaloupe. The first hurdle recommends use of a validated process for compost production; the second recommends microbial testing, and the third recommends applying an application interval to minimize risk from any potentially remaining pathogenic microorganisms.

During the development of the Leafy Greens Guide, the use of the National Organic Program's 120-day waiting period for use of raw manure was suggested for use as an appropriate interval for composted soil amendments. However, because the 120-day period is specific to raw (uncomposted) manure, it was judged reasonable to shorten this period to 45-days for soil amendments that underwent an actively monitored composting process.

The Sampling Plan for composted SAs in the Cantaloupe Guide is the same as the Leafy Greens Guide and is based on practices recommended by compost suppliers.

3.3 Physically Heat Treated Soil Amendments

Due to limited information related to the process and expected microbial populations found in physically heat treated soil amendments, metrics were primarily based on the state of California's composting metrics described above. Some processes are discussed in the literature and this information was used to set some metrics for application intervals (US EPA 1994). Most of these US EPA-based requirements are for biosolids, but are considered to be appropriate for application to raw manure. Because the process for physically heat treating manure is much more controlled than composting, a stricter requirement for fecal coliform concentrations (<10 MPN) was considered reasonable for heat treated soil amendments.

Due to the stricter testing requirements and more tightly controlled process used with heat treated soil amendments, if a validated process is used, no application interval is required for these types of amendments. If the process is not validated, a >45-day application interval was deemed appropriate based on the same decision-making process that was used for composted soil amendments (described above).

The Sampling Plan for physically heat treated SAs containing animal manure in the Cantaloupe Guide is the same as the Leafy Greens Guide and is based on practices recommended by compost suppliers.

3.4 Non-Synthetic Crop Treatments

Due to limited information related to the process and expected microbial populations found in non-synthetic crop treatments, metrics were primarily based on the composting metrics described above. However, due to the foliar application of many of these types of treatments, a more stringent guideline was considered to be appropriate for microbial testing (e.g. negative for *E. coli* O157:H7 and *Salmonella* spp.). Specific metrics are found in Table II-4 of the Cantaloupe Guide, and a decision tree for these treatments can be found in Figure 5.

Due to the stricter testing requirements and used with non-synthetic crop treatments and their intended use as foliar applicants, if a validated process is used no application interval is required for these products. If the process is not validated, a >45-day application interval was deemed appropriate based on the same decision-making process that was used for composted soil amendments (described above).

4.0 FLOODING

The definition of flooding used in the Leafy Green Guide was adopted for use as the definition of flooding in *California Commodity Specific Food Safety Guidelines for the Production, Harvest, Cooling, Packing, Storage, and Transporting of Cantaloupes and Other Netted Melons*. Therefore the rationale as provided in the Leafy Greens Guide's Technical Basis document pertains here.

The distance not to be harvested from the high-water mark of any flood event was selected to be 30 feet, based on the turn-around distance of farm equipment to prevent cross-contamination. This distance may be increased if there is the uncertainty about the location of the high-water mark or if some equipment has a greater turning radius— whether to increase this distance is to be determined by an appropriately trained food safety expert, with possible consultation with other experts as necessary.

The required waiting period after flooding prior to planting (60 days) was selected based on comments from regulatory bodies; these comments were consistent with original time periods based on USDA NOP guidance on use of manure (i.e., it was assumed that the worst-case flooding event would be equivalent to use of raw manure on fields) (USDA 2002). This 60-day prior to planting time period is roughly equivalent to 120-days prior to harvest depending on the specific growing season, and was considered to be easier to implement in the field.

As did the Leafy Green and Green Onions Guides, the Cantaloupe Guide provides an option to reduce this time period to 30 days if growers can demonstrate through a valid sampling program that soil microbial levels meet specific acceptance criteria. A soil sampling protocol was developed under the direction of Dr. Trevor Suslow who has significant experience in soil testing following flooding events (see Appendix D for soil sampling protocol).

Regardless of the use of the standard 60-day period or the 30-day period, all decisions related to use of flooded land should be made with the consultation of a qualified food safety professional. This person should have the same qualifications as described in the Environmental Assessments section below.

5.0 ENVIRONMENTAL ASSESSMENTS

In order to maintain vigilance over the conditions associated with the production of cantaloupes, periodic monitoring of production fields and the surrounding area is required. This monitoring requires visual observation of field conditions with focus on water sources, the production area, and neighboring land uses. This monitoring should begin one week prior to planting and continue through the growing cycle. In addition, three formal assessments must also be conducted—approximately one week prior to planting, within one week prior to harvest, and at harvest.

5.1 Animal Activity in Field (Wild or Domestic)

The metrics developed for assessing animal activity in production fields were based on best professional judgment about proper assessment and corrective actions. In general, it was assumed that continuous monitoring for this type of event was not feasible, so periodic monitoring as well as pre-harvest and harvest formal assessments were determined to be viable alternatives.

Research has shown that not all animals are of equal risk for spreading pathogenic organism to food crops; however all fecal material presents an opportunity for contamination and is considered a food safety hazard. Due to the likely subjective nature of determining whether or not other animal activity such as crop damage in the field is significant and presents a risk of contaminating cantaloupes, the Cantaloupe Guide recommends that a trained food safety professional be involved in decisions related to animal activity in the field. The qualifications for this person are as follows:

- The design and implementation of food safety programs and systems for cantaloupe operations from farm to market is a complex task requiring significant knowledge from several fundamental areas of science. Personnel entrusted with management level responsibility for food safety in the fresh produce industry should have training or experience sufficient to establish a solid understanding of the principles of food safety as applied to agricultural production.
- Each fresh produce production operation involved in growing, harvesting, and / or packing cantaloupes should have an appropriately qualified individual whose primary job function is development, implementation, and supervision of a comprehensive food safety program. This person should be a direct employee; however, for some smaller operations where this is impractical, a continuous, contractual relationship involving at least quarterly direct involvement with the production operation is also an acceptable option.
- It is recommended that the individual should have some training or experience in actual food safety principles related to fresh produce.

These requirements recognize the fact that food safety in the fresh produce industry is an endeavor based on scientific principles and that significant experience and training is required to prepare individuals for food safety management responsibilities in the industry.

Because there are too many subjective situations regarding crop damage by animals it was not feasible to develop metrics for all of them. Food safety professionals should use their best

professional judgment to determine whether or not to harvest cantaloupes, how much buffer distance should be assigned for various crop damage incidents, and whether remedial options might reduce or eliminate risk from these events. The best practices recommend establishing a buffer around areas of animal-related crop damage that cannot otherwise be adequately controlled. The only established metric for this area is the recommendation not to harvest cantaloupes when there is evidence of fecal material and if fecal material is found, a minimum 5-foot radius buffer distance from the spot of the contamination should not be harvested. This distance was selected using best professional judgment based on practicality in the field.

