



Good Agricultural Practices for Food Safety in Blueberry Production: Basic Principles

Prepared by

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BLUEBERRY GAP BASIC PRINCIPLES

This document represents generally accepted, broad-based agricultural guidance, developed from current knowledge of food safety practices of FDA, USDA, and others. By identifying basic principles of food safety in blueberries from growing to processing, users of this guide will be better prepared to address elements of food safety concerns and will be better prepared for third party audits. These principles focus on risk reduction not risk elimination. Risk reduction is of utmost importance as all potential risks cannot be completely eliminated in food production. These guidelines are general and designed for all aspects of blueberry production (growers, packers/shippers, etc.). Based on the size and scope of your operation, some aspects may not be applicable for your situation. However, these GAP principles should be the basis to develop your own individual food safety programs.

1. It is best to prevent microbial contamination of fresh and processed blueberries than to rely on corrective actions once contamination has occurred. Once contamination has occurred (from molds, yeast, bacteria, insect parts, and/or non-pathogenic contaminants) it is nearly impossible to eliminate. Blueberries are delicate fruits that can not be easily sanitized without losing the “bloom”, a whitish wax film that covers fresh blueberries which gives this fruit its aesthetic characteristics.
2. To minimize food safety hazards in fresh blueberries, growers, packers, or shippers should use Good Agricultural and Management Practices.
3. Blueberries can become contaminated at any point along the farm-to-table food chain. The major source of microbial contamination with fresh blueberries is associated with human or animal feces.
4. Water that comes in contact with blueberries (its source and quality) has the potential for contamination. Water used for sprinkle irrigation, for processing and to mix pesticides is a potential source of contamination. Use potable water to minimize the potential of microbial contamination in fresh or frozen blueberries.
5. Worker hygiene and sanitation practices during production, harvesting, sorting, packing, and transport play a **critical role** in minimizing the potential for microbial contamination of fresh blueberries.
6. All pesticides (including herbicides) should only be used in strict accordance with manufacturers’ recommendations, and state and federal rules and regulations.
7. Practices using animal manure or municipal biosolid wastes should be managed closely to minimize the potential for microbial contamination of fresh blueberries.
8. Accountability at all levels of production (farm, packing facility, distribution center, and transport operation) is important to a successful food safety program. There must be trained qualified personnel and effective monitoring to ensure that all elements of the program function correctly and to help track blueberries back through the distribution channels to the grower. There is no evidence that steps have been taken to reduce risk unless written logs and reports of the steps taken are available.

I. Farm History

Previous land use.

Good Agricultural Practices (GAP) includes knowing what the land was used for prior to blueberry planting. It is important to know previous land use mainly because of the potential for toxic or harmful chemical residues, excessive levels of heavy metals, or persistent populations of human pathogens that are associated with fecal contamination. Of greatest concern would be a prior land use that may have involved industrial dumping, animal grazing, disposal sites for dairy or poultry operation waste, or distribution of municipal wastes (biosolids).

Adjacent land use activities and environment.

Be aware of animal operations, pesticide and herbicide applications, run-off from water sources or water applications, and other activities that could result in spreading of pollutants or contaminants. Consider vegetative buffers to mitigate run-off or to serve as windbreaks in the prevention of wind-borne contaminants. Diversion canals or berms may also be necessary to prevent contamination from water.

II WATER

Water used in blueberry production involves numerous field operations including irrigation, applications of pesticides and fertilizers, cooling, and frost control. Post-harvest uses include blueberry rinsing and washing. Water of inadequate quality has the potential to be a direct source of contamination and a vehicle for spreading localized contamination in the field, facility, or transportation environments. Wherever water comes in contact with fresh blueberries, its quality dictates the potential for pathogen contamination. If pathogens survive on the fruit, they may cause foodborne illness.

Hazards associated with water

Be aware that water is a pathogen carrier. There is a large class of bacteria known as coliform bacteria transmitted by water. *E. coli* is mainly a water-borne pathogen that can be transferred to blueberries during washing, cooling or packing. Outbreaks caused by *Salmonella*, *Giardia (Giardia lamblia)* and *Cyclospora (Cyclospora cayetanensis)* in fresh blueberries are also associated with contaminated waters. Symptoms of these illnesses go from non-severe gastroenteritis (diarrhea, fever, and vomiting) fatigue and abdominal pain to liver and kidney problems to permanent neurological symptoms. Even small amounts of contamination with some of these organisms can result in foodborne illness.

Agricultural Water

Water supply. Water quality should be adequate for its intended use. Agricultural water quality varies. **Surface waters** may be subject to contamination, such as waste water discharge or polluted runoff from upstream livestock operations, etc. **Ground water** that is influenced by surface water, such as older wells with cracked casings, may also be vulnerable to contamination.

1. Identify the source and distribution of water used and be aware of its relative potential for being a source of pathogens: a) Deep well, b) Shallow well, c) Horizontal suction well, d) Spring fed irrigation pond, e) Lake, stream, f) River, g) Drain, h) Others.
2. Identify and document the irrigation delivery system (i.e. overhead sprinklers, drip irrigation, flood or furrow, etc.).

3. *Maintain wells in good working condition.* To reduce the risk of microbial contamination of irrigation wells: a) Slope ground away to prevent rain water from pooling around wellhead, b) Locate well more than 50 feet from septic drain field, c) Keep livestock manure more than 50 feet from wellhead, d) Locate restroom facilities more than 50 feet from wellhead, e) Do not house pets near wellhead.

4. *Protect irrigation ponds.* To reduce the risk of microbial contamination of irrigation ponds do not allow livestock access. Locate livestock housing and manure/compost storage downhill and more than 50 feet from pond. Building raised berms around ponds can prevent overland runoff of manure/compost, and other pollutants, into the pond. When building a pond, locate it more than 50 feet away from septic drain field. Reduce the risk of microbial contamination to irrigation ponds by locating field restroom facilities more than 50 feet away from ponds. Geese can be a source of microbial contamination to ponds. To reduce goose activity in and around your pond, create a buffer strip of thick grasses. The buffer strip should be at least 6 feet deep and 36 inches tall and very dense.

5. *Surface water.* When using a lake, stream, river or drain as an irrigation source, blueberry growers need to be aware of the activities in the watershed. The larger the watershed and the further downstream the irrigation intake, the more vulnerable irrigation water becomes to potential microbial contamination from human and animal activities in the watershed. These might include runoff of livestock manure and wildlife droppings, failing residential septic systems and delivery of pet wastes through urban storm water systems.

6. *Irrigation and pesticide application.* Review existing irrigation and pesticide application practices and conditions to identify potential sources of contamination. Water used for mixing pesticide or foliar feed can be a source for microbial contamination.

- Use potable water for crop protection sprays.
- Document the water source and test water coming from that source.
- Rinse and clean tanks after each use following all applicable federal and state pesticide laws and regulations regarding equipment and rinse water.

7. *Protect water quality.* Consider practices that will protect water quality. These may include ensuring that wells and ponds are properly constructed and protected, treating water to reduce microbial loads, or using alternative application methods that reduce or avoid water-to-blueberry contact. The feasibility of these and other practices will depend on available water sources, the intended water use and the needs and resources of the particular blueberry operation.

Best Management Practices for Irrigation Water:

Overhead irrigation: Apply early in morning to conserve water and minimize leaf drying time. Longer periods between overhead irrigation and harvest lower the risk of microbial contamination and reduce blueberry fruit rots.

Microbial testing of agricultural water. For surface water, conduct testing 2 times during season in temperate climates, at peak use (low flow), and at harvest. Test annually with municipal water, and quarterly with groundwater. It is recommended to request analysis of total coliform bacteria and generic *E.coli* from the analytical lab service. Though not ideal for predictive GAP programs, these

bacteria are the current practical indicators of the potential for recent fecal contamination. Record test results and use this information to develop a long-term monitoring plan.

Where water quality is unknown or cannot be controlled, growers should use other good agricultural practices to minimize the risk of contamination. In general, the grower should consider the relative risk of microbial contamination to current or potential irrigation water sources. Risks for groundwater sources generally increase as well depth decreases. Risks to surface water sources generally increase as the size of the water body's watershed increases.

Processing Water

Processing water should be potable so it does not contaminate blueberries. Packers should ensure that water quality is adequate for its intended use, both at the start and at the end of all post-harvest processes. Therefore: a) Use potable water for all blueberry washing, cooling, dipping, icing, and processing, b) Avoid water temperatures in dump tanks that are more than 10°F cooler than blueberries. Research has shown that if the water is cooler than the fruit temperature, microorganisms residing either on the surface of the fruit or in the wash water can be internalized, making subsequent wash and sanitizing treatments ineffective.

Reduce the risk of contaminating processing water by:

- Periodic water sampling and microbial testing.
- Ensure packinghouse water sanitation.
- Change water as needed to maintain sanitary conditions.
- Clean and sanitize water contact surfaces (hydrocoolers, dump tanks, flumes, wash tanks).
- Install backflow devices and air gaps to separate clean from dirty water.
- Routinely inspect and maintain equipment (Chlorine injectors, filtration systems, backflow devices).

III. Worker Health and Hygiene

Worker hygiene plays a critical role in minimizing potential contamination in blueberries. This is especially true for fresh fruit which has multiple “touch points” with human hands during harvest and postharvest. Individual attention to the needs of proper health and hygiene should not be taken for granted. Be aware of and follow applicable standards for protecting worker health established under the Occupational Safety and Health Act (OSHA) and the U.S. Code of Federal Regulations (21 CFR 110.10). The CFR applies to worker health and hygiene within the context of Good Manufacture Practices (GMP) in the manufacturing, packing, or holding of human food (which includes fresh and frozen fruit). These hygienic practices should be implemented when planting, pruning, harvesting, tending and packing blueberries. Growers should try and follow these standards because blueberry pickers are also food handlers. Anything that comes in contact with your blueberries has the potential to infect and cause illness. Humans are also disease carriers and they can infect whatever they touch if proper hygienic rules are not followed.

When implementing your GAP for Food Safety program, make sure you follow the principles established by MIOSHA (Michigan Occupational Safety and Health Administration) for preventing occupational injuries and illnesses. Those principles are:

- Have one person to implement and maintain the program.
- Enforce safety policies, practices and procedures.

- Communicate to employees what is required regarding safety.
- Investigate injuries and illnesses to identify causes.
- Review the safety program with all new workers at time of hire.
- Correct hazards found during inspections.
- TRAINING and re-enforcement of training in general work safety practices and illness prevention maximizes compliance by workers.
- Document steps taken and maintain the injury and illness prevention program.

The injury and illness prevention documentation should be included within each operation's food safety program and should be reviewed with all new employees as they are hired. Detailed records can provide growers/packers and shippers with a clear picture of their work environment, and can help prevent work-related injuries and illnesses in the future. Injury and illness data can help identify problem areas. The more you know, the better you and MIOSHA can identify high-hazard areas in your facility.

One can better administer company safety and health programs with accurate records. As employee awareness increases, workers are more likely to follow safe work practices and report workplace illnesses and hazards.

Control of Potential Microbial Hazards

Microbial Hazards are biological agents that are likely to cause illness in the absence of its control. These types of hazards are mostly caused by:

- **Bacteria** – Single-celled organisms that live independently (i.e. *E .coli*, *Salmonella*, *Shigella*)
- **Parasites** – Intestinal worms or microscopic protozoa that live in a host animal or human (i.e. *Giardia*, amoebas).
- **Viruses** – Simple organisms that can only replicate in a host (i.e. H1N1; Hepatitis A and B).

Prevention is key for growers, farm workers, packers/shippers to control potential microbial hazards and contamination sources. Preventing problems before they become critical contamination hazards is key in any fresh fruit operation such as blueberry production. Studies have shown that once contamination occurs it is VERY difficult to remove all pathogens from fruit. Therefore, the best way to avoid contamination is by preventing it from happening.

- Growers and/or supervisors should be familiar with typical signs and symptoms of infectious diseases. (See Appendix C).
- Any worker showing symptoms of an infectious illness should not have direct or indirect contact with fresh fruit.
- Provide protection to your blueberries from workers with infectious diseases and lesions.
- Employees/workers should be instructed to report any active case of illness to their supervisor before beginning work.
- Infectious diseases, accompanied by diarrhea or open lesions, that include boils, sores, or infected wounds, are sources of disease-causing microorganisms should be immediately reported.

