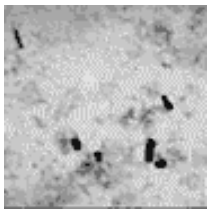
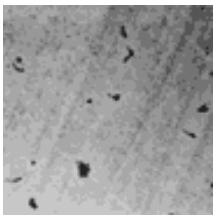
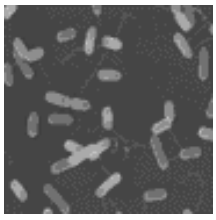
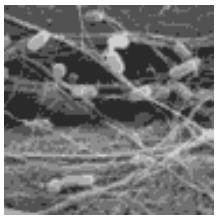
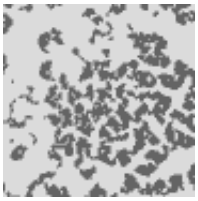
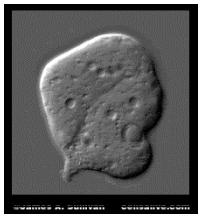
ADDITIONAL RESOURCES

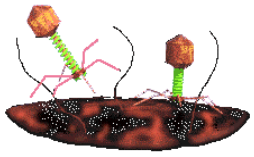
PART I
Foodborne Disease and Fresh Produce

Table 1. Pathogens Associated with Fresh Fruits and Vegetables

Disease / Microorganism	Source of Illness	Symptoms
	BACTERIAL ILLNESSES	
Botulism Botulinum toxin produced by ***Clostridium botulinum*** 	Spores of this bacterium are wide-spread. But they produce toxin only in an anaerobic (without oxygen) environment with low acidity. Can cause problems in low-acid canned goods if the foods are not properly processed. Such products include corn, green beans, soups, beets, asparagus, mushrooms, tuna, and liver pate. Problems have also been identified in luncheon meats, ham, sausage, stuffed eggplant, lobster, and smoked and salted fish. Potential hazard exists when fruit and vegetables are placed in packages with poor oxygen permeability.	Onset: Generally 4-36 hours after eating. Symptoms: Neurotoxic symptoms, including double vision, inability to swallow, speech difficulty, and progressive paralysis of the respiratory system. Get medical help immediately. Botulism can be Fatal.
Campylobacteriosis ***Campylobacter jejuni*** 	Bacterium on poultry, cattle, and sheep can contaminate meat and milk of these animals. Raw food sources: raw poultry, meat, and unpasteurized milk. Organism has been isolated from the surface of cucumbers. It can get introduced to produce through cross contamination from infected animal products.	Onset: Generally 2-5 days after eating. Symptoms: Diarrhea, abdominal cramping, fever, and sometimes bloody stools. Lasts 7-10 days.
Listeriosis, meningitis encephalitis ***Listeria monocytogenes*** 	Found in some types of unpasteurized soft cheese, unpasteurized milk, seafood products, frozen cooked crabmeat, cooked shrimp and cooked surimi (imitation shellfish), coleslaw and produce. ***Listeria*** is much more resistant to heat, salt, nitrite, and acidity than many other micro-organisms. They survive and grow at low temperatures. Other potential sources of contamination include processing equipment, sewage and other inert surfaces.	Onset: From 7-30 days after eating, but most symptoms have been reported 48-72 hours after consumption of contaminated food. Symptoms: Fever, headache, nausea, and vomiting. Primarily affects pregnant women and their fetuses, newborns, the elderly, people with cancer, and those with impaired immune systems. Can cause fetal and infant death.