6.0 REFERENCES

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APPENDIX C. CROP LAND AND WATER SOURCE ADJACENT LAND USE

This table is supplied as guidance for developing mitigation strategies related to potential hazards from adjacent land use.

Land Use/Water Source	Recommended Distance (This distance may be either increased or decreased depending on risk and mitigation factors.)	Considerations for Risk Analysis*		
		Risk/Mitigation Factors	Increase Distance	Decrease Distance
Composting Operations (manure or animal products)	Due to the lack of science at this time, an interim guidance distance of 400 ft. from the edge of crop is proposed. This number is subject to change as science becomes available. The proximate safe distance depends on the risk/mitigation factors listed to the right. Evaluate risk and document consideration of these factors. Research is being proposed to study appropriate distance.	Distance from active compost operation	--	--
		Topography: Uphill from crop	√	
		Topography: Downhill from crop		√
		Opportunity for water run off through or from composting operations	√	
		Opportunity for soil leaching	√	
		Presence of physical barriers such as windbreaks, diversion ditches, vegetative strips		√
Concentrated Animal Feeding Operations (as defined in 40 CFR 122.23)	Due to the lack of science at this time, an interim guidance distance of 400 ft. from the edge of crop is proposed. This number is subject to change as science becomes available. The proximate safe distance depends on the risk/mitigation factors listed to the right. Evaluate risk and document consideration of these factors. Research is being proposed to study appropriate distance.	Fencing and other physical barriers such as berms, diversion ditches and vegetated strips can be employed to prevent intrusion of domestic animals, control runoff, etc.		√
		Topography: Uphill from crop	√	
		Topography: Downhill from crop		√
		Opportunity for water run off through or from CAFOs	√	
		Opportunity for soil leaching	√	
		Manure Management Program utilized		√
Non-synthetic Soil Amendment Pile (containing manure or animal products)	Due to the lack of science at this time, an interim guidance distance of 400 ft. from the edge of crop is proposed. This number is subject to change as science becomes available. The proximate safe distance depends on the risk/mitigation factors listed to the right. Evaluate risk and document consideration of these factors. Research is being proposed to study appropriate distance.	Access and review COA for materials in question.		√
		Topography: Uphill from crop	√	
		Topography: Downhill from crop		√
		Opportunity for water run off through or from non-synthetic soil amendment storage areas	√	
		Opportunity for soil leaching	√	

Land Use/Water Source	Recommended Distance (This distance may be either increased or decreased depending on risk and mitigation factors.)	Considerations for Risk Analysis*		
		Risk/Mitigation Factors	Increase Distance	Decrease Distance
	For non-synthetic crop treatments that have been heat treated using a validated process an interim guidance distance of 30 feet from the edge of the crop is proposed	Covering on pile to prevent wind dispersion		√
Grazing Lands/Domestic Animals (includes homes with hobby farms, and non-commercial livestock)	30 ft. from the edge of crop.	Fencing and other physical barriers such as berms, diversion ditches and vegetated strips can be employed to prevent intrusion of domestic animals, control runoff, etc.		√
		Topography: Uphill from crop	√	
		Topography: Downhill from crop		√
		Opportunity for water run off through or from grazing lands	√	
		Opportunity for soil leaching	√	
Homes or other building with a septic leach field.	30 ft. from the edge of crop to the leach field.	Active leach field: < 10 yrs. old		√
		Active leach field: > 25 yrs. old	√	
		Inactive leach field		√
		Topography: Uphill from crop	√	
		Topography: Downhill from crop		√
		Physical barriers		√
Well Head Distance from Untreated Manure	200 ft. separation of untreated manure from wells, although less distance may be sufficient.	Topography: Uphill from manure		√
		Topography: Downhill from manure	√	
		Opportunity for water runoff from or through untreated manure to well head	√	
		Opportunity for soil leaching	√	
		Presence of physical barriers such as windbreaks, diversion ditches, vegetative strips		√
Surface Water Distance from Untreated Manure	At least 100 ft. separation for sandy soil and 200 ft. separation for loamy or clay soil (slope less than 6%; increase distance to 300 ft. if slope greater than 6%) is	Topography: Uphill from manure		√
		Topography: Downhill from manure	√	

Land Use/Water Source	Recommended Distance (This distance may be either increased or decreased depending on risk and mitigation factors.)	Considerations for Risk Analysis*		
		Risk/Mitigation Factors	Increase Distance	Decrease Distance
	recommended.	Opportunity for water runoff from or through untreated manure to surface waters.	√	
		Opportunity for soil leaching	√	
		Presence of physical barriers such as windbreaks, diversion ditches, vegetative strips		√
Rationale	• The bases for these distances above is best professional judgment of authors, contributors, and expert reviewers to prevent potential cross-contamination from adjacent land uses, taking into consideration the 200 foot distance cited in FDA (US FDA 2001) for separation of manure from wellheads and the 30 foot turn-around distance for production equipment. Because of the numerous factors that must be taken into account to determine appropriate distances, a qualitative assessment of the relative risk from various types of land use and surface waters was used to determine appropriate distances.			

Growers should check for local, state and federal laws and regulations that protect riparian habitat, restrict removal of vegetation or habitat, or restrict construction of wildlife deterrent fences in riparian areas or wildlife corridors. Growers may want to contact the relevant agencies (e.g., the Regional Water Quality Control Board and state and federal fish and wildlife agencies) to confirm the details of these requirements.

APPENDIX D. SOIL SAMPLING PROTOCOL

This table is supplied as guidance for taking soil samples for microbial testing prior to replanting after a flooding event. The sampling protocol outlined below is provided as an example. **NOTE: Protocol specifics may vary depending on site-specific conditions and laboratory requirements. Please check with your laboratory prior to gathering the sample as the number and weight of samples may vary based on the size of the production block that was flooded and laboratory-specific testing methods** (AOAC certified/approved technologies are preferred).[1]