There are more than 200 known foodborne illnesses. Symptoms of these illnesses go from non-severe gastroenteritis (diarrhea, fever, and vomiting) to liver and kidney problems to permanent neurological symptoms. The symptoms of diarrhea, fever, and vomiting are also symptoms of several other pathogens occasionally transmitted by food contaminated by infected workers. Infected

workers who work with fresh blueberries increase the risk of transmitting foodborne illnesses. Ensure the use of agricultural and management practices that minimize the potential for direct or indirect contact between fecal material and fresh blueberries.

Train Workers in Good Hygiene, and Document the Training

Workers that handle fruit need to understand and practice proper hygiene. The importance of training cannot be overemphasized. Workers can unintentionally contaminate fresh blueberries, water supplies, and other workers, and transmit foodborne illness if they do not understand and follow basic hygienic principles. Therefore, to prevent microbial contaminations begin with a written training program following these guidelines:

- Train all employees to follow good hygienic practices. All employees should have a good working knowledge of basic sanitation and hygiene principles.
- Each grower should develop a sanitation training program for their workers/employees. Depending on the workers' job requirements, periodic refresher or follow-up training sessions may be needed.
- For part time and seasonal field workers, the grower or the supervisor should verbally instruct and demonstrate to newly hired workers proper health and hygienic practices.
- DOCUMENT the training. Document the frequency and content of training meetings.

Ensure that all personnel, directly or indirectly involved in fresh blueberry operations comply with established hygienic practices.

Growers should require **all** visitors, including auditors, product inspectors and buyers to comply with established hygienic practices when picking or inspecting blueberries.

U- Pick Operations

Every U-pick operation should have rules for customers that come to buy berries. Ideally, these operations should have a separate parking area from the fields and a central location where people must pass before and after coming from the fields.

BEFORE entering your blueberry fields, inform customers or visitors about the rules of your operation:

- Rules should also be posted at u-pick field entrances.
- The personal hygiene of customers is just as important as that of field workers
- Visitors/buyers of “U-Pick” operations should be instructed **first** to wash hands properly with soap and water before picking blueberries.
- Do NOT pick blueberries on the ground or touching the ground, as they may be contaminated.
- Have clean and disinfected picking containers or clean containers with unused plastic bags.
- Do not allow outsiders to bring their own containers, as they may be sources of contamination.
- Have potable drinking water, clean toilet and hand washing facilities for visitor use.
- Post clear signs indicating where the facilities are located.
- Ideally no children loose in the fields or picking berries.
- Do NOT allow pets in the fields.

Explain washing hands is for FOOD SAFETY purposes and is part of your Good Agricultural Practice. If possible, have posted signs in the u-pick lots reminding customers about this. Hand

washing posters are often available from local health departments. Remember to ask parents to closely supervise children when they are in the fields.

Hand Washing

Why the importance of hand hygiene? Because the most common method of microbial transmission is thorough your hands. Past outbreaks of food borne illnesses have usually been associated with fruit becoming contaminated with fecal material due to improperly washed hands. When handling blueberries hands should be clean. *Clean* means the physical removal of visible filth with soap and water of adequate sanitary quality (potable). Besides soap, gels or hand sanitizers can also be used to clean hands because they reduce bacterial levels. But, gels or hand sanitizers should not substitute hand washing with soap and water. **NOTE:** No third party auditor accepts sanitizers in lieu of soap.

- Have adequate hand washing stations available.
- Have written training procedures on the importance of hand washing and personal hygiene.
- Document the frequency and content of trainings.
- Remind workers daily of the importance of hand washing.

Document your policy on maintenance of hand washing facilities and be sure potable water, soap and single use towels are always available.

Place written and/or international icon signs in appropriate places indicating water is for "hand washing use only" also, signs indicating where those facilities are located.

Correct Way to Wash Hands:

Six simple steps to follow for proper hand washing are:

1. Wet hands with clean or potable water.
2. Apply soap.
3. Scrub hands, between fingers and under fingernails (best with a fingernail brush) and top of your hands for at least **20 seconds** to do it properly.
 - Friction and the duration of that friction is KEY to good hand washing.
4. Rinse off soap thoroughly.
5. Dry hands with single-use paper towels.
 - Drying hands on our own clothes defeats the purpose of cleaning your hands. Clothes are exposed to environmental contamination and hands will pick up all that is on the surface of your pants or shirts.
6. Discard used towel in a trash can.

Ensure good hygienic practices are followed by visitors to the farm, packing, or transport facilities.

Proper Hand Washing is KEY factor in helping to reduce microbial contamination risks.

Wash hands if hand harvesting blueberries, before starting to work; after using bathroom; after smoking, after breaks, before and after eating or snacking.

Alternative Good Hygienic Practices. When possible, use disposable gloves in combination with proper hand washing for sorting blueberries. If non-disposable gloves are used be sure to have them washed and cleaned very frequently. Always wash hands first before putting disposable or non-disposable gloves on.

Gloves should be removed for non-food related work activities, for example, receiving money, writing forms, etc. If disposable, throw them away and use a new pair. If non-disposable, wash your hands first before putting them on again. Non-disposable gloves that are going to be reused should be placed on a clean surface if you need to take them off to do something else.

Drinking Water:

The water shall be suitably cool and in sufficient amounts, taking into account the air temperature, humidity and the nature of the work performed, to meet the needs of all employees.

- All drinking water must be potable or safe for human consumption.
- Best to use single use cups, a drinking fountain or bottled water.
- Water containers must be cleaned & rinsed daily and must be kept covered.
- If in containers drinking water must be changed daily.
- Drinking cups or water bottles should not be shared and it is best not to have personal cups or glasses.
- Glass cups or glasses should be avoided as they may break and create a physical hazard.

Toilet Use

It is imperative to let all workers know that after going to the bathroom they have to wash their hands with soap and water. Washing properly lowers the risk of contamination of feces to fruit and to humans. Growers should train workers (especially seasonal) how to use toilets properly. When using toilet facilities, workers, visitors and anybody associated with your operation should be reminded:

- NO soiled toilet paper on the floor.
- NO soiled toilet paper in waste baskets or boxes.
- Soiled toilet paper should go into the bowl.
- DO NOT dry hands on pants or shirt sleeves. Drying hands on our own clothes defeats the purpose of cleaning your hands. Clothes are exposed to environmental contamination and hands will pick up all that is on the surface of your pants or shirts.

First Aid:

A lesion with pus (such as a boil or infected wounds that are open or draining) that might have contact with blueberries (during harvest, sorting or packing) or packing equipment, increases the risk of contaminating fresh blueberries. Adequate first-aid materials should always be available at the farm headquarters, and/or on buses or transportation used for workers. Keep in mind the number of your workers/employees and have ample materials to suit their needs. These materials should be kept in a sanitary and usable condition. A "Safety Poster" (EPA 735-H-93-001) with information on nearest medical facility and Michigan's Pesticide Emergency Information should be displayed on a Central Notification board..

When workers are widely scattered in small crews that are contacted by a foreman, adequate protection may be accomplished by having a first aid kit in the foreman's vehicle.

Provisions made in advance with a physician or a communication system for contacting a doctor or a combination of both will avoid unnecessary delay in treatment of serious injuries. The following are some useful guidelines regarding first aid:

- First-aid kit should be ready and available at ALL times.
- Inspect frequently and replenish first-aid kits as needed.
- There shall be at least 1 worker for every 20 workers at any remote location trained in first aid.

- Make advance medical provisions in case of serious injuries.

Blood and Bodily Fluid Contamination Policy: There should be in place a written protocol to follow in case a worker has an open wound that may bleed onto the blueberries. The protocol should advise what to do with the fruit, machines, floor, etc. that has become contaminated with blood or other bodily fluids. Third party auditors are requiring growers and packers/shippers to have written protocols to deal with blood or other bodily fluids coming in contact with fruit.

Personal Hygiene

Workers and everybody having contact with fresh blueberries at harvest or during the sorting/packing process should:

- Take a shower daily and wear clean clothes to work.
- No open toed shoes in any area (picking, sorting, packing, etc).
- In the fields, hands should be washed with soap and water before picking blueberries.
- DO NOT allow outside food vendors to come into fields.
- Wash hands before and after eating, snacking or smoking.
- Dispose of wrappings and containers in a covered trash can and do not throw food items on the floor since they are sources of contamination as it encourages rodents and insects.
- **In packing and sorting**, personnel with direct fruit contact should use disposable gloves, face masks, hair nets, beard nets, clean clothes or clean aprons or clean uniforms.
- Eating areas should be clean and separated from packing facilities.

Clothes used in fields should not be mixed with family's clothes to avoid contaminated clothing (pesticide residues, dust, etc.) to contaminate clothes belonging to your family. Therefore, wash your working field clothes apart from those of your family and in hot water.

Good hygiene helps prevent you and others from getting sick and keeps blueberries safe to eat.

IV: Hazard Analysis and Critical Control Points (HACCP)

It is the standard food safety management system that is required by law for certain sectors of the food industry and frequently mandated by private food safety standards. It is recognized by the US food regulatory agencies. As part of your own Food Safety program, it is recommended to also write your own HACCP plan as it will help you not only to recognize existing hazards but highlight potential problems. Some of the benefits of a HACCP plan are that it improves efficiency, competitiveness and marketability.

The focus is on PREVENTION, and it's applicable to ALL PHASES of blueberry production (from picking to storage to packing to shipping, etc).

This HACCP section will help you get started on your very own HACCP plan. Though they are not yet required for audits, HACCP plans will certainly simplify and prepare you for one.

What does this all mean?

- Hazard – Any biological, chemical or physical agent that is likely to cause injury or illness if not controlled.

- Hazard Analysis – Evaluation of hazards associated with the food to decide which are significant and have to be addressed on the HACCP plan
- Control Point (CP) – Step where biological, chemical or physical factors can be controlled.
- Critical Control Point (CCP) – Step where control is essential to prevent, eliminate or reduce to an acceptable level, a food safety hazard.

A step is any stage, point or procedure from the farm to the table.

Some examples: picking, sorting, cooling or transporting blueberries.

A hazard can be anything from pesticide residue, to foreign objects like buttons, to bacteria from dirty lugs/hands. Basically anything that might cause illness or injury.

You can have many control points.

You should have less critical control points than you have steps (not every step will have a CCP). If you have more than this you are most likely confusing a control point with a critical control point. You may also have management problems if control points keep repeating themselves.

HACCP uses standard operating procedures (SOP), with a solid foundation of:

- GAP – Good Agricultural Practices
- GMP – Good Manufacturing Practices
- GHP – Good Health/Hygienic Practices

A common standard among GAP, GMP and GHP is **cleanliness**. Without a proper foundation you will have many problems and LOTS of critical control points in your HACCP plan.

What does clean mean?

- Clean – visible removal of dirt/filth from a surface
- Sanitize – reduction of microorganisms on surfaces to safe levels via heat or chemicals

Cleaning involves a physical aspect (like scrubbing) and a detergent (like soap) to remove dirt/filth.

- Sanitizing Heat - the item is immersed or sprayed with hot (77°C/171°F or hotter) water for at least 30 seconds; the higher the heat the shorter the time required to kill microorganisms.
- Sanitizing Chemical - the item is immersed, rinsed, or sprayed with a specific concentration of sanitizing solution for a required amount of time.

Ex: Bleach (1 tablespoon in 1 gallon of water sanitizes a cutting board if left in for 2 min)

The effectiveness of sanitizers is influenced by contact time, selectivity, temperature, and concentration.

To be effective, cleaning and sanitizing **MUST** be a two-step process.

Surfaces must first be cleaned and rinsed before being sanitized or the sanitizer will not work.

Cleaning agents must be stable, non-corrosive, and safe for workers to use.

Always remember to read your product labels before use, and follow instructions carefully.

The 7 principles of HACCP:

- 1 – Conduct a hazard analysis

- 2 – Determine critical control points
- 3 – Establish critical limits
- 4 – Establish monitoring procedures
- 5 – Establish corrective actions
- 6 – Establish verification process
- 7 – Establish record keeping and documentation procedures

The most important part is to remember that each HACCP plan is tailored specifically to each particular farm or operation. In other words, you can not copy your neighbors HACCP plan just because you both have the same type of blueberries on the same sized land, and expect it to work well for you. But, you may use a general HACCP plan to get you started and tailor it as you go along, to your specific operation.

Always start at the very beginning. Write everything out. It makes things easier to see. You may forget something if it is not written down. Whether you use a traditional flow chart or a table chart is up to you and what is easier for you to use.

Conducting a Hazard Analysis:

Go through each step. Write down ALL potential hazards and decide if they are significant or not and WHY. Write down what you can do to prevent them. Finally, decide if it's a CCP or just a CP Don't forget to look UP and DOWN when going through your operation. Objects above or below the level of your blueberries can have a direct impact on them also.