Sampling Protocol [2]	Measurement Criteria	Remedial Actions	Timeline
• Collect soil samples from various locations in the potentially contaminated area to assure a representative sample. A map of the flooded field that identifies the sampling locations is recommended. At a minimum, collect no less than 5 individual samples per acre (e.g. soil cores or scooped soil). Individual samples can be combined into a composite sample of at least 500 grams (with a maximum of 5 acres per composite sample). • The following two methods provide examples of how to collect samples: o Take soil cores to a depth of 15 cm. Composite five cores per location into one sterile polyethylene bag. o Using a sterile scoop, remove top 2-3 cm x 2-3 cm of surface soil from a bed (seed-bed or prepared planting row) or furrow at five locations. Composite per location into one sterile polyethylene bag • If doing a comparative soil analysis, also collect from appropriate non-flooded areas.[3] • Although working in a non-sterile outdoor environment, reasonable aseptic sample collection techniques should be utilized if taking samples from different fields (i.e. change gloves, use different collection devices or clean devices thoroughly between fields). • Double-bagging of samples is preferred. This practice protects the sample integrity if the bag is damaged and against potential cross-contamination between samples from soil on the first sample bag's lip or exterior. • Samples should be stored on ice during transport and/or shipping to laboratory.	• *Salmonella* spp.: Negative or < DL (<1/ 30 grams) • Enterohemorrhagic *E. coli* (EHEC) or Shiga toxin-producing *E. coli* (STEC)*:* Negative or < DL (<1/ 30 grams) • If EHEC/STEC test result is positive, confirm presence of pathogens with further testing.[4] If conducting a comparative analysis:[3] • Fecal coliforms:[5] a significant difference between flooded and non-flooded field(s)	• If test result for any one pathogen is positive, wait 2 weeks and retest for the same pathogen. If initial testing was quantitative and the pathogen levels were near the lower limits of the measurement criteria, than a shorter interval for retesting may be warranted. • Soil preparation such as aerating, tilling, disking, etc. helps to reduce the survival of pathogenic organisms. • All equipment utilized to till contaminated soil should be cleaned and sanitized upon exiting the field. • Observe appropriate turn-around buffer zones when using vehicles and equipment in close proximity to uncontaminated areas.	If test results for pathogens are negative, replant after a minimum of 30 days. The 30-day interval should commence after flood waters have receded to the point where they are not visible in the areas that are to be planted and the soil should be at a moisture level at which the grower can get equipment in to the field for preparation or soil moisture test results are in the normal range for that particular field.[6]

[1] Currently no methods for detecting EHEC/STEC in soil are AOAC-approved.
[2] From an unpublished protocol from the Suslow Lab, UC Davis.
[3] Because the levels and composition of the microbial community in soil often varies widely and "normal" levels, generally speaking, are difficult to define, comparative soil analysis may be useful in evaluating food safety risks related to a flooding event. An optimal comparison would be microbial test results of soil taken concurrently from flooded and non-flooded areas of the same field. Alternatively, post-flooding soil microbial testing results could be compared with 1) pre-flooding soil test results if microbial testing was conducted on the field in the past or 2) concurrent microbial test results from a nearby non-flooded field that has the same soil type and was managed similarly to the flooded field.
[4] Because PCR methods may result in false positives or the detection of non-viable organisms, confirming the presence of EHEC/STEC by culturing is recommended.
[5] Incubation temperature specific for fecal coliforms (also known as thermotolerant coliforms) is 42-44°C; commonly used lower incubation temperatures (e.g. 35°C) provide results for total coliforms.
[6] Methods typically used by growers to determine soil moisture content include, but are not limited to, tensiometers, electric resistance blocks, oven drying analysis, or other methods that are measurable and repeatable.

APPENDIX E. TOOLS FOR CONDUCTING A PRE-PLANTING FOOD SAFETY ASSESSMENT OF FORMERLY FLOODED PRODUCTION GROUND

Risk Factor	Area of Observation/Observation Point	Analysis	Rationale
Extent of flooding	Degree and duration of soil exposure to flood waters and related conditions	Identify the high water mark. What area of the field was flooded? How long was it under water?	Documentation of the flooding event to support replanting decisions.
Source of flood waters	Determine the source of flood waters. Potential sources: • Drainage canal • River • Irrigation canal • High water table • Pond • Reservoir • Catch basin • Saturated water table	Do the flood waters come from: - A flowing surface water source such as a river, stream or creek? - A pooled surface water source (e.g. pond, reservoir) that overflowed? - A saturated groundwater source (e.g. rising water table)? Were the floodwaters flowing over the field? or Were the floodwaters stagnate and pooled on the field?	Knowledge of the sources of flood waters will help evaluate the likelihood of soil contamination by flood waters.
Upstream contaminants	Identify sources of potential chemical contamination	Potential sources include: Manufacturing facility Storage facility Industrial complexes Equipment & automotive service industries Mining Landfills Hazardous waste disposal sites	Flood waters may contain sewage, chemicals, heavy metals, debris, human pathogens, or other contaminants. Knowledge of any possible upstream contributors of microbiological, chemical, or physical contaminants will help evaluate the likelihood of soil contamination by flood waters.
	Identify sources of potential microbiological contamination	Potential sources include: Septic systems Sewage treatment plants	

		Manure stacks Livestock facilities Barnyard Landfills Composting operations	
	Identify sources of potential contamination from physical hazards	Potential sources include: Manufacturing facility Salvage yards Landfills	
Field conditions	Determine the time interval between the flooding event, crop planting, and crop harvest	Document when water was no longer visible in the field. Was the soil reworked after flooding? If so, how many days after the flooding event was equipment able to gain access to the field?	Helpful for assessing when to begin post-flooding, pre-planting interval.
Soil	Determine the background level of indicator organisms or pathogens in the flooded-affected field	Has the soil in the flooded field been previously tested for coliforms and/or pathogens? Has the soil in a nearby field that has been similarly managed been previously tested for coliforms and/or pathogens?	If testing soil from flooded fields, historical data may be helpful in assessing the test results.

APPENDIX F: ENVIRONMENTAL HEALTH STANDARDS FOR COMPOSTING OPERATIONS

California Code of Regulations, Title 14, Division 7

Chapter 3.1 Composting Operations Regulatory Requirements

Article 7. Environmental Health Standards

NOTE: *The regulations contained in this document may change at any time, for updates check: http://www.calrecycle.ca.gov/Laws/Regulations/Title14/ch31a5.htm#article7*

Section 17868.1. Sampling Requirements.
All composting operations that sell or give away greater than 1,000 cubic yards of compost annually, and all facilities shall meet the following requirements:

(a) Operators shall verify that compost meets the maximum acceptable metal concentration limits specified in section 17868.2, and pathogen reduction requirements specified in section 17868.3. Verification of pathogen reduction requirements shall occur at the point where compost is sold and removed from the site, bagged for sale, given away for beneficial use and removed from the site or otherwise beneficially used. This verification shall be performed by taking and analyzing at least one composite sample of compost, following the requirements of this section as follows:

(1) An operator who composts green material, food material, or mixed solid waste shall take and analyze one composite sample for every 5,000 cubic-yards of compost produced.

(2) An operator who composts biosolids shall meet the sampling schedule described in Table 1 below.

Table 1
Frequencies of Compost Sampling for Biosolids Composting Facilities

Amount of Biosolids Compost Feedstock (metric tons per 365 day period)	Frequency
Greater than zero but annually fewer than 290	annually
Equal to or greater than 290 but fewer than 1,500	quarterly
Equal to or greater than 1,500 but fewer than 15,000	bimonthly
Equal to or greater than 15,000	monthly

(A) The amount of biosolids compost feedstock shall be calculated in dry weight metric tons.

(3) Composite sample analysis for maximum acceptable metal concentrations, specified in section 17868.2, shall be conducted at a laboratory certified by the California Department of Health Services, pursuant to the Health and Safety Code.

(b) A composite sample shall be representative and random, and may be obtained by taking twelve (12) mixed samples as described below.

(1) The twelve samples shall be of equal volume.

(2) The twelve samples shall be extracted from within the compost pile as follows:

(A) Four samples from one-half the width of the pile, each at a different cross-section;

(B) Four samples from one-fourth the width of the pile, each at a different cross-section; and,

(C) Four samples from one-eighth the width of the pile, each at a different cross-section.

(c) The EA may approve alternative methods of sampling for a green material composting operation or facility that ensures the maximum metal concentration requirements of section 17868.2 and the pathogen reduction requirements of section 17868.3 are met.

Section 17868.2. Maximum Metal Concentrations.

(a) Compost products derived from compostable materials that contain any metal in amounts that exceed the maximum acceptable metal concentrations shown in Table 2 shall be designated for disposal, additional processing, or other use as approved by state or federal agencies having appropriate jurisdiction.

Table 2
Maximum Acceptable Metal Concentrations

Constituent	Concentration (mg/kg) on dry weight basis
Arsenic (As)	41
Cadmium (Cd)	39
Chromium (Cr)	1200
Copper (Cu)	1500
Lead (Pb)	300
Mercury (Hg)	17
Nickel (Ni)	420
Selenium (Se)	36
Zinc (Zn)	2800

(b) Alternative methods of compliance to meet the requirements of Subdivision (a) of this section, including but not limited to sampling frequencies, may be approved by the EA for green and food materials composting operations and facilities if the EA determines that the alternative method will ensure that the maximum acceptable metal concentrations shown in Table 2 are not exceeded.

Section 17868.3. Pathogen Reduction.
(a) Compost products derived from compostable materials, that contain pathogens in amounts that exceed the maximum acceptable pathogen concentrations described in Subdivision (b) of this section shall be designated for disposal, additional processing, or other use as approved by state or federal agencies having appropriate jurisdiction.

(b) Operators that produce compost shall ensure that:

(1) The density of fecal coliform in compost, that is or has at one time been active compost, shall be less than 1,000 Most Probable Number per gram of total solids (dry weight basis), and the density of Salmonella sp. bacteria in compost shall be less than three (3) Most Probable Number per four (4) grams of total solids (dry weight basis).

(2) At enclosed or within-vessel composting process operations and facilities, active compost shall be maintained at a temperature of 55 degrees Celsius (131 degrees Fahrenheit) or higher for a pathogen reduction period of 3 days.

(A) Due to variations among enclosed and within-vessel composting system designs, including tunnels, the operator shall submit a system-specific temperature monitoring plan with the permit application to meet the requirements of Subdivision (b)(2) of this section.

(3) If the operation or facility uses a windrow composting process, active compost shall be maintained under aerobic conditions at a temperature of 55 degrees Celsius (131 degrees Fahrenheit) or higher for a pathogen reduction period of 15 days or longer. During the period when the compost is maintained at 55 degrees Celsius or higher, there shall be a minimum of five (5) turnings of the windrow.

(4) If the operation or facility uses an aerated static pile composting process, all active compost shall be covered with 6 to 12 inches of insulating material, and the active compost shall be maintained at a temperature of 55 degrees Celsius (131 degrees Fahrenheit) or higher for a pathogen reduction period of 3 days.

(c) Alternative methods of compliance to meet the requirements of Subdivision (b) of this section may be approved by the EA if the EA determines that the alternative method will provide equivalent pathogen reduction.

(d) Compost operations and facilities shall be monitored as follows to ensure that the standards in Subdivision (b) of this section are met:

(1) Each day during the pathogen reduction period, at least one temperature reading shall be taken per every 150 feet of windrow, or fraction thereof, or for every 200 cubic-yards of active compost, or fraction thereof.

(2) Temperature measurements for pathogen reduction shall be measured as follows:

(A) Windrow composting processes and agitated bays shall be monitored twelve (12) to twenty-four (24) inches below the pile surface;

(B) Aerated static pile composting processes shall be monitored twelve (12) to eighteen (18) inches from the point where the insulation cover meets the active compost.

Section 17868.5. Green Material Processing Requirements.
In order for a feedstock to be considered green material, as defined in section 17852(a)(21), the following requirements shall be met:

(a) The feedstock shall undergo load checking to ensure that physical contaminants are no greater than 1.0 percent of total weight. Load checking shall include both visual observation of incoming waste loads and load sorting to quantify percentage of contaminating materials.

(1) A minimum of one percent of daily incoming feedstock volume or at least one truck per day, whichever is greater, shall be inspected visually. If a visual load check indicates a contamination level greater than 1.0 percent, a representative sample shall be taken, physical contaminants shall be collected and weighed, and the percentage of physical contaminants determined. The load shall be rejected if physical contaminants are greater than 1.0 percent of total weight.

(b) Upon request of the EA, the operator shall take a representative sample of feedstock, physical contaminants shall be collected and weighed, and the percentage of physical contaminants determined.

(c) Any agricultural material handling operation using this material shall ensure the feedstock meets the metal concentration limits specified in Table 2 of section 17868.2.

(d) Facility personnel shall be adequately trained to perform the activities specified in this section.

(e) Any operation or facility using this feedstock shall maintain records demonstrating compliance with this section.

Note:

Authority cited:
Sections 40502, 43020, and 43021 of the Public Resources Code.

Reference:
Sections 43020 and 43021 of the Public Resources Code.

APPENDIX G: LAND AND/OR NATURAL RESOURCE MANAGEMENT AGENCY CONTACTS

The following list of permitting agencies and technical service providers is meant as a resource to help growers comply with the metrics in a way that is compatible with environmental protection and permitting requirements.

Permit Issuing Agencies:

California Department of Fish and Game

The California Department of Fish and Game should be contacted for Lake and Streambed Alteration Agreements, Incidental Take Permits and/or Depredation Permits. Please see below for specific program area contact information.

Julie Means
Lake and Stream Alteration Agreement, Fish and Game Code Section 1602
California Department of Fish and Game
1234 East Shaw Ave.
Fresno, CA 93710
Office: (559) 243-4014 ext. 240
Fax: (559) 243-4020

Contact Julie Means if the project proponent plans to divert or obstruct the natural flow of, or alter the bank (including riparian habitat), bed or channel of a river, stream or lake. The project proponent must submit a written Notification and appropriate fee to the Department. Information is available at www.dfg.ca.gov/1600/. The Department has 30 days to determine a Notification complete and 60 days from the date the Notification is determined complete to issue an Agreement.