- In the field this might be recent fertilizer application. The fertilizer gets stirred up by the workers and onto the blueberries.
- In packing houses this might be rails moving packing boxes from one place to another directly above the blueberry lines. Bacteria and dust on the boxes or from the storage area can fall directly onto your fruit.
- For shippers this might be a point of condensation on the truck that falls directly onto the blueberries.

How to tell a Control Point from a Critical Control Point:

A control point is usually related to management issues and can often be controlled by proper training. A critical control point is a point where it will significantly affect ALL of your blueberries. When reading a good plan, you should not find the same hazards repeated throughout your steps

Where might things affect ALL of your blueberries?

A few examples might include:

- On the farm: If lugs are placed on ground. These are often stacked after being filled. The bottom that was on the ground has just become the top of your bottom lug, cross-contaminating your blueberries.
- On the packing line: If the cooler malfunctions and you can't tell because the thermometer is reading wrong or any other reason, you just increased the chance of spoilage and increased bacterial counts.

To double check if your control points are critical control points please see **CP vs CCP Questions** in [Appendix D](#). These are two sets of questions that will lead you to a conclusion either way. If it leads you to the answer "Not a CCP" you may stop answering the questions that follow at this point.

Types of charts:

There are two basic types of charts:

Flow charts and table charts. It is up to you which one you select. They work best if you are comfortable using them as they both give the same type of information. See [Appendix D](#) for the types and examples.

Establishing critical limits and monitoring procedures:

Critical limits are minimum or maximum values of biological, physical or chemical parameters that must be controlled at a CCP. Critical limits can include maximum accepted pesticide residues on the blueberries, minimum water temperatures in the water tank for frozen blueberries or maximum allowable foreign objects in with the blueberries. These limits are either established by laws, retailers, consumers or a combination.

Monitoring procedures: what is observed or measured to check that everything is under control.

These can be making sure that all workers are wearing aprons and hair nets, to checking the temperature on the thermometer in the cooling rooms or transporting trucks.

Establishing corrective actions and verification processes:

Corrective actions are those done when a critical limit is not met, to try and restore things to where they should be. An example of a corrective action would be to make a worker put on an apron or not work if they are seen without one. It could also be to reset the thermostat in the cooling room if the temperature is too high or too low.

Verification processes make sure that the hazards are effectively controlled.

Some of these processes will be done by you directly, and others need to be sent out (such as water testing, microbial tests, etc.).

Verification processes can include:

- A schedule of monitoring procedures
- Review of the HACCP plan to make sure nothing is missing
- Review of critical limits (have new laws come out?)
- Sampling and testing to verify Critical Control Points (CCP)
- Checking the amount of pesticide residue on the blueberries to make sure that the critical limits are being met
- Testing lugs after they are cleaned and sanitized, for bacteria. This lets you see just how well the cleaning and sanitizing process is working.

Establishing record keeping and documentation procedures:

- Everything that is done and checked must be written down. (includes cleaning and sanitization schedules as well as blueberry picking records)
- If not written, you can not prove that the action was done.
- Saves time by not repeating an action
- Easier to enforce rules and regulations

- Allows for easier access when needed for audits.

You can get some downloadable table forms and a flow chart along with other forms to help you with your HACCP record keeping at:

- <http://www.nyc.gov/html/doh/downloads/pdf/rii/rii-hazards-blank-form.pdf>

(Please note these are for everybody in all sectors of the food industry, some forms may not be applicable to your operation)

V: FIELD SANITATION

Poor management of human and other wastes in the field can significantly increase the risk of contaminating blueberries. The purpose of Field Sanitation is to prevent microbial contamination or cross-contamination of fresh blueberries during pre-harvest, harvest and post-harvest activities. Such contaminations may result from contact with soils, fertilizers, water, workers, and harvesting equipment. These potential hazards can be controlled through Good Agricultural Practices.

In Michigan fields sanitation standards are established by OSHA and MIOSHA. *MIOSHA Standard, Part 500, Field Sanitation*, affords hand labor agricultural employees adequate drinking water, toilets and hand washing facilities. Documentation of field sanitation practices and employee training minimizes the risks for microbiological contamination. It is essential that blueberry growers document compliance with MIOSHA standards. Training for both supervisory and field personnel should continually reinforce the importance of good field sanitation practices. Blueberry growers need to check that harvest contractors and crews are aware of microbial food safety risk reduction principles and adhere to established food safety practices.

The definition of “**Agricultural employer**” (See **Appendix B**) helps you to determine your legal responsibility when contracting hand labor for planting, pruning, harvesting and tending your blueberry fields.

Part 500, Field Sanitation, is brief and does not contain information specific to all situations that may occur in your operation. However, employers are expected to know the law and make reasonable efforts to comply with it.

Michigan’s MIOSHA law (equivalent to the federal law) requires employers of 11 or more field workers to provide toilets, potable drinking water, and hand washing facilities to hand laborers in the field; to provide each employee reasonable use of these; and to inform each employee of the importance of good hygiene practices.

In general, employers must inform employees of the location of facilities and water and allow employees reasonable opportunity to use them.

- Importance of good hygiene practices to minimize exposure to the hazards in the field: heat, communicable diseases, retention of urine and agricultural residues.
- To use the water and facilities provided for drinking, hand washing and elimination.
- To drink water frequently, especially on hot days.
- To urinate as frequently as necessary.
- To wash hands before and after using the toilet.
- To wash hands before and after eating and smoking.

Drinking Water

Farm workers experience the highest risk of heat-related illness of any occupation (Federal OSHA). Heat-related illness can be partly minimized with adequate consumption of water.

1. Drinking water must be potable and in locations readily accessible to all employees. Potable means clean and safe according to Michigan drinking water standards. Fresh water must be provided daily in suitable containers.
2. Water shall be dispensed in single-use drinking cups or by fountains. The use of common drinking cups or dippers is prohibited.
3. Drinking water containers shall be constructed according to OSHA specifications, kept covered and shall be refilled and regularly cleaned.

Toilet and hand-washing facilities

Growers with poor management of human and other wastes in the field or packing facility can increase the risk of contaminating blueberries. Good field sanitation helps to:

- reduce the potential for contaminating blueberries
- ensures that employees and consumers are protected from foodborne diseases

Growers should operate their facilities or farms in accordance with the laws and regulations that describe field and facility sanitation practices. The OSHA 29 CFR 1928.110, subpart I describes the appropriate number of toilets to the number of workers, proper hand washing facilities, maximum worker-to-restroom distance, and how often such facilities should be cleaned. Some points to remember are:

- Toilets are fixed or portable facilities in close proximity to each other and supplied with toilet paper adequate to employee needs.
- Toilet facilities should be accessible to reduce the incidence of workers in the field or outside packing areas relieving themselves elsewhere (such as in fields).
- One toilet and one hand washing facility must be provided for each 20 employees or less. Where 10 or fewer employees are present, these facilities must either be provided by the employer or readily available to the employees by using employer furnished transportation.
- Toilet facilities in the field should not be located near a water source used in irrigation or in a location that would subject such facilities to potential runoff in the event of heavy rains.
- Toilet facilities shall be operational and maintained in clean and sanitary condition in accordance with appropriate public health sanitation practices.

Hand washing facilities are facilities providing a basin, container, or outlet with an adequate supply of potable water, soap and single-use towels. Water-less soap products (hand sanitizers) are not acceptable alternatives to water, soap and towels. "Potable water" means water that meets the standards for drinking purposes.

- Hand washing facilities shall be refilled with potable water to ensure an adequate supply and shall be maintained in a clean and sanitary condition.
- When toilets must be cleaned or serviced near the field, use appropriate barriers or physical containment to prevent contamination in the event of an accidental leak or spill. The disposal of wastes from toilet or hand washing facilities shall not cause unsanitary conditions, contamination or nuisance.

- Rinse water must be recaptured and contained and only be discharged **outside** of the field perimeter.

Document your policy on maintenance of hand washing facilities. Include sanitation procedures for rinsing and cleaning wash water tanks; frequency of water level checks (must have sufficient water at all times and use a minimum of 15-gallon water tank) and be sure potable water, soap and single use towels are always available.

Sewer Disposal

Improper disposal of human waste from toilets could lead to water, soil, animal, crop, or worker contamination. Systems and practices should be in place to ensure safe management and disposal of waste from permanently installed or portable toilets to prevent drainage into the field. Operators should follow EPA regulations for the use or disposal of sewage sludge, 40 CFR Part 503, or refer to EPA's "Domestic Septage Regulatory Guidance: A Guide to the EPA Part 503 Rule," or corresponding or similar standards or regulations.

1. Use caution when servicing portable toilets. Waste water from portable toilet facilities that may drain into a field can contaminate fresh blueberries.
2. Sewage transport trucks need direct access to toilet facilities to ensure proper collection and disposal of wastes through a municipal sewage system or a sub-surface septic tank system.
3. Have a plan for containment and treatment of any effluent in the event of leakage or a spill.
4. Operators should be made aware and be prepared in the event of any incidence of leakage or spillage of effluent in a field.

Pre-Harvest Field Sanitation

1. Storage facilities should be inspected for evidence of pests, such as rodents, birds, and insects.
2. Clean and disinfect harvest storage facilities prior to use.
3. Routinely clean and sanitize containers used to transport ready-to-eat blueberries.
4. Clean field floors of any undesirable residue before starting harvest.
5. Exclude all animals, especially rodents and birds from all hauling facilities.
6. Keep "bone-yards" and debris piles away from fields and inspect unused buildings for pest and wildlife nesting.

Harvest Field Sanitation

Contact with manure or biosolids, poor quality water, workers with poor hygiene, and unclean packaging or packing boxes greatly increases the risk of contaminating blueberries with pathogenic microorganisms.

1. Keep harvest containers clean to prevent cross-contamination of fresh blueberries.
2. Harvesting lugs or other containers should not be used to store or carry non-produce items during harvest.
3. Harvest containers used repeatedly during a harvest should be cleaned after each load is delivered and prior to reuse.
4. If the containers are stored outside, they should be cleaned and sanitized before being used to haul fresh blueberries.
5. Discard damaged containers that are no longer cleanable (increases risk of contamination).

6. Keep harvesting equipment which comes in contact with fruit, clean and in good condition. Protect light bulbs and glass on harvesting equipment to avoid contamination of fruit or fields in case of breakage.
7. Avoid recontamination of harvested fruit in the field (e.g. from soil).
8. Vehicles used to transport harvested blueberries should be clean and not be used to transport non-food products (biosolids, pesticides, fertilizers, etc).
9. Exclude domestic and wildlife animals from fields. Wildlife in an open farm environment is one of the most difficult challenges growers of all crops have to face in managing food safety risks.
10. Minimize habitat, nesting and hiding places for rodents and wildlife in and around the fields.
11. Maintain an active vertebrate pest management program in your field to minimize the chance of contamination by bird, squirrel, or deer, etc. fecal material.

Equipment Maintenance

Assign responsibility for equipment to ONE person. This person needs to oversee:

1. That equipment is functioning properly and how it is being used during the day.
2. Ensure proper cleaning and sanitizing of equipment before use. Field equipment, such as harvesting machinery, containers, tables, buckets, etc., can easily spread microorganisms to fresh blueberries.
3. Remove biofilms (sticky to slimy accumulations of fungi and bacteria) by proper cleaning (See Appendix B). Sanitizers will prevent their formation but can not penetrate existing biofilms. First clean, and then sanitize any equipment that will touch blueberries. A biofilm can form on any surface exposed to bacteria and some amount of water. Thus the importance of cleaning fruit contact surfaces!
4. Any equipment used to haul garbage, manure, or other debris should not be used to haul fresh blueberries or contact the containers or pallets that are used to haul fresh blueberries without first being carefully both cleaned and sanitized.

Record Keeping

Maintaining readily retrievable records of all blueberry farm/packing or processing operations is essential and beneficial when it comes to food safety. Although there are many common elements, each farm operation is unique. Specific documentation and record keeping down to the field are optimal to maximize YOUR investment in risk reduction. There are no off the-shelf GAP programs but resources are available to get you started with a written plan and key documentation development. Remember – **don't be intimidated into inaction** your GAP program can evolve in phases.

1. Detailed diagram of facility and blueberry fields layout.
2. Flow-chart/spreadsheet for variety and harvest sequence.
3. Diagram of adjacent land use, operations, and influences.
4. Crop management flow chart (pre-bloom to post-harvest).
5. Placement and servicing of sanitary facilities.
6. Invoice records for sanitation and personal hygiene supplies.