Anne Ferranti
Incidental Take Permit for State Listed species, Fish and Game Code Section 2081.
California Department of Fish and Game
1234 East Shaw Ave.
Fresno, CA 93710
Office: (559) 243-4014 ext. 222
Fax: (559) 243-4020

Contact Anne Ferranti if there is a potential to take a State threatened, endangered or candidate species under a lawful activity. Take is defined to hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, or kill. Before an "Incidental Take Permit" will be issued an Environmental Impact Report pursuant to the California Environmental Quality Act (CEQA) is required.

Jeff Cann
Depredation Permits, Wildlife Management, Fish and Game Code Sections 4181 and 4181.5
California Department of Fish and Game
20 Lower Ragsdale Drive
Monterey, CA 93940
Office: (831) 649-7194
Fax: (831) 649-2894

Contact Jeff Cann if property is being damaged or destroyed by deer, elk, bear, beaver, wild pig, wild turkey, or gray squirrel. The department will determine if actual damage by the above species is occurring

and recommend alternative prevention methods before a depredation permit is issued. Department staff is also available to discuss fencing or other wildlife issues.

Regional Water Quality Control Boards

The following Regional Water Boards have agricultural waiver programs. They should be contacted regarding compliance issues with agricultural waivers in the respective regions. The Regional Water Boards should be contacted for all issues that may affect water quality and by growers who need help with well, pond and other irrigation water disinfection procedures.

Jill North
Environmental Scientist
Central Coast Regional Water Quality Control Board
895 Aerovista Place, Suite 101
San Luis Obispo, CA 93401-7906
Office: (805) 542-4762
Fax: (805) 788-3583
jnorth@waterboards.ca.gov

Joe Karkoski
Division Chief, Irrigated Lands Assessment and Planning Office
Central Valley Regional Water Quality Control Board
11020 Sun Center Drive #200
Rancho Cordova, CA 95670
Office: (916) 464-4668
jkarkoski@waterboards.ca.gov

Rebecca Veiga Nascimento
Environmental Scientist
Los Angeles Regional Water Quality Control Board
320 West 4th Street, Suite 200
Los Angeles, CA 90013
Office: (213) 576-6661
rveiga@waterboards.ca.gov

Technical Assistance Agency Contacts:

Environmental Protection Agency

Jovita Pajarillo
Associate Director
Water Division (WTR-1)
(415) 972-3491
pajarillo.jovita@epa.gov

National Marine Fisheries Service

The National Marine Fisheries Service should be contacted for technical assistance about land use activities that could affect steelhead or their habitat, riparian management activities, activities that affect a floodplain or activities that might deliver sediment to streams.

William Stevens
Natural Resource Management Specialist
National Marine Fisheries Service
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404-6528
Office: (707) 575-6066
Fax: (707) 578-3435
William.Stevens@noaa.gov

Natural Resources Conservation Service (NRCS)

The Natural Resources Conservation Service (NRCS) can provide free confidential technical assistance in evaluating the effect of proposed food safety protection measures on other natural resource protection goals such as water quality protection, erosion control, and wildlife management and endangered species protection. The NRCS can help growers develop management plans to comply with the metrics in a way that is compatible with environmental protection.

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APPENDIX H: AUDIT CHECKLIST

FOR THE

CALIFORNIA

Commodity Specific Food Safety Guidelines for
the Production, Harvest, Cooling, Packing, Storage, and Transporting
of Cantaloupes and Other Netted Melons

Version 2.0

Audit Checklist - Version 2.0					
Audit Item Number	**Guidance Reference Number**	**Required Elements of Food Safety Program**	**Document (D), Record (R), Observation (O)**	**YES/NO/NA**	**Comments**
	I.	**Common Elements**			
	1.0	***Food Safety Policies and Plans***			
1	1.1	A written food safety policy signed by senior management that outlines the company's commitment to food safety, how it is implemented, and how it is communicated to employees.	D		
2	1.1	A systematic risk-based hazard analysis of the company's operations from ground selection through shipment.	D		
3	1.1	A comprehensive food safety plan based upon hazard analysis	D		
4	1.1	Food safety plan reviews	R		
5	1.1	An identified person responsible for the company's food safety program and 24-hour contact information for both a primary and secondary contact.	D		
6	1.1	A corrective actions policy with verification for effectiveness	D		
7	1.1	Log of corrective actions	R		
8	1.1	A self-audit procedure	D		
9	1.1	A record of self-audit exercise at least annually	R		
10	1.1	A list of current growers and buyers with contact information	R		
	2.2	***Product traceability program must***			

Audit Checklist - Version 2.0					
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		include:			
11	2.2.1	Records of the immediate source of their cantaloupes	R		
12	2.2.1	Records of the immediate buyer of their cantaloupes	R		
13	2.2.1	Records of any independent third-party carriers that are transporting the cantaloupes from their facility to a buyer	R		
14	2.2.1	A trace back and trace forward exercise performed at least annually at each of the company's facilities	R		
15	2.2.1	Finished product labeled appropriately for traceability purposes	O		
	3.0	***Training, Hygiene, and Worker Health***			
16	3.1	A written program of operations-specific practices for workers, visitors, vendors and 3rd party contractors is available.	D		
	3.2	***Training program must include:***			
17	3.2	Documentation of food safety training, personal hygiene training, and worker health training for all staff.	R		
18	3.2	Documentation of visitors, vendors and 3rd party contractors' awareness of the company's health and hygiene	R		

Audit Checklist - Version 2.0					
Audit Item Number	**Guidance Reference Number**	**Required Elements of Food Safety Program**	**Document (D), Record (R), Observation (O)**	**YES/NO/NA**	**Comments**
		requirements.			
	3.3	***Hygiene program must require that:***			
19	3.3	Employees wash their hands before beginning or returning to work, after eating, smoking, using toilet facilities, or any other clear source that may cause hands to become contaminated with pathogens.	O		
20	3.3	If gloves are used, a written procedure must be documented.	D		
21	3.3	If gloves are used, they must be provided by the employer and not removed from the work place by employees.	O		
22	3.3	If gloves are reused, they must be cleaned and sanitized daily.	R		
23	3.3	If gloves are used, they must be changed as necessary after any event that may cause gloves to become contaminated.	O		
24	3.3	Gloves must not be worn when using the toilet facilities, eating or handling unsafe or non-food grade materials.	O		
25	3.3	Hand-held tools and protective garments must not be taken into the toilet facilities or placed on the ground.	O		
26	3.3	Personal items must be stored outside of the harvest area.	O		

Audit Checklist - Version 2.0					
Audit Item Number	**Guidance Reference Number**	**Required Elements of Food Safety Program**	**Document (D), Record (R), Observation (O)**	**YES/NO/NA**	**Comments**
27	3.3	Smoking, eating and drinking (except water) shall be confined to designated areas.	O		
28	3.3	Spitting, chewing gum or tobacco, urinating, or defecating shall be confined to designated areas.	O		
	3.4	***Worker health program must require that:***			
29	3.4	Workers, visitors, vendors and 3rd party contractors with symptoms of illness or infectious disease are prohibited from handling cantaloupe.	O		
30	3.4	Workers, visitors, vendors or 3rd party contractors with open cuts or lesions are prohibited from handling cantaloupe.	O		
31	3.4	Procedures are in place for food contact surfaces or cantaloupe that comes in contact with blood or other bodily fluids.	D		
32	3.4	First aid kits are available and materials are unexpired and maintained in sanitary and usable condition.	O		
	3.5	***Toilet facilities and hand washing stations must:***			
33	3.5	Meet applicable stated and/or federal regulations.	D		
34	3.5	Be supplied with potable running	R		

Audit Checklist - Version 2.0					
Audit Item Number	**Guidance Reference Number**	**Required Elements of Food Safety Program**	**Document (D), Record (R), Observation (O)**	**YES/NO/NA**	**Comments**
		water or treated with sufficient levels of disinfectant to ensure that water meets local, state, or US EPA microbial standards for drinking water (e.g., no detectable generic *E. coli*).			
35	3.5	Be serviced on a scheduled basis at a location that minimizes the potential risk of product contamination.	R		
36	3.5	Be properly stocked with soap and disposable towels.	O		
37	3.5	Constructed of materials that can be cleaned and sanitized.	O		
38	3.5	Establish a response plan in the event of a major spill or leak.	D		
	4.0	***Sanitation***			
39	4.1	A master sanitation schedule must be documented and clearly identify all equipment and/or equipment numbers, SSOPs, and cleaning frequency.	D		
	4.2	***Food contact surfaces, facilities and equipment***			
40	4.2	Food contact surfaces are constructed of material that is easily cleanable and able to be sanitized.	O		
41	4.2	Food contact surfaces are cleaned and sanitized daily, after	R		

Audit Checklist - Version 2.0					
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		maintenance, after moving between ranches, or if potential contamination occurs.			
42	4.2	A pre-operative inspection of equipment and facilities must be conducted daily to ensure that sanitation has been satisfactorily completed.	R		
43	4.2	The efficacy of cleaning and sanitation methods must be verified.	R		
44	4.2	If environmental monitoring is conducted, the program must be documented and testing data must be on file.	R		
45	4.2	If hand-held tools are used, receptacles must be available with proper sanitizing solution.	O		
	4.3	*The SSOP for toilet facilities and hand washing stations must include:*			
46	4.3	The frequency and specific protocols of toilet and hand washing facility sanitation.	D		
47	4.3	Equipment and supplies storage and control procedures for portable facilities when not in use.	D		
48	4.3	Procedures for trash disposal.	D		
	4.4	***Personnel with cleaning and sanitation duties must be trained:***			

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49	4.4	To understand the methods required for effective cleaning and sanitation.	R		
50	4.4	In proper cleaning and sanitizing techniques outlined in the SSOP.	D		
51	4.4	About the potential for cross-contamination when using water to clean.	D		
52	4.4	To use, handle and store cleaning and sanitizing chemicals safely.	D		
53	4.4	In the proper use of cleaning equipment.	D		
	4.5	***Cleaning and sanitizing chemicals must be:***			
54	4.5	Be stored in a secure, vented area.	O		
55	4.5	Be away from the food handling area and any storage areas for raw or finished product packaging materials.	O		
56	4.5	Be labeled in accordance with applicable manufacturer's instructions and a MSDS kept on file.	O		
	5.0	***Equipment Construction and Maintenance***			
57	5.1	A master maintenance schedule must be documented and clearly identify all equipment and/or equipment numbers and maintenance frequency.	D		

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58	5.1	A pre-operative inspection of equipment and facilities must be conducted daily to ensure that maintenance deficiencies or requirements are completed.	R		
59	5.1	Glass and brittle plastic on equipment are shatter-proof or covered.	O		
60	5.1	Food grade lubricants are used on equipment where food contact may occur.	D		
61	5.1	Food contact surfaces must be constructed of materials that can be easily cleaned and sanitized and will not harbor pathogens.	O		
	6.0	***Flooding***			
62	6.1	Flood events and/or any activities related to mitigating flood events are documented.	R		
63	6.2	Cantaloupes which have come in contact with flood waters were destroyed.	R		
	II.	**Primary Production Operations (Growing)**			
	7.0	***Environmental Risk Assessments***			
	7.1	***Pre-plant environmental risk assessment***			
64	7.1	A written pre-planting environmental risk assessment of the production	R		

Audit Checklist - Version 2.0					
Audit Item Number	**Guidance Reference Number**	**Required Elements of Food Safety Program**	**Document (D), Record (R), Observation (O)**	**YES/NO/NA**	**Comments**
		field, water sources, and surrounding area was completed and documented both the planting and the assessment dates, any presence of fecal contamination and any corrective actions described in Table II-1.			
65	7.1	Document historical land use that may pose a risk to production area.	D		
66	7.1	Document historical flooding events that may pose a risk to production area.	D		
67	7.1	Document adjacent land use that may pose a risk to production area.	D		
	7.2	***Pre-harvest environmental risk assessment***			
68	7.2	A written pre-harvest environmental risk assessment of the production field, water sources, and surrounding area was completed within one week prior to harvest and documented any changes that may have occurred in the field, any presence of fecal contamination, and any corrective actions described in Table II-1 and Figure 2.	R		
	8.0	**Water**			
69	8.1	A written water system description (e.g. map, photo, drawing) indicating	D		

Audit Checklist - Version 2.0					
Audit Item Number	**Guidance Reference Number**	**Required Elements of Food Safety Program**	**Document (D), Record (R), Observation (O)**	**YES/NO/NA**	**Comments**
		the location and irrigation system, all fixtures and direction of water flow.			
70	8.1	A written record showing source water used.	R		
71	8.1	A written procedure for water testing covering sampling frequency, persons responsible for sampling, sampling location, sample volume, collection methods, test types, and acceptance criteria.	D		
72	8.1	Irrigation water is tested for *E. coli* and meets or exceeds acceptance criteria for:	R		
73	8.1	Non-Foliar: Less than 235 MPN/100ml (rolling geometric mean n=5) and no single sample exceeded 576 MPN/100ml	O		
74	8.1	Foliar: Less than 126 MPN/100ml (rolling geometric mean n=5) and no single sample exceeded 235 MPN/100ml.	O		
75	8.1	If water tests did not meet the acceptance criteria, corrective actions were taken to eliminate the contamination sources.	R		
	9.0	**Soil Amendments**			
76	9.1	Documentation that raw manure, bio-solids, incompletely composted animal manure and/or green waste,	R		