VI. HARVEST

Fresh pack - Manual harvest considerations

Consumers and wholesale buyers associate appearance and firmness with fruit quality and freshness. Successful blueberry marketing requires that fruit be of the highest quality and appearance. The presence of the whitish bloom of blueberries is highly desirable, and consumers regard it as a sign of quality. Over handling the berries will remove the bloom and affect fruit quality. Hand harvesting of blueberries maintains the highest quality and minimizes fruit damage, but proper Food Safety practices are crucial.

- Blueberries are extremely perishable and easily damaged by rough handling and adverse temperatures.
- Blueberries are harvested and handled during hot, humid weather, thus proper postharvest handling is essential to maintain quality and food safety.
- Proper instruction and careful supervision of the picking crew is essential to the success of any harvesting operation.
- Have a responsible person supervise hand pickers at all times.

Ideally pick only dry fruit. Wet berries are very susceptible to spoilage and often resemble overripe berries leaking juice. To reduce the risk of infection by post harvest disease organisms wait a few hours to begin harvesting after a rain or heavy dew. This also improves the appearance of blueberries.

Clean and sanitize totes daily. Harvest containers used repeatedly during harvest should be cleaned after each load is delivered. If the containers are stored outside, they should be cleaned and sanitized before being used to haul blueberries. Containers that are no longer cleanable increase the risk of microbial contamination of fresh blueberries so they should be disposed off.

Cool berries quickly. Harvested blueberries are extremely perishable and easily damaged by adverse temperatures. Blueberries should never be allowed to remain in the sun because the dark berries absorb heat readily, which may cause spoilage during storage. Therefore, immediate cooling of harvested blueberries is required.

Teach workers about proper hand washing. All workers should be reminded that they should wash their hands properly **before** handling blueberries (eaten fresh and often not washed).

Rules for Hand Pickers:

The law requires pickers to WASH their hands prior to handling any fruit product.

- Keep your hands clean. Remember blueberries are a food product that you are handling.
 - The law requires you to wash your hands **after** each visit to the bathroom or portable facility.
 - Wash hands WHENEVER they come in contact with body fluids, including saliva and runny noses.
 - Wash hands after smoking, snacking or eating.
- DO NOT pick fruit that has bird droppings on it.
- DO NOT harvest fruit that has fallen on the ground.
- DO NOT pick wet berries.
- Harvest only well-ripened fruit.
- Place hands under the clusters to avoid dropping the berries.

- Avoid overfilling your hands; do not squeeze or roll the blueberries.
- NO trash or culled blueberries into harvesting containers.
- NO smoking while harvesting.

Processing blueberries - Mechanical Harvest Considerations

Mechanical harvest is a common practice in most blueberry growing regions including Michigan. Mechanical harvesters may create food safety hazards if the equipment breaks down in the middle of the harvest or if it has received poor maintenance. Food safety recommendations are similar to those outlined for hand harvesting with some exceptions.

1. Know how the harvester has been previously used. Be sure it was not previously used in a field where manure or compost was applied.
2. Harvesters should be in good mechanical conditions. Breakable parts like light bulbs and plastic covers must be protected and secured to prevent fruit contamination in case of breakage. Ruptured or leaking fuel and hydraulic lines can cause extensive contamination of both harvested fruit and fields.
3. Before and after harvesting, properly clean and sanitize all *surfaces* that have been in contact with the fruit; catch pans, “fish scales”, sway beaters, conveyer belts, etc. Microorganisms accumulate on *food contact surfaces* and easily spread them to fresh blueberries.
4. Harvesting equipment should be **cleaned** and **sanitized** ([See Appendix B](#)) when moved between different blueberry fields.
5. Do not allow drinking, smoking or eating while operating the harvesting equipment. Pop can tabs and plastic taps can be physical hazards if they land on conveyer belts, catch pans, or lugs collecting harvested blueberries. Similar situations could be possible with broken glass bottles. Cigarette butts will go undetected if they land on harvested blueberries.

Rules for blueberry mechanical harvesting:

1. Harvest only dry fruit in the coolest part of the day.
2. Minimize the drop heights on the machine and pad the impact surfaces.
3. Eliminate as much vibration as possible.
4. Limit the depth of harvested fruit in the field containers to 4 or 5 inches.
5. Handle and dump field containers very gently.
6. Cool blueberries as soon as possible after harvest.

VII. POST-HARVEST

Post-harvest management practices that reduce loss due to spoilage or shrinkage reduce microbial contamination risks. These include sorting, quick cooling, use of chlorinated wash water, and good refrigerated storage and shipping of blueberries. Most of these practices are similar to both fresh pack and processed blueberry operations.

General Fresh Packing/Sorting Considerations

1. Remove as much dirt, plant debris, and other contaminants as practicable from blueberries outside of packing areas.
 - a. Locating blowers that remove plant debris and other contaminants outside the packing areas prevents recontamination of blueberries in the sorting line.
 - b. Remove as often as possible, accumulated debris in the trash shoot and discharge screen.
2. Inspect conveyers for damage on a regular basis. Damaged conveyor surfaces harbor pathogenic microorganisms and cause damage to the surface of blueberries, they should be inspected, cleaned, and if needed repaired or discarded.
3. Inspect clamshell fillers and clean and remove biofilms accumulated on all fruit contact surfaces every time a new blueberry lot is processed, and at the end of the day.
4. Protect packing containers and other packing materials that are not used right away from contamination when in storage. Contamination can occur from pests such as rodents, dirt, and water condensing from overhead equipment and structures.
5. Open packing facilities should be aware of potential contamination of airborne contaminants (birds nesting on the packing area, nearby livestock, poultry areas or manure storage or treatment facilities, etc.).

Processed blueberries

Along with the general fresh packing considerations 1, 2 and 4 (see above) it is critical to pay attention to the following issues in processed blueberries:

1. Use potable water to wash off blueberry surfaces from dirt, soil and other contaminants.
2. Wash using a sanitizing agent (chemical agent generally).
3. Keep wash water not more than 10°F cooler than blueberries. If temperature is much lower than the temperature of the blueberries, water may be drawn into stem areas. Any pathogen on the fruit or in the water could get drawn into the fruit's interior along with the water.
4. Wash, rinse, and sanitize the packing line belts, conveyors, and fruit contact surfaces at the end of each day to avoid buildup of harmful microorganisms.
5. Store packaging materials in a clean area.
6. Keep Material Safety Data Sheets (MSDS) for cleaning and sanitizing products in a place accessible to all employees.

Wash water quality

To prevent contamination with pathogens, keep washing and packing operations clean and sanitary.

- Use potable water for all berry washing, cooling, dipping, icing, and processing.
- Avoid water temperatures in dump tanks that are more than 10°F cooler than blueberries. Research has shown that if water is cooler than the fruit temperature microorganisms that reside either on the surface of the fruit or in the wash water can be internalized, making subsequent wash and sanitizing treatments ineffective.

Processing water

Reduce the risk of contaminating processing water:

- Periodic water sampling and microbial testing.
- Ensure packinghouse water sanitation.
- Change water as needed to maintain sanitary conditions.

- Clean and sanitize water contact surfaces
 - Hydrocoolers, dump tanks, flumes, wash tanks
- Install backflow devices and air gaps to separate clean from dirty water
- Routinely inspect & maintain equipment
 - Chlorine injectors, filtration systems, backflow devices

Water disinfection

Water is a singular critical point capable of amplifying an error in sanitation or hygiene management during production, harvest, or postharvest of blueberries. The purpose of disinfection is to prevent cross contamination of blueberries by water.

Use chlorinated water and other labeled disinfectants to wash produce. Various formulations of sodium hypochlorite are available and registered with the EPA. Check with state regulatory agencies for additional restrictions or for a more complete list of registered sanitizers.

Measure available chlorine. Use a sanitizer test kit or swimming pool kit to monitor the level of chlorine in the sanitizer solution. Organic matter ([See Appendix B](#)) reacts with chlorine and quickly reduces the amount of chlorine available to kill microbes.

Maintain pH at 6.0-7.0 so that chlorine remains active.

Monitor water temperature closely. At higher temperatures, available chlorine kills microbes faster, but chlorine activity is lost faster.

VIII. PACKING/SHIPPING FACILITIES

Blueberries being moved to staging area **prior** to packing or processing should be protected from possible contamination sources (i.e. dust, insect. foreign objects, etc.).

Prior to packing, blueberries should be properly stored and/or handled to reduce contamination.

Employee facilities such as locker rooms, lunch and break areas, etc. should be clean and located separately from packing area.

Employees and visitors should follow a written policy regarding personal health and hygiene in the packing area.

Packinghouse General Housekeeping

- Ensure that packing facilities are enclosed.
- Packing facility interior is clean and maintained in an orderly manner.
- Floor drains should be free of obstructions.
- Measures are taken to exclude animals or pests from packing and storage facilities.
- Interior walls, floors and ceilings are well maintained and are free of major cracks and crevices.

- There is a policy in place, to describe procedures to follow for handling and disposal of blueberries which have fallen on the ground, for spills or for finished products that are opened.
- Pipes, ducts, fans and ceilings which are **above** blueberry handling operations should be clean. Rails moving packing boxes from one place to another directly above the blueberry lines should be covered underneath to avoid contaminants falling into blueberries below.
- Ensure glass materials **above** the blueberry flow zones are contained in case of breakage.
- The plant grounds should be free of litter, debris or weeds as they are sources of contamination by pests (rodents, insects, etc.).
- The plant grounds should be reasonably free of standing water to avoid soil contamination in the facilities, and breeding grounds for mosquitoes.
- Only food grade approved and labeled lubricants should be used in the packing equipment and/or machinery.
- Chemicals not approved for use on blueberries or for machinery use should be stored and segregated away from packing area.
- Outside dumpsters and garbage receptacles should have lids and maintained closed. Both should be located away from packing facility entrances and the area around should be kept clean.
- Possible wastewater spillage is prevented from contaminating any food handling area by barriers, drains or a sufficient distance.

Containers and Pallets

- Packing containers should be properly stored, covered or sealed when not in use, to protect them from dust and pest contamination (cobwebs, mites, birds, rodents, etc.).
- Torn boxes with clamshells or other fruit packaging containers should be sealed to avoid dust and pest contamination.
- Pallets, totes, bins, cellars, storage rooms, etc., are clean and in good condition to avoid blueberry contamination with foreign materials (plastics, wood splinters, cobwebs, etc.).
- Blueberries stored temporarily outdoors in lugs, trucks, bins and other containers are covered and protected from contamination.
- Storage facilities/areas are inspected for foreign material or contamination sources **prior** to loading with blueberries.
- Inspection records are written and maintained.
- Storage rooms, buildings, and/or facilities are maintained and sufficiently sealed or isolated to be protected from external contamination.
- Non-food grade substances (paints, lubricants, pesticides, etc.) should NOT be stored in close proximity of blueberries.
- Mechanical equipment used during the storage process is clean and maintained (forklift, etc.) to prevent contamination of blueberries.

Cold Storage Facilities

- Cold storage facilities are clean and maintained in an orderly manner.
- Refrigeration system is working properly.
- Refrigerated rooms are monitored daily for temperature and written logs are kept.
- Thermometer(s) are checked periodically for accuracy and written records are kept.

- Refrigeration system condensation does not come in contact with packed and unpacked blueberries.
- Refrigeration equipment (condensers, fans, etc.) is cleaned on a scheduled basis. Keep a log.
- A policy has been written and is followed to recondition or dispose of product which has come in contact with the floor or other potentially contaminating surfaces.

Packing House Sanitation

Operations with poor sanitation in the packing environment significantly increase the risk of contaminating fresh blueberries and water. Pathogenic microorganisms may be found on the floors and in the drains in the packing facility and on the surfaces of sorting, grading, and packing equipment. Without good sanitary practices, any of these surfaces that come in contact with fresh blueberries could be a potential source of microbial contamination. Packers should employ good sanitation practices as a standard operating procedure to maintain control throughout the packing operation.

Proper handling of fresh blueberries after they leave the field can help to prevent contamination with pathogens.

Worker Hygiene -See Section III. Worker Health and Hygiene

Containers and Packaging

Containers and packaging should be free of contamination (both while in storage and while in use). They should be kept clean and free from dust (cover any open boxes, keep any items not in use in closed boxes or covered).

- Seal any torn boxes to prevent dust and or animal contamination.
- Keep birds and other pest out of the area.
- Do not store containers and packaging materials in the fields for prolonged periods of time.
- Do not reuse any cardboard or clam shells.

Packing facility maintenance

Packing and storage facilities should always be maintained in a clean condition. Equipment used in sorting, grading, and packing blueberries should be easily cleanable. Keep in mind the design, construction, use, and ease of cleaning when selecting equipment to reduce the risk of cross contamination.

Keep equipment or machinery that comes in contact with fresh blueberries as clean as practicable. All sorting, grading, and packing equipment that makes contact with blueberries may serve as a vehicle for spreading microbial contamination. **Clean** (See Appendix B) processing equipment daily. Equipment such as boots, gloves, coveralls or aprons should be cleaned and inspected for defects on a regular basis and replaced as needed.

Clean packing areas at end of each day. Daily cleaning and sanitizing of the washing, grading, sorting, and packing lines reduces the potential for microbial contamination. To prevent cross-contamination of blueberry lots, clean conveyer belts after running new loads from different farms or fields.

Clean product storage areas regularly. Remove unnecessary items from product storage areas on an ongoing basis. Clean these areas on a regularly scheduled and "as needed" basis. Take steps to minimize free-floating dust and other airborne contaminants.

Pest Control

All animals, including mammals, birds, reptiles, and insects, are potential sources of contamination. They harbor, or can be vectors for a variety of pathogenic agents, such as *Salmonella*. In general, pest problems can be minimized by taking precautions, such as the following:

- **Establish a pest control system.**
Include regular and frequent monitoring of affected and treated areas to accurately assess the program's effectiveness.
- **Maintain grounds in good condition.**
Grounds in the immediate vicinity of all packing areas should be kept clear of waste, litter, and improperly stored garbage. Keep all grasses cut to discourage breeding, harboring, and feeding of pests.
Remove any unused and/or inoperative equipment to eliminate areas that harbor pests.
Clean daily to remove products or remnants that attract pests in and around the packing facility and any other places where products are handled or stored.
Maintain adequate surface drainage to reduce breeding places for pests.
- **Monitor and maintain facilities regularly.**
Regularly inspect all facilities to check for evidence of pest populations or animal contamination. Minimize the availability of food and water to pests.
Remove dead or trapped birds, insects, rodents, and other pests promptly to ensure clean and sanitary facilities and to avoid attracting additional pests.
Ensure potential nesting or hiding places for pests have been eliminated.
Clean surfaces soiled by birds or other wildlife.
- **Block access of pests into enclosed facilities.**
Exclude pests by blocking areas, such as holes in walls, doors, flooring, etc., and vents that allow entrance into the facility. Consider the use of screens, wind curtains, and traps.
- **Use a pest control log.**
Maintain a pest control log that includes dates of inspection, inspection report, and steps taken to eliminate any problems. Establish frequent monitoring of affected and treated areas to determine the effectiveness of the treatment applied.

IX. PESTICIDE USE AND SAFETY

Pesticide Use and Worker Safety

Pesticides are toxic (poisonous) chemicals used to control pests. Pesticide classes are named after the pests that they help to control (insecticides control insects; herbicides control weeds; fungicides control fungi; and rodenticides control rodents). FIFRA (See [Appendix B](#)) ensures that both human health and environmental health are evaluated and that federal precautions and restrictions are put into place to ensure that no unreasonable adverse effects occur from legal pesticide use. At state level the Natural Resources and Environmental Protection Act. No. 451, Part 83 Pesticide Control gives the Michigan Department of Agriculture authority to regulate the labeling, registration and application of pesticides. Also, it provides certification for restricted use-pesticide (RUP) applicators.

Pesticide Use Guidelines

Keep written documentation of your farm's compliance with local state and federal pesticide regulations. **Regulation 637** (NREPA, 451, Part 83) sets the standards for pesticide use.

Pesticide selection. All pesticides used on blueberries must meet the standards set forth in the **Food Quality Protection Act** of 1996 or FQPA, and must be registered with the Environmental Protection Agency (U.S. EPA, 2001c) and with Michigan Department of Agriculture (MDA).

Pesticide handling. Pesticide handling should be controlled throughout each step of use from acquisition, storage and use in the fields. Follow **carefully** the label instructions or those on the Material Safety Data Sheet (MSDS).

Pesticide application. Read carefully the instructions for application **before** product use: restrictions, rates, doses, number of applications permitted and minimal intervals between applications. Follow label instructions for mixing, loading and handling of pesticides being used. Water used to prepare pesticides should be potable.

Pesticide storage. All pesticides should be stored safely away from children, animals, and anyone who might misuse them (U.S. EPA, 2001c). Storage building should have a dependable lock, and only a reliable person should be in charge of it. Use highly-visible warning signs on doors and windows. Post "No Smoking" warnings, since many pesticides are highly flammable

Store pesticides in a locked secure place away from populated areas, on well-drained land, and away from domestic water supplies. Construction should be done with non-combustible material, have a leak-proof floor and emergency exits.

Pleased NOTE:

- Pesticides should be stored in clearly labeled containers, preferably in their original containers.
- Pesticides and blueberries should **never** be transported in the same vehicle.

Use permits and posting requirements

Restricted use pesticides (RUPs) can only be **purchased and used by certified applicators**.

Growers should comply with all federal, state and local field posting requirements in areas treated commercially with pesticides. Warning signs should be posted on fields recently treated with pesticides to prevent workers or visitors from coming in contact with treatment chemicals.

Signs should only be removed after the established re-entry period into the field has passed so that residual levels are at an acceptable level.

Pesticide application recordkeeping

All certified applicators are required to maintain records of federally restricted use pesticide (RUP) applications.

1. General-use pesticide application – records must be kept for one year
2. Restricted use pesticides RUP – records must be kept for three years
3. Records must include:

- Name and concentration of the pesticide and EPA registration number
- Target pest or purpose
- Date of application
- Address or location of application
- Method and rate of application

Pesticide application data must be recorded within 14 days of application. Since there are no Federal forms for these records your written information becomes the official record.

You may want to keep records longer than 3 years for future pest management decisions.

Private/Commercial applicator certification

Identify individuals or companies responsible for pesticide permits and applications.

Verify proper licensing and registration of pest control operators, businesses, advisors, etc.

Completion of private applicator certification is required prior to any restricted use (RUP) pesticide possession and/or use.

Documentation of training

Provide written documentation of pesticide applicator and field worker safety training.

MIOSHA Right-to-Know requires employers to:

- Obtain and retain material safety data sheets (MSDS)
- Develop and implement a written employee training program
- Ensure all containers of hazardous materials are properly labeled

Blueberry growers are not required to comply with the act for hazardous chemicals regulated under FIFRA or the Michigan Pesticide Control Act. Pesticides are not covered under the Right-to-Know law if they are used for agricultural purposes. The law covers other hazardous chemicals used on farms, such as some petroleum products, some fertilizers and other non-pesticide chemicals. If you have concerns about MIOSHA Right-to-Know provisions, contact the Michigan Department of Labor and Economic Growth, Division of Safety Standards, or Michigan Department of Community Health (MDCH) Division of Occupational Health.

Applicator, mixer/loader and field worker safety requirements

Document compliance with all federal, state and local laws and regulations relating to applicator, mixer/loader and field worker safety.

Pesticide disposal

Instructions and restrictions on pesticide disposal are available from the product's manufacturer and by Michigan's local environmental regulators. Strict hazardous waste disposal and handling requirements must be followed (Natural Resources and Environmental Protection Act No. 451, Part 111). Waste pesticides and pesticide containers are subject to regulation as hazardous waste **unless** they are disposed off properly. Report spills and discharges to the Pollution Emergency Alerting System (PEAS).

Worker Safety

Blueberry farms should have a "Central Notification Board" displaying a "Safety Poster" (EPA 735-H-93-001) with information on nearest medical facility and Michigan's Pesticide Emergency Information.

Protection during applications – Do not apply a pesticide in a way that will expose workers or other persons. Workers should be excluded from areas while pesticides are being applied.

Restricted-entry intervals – Follow the restricted-entry intervals specified on the label of all pesticides labeled for use in blueberry production. Workers should be excluded from entering a pesticide-treated area during the restricted-entry interval, with only narrow exceptions.

Personal protective equipment -- Personal protective equipment must be provided and maintained for pesticide handlers and early-entry workers.

Notification to workers -- Workers must be notified of pesticide applications taking place or when a restricted entry interval is in effect to avoid exposures. Field workers should be informed of pesticide applications, orally and/or by official warning signs.

Decontamination supplies – Provide handlers and workers with an ample supply of water, soap, and towels for routine washing and emergency decontamination.

Emergency assistance – Transportation must be made available to a medical care facility if a worker or handler may have been poisoned or injured. Information must be provided about the pesticide to which the person may have been exposed.

Pesticide safety training and safety posters -- Training is required for all workers and handlers, and a pesticide safety poster must be displayed.

Access to labeling and site-specific information -- Handlers and workers must be informed of pesticide label requirements. Central posting of recent pesticide applications is required.

X. TRACEBACK

Traceback is the ability to track food items, including fresh blueberries, back to their source of origin (farms, packers, shippers, etc.). It is an important complement to good agricultural and management practices because it minimizes liability and aids in the source identification if a food safety problem arises. This system along with good record keeping and GAP can clear your establishment as the source of a contamination hazard if an outbreak of a foodborne disease occurs. Without traceback the blame is usually placed on the farm or on whoever does not have good written records. Mock recalls are now incorporated and required by the USDA and private 3rd party audit firms, thus the importance of having a traceability system established in your farms or plants.

Suggested traceback procedures:

There should be some mechanism for marking or identifying the blueberries and follow them from the farm or grower to receiver. Establish a code lot numbering system. If a pallet is commingled, it is recommended that all trays/crates be properly coded.

Growers/Packers should be able to track individual containers from the farm, to the packer, distributor, and retailer, in as much detail as possible. Write down (document/record):

- Field practices prior to harvest.
- Source of your blueberries (which plot or farm they were harvested from).

- When (date) of harvest.
- Maintain records of lot numbers for all loads of blueberries leaving your establishment.
- Who they were turned over to from your farm to your transport and if possible, all the way to the receiver.

If you take or send your blueberries via a freight company always keep written records of:

- Name of truck driver (even if it is you)
- Truck number
- Date and Time of shipment
- Destination
- Get the party receiving your fruit to sign and date your records.

It is best to keep as many details as possible of your shipments to make it easier to pinpoint problems in case they occur.

XI. TRANSPORTATION

Proper transport of blueberries from farm to market reduces the potential for microbial contamination. Microbial cross-contamination from contaminated surfaces may occur during loading, unloading, storage, and transportation operations. Therefore, wherever blueberries are transported and handled, the sanitation conditions should be evaluated.

- A complete inspection of the trailer or container should be performed before the blueberries are loaded.
- All transportation vehicles must have a pre-load check list to ensure they are clean and in good sanitary conditions. Dirty vehicles can contaminate blueberries with harmful microbes. Trailers and containers must be clean ([See Appendix B](#)) and free of odors.
- Fresh blueberries should be separated from other foods and nonfood sources to prevent contamination or cross-contamination during transport operations.
- Transportation units should not be wet or have any water condensation.
- DO NOT ship blueberries in trucks which have carried live animals or harmful substances. If these trucks must be used, thoroughly clean and sanitize them before transporting berries.
- Use refrigerated trucks when possible. Refrigeration equipment should be functioning appropriately. Temperature monitoring devices should be used to monitor the performance of the refrigeration system all the time from the shipping point to the delivery location.
- Hermetic seals are highly recommended to avoid pest access, environmental contamination or temperature fluctuation during transportation.
- Ask the freight company to keep a detailed log of previous loads and to clean and sanitize containers between loads. This needs to be checked before fresh blueberries are placed in the unit.

If you are a grower and are transporting your blueberries to the packer or shipper in your own truck be aware of the following:

- Clean and sanitize the area where lugs/pallets full of blueberries are going to be placed.
- Transport harvested blueberries as soon as possible to the packer/shipper.

- Chemicals and blueberries should NEVER be transported in the same vehicle at the same time.
- DO NOT transport people/pets together with your lugs or pallets.
- Fresh blueberries should be separated from other foods and nonfood sources to prevent contamination or cross-contamination during transport operations.
- Never transport wet blueberries.

Remember to follow all hygienic rules, especially when you are touching the fruit. As a grower or packer/shipper you are also a food handler and prevention of contamination should be of utmost importance in all your activities and operations.