Audit Checklist - Version 2.0					
Audit Item Number	**Guidance Reference Number**	**Required Elements of Food Safety Program**	**Document (D), Record (R), Observation (O)**	**YES/NO/NA**	**Comments**
		or non-thermally treated animal manure have not been applied in the 12 months prior to harvest.			
77	9.1	Documentation (e.g. Letter of Guaranty, ingredient statement, bag label, etc.) verifying that soil amendments do not contain raw manure, bio-solids, or incompletely composted animal manure and/or green waste.	D		
78	9.1	Soil amendments are managed such that the likelihood of them being a source of contamination is reduced (e.g., timing of applications, storage location, source and quality, transport).	R		
79	9.1	If soil amendments containing composted animal manure are used, the supplier name, process validation records, and microbial test results are available, and material was applied more than 45 days before harvest.	R		
	10.0	**Non-Synthetic Crop Treatments**			
80	10.1	If non-synthetic crop treatments are used, documentation must exist that non-synthetic crop treatments do not contain raw manure.	D		
81	10.1	Non-synthetic crop materials are	R		

Audit Checklist - Version 2.0					
Audit Item Number	**Guidance Reference Number**	**Required Elements of Food Safety Program**	**Document (D), Record (R), Observation (O)**	**YES/NO/NA**	**Comments**
		managed such that the likelihood of them being a source of contamination is reduced (e.g., timing of applications, storage location, source and quality, transport).			
82	10.1	If non-synthetic crop treatments are used, the supplier name, process validation records, and microbial test results are available, and material was applied more than 45 days before harvest.	R		
	11.0	**Equipment Facilitated Cross-Contamination**			
83	11.1	Records show that equipment being used for activities that may pose a food safety risk is thoroughly cleaned and sanitized.	R		
	12.0	**Crop Protection Chemicals**			
84	12.1	Records of all crop protection chemicals used; chemicals used are registered for use on cantaloupes, comply with federal, state or local regulations, and corresponding MSDS sheets are available.	R		
85	12.1	Records show that crop protection chemicals were applied by trained, licensed and/or certified pesticide applicator.	R		

Audit Checklist - Version 2.0					
Audit Item Number	**Guidance Reference Number**	**Required Elements of Food Safety Program**	**Document (D), Record (R), Observation (O)**	**YES/NO/NA**	**Comments**
	III.	**Harvest and Field Packing Unit Operations**			
	13.0	**Harvest environmental risk assessment**			
86	13.1	A written harvest environmental risk assessment of the production field, water sources, and surrounding area was completed and documented the assessment dates, any changes since the pre-harvest assessment, any presence of fecal contamination, and any corrective actions described in Table III-1 and Figure 6.	R		
	14.0	**Harvest**			
87	14.1	An individual is designated as responsible for harvesting food safety.	D		
88	14.1	Practices and procedures are in place to protect against the introduction of pathogens between multiple harvests in the production area (e.g. daily harvest environmental risk assessment).	O		
	15.0	**Field Packing Operations**			
89	15.1	Field packing equipment is maintained and appropriate for packing cantaloupes in accordance with Sections I-3.5, I-4.1-4.4, and I-5.1.	O		

Audit Checklist - Version 2.0					
Audit Item Number	**Guidance Reference Number**	**Required Elements of Food Safety Program**	**Document (D), Record (R), Observation (O)**	**YES/NO/NA**	**Comments**
90	15.1	Workers, visitors, vendors and 3rd parties have met the requirements of Section I-3.1-3.4.	O		
	16.0	**Water Used During Harvest**			
91	16.1	Water management plan must include preventive controls, monitoring and verification procedures, and corrective actions.	D		
92	16.1	A written procedure for water testing covering sampling frequency, persons responsible for sampling, sampling location, sample volume, collection methods, test types, and acceptance criteria.	D		
93	16.1	Water used on cantaloupe or food contact surfaces must have no detectable generic *E. coli* and have sufficient levels of disinfectant (e.g. Chlorine-based disinfectants greater than 10 ppm free chlorine after application and pH 6.5-7.0, ORP greater than 725mV, or other approved and validated treatment per product US EPA label for human pathogen reduction in water).	R		
94	16.1	If water tests did not meet the acceptance criteria, corrective actions were taken to eliminate the contamination sources.	R		

Audit Checklist - Version 2.0					
Audit Item Number	**Guidance Reference Number**	**Required Elements of Food Safety Program**	**Document (D), Record (R), Observation (O)**	**YES/NO/NA**	**Comments**
	17.0	**Harvest and Field Packing Containers**			
95	17.1	SOP for inspecting incoming harvest and field packing materials and containers to ensure that they are in sanitary condition and suitable for use.	D		
96	17.1	Field containers are distinguishable from finished product containers.	O		
97	17.1	SOP for daily inspection of harvest and field packing materials and containers that includes overnight storage and daily inspection.	D		
98	17.1	Single-use harvest and field packing materials or containers are not reused.	O		
99	17.1	Harvest and field packing materials or containers are properly labeled for traceability and meet the requirements of Section I-2.2.1.	O		
100	17.1	SSOP for reusable containers that addresses cleaning frequency, sanitizer type and concentration, and specific cleaning procedures prior to reuse.	D		
	IV.	**Facilities**			
	18.0	**Facility Construction, Design and Maintenance**			
101	18.1	Facility grounds, roads and parking	O		

Audit Checklist - Version 2.0					
Audit Item Number	**Guidance Reference Number**	**Required Elements of Food Safety Program**	**Document (D), Record (R), Observation (O)**	**YES/NO/NA**	**Comments**
		areas must be maintained in a condition that will control, reduce, or eliminate the risk of contamination including the following:			
102	18.1	Adjacent land use does not pose a risk of cross-contamination.	O		
103	18.1	Grounds are free of standing water, litter, waste, tall grass and weeds.	O		
104	18.1	Waste treatment and disposal does not pose a risk of cross contamination.	O		
105	18.2	Facility and equipment used in packing and/or cooling cantaloupe shall be designed, constructed and maintained to facilitate cleaning and sanitation.	O		
106	18.2	Facility has a written risk assessment addressing areas of potential risk.	D		
107	18.2	Water on the floor drains appropriately.	O		
108	18.2	Air intakes are not located near potential sources of contamination.	O		
109	18.2	Food contact surfaces are appropriate for their intended use.	O		
110	18.2	Food contact surfaces are constructed of appropriate materials.	O		
111	18.2	Facility water systems are equipped with back-flow prevention devices where appropriate and tested to	O		