APPENDIX A: Short Introduction to Blueberry Production

The Highbush Blueberry Plant

The highbush blueberry, *Vaccinium corimbosum* L., is a highly specialized crop. It has exacting soil and climatic needs (1). The blueberry plant is a perennial, consisting of a shallow root system and woody canes which originate from the crown of the plant. Growth habit varies among cultivars, with some bushes growing very upright, while others have a more spreading growth habit. Although there are cultivar variations, most highbush blueberry varieties require 750 hours of chilling below 45 °F to end their winter rest. In early spring, during the bud-break stage, temperatures below 18 °F will cause serious damage to the blueberry plant. The best soils are well-drained sandy silt loam or silt loam, with a pH of 4.5 to 5.2, organic matter of 4 to 7% and adequate phosphorus and potassium. In major commercial blueberry areas, blueberries are produced on sandy soils with high water tables. Except for some Michigan soils, most soils in the Midwest require amendments and irrigation for maximum growth and yield.

Annual Growth Cycle.

In early spring buds begin to grow. Terminal buds grow and develop before the lateral buds. Flowers at the tip of the bud emerge and open first and have the potential to have the largest fruit. Fruit from the lower buds will always be smaller. After bloom, the fruit begins to grow and by the time the fruit starts its final swell for harvest, most of the shoot and leaf growth for the season has stopped. After harvest the plant begins to prepare for next years growth. Next year's flower buds are formed during the fall. If another spurt of shoot growth doesn't begin, then the terminal bud becomes fat and plump as it changes from a leaf bud to a flower bud. Under good conditions, other leaf buds below the terminal bud will also change to fruit buds. To learn more about the fruit growth stages go to: <http://www.msue.msu.edu/fruit/bbgrw.htm>

According to the North American Blueberry Council, Michigan ranks 1st among the highbush blueberry producing states. Michigan's contribution is approximately 30% of the total national production.

Michigan Production Regions:

In Michigan blueberry production occurs mainly in the West Central part of the state in Van Buren (Southwest Michigan), Ottawa (West Central Michigan) and Allegan (Southwest Michigan) counties, about 83% of Michigan's acreage. Van Buren County has 37%; Ottawa has 31%, Allegan has 15%; Muskegon has 6% acres; Berrien has 6%; and the rest of the state has 5% (10).

Midwest Varieties (Michigan and Indiana):

Blueberry varieties exploited in the North Central states are selected by their cold hardiness and marketable characteristics such as color, berry size, flavor and fruit firmness. Prevailing varieties in this region are the following:

Bluecrop: Ripens early mid season. This berry is suitable for mechanical harvest. It is also the most popular variety world-wide.

Bluejay: A mid season berry. The fruit is medium sized with long stems that aid in the mechanical harvesting. The bush is vigorous and upright.

Blueray: An early mid season berry. The bush is vigorous and productive. This berry is popular for the u-pick trade, but doesn't machine harvest well.

Jersey: A late mid season berry. The bush is very vigorous and productive. It is suitable for mechanical harvesting.

Elliot: A late season berry. The bush is vigorous, upright, winter hardy and productive. It is suitable for mechanical harvesting.

Nelson: The bush is vigorous, upright, and suitable for commercial and pick-your-own harvest.

Patriot: An early season berry. The bush is vigorous, upright and relatively open. It is tolerant or resistant to some strains of *Phytophthora cinnamomi* that causes root rot.

Spartan: An early season berry. The bush is vigorous, upright and open, and productive, suitable for machine harvest and very desirable for the pick-your-own trade.

Duke: It ripens early. This variety is well adapted for mechanical harvest.

Rubel: A mid season variety suitable for mechanical harvest (3, 4, 5).

APPENDIX B: Common Terms, Acronyms and Definitions

Agricultural employer: Any person, corporation, association, or other legal entity that:

- Owns or operates an agricultural establishment;
- Contracts with the owner or operator of an agricultural establishment in advance of production for the purchase of a crop and exercises substantial control over production; or
- Recruits and supervises employees or is responsible for the management and condition of an agricultural establishment.

Bacteria: Single celled relatively simple microorganisms. Most are harmless and many are beneficial, although some can cause food poisoning and infectious diseases in humans and animals.

Biofilm: A slimy, glue-like substance formed by bacteria that anchors them to all kinds of material (metals, plastics, soil particles, and tissue). Often they are formed from many species of bacteria, as well as fungi, algae, protozoa, etc. Any surface exposed to bacteria and some amount of water can support a biofilm. Biofilms have been found to be involved in a wide variety of microbial infections in the body (80% of all infections). They can also contribute to crop disease. An example of a common biofilm is the "gunk" that clogs your drains.

Clean: Visible removal of dirt/filth from a surface, involves a physical aspect (like scrubbing) and a detergent (like soap) to remove dirt/filth. One can not properly clean without both scrubbing and using a detergent. Cleaning agents must be stable, non-corrosive, and safe for workers to use.

Code of Federal Regulations Title 21, Section 110.10 (21 CFR 110.10): Applies to worker health and hygiene within the context of Good Manufacture Practices (GMP) in the manufacturing, packing, or holding of human food (which includes fresh and frozen fruit).

Control Point (CP): Step where biological, chemical or physical factors can be controlled.

Critical Control Point (CCP): Step where control is essential to prevent, eliminate or reduce to an acceptable level, a food safety hazard.

Food and Drug Administration (FDA): agency within the U.S. Department of Health and Human Services. It is responsible for assuring the safety, efficacy, and security of human and veterinary drugs, biological products, medical devices, our nation's food supply, cosmetics, and products that emit radiation.

FIFRA (Fungicide Insecticide and Rodenticide Act): This Act from the US Congress contains all federal regulations relating to pesticides and pesticide use. Each state must frame their pesticide regulations within the context of FIFRA. States may make pesticide regulations more restrictive than FIFRA but never less restrictive. The Environmental Protection Agency (EPA) administers FIFRA.

Food Safety: Assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use.

Food Security: preventive management controls and measures to protect facilities, employees, product tampering and brand from deliberate contamination or harm during all steps including transportation (incoming and outgoing).

GAP (Good Agricultural Practices): A collection of principles to apply for on-farm production and post-production processes, resulting in safe and healthy food and non-food agricultural products, while taking into account economical, social and environmental sustainability. They are applied through sustainable agricultural methods, such as integrated pest management, integrated fertilizer management and conservation agriculture. They rely on four principles:

- Economically and efficiently produce safe (food safety); sufficient secure (food security), and nutritious food (food quality)
- Sustain and enhance natural resources;
- Maintain viable farming enterprises and contribute to sustainable livelihoods;
- Meet cultural and social demands of society.

General use pesticide: can be purchased and applied by anybody without any legal restriction.

GHP (Good Health/Hygienic Practices): All practices regarding the conditions and measures necessary to ensure the safety and suitability of food at all stages of the food chain.

GMP (Good Manufacturing Practices): Term that is recognized worldwide for the control and management of manufacturing and quality control testing of foods, pharmaceutical products, and medical devices.

HACCP (Hazard Analysis and Critical Control Points): It is the standard food safety management system required by law for certain sectors of the food industry and is frequently mandated by private food safety standards. It is recognized by the US food regulatory agencies. The focus is on PREVENTION, and it is applicable to ALL PHASES of blueberry production (from picking to storage to packing to shipping, etc). Benefits of HACCP plan: improves efficiency, competitiveness and marketability.

Hazard: Any biological, chemical or physical agent that is likely to cause injury or illness if not controlled. It can be anything from pesticide residue, to foreign objects like buttons, to bacteria from dirty lugs or hands. Basically, anything that might cause illness or injury.

Hazard Analysis: Evaluation of hazards associated with the food to decide which are significant and have to be addressed on the HACCP plan.

Microorganism: An organism that is so small it can only be seen under a microscope. Some examples are bacteria, protozoa and fungi.

MIOSHA (Michigan Occupational Safety and Health Act): Agency in charge of regulations to protect workers on the job in MI.

MIOSHA Right-to-Know requires employers to:

- Obtain and retain Material Safety Data Sheets (MSDS)
- Develop and implement a written employee training program
- Ensure all containers of hazardous materials are properly labeled

Organic matter: Material that has come from a once-living organism; is capable of decay or the product of decay; or is composed of carbon based matter.

Organism: An individual form of life. Examples include a plant, animal, bacteria, or fungus.

OSHA (Occupational Safety and Health Act): Federal agency in charge of regulations to protect workers on the job.

Parasite: An organism that lives on or in a different kind of organism (the host) from which it gets some or all of its nourishment. Parasites contribute nothing to the survival of its host and are generally harmful to their hosts. The damage they do ranges from minor inconvenience to debilitating or fatal disease.

PEAS (Pollution Emergency Alerting System): 24-hour hotlines used to report an environmental emergency affecting air, land, or water in Michigan.

Pest: Insect, rodent, weed, terrestrial or aquatic plant or animal, nematode, fungus, bacteria, virus or other form of microorganism that is harmful to the system in which it is living.

Pesticide: Any substance or mixture of substances intended for preventing, repelling, or mitigating any pest, or intended for use as a plant regulator, defoliant, or desiccant. Fungicide Insecticide and Rodenticide Act (FIFRA) (U.S. EPA, 2001c).

Potable water: Water which is fit to drink by humans and other animals. It is also called drinking water, whether it is used as such or not. Water may be naturally potable, as is the case with pristine springs, or it may need to be treated in order to be safe. In either case, the safety of water is assessed with tests which look for potentially harmful contaminants.

Protozoa: Complex single celled microorganisms usually microscopic.

Restricted use pesticides (RUPs): One whose sale is restricted because of detrimental effects to the applicator and/or the environment and can only be purchased and used by certified applicators or under the direct supervision of a certified applicator. For detailed information on the "Restricted Use" Classification, consult 40 CFR Subpart I, 152.160.

Sanitize: Reduction of microorganisms on surfaces to safe levels for human health via heat or chemicals. The effectiveness of sanitizers is influenced by contact time, selectivity, temperature, and concentration. To be effective, cleaning and sanitizing must be a two-step process. Surfaces must first be cleaned and rinsed before being sanitized or the sanitizer will not work. Sanitizers are inactivated by organic matter.

Sanitizing Chemical: The item is immersed, rinsed, or sprayed with a specific concentration of sanitizing solution for a required amount of time.

Sanitizing Heat: The item is immersed or sprayed with hot (77°C/171°F or hotter) water for at least 30 seconds; the higher the heat the shorter the time required to kill microorganisms.

SARA Title III: The part of the Superfund Amendments and Reauthorization Act, which created the Emergency Planning and Community Right to Know, program.

SOP (Standard Operating Procedures): Is a written document/instruction detailing all steps and activities of a process or procedure. Standard Operating Policies and Procedures can be effective to improve performance and organizational results. Every good quality system is based on its standard operating procedures (SOPs).

SSOP (Standard Sanitary Operating Procedures): is the common name give to the sanitation procedures in food production plants which are required by the Food Safety and Inspection Service of the USDA and regulated by 9 CFR part 416 in conjunction with 21 CFR part 178.1010. It is considered one of the prerequisite programs of HACCP.

Sustainability: rests on the principle that we must meet the needs of the present without compromising the ability of future generations to meet their own needs. *Stewardship of both natural* (maintaining or enhancing land and natural resources for the long term) *and human resources* (social responsibilities such as working and living conditions of workers, consumer health and safety, needs of rural communities) is of prime importance.

Traceback: "Traceability" and "source verification" is the ability to identify the origin of a product as far back in the production sequence as possible or necessary. It is the capability for tracing goods along the distribution chain on a batch number or series number basis. This assures safety and determines compliance in "certified" programs. Traceability is an important aspect in many industries. Some examples are in the food industry where it contributes to food safety and makes recalls possible.

Virus: Very simple organisms that can grow and reproduce only inside living cells.

APPENDIX C: Signs and Symptoms of Common Infectious Diseases

Common cold: Several hundred different viruses can cause a cold. The most common is the *Rhinovirus*. It is a milder respiratory illness which makes you feel ill for a few days. Cold symptoms usually begin with a sore throat, which usually goes away after a day or two. Nasal symptoms, runny nose, and congestion follow, along with a cough by the fourth and fifth days. Fever is uncommon in adults, but a slight fever is possible. Children are more likely to have a fever with a cold. Symptoms usually last for about a week and you are highly contagious for the first three days. Complications can include secondary bacterial infections.

E coli (*Escherichia coli*): Has 57 strains, among them the deadly O157:H7. It is large and diverse group of bacteria. Most strains of *E. coli* are harmless but others can make you sick. Some kinds of *E. coli* can cause diarrhea, while others cause urinary tract infections, respiratory illness and pneumonia, and other illnesses. Other kinds of *E. coli* are used as markers for water contamination—so you might hear about *E. coli* being found in drinking water, which are not themselves harmful, but indicate the water is contaminated. Symptoms often include severe stomach cramps, diarrhea (often bloody), vomiting and fever. Most people get better within 5–7 days. Some infections are very mild, but others are severe or even life-threatening.

Flu (aka Influenza): Several different viruses can cause the flu. Flu symptoms are usually more severe than cold symptoms and come on quickly. Symptoms include sore throat, fever, headache, muscle aches and soreness, congestion, and cough. The H1N1 flu ("swine flu") in particular is also associated with vomiting and diarrhea. Most symptoms improve in two to five days, but it's not uncommon to feel run down for over a week. A common complication of the flu is pneumonia, particularly in the young, elderly, or people with lung or heart problems.

Hepatitis A or B: Viral, vaccine available for both kinds. **Hepatitis A:** an acute liver disease caused by the hepatitis A virus (HAV), lasting from a few weeks to several months. It does not lead to chronic infection. Transmission is via ingestion of fecal matter, even in microscopic amounts, from close person-to-person contact or ingestion of contaminated food or water. **Hepatitis B:** a liver disease caused by the hepatitis B virus (HBV). It ranges in severity from a mild illness, lasting a few weeks (acute), to a serious long-term (chronic) illness that can lead to liver disease or liver cancer. Transmission is via contact with body fluids, having sex with an infected person, sharing contaminated needles, or from an infected mother to her newborn.

Salmonella: 2,400 Strains, among them, *Salmonella typhi*, which causes Typhoid fever. The salmonella bacteria attack the stomach and intestines. In more serious cases, the bacteria may enter the circulatory system. The bacteria attack all age groups. Children, the elderly and people who are already ill are much more likely to get a serious infection. **Symptoms:** Diarrhea or constipation; headaches, stomach cramps; nausea and vomiting; fever and possibly blood in the fæces. Serious cases require medical attention. Most mild types of salmonella infection clear up in four to seven days. They are commonly responsible for food poisoning.

Shigella: A bacteria that causes shigellosis, an acute bacterial infection of the lining of the intestines. **Symptoms** develop on average in about 3 days after contact with the bacteria. Symptoms include: Acute (sudden) abdominal pain or cramps; acute fever; bloody, mucus or pus in stools; crampy rectal pain; nausea and vomiting and watery diarrhea. People infected with the bacteria release it into their stool. The bacteria can spread from an infected person to contaminate food/fruit, water, or directly to

another person. Getting just a little bit of the Shigella bacteria into your mouth is enough to cause symptoms. Other names for shigellosis are: shigellosis gastroenteritis/enteritis.

Staph infection (*Staphylococcus aureus*): A bacteria commonly found on the skin and in the nose of healthy people. It is one of the major causes of community-acquired and hospital-acquired infections. Infections can be minor (such as pimples and boils) or serious and sometimes fatal (such as blood infections, meningitis, or pneumonia). It produces numerous toxins that cause diseases from toxic-shock syndrome to food poisoning. The bacteria multiply rapidly in the food without evidence of food spoilage. Some have acquired resistance to practically all antibiotics. **Symptoms of food poisoning:** nausea; vomiting; diarrhea; loss of appetite; severe abdominal cramps; mild fever & swollen abdomen. Symptoms usually appear within 4 to 6 hours. Recovery generally takes two days, sometimes longer in severe cases. Main source of contamination in food poisoning outbreaks are the food handlers. Equipment and surfaces can also be sources of contamination. **Prevention:** Wash the hands thoroughly before and after touching fruit or preparing any food. Food/fruit preparation implements should be sanitized before they are used on other foods. Food must be kept hot enough (60°C, 140°F, or above) or cold enough (7.2°C, 45°F, or below). It is highly vulnerable to destruction by heat treatment and nearly all sanitizing agents. Presence of the bacteria or its toxins is generally an indication of poor sanitation.

"Strep throat" or streptococcal sore throat is caused by *Streptococcus pyogenes*: In most cases it is painful. Acute strep infections may take the form of throat inflammation (pharyngitis), scarlet fever (rash), or a skin inflammation. Skin on the face or lower legs are most commonly affected by this infection, but can occur on any part of the body. If strep throat is not treated, it can develop into rheumatic fever, a disease that affects the joints, heart valves, and acute kidney inflammation. **Transmission:** It is spread by direct, close contact with an infected person via air-borne germs. Moist bacteria (can persist for up to 15 days) on toothbrushes or similar items, might spread it.

APPENDIX D: HACCP Materials

Types of charts available: These along with others, are available from:
<http://www.nyc.gov/html/doh/downloads/pdf/rii/rii-hazards-blank-form.pdf>

FLOW CHART:

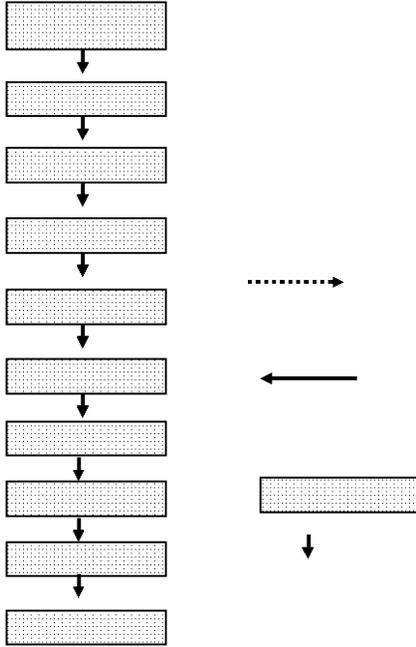


TABLE CHART:

1. Hazard Analysis Table

PROCESS STEP					
Processing Step	Potential Hazards (C) Chemical (P) Physical (B) Biological	Is this potential food safety hazard significant?	Justification of Decision	Preventive Measures	Is this step a CCP?

Table Chart Example:

Processing Step	Potential Hazard	Is hazard significant?	Justification	Preventative measure	Is this a CCP?
Get lugs from storage	Mold, bacteria, chemicals			Clean and sanitize lugs and storage area, keep pests out	
Fill lugs					
Place lugs at location					
Transport to location					

General examples of flow and table charts for fresh packing:

Flow chart:

Depositing blueberries onto conveyor: potential hazards: bacteria, mold, chemicals, foreign objects
 ↓ From where- dirty lugs/hands, soil, bush itself, pesticides, pests

Blower: potential hazards: bacteria, mold, fruit damage
 ↓ From where – dirty lines, sharp surfaces

Sorter: potential hazards: bacterial, foreign objects
 ↓ From where – jewelry, dirty lines

Packing: potential hazards: foreign objects, bacteria
 ↓ From where – jewelry, dirty hands/boxes/hoppers

Cooling: potential hazards: spoilage, freezing damage
 From where - temperature variations (too high or too low)

Table chart:

Processing Step	Potential Hazard	Is hazard significant?	Justification	Preventative measure	Is this a CCP?
Depositing Blueberries onto conveyor	Bacteria, mold, chemicals, foreign objects			Refuse obviously damaged blueberries	
Blower					
Sorter					
Packing					
Cooling					

APPENDIX E: Checklists Forms

We have included in this appendix examples of checklist forms that can be modified to meet the needs of your operation. These are only intended to help you set up and/or simplify your own GAP for Food Safety manuals.

PLEASE NOTE: These forms **are not** associated with the USDA Checklists.

To see and or follow the USDA Checklists and scoresheet please go to the USDA website:

(www.ams.usda.gov/gapghp) and click under the section called "Resources" on the right-hand side of the page.

Current UDSA News: USDA GAP&GHP Audit Program requirements have changed effective November 9, 2009. The traceback portions of the audit have been incorporated into the audit as a mandatory component rather than its own standalone section.

Grower/SHIPPER/PROCESSOR GUIDELINES: CONTACT FORM AND IMPLEMENTATION CHECKLIST

Name of Shipping or Processing Operation: _____

Name of Owner/Operator: _____

Food Safety Supervisor: _____

Mailing Address: _____

Phone: _____ Fax: _____

Shipping Location: _____

Date Form Completed: _____

Question	Check if "Yes"	Description (if Applicable)
Is a Food Safety Program (FSP) in place for this operation?		
Is water testing done on a regular basis?		
Is there a pest control program in place?		
Is a program to train employees on the Food Safety Program in place?		
Is a HACCP plan in place?		
Is a trace-back policy in place?		
Are mock recalls conducted during the season?		
Is a cooler facility sanitation and maintenance program in place?		
Is a Transportation policy in place?		
Is a trailer/cargo container sanitation policy in place?		
Is a packaging storage policy in place?		
Is eating area separated from work area?		
Is a policy for visitors in place?		
Have growers been trained in an FSP and has this training been documented?		

Keep a copy of your operation's procedures and programs in a well-known and easily accessible place.

Note: This form is only an example and should be modified to meet the needs of your operation.
Adapted from California Strawberry Commission Food Safety Program.

GROWER GUIDELINES: DAILY CHECKLIST

Name of Farming Operation: _____

Farm Location: _____

Date: _____

Daily Action		
Clean and rinse hand washing and drinking water containers.	Yes	No
Change hand washing and drinking water.	Yes	No
Provide toilet paper, soap, single-use paper towels and disposable drinking water cups.	Yes	No
Provide toilet and hand washing facilities that meet required standards for quantity, cleanliness and accessibility.	Yes	No
Remind workers of proper hygiene practices and observe that practices are followed.	Yes	No
Inspect transportation equipment for cleanliness prior to loading blueberries bound for the packing/sorting facilities.	Yes	No
Have pesticide use records and posted warning signs as required.	Yes	No
Maintain detailed trace-back procedures.	Yes	No
Check pest (insects, birds and rodents) control program for packaging storage and cooler facility.	Yes	No
Make sure that packaging is properly stored in a safe, secure location.	Yes	No
Shippers: Inspect trailers/cargo containers for cleanliness prior to loading.	Yes	No

Note: This form is only an example and should be modified to meet the needs of your operation.
Adapted from California Strawberry Commission Food Safety Program

GROWER GUIDELINES: WEEKLY, MONTHLY and QUARTERLY CHECKLIST

Name of Farming Operation: _____

Farm Location: _____

Date: _____

Weekly Checklist		
Document the number of workers, toilets and hand washing facilities provided, and maintenance of facilities.	Yes	No
Shippers: Document sanitation measures and maintenance of facility, refrigeration units, and water sources in cooler facility.	Yes	No

Monthly Checklist		
Conduct tailgate meetings on worker safety and proper hygiene practices.	Yes	No
Verify documentation of field worker safety training.	Yes	No

Quarterly Checklist		
Test open water sources (reservoirs, canals, uncapped wells, etc.) in the field for fecal coliform/ <i>E. coli</i> and maintain copies of water quality reports.	Yes	No

Note: This form is only an example and should be modified to meet the needs of your operation.
Adapted from California Strawberry Commission Food Safety Program

GROWER GUIDELINES: EMPLOYEE WRITTEN TRAINING CHECKLIST

The establishment of a written training program for employees that addresses important health and safety issues may help reduce the risk of microbial contamination. Documentation of employee training is necessary to verify that federal, state and local requirements for worker safety training are met. Here is a checklist to document a training program.

Name of Farming Operation:

Owner/Operator Name:

Name of Trainer(s):

Trainer Affiliation/Company:

Date: _____

Topics discussed: Check those that apply.

- Worker Health and Hygiene
 Trace-Back
 Field Sanitation
 Pesticide Use
 General Sanitation
 Other: _____

List of Attendees

Name of Attendee	Signature of Attendee

Note: This form is only an example and should be modified to meet the needs of your operation.
 Adapted from California Strawberry Commission Food Safety Program

GROWER GUIDELINES: SOIL AMENDMENT LOG

Name of Farming Operation: _____

Farm Location: _____

Date: _____

Date Applied	Total Quantity	Method of Material Application	Source of Material	Physical Make-up and percentage	Pathogen Reduction Test
					Yes_ No_
					Yes_ No_
					Yes_ No_
					Yes_ No_
					Yes_ No_
					Yes_ No_
					Yes_ No_
					Yes_ No_
					Yes_ No_
					Yes_ No_
					Yes_ No_

Note: This form is only an example and should be modified to meet the needs of your operation.
Adapted from California Strawberry Commission Food Safety Program

GROWER GUIDELINES: PATHOGEN REDUCTION CHECKLIST FOR COMPOSTED SOIL

Name of Farming Operation: _____

Farm Location: _____

Material Added: _____

Name of Compost Producer: _____

Contact Information for Compost Producer: _____

Date Applied: _____

Questions to ask the Compost Producer:

1. What is the percentage and physical make-up of the composted material?

2. On what date did the compost process begin?

3. Was the compost produced through a process that combined plant and animal materials with an initial C:N ratio of between 25:1 and 40:1?