Audit Checklist - Version 2.0					
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		ensure the devices are functioning properly.			
112	18.2	Lights are equipped with shatter-proof light bulbs or have protective coverings to prevent foreign material contamination.	O		
113	18.2	There is no evidence of overhead condensation that could pose a risk of contamination to the product or food contact surfaces.	O		
114	18.2	Waste water collection areas are designed to prevent cross-contamination.	O		
115	18.2	There is a designated area away from food handling areas for workers, visitors, vendors and 3rd parties to store their personal items.	O		
116	18.3	The facility has a written pest control program.	D		
117	18.3	All materials must be acceptable for use in and around a food facility.	O		
118	18.3	Records include: detailed maps showing the location of each rodent trap and bait station, a copy of the applicator's license, a list of chemicals, MSDS sheets, and a schedule of the applicator's activities and corrective actions.	D		
119	18.3	An inspection buffer must be	O		

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		maintained on both the inside and outside of the facility.			
	19.0	***Facility Sanitary Operations***			
120	19.1	The facility has a flow diagram of their operations.	D		
121	19.1	The facility a written hazard analysis in accordance with Section I-1.1.	D		
122	19.1	Cantaloupes do not contact the floor or any other non-food contact surface.	O		
123	19.1	Cantaloupes that fall on the floor must be discarded.	O		
124	19.1	Condensation that forms in the facility (e.g. after defrost) does not pose a risk of contamination to cantaloupes and food contact surfaces.	O		
125	19.1	Waste is placed in appropriate receptacles with serviceable lids.	O		
126	19.1	Old or unused equipment does not pose a risk of contamination.	O		
	19.2	***Cooling and Cold Storage***			
127	19.2	Packing materials and product containers (e.g. bins) are stacked to allow uniform air flow and distribution.	O		
128	19.2	Equipment used to control environmental conditions (e.g. temperature and humidity) is	O, R		

Audit Checklist - Version 2.0					
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		maintained and calibrated on a routine basis.			
	20.0	***Receiving***			
129	20.1	Documentation accompanying incoming cantaloupe loads is available, maintained, and sufficient to facilitate product traceability.	D		
130	20.1	Incoming cantaloupe loads are inspected for potential risks of contamination	O		
	21.0	**Unloading Operations**			
131	21.1	Unloading operations are conducted in a manner that minimizes, reduces, or eliminates the potential for cross-contamination.	O		
	22.0	**Cooling Field Cantaloupes**			
132	22.1	If water is used to cool cantaloupes, it must have no detectable total coliforms and have sufficient levels of disinfectant to reduce the risk of cross-contamination (e.g. Chlorine based disinfectants greater than 10 ppm free chlorine after application and pH 6.5-7.0, ORP greater than 725mV, or other approved and validated treatment per product US EPA label for human pathogen reduction in water).	O		
133	22.1	Disinfectant levels must be	O,R		

Audit Checklist - Version 2.0					
Audit Item Number	**Guidance Reference Number**	**Required Elements of Food Safety Program**	**Document (D), Record (R), Observation (O)**	**YES/NO/NA**	**Comments**
		monitored and measured and instrumentation must be maintained and calibrated routinely.			
134	22.1	All cooling equipment, including dumps, spray nozzles, filters, contact surfaces, fans, coils and condensers must be cleaned and sanitized on a regular basis to assure the potential for cross-contamination is minimized.	R		
135	22.1	Procedures for when and how often recirculated water is to be refreshed are documented and followed.	O		
	23.0	**Facility Water**			
136	23.1	Water management plan must include preventive controls, monitoring and verification procedures, and corrective actions.	D		
137	23.1	Water used on cantaloupes or food contact surfaces in the facility must meet EPA microbial standards for drinking water of no detectable total coliforms and have sufficient levels of disinfectant to reduce the risk of cross-contamination (e.g. Chlorine based disinfectants greater than 10 ppm free chlorine after application and pH 6.5-7.0, ORP greater than 725mV, or other approved and validated treatment per product US	R		

Audit Checklist - Version 2.0					
Audit Item Number	**Guidance Reference Number**	**Required Elements of Food Safety Program**	**Document (D), Record (R), Observation (O)**	**YES/NO/NA**	**Comments**
		EPA label for human pathogen reduction in water).			
138	23.1	Disinfectant levels must be monitored and measured and instrumentation must be maintained and calibrated routinely.	R		
139	23.1	Procedures for when and how often recirculated water is to be refreshed are documented and followed.	O		
140	23.1	Waste water is disposed appropriately.	O		
	24.0	***Post-harvest Product Containers, Packaging Materials, Finished Product Containers and Pallets***			
	24.1	Post-harvest product containers:			
141	24.1	Are stored in a manner that protects against pest infestation, dust and debris.	O		
142	24.1	Are distinguishable from field containers and/or finished product containers.	O		
143	24.1	If reusable, are constructed of or covered with materials that are cleaned and sanitized.	O		
144	24.1	If reusable, have an SSOP for cleaning and sanitizing and cleaning logs with dates and time of cleaning, concentrations of sanitizers and cleaning agents.	D,R		

Audit Checklist - Version 2.0					
Audit Item Number	**Guidance Reference Number**	**Required Elements of Food Safety Program**	**Document (D), Record (R), Observation (O)**	**YES/NO/NA**	**Comments**
	24.2	Finished product containers, packaging materials and pallets must have:			
145	24.2	A SOP for inspecting incoming packaging materials to ensure that they are in sanitary condition and suitable for use.	D		
146	24.2	Protection from wind-blown dirt, chemical sprays, birds, rodents and other pests.	O		
147	24.2	Labels for traceability per the requirements of Section I-2.2.1.	O		
148	24.2	A storage area or yard that is clean and included in facility pest control program.	O		
	25.0	**Cold Storage and Warehousing**			
149	25.1	Product is stored and warehoused under conditions that will protect them against physical, chemical and microbial contaminations and in a manner that does not facilitate cross-contamination.	O		
150	25.1	Product is stored and warehoused at appropriate temperatures and temperature monitoring devices are calibrated on a regular basis.	O,R		
151	25.1	Refrigeration temperature logs are available.	R		
152	25.1	Storage and warehouse facilities are	R		

Audit Checklist - Version 2.0					
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		cleaned, sanitized and maintained and appropriate in accordance with Sections I-3.6, I-4.1-4.4, and I-5.1.			
153	25.1	Workers, visitors, vendors and 3rd parties have met the requirements of Section I-3.1-3.4.	O		
	V.	**Transportation**			
	26.0	**Transportation**			
154	26.1	SOP for loading and unloading procedures, including transportation vehicle inspection for cleanliness and odors.	D		
155	26.1	Documentation that refrigeration equipment in refrigerated vehicles is working.	D		
156	26.1	Documentation that operator maintains a temperature that is appropriate for the particular cantaloupe being transported.	D		