4. Were daily temperature readings registered of 131° Fahrenheit or higher?

5. Did the compost remain at 131° Fahrenheit for 15 days or longer for windrow composting?

6. Were windrows turned a minimum of five (5) times?

7. Was microbiological testing conducted?

Note: This form is only an example and should be modified to meet the needs of your operation.
Adapted from California Strawberry Commission Food Safety Program

GROWER GUIDELINES: COMPOST PROCESS CONTROL SHEET

Name of Farming Operation: _____

Farm Location: _____ Year: _____

Water	Irrigation Water Primary Source	Irrigation Water Secondary Source	Pesticide and Foliar Application Source	Hand Washing Water Source	Drinking Water Source
Source: Capped Well _____ Uncapped Well _____	Yes/ No	Yes/ No	Yes/ No	Yes/ No	Yes/ No
Open Source: Canal, Réservoir, Pond, etc.	Yes/ No	Yes/ No	Yes/ No	Yes/ No	Yes/ No
Source: Municipal District Water	Yes/ No	Yes/ No	Yes/ No	Yes/ No	Yes/ No
Irrigation Water: Drip	Yes/ No	Yes/ No	Yes/ No	Yes/ No	Yes/ No
Irrigation System: Overhead	Yes/ No	Yes/ No	Yes/ No	Yes/ No	Yes/ No
Recycled Water	Yes/ No	Yes/ No	Yes/ No	Yes/ No	Yes/ No

Describe the filtration system location (attach diagram):

List Applicable Dates for Testing Water Quality in Each Category

Water	Irrigation Water Primary Source	Irrigation Water Secondary Source	Pesticide and Foliar Application Source	Hand Washing Water Source	Drinking Water Source
Capped Well Annual Test					
Uncapped Well: Canal, Reservoir, Pond, etc. Quarterly Test					
Source: Municipal District Water					
Municipal District Quality Report					
Corrective Action and Date Taken: Chlorinate, Disinfect, Filter, etc.					
List Potential Risks from Adjacent Land					

Note: This form is only an example and should be modified to meet the needs of your operation.
Adapted from California Strawberry Commission Food Safety Program

GROWER/PACKER/SHIPPER GUIDELINES: FIELD SANITATION REQUIREMENTS CHECKLIST

Name of Farming Operation: _____

Date: _____

Rule	Completed	Description
Separate toilet facilities are provided; one facility for each 20 persons of each sex. Where there are fewer than five employees, separate toilet rooms for each sex are not required provided facility can be locked from the inside		
Toilet facilities are screened to keep insects and animals out.		
Field sanitation units are ventilated and provided with self-closing doors, lockable from the inside, and constructed to provide privacy.		
Toilet facilities, at all times, are operational, maintained in a clean and sanitary condition, and kept in good repair.		
Documentation is maintained stating average number of employees per week, number of field toilets in use, frequency of cleaning,		
A procedure for maintenance and sanitation is in place and easily accessible		
Toilet paper is provided in a suitable holder in each toilet unit.		
Effective odor control and solid-liquefying chemicals are used at all times in the toilet's chemical waste holding tanks.		
The toilet and hand washing facilities are located within close proximity to each other.		
For workers' convenience, both the toilet and hand washing facilities must be located within one quarter mile walk or within five (5) minutes, whichever is shorter.		
Written records of service and maintenance are maintained and retained for two years.		
Contents of chemical tanks are disposed of by draining or pumping into a sanitary sewer, approved septic tank, a holding tank of suitable size or any other method approved by the local health department.		
The disposal of wastes from toilet or hand washing facilities does not cause unsanitary conditions, nuisance or contamination.		

Note: This form is only an example and should be modified to meet the needs of your operation.
Adapted from California Strawberry Commission Food Safety Program

GROWER/PACKER/SHIPPER GUIDELINES: PROPER HAND WASHING PROCEDURES CHECKLIST

Name of Farming Operation: _____

Name of Person Completing This Checklist: _____

Date: _____

Rule	Completed	Description
Pure, wholesome and potable water (drinking water quality) is available for hand washing.		
Hand washing facilities are refilled with potable water as often as necessary to have an adequate supply at all times. (15-gallon minimum requirement for water tank.)		
Anti-bacterial, liquid soap and disposable single-use towels are provided.		
Signs are posted indicating that the water is only for hand washing purposes.		
Hand washing facilities are maintained in a clean and sanitary condition.		
One hand washing facility is available for every twenty (20) employees or fraction thereof.		
Hand washing facilities are provided with the field sanitation units or in the immediate vicinity.		
Both the hand washing and toilet facilities must be located within a one-quarter (1/4) mile or within five (5) minutes walk, whichever is shorter.		
The disposal of wastes from the hand washing & toilet facilities does not cause unsanitary conditions, nuisance or contamination.		

Note: This form is only an example and should be modified to meet the needs of your operation.
Adapted from California Strawberry Commission Food Safety Program

GROWER GUIDELINES: ACKNOWLEDGEMENT OF PESTICIDE SAFETY TRAINING FOR INDIVIDUAL EMPLOYEES

Name of Farming Operation: _____

Employee Name (First, Middle and Last): _____

Applicator: _____ Mixer/Loader: _____

Hire Date: _____

It is the responsibility of the employee to make sure he/she understands the items discussed here regarding pesticide safety. Your signature indicates that you have read, understand, and agree to adhere to the items discussed. Applicators will be held personally responsible for violations of pesticide labeling. If there is something you do not understand, ask your trainer.

List the training methods and materials used to train employees in the safe use and handling of pesticides (study guides, slides, videotapes, etc.) One copy must be kept in the employer's files.

The Pesticide Safety Series is available to employees and is posted at (Employer: list specific location here):

Product Label	Training Date	Employee Signature
		/
		/
		/
		/
		/
		/
		/
		/
		/
		/

Trainer's Signature

Employer's Signature

Note: This form is only an example and should be modified to meet the needs of your operation.
Adapted from California Strawberry Commission Food Safety Program

GROWER GUIDELINES: HARVESTING TOOL CLEANING WEEKLY CHECKLIST

Name of Farming Operation: _____

Name of Person Filling Out This Form: _____

Date: _____

Harvesting Tool Cleaning Checklist Question	Answer
Are lugs and harvesting buckets being maintained so as to remain free of damage, such as cracks?	Yes__ No__
Is there a regular inspection program to periodically replace damaged lugs and harvesting buckets?	Yes__ No__
Are the harvesting containers kept clean of foreign materials, such as baseball caps or other personal objects?	Yes__ No__
Are stations available for the harvesting containers to be cleaned and dipped in sanitizers at the end of the day?	Yes__ No__
Is the sanitizer concentration verified and documented in a log?	Yes__ No__
Is there a hand washing program in place? Is it being followed?	Yes__ No__
Is the mechanical harvester cleaned and sanitized at the end of a harvest day?	Yes__ No__
Is the mechanical harvester cleaned and sanitized before it is moved from one field to another or from one location to another?	Yes__ No__
Is there a cleaning and sanitizing protocol for the mechanical harvester?	Yes__ No__

Note: This form is only an example and should be modified to meet the needs of your operation.
Adapted from California Strawberry Commission Food Safety Program

PACKER/PROCESSOR GUIDELINES: INSTRUCTIONS FOR PROCESSING FACILITY EMPLOYEES

General Rules:

1. Employees must wear clean outer garments that are washable. Shoes must be in good repair and of leather construction. No open toes.
2. All employees must wash hands with soap and warm water and sanitize their hands prior to handling blueberries, after using restrooms, returning to their work station from break or lunch, or at any other time when their hands may have become soiled.
3. All employees are to wear effective hair restraints including hairnets and beard covers. In cooling facilities, only wear when appropriate.
4. All jewelry, including watches, must be removed before entering the plant. Medical alert bracelets and, in most cases, plain wedding bands are acceptable.
5. Shirt pockets are to be emptied and cleared of pencils, etc., when in the plant.
6. No glass or food items of any kind are permitted in the plant processing areas. Food may only be consumed in the lunchroom or outside the building in designated areas.
7. No employee infected with any infectious or communicable disease, including boils, sores, open wounds or any other affliction that may spread disease, may be in contact with BLUEBERRIES.
8. Candy, chewing gum, lozenges, etc. are not allowed in the plant.
9. Tobacco is not permitted in the plant. Smoking areas are designated.
10. Extra or non-working clothing must be stored in lockers or some other acceptable facility.
11. Cellular phones and Personal Digital Assistants (PDA's) are not allowed in manufacturing plants unless approved by management.

All employees are expected to comply with the Good Manufacturing Practices required by the US Food and Drug Administration (FDA) and US Department of Agriculture (USDA).

Employee: _____

Date: _____

Note: This form is only an example and should be modified to meet the needs of your operation.
Adapted from California Strawberry Commission Food Safety Program

PACKER/PROCESSOR GUIDELINES: PROCESSING FACILITY VISITORS' AGREEMENT

General Rules:

1. All visitors must agree to abide by all FDA, state and local regulations governing the operation of this facility.
2. Visitors must wear clean outer garments that are washable. Shoes must be in good repair and of leather construction. No open toes.
3. All visitors must wash hands with soap and warm water and sanitize their hands prior to handling BLUEBERRIES.
4. All visitors are to wear effective hair restraints including hairnets and beard covers.
5. All jewelry, including watches, must be removed when entering the plant. Medical alert bracelets and, in most cases, plain wedding bands are acceptable.
6. Shirt pockets are to be emptied and cleared of pencils, etc., when in the plant.
7. No glass or food items of any kind are permitted in the facility's processing areas. Food may only be consumed in the lunchroom or outside the building.
8. No visitors infected with any infectious or communicable disease, including boils, sore, open wounds or any other affliction, which may spread disease, may be in contact with blueberries.
9. Candy, chewing gum, lozenges, etc. are not allowed in the plant.
10. Tobacco is not permitted in the plant. Smoking areas are designated.
11. Extra clothing must be left in the office and not taken into the plant.
12. Cellular phones and Personal Digital Assistants (PDAs) are not allowed in manufacturing plants unless approved by management.
13. All visitors are expected to comply with the Good Manufacturing Practices required by the US Food & Drug Administration (USDA) and USDA.

Visitor: _____

Date: _____

Note: This form is only an example and should be modified to meet the needs of your operation.

SHIPPER/PROCESSOR GUIDELINES: TRAILER/CARGO CONTAINERS CHECKLIST

Name of Shipping/Processing Operation _____

Name of Carrier Operation _____

Inspector _____ Date _____

Is refrigeration unit in working order? _____

CARRIER CONDITION

Floor:	Tight _____	Cracks _____	Holes _____
Sides:	Smooth _____	Cracks _____	Broken _____
Roof:	Smooth _____	Cracks _____	Holes _____
Doors:	Excellent _____	Fair _____	Poor _____
Door Seals:	Excellent _____	Fair _____	Poor _____

CARRIER CLEANLINESS

Floor:	Clean _____	Needs Sweeping _____	Filthy _____
Walls:	Clean _____	Dusty _____	Filthy _____
Roof:	Clean _____	Dusty _____	Filthy _____
Odors:	None _____	Off-odors _____	Putrid _____
Insects:	None _____	Evidence _____	Live _____
Rodents:	None _____	Evidence _____	Live _____
Chemicals:	None _____	Evidence _____	Powders _____
Other:	None _____	Evidence _____	Glass, etc. _____

Comments:

Accept: _____ Reject: _____ Reason: _____

Corrective Action: _____ Accepted? _____

Note: This form is only an example and should be modified to meet the needs of your operation.
Adapted from California Strawberry Commission Food Safety Program

SHIPPER/PROCESSOR GUIDELINES: RECALL TEAM CONTACT LIST

Name of Operation: _____

Date List Updated: _____

Contact	Information
President/CEO	Phone #: Fax #: Cell Phone #: Home Phone #: E-mail:
Recall Coordinator	Phone #: Fax #: Cell Phone #: Home Phone #: E-mail:
Distribution	Phone #: Fax #: Cell Phone #: Home Phone #: E-mail:
Production	Phone #: Fax #: Cell Phone #: Home Phone #: E-mail:
Quality Assurance	Phone #: Fax #: Cell Phone #: Home Phone #: E-mail:
Consumer Affairs	Phone #: Fax #: Cell Phone #: Home Phone #: E-mail:
Legal Counsel	Phone #: Fax #: Cell Phone #: Home Phone #: E-mail:
Public Relations	Phone #: Fax #: Cell Phone #: Home Phone #: E-mail:

Note: This form is only an example and should be modified to meet the needs of your operation.
Adapted from California Strawberry Commission Food Safety Program