Infection by ***Escherichia coli*** 	Part of normal gastrointestinal tract microflora of humans and other warm-blooded animals. Their presence in foods is generally used as an index of handling or post-heat processing contamination. Illnesses associated with ***E. coli*** O157:H7 have been associated with unpasteurized apple juice and cider, lettuce, salads, salmon and cheese.	Onset: From 8-44 hours after consumption of contaminated food. Enterotoxigenic ***E. coli-*** Symptoms: Fever, abdominal spasms, shriveling, aqueous diarrhea, vomiting and dehydration. Enterohemorrhagic ***E. coli*** (O157:H7)-most important in terms of foodborne disease. Symptoms: stools with blood, leading cause of renal failure in children, can cause damage to the brain. Mortality rate is very high.
Perfringens food poisoning ***Clostridium perfringens*** 	In most instances, caused by failure to keep food hot. A few cells are often present after cooking and multiply to toxic levels during cool down and storage of prepared foods. Meats and meat products are the foods most frequently implicated in outbreaks. Raw vegetables also have been implicated in outbreaks.	Onset: Generally 8-12 hours after eating. Symptoms: Abdominal pain and diarrhea, and sometimes nausea and vomiting. Symptoms last for a day or less and are usually mild. Can be more serious in older or debilitated people.
Salmonellosis ***Salmonella*** 	Raw produce sources implicated in outbreaks include melons, tomatoes, alfalfa sprouts and orange juice. Raw meats, poultry, eggs, milk and other dairy products, shrimp, frog legs, yeast, coconut, pasta, and chocolate are most frequently involved. Individuals carrying this organism but exhibiting no symptoms of illness could contaminate produce due to poor hygiene practices.	Nontyphoid Infections (gastroenteritis) Onset: Generally 8-12 hours after eating. Symptoms: Abdominal pain and diarrhea, and sometimes nausea and vomiting. Symptoms last a day or less and are usually mild. Can be more serious in older or debilitated people. Typhoid Fever Onset: 8 to 15 days incubation, fever continues for several days, septicemia 10 days or more after infection. Symptoms: Malaise, anorexia and headache, gradual increase in temperature.
Shigellosis (bacillary dysentery) ***Shigella*** 	Have been found in lettuce, green peas, milk, dairy products, poultry, and potato salad. Food becomes contaminated when a human carrier does not wash hands and then handles produce. Organisms multiply in food left at room temperature.	Onset: 1-7 days after eating. Symptoms: Abdominal cramps, diarrhea, fever, sometimes vomiting and blood, pus, or mucus in stool.

Staphylococcal food poisoning Staphylococcal enterotoxin produced by ***Staphylococcus aureus*** 	Bacterium found everywhere in the environment. Toxin is produced when food contaminated with the bacteria is left too long at room temperature. Most outbreaks are due to human food handling. High-protein foods are more commonly associated with toxin production. Such foods include meats, poultry, egg products, tuna, potato and macaroni salads, and cream filled pastries. Usually not a problem in raw produce due to competition by natural microflora.	Onset: Generally 30 minutes-8 hours after eating. Symptoms: Diarrhea vomiting, nausea, abdominal pain, cramps, and prostration. Lasts 24-48 hours. Rarely fatal.
Vibrio Infection ***Vibrio vulnificus*** ***Vibrio cholerae*** ***Vibrio parahaemolyticus*** 	Contaminated water has been associated with foodborne outbreaks. The bacterium lives in coastal waters and can infect humans either through open wounds or through consumption of contaminated seafood. The bacteria are most numerous in warm weather. Can reach raw fruits and vegetables through cross contamination or handling.	***Vibrio vulnificus*** Onset: 1-7 days Symptoms: Chills, fever, and/or prostration. At high risk are people with liver conditions, low gastric (stomach) acid, and weakened immune systems. ***Vibrio cholerae*** Onset: 24-72 hrs Symptoms: Profuse watery diarrhea and vomiting, which can lead to severe dehydration and death within hours. ***Vibrio parahaemolyticus*** Onset: 2-48 hrs Symptoms: Watery diarrhea, abdominal cramps, nausea, vomiting.
PARASITIC ILLNESSES		
Amebiasis ***Entamoeba histolytica*** 	Exist in the intestinal tract of humans and are expelled in feces. Polluted water and vegetables grown in polluted soil spread the infection. Infected handlers can also be sources of contamination.	Onset: 3-10 days after exposure. Symptoms: Severe cramp pain, tenderness over the colon or liver, loose morning stools, recurrent diarrhea, loss weight, fatigue, and sometimes anemia.
Cryptoporidiosis ***Cryptosporidium parvum***	Cryptosporidium sp. could occur, on any food touched by a contaminated food handler. Fertilizing salad vegetables with manure is another possible source of human infection. Large outbreaks are associated with contaminated water supplies.	Onset: 7 days average (2-28 days) Symptoms: Severe watery diarrhea, but may, alternatively, be asymptomatic. Pulmonary and tracheal disease in humans is associated with coughing frequently a low-grade fever, these symptoms often accompanied by severe intestinal distress. Lasts 2-4 days, has extended to 1-4 weeks.

Cyclospora cayetanesis	Contaminated water, berries and lettuce	Onset: 1-11 days Symptoms: Fatigue, protracted diarrhea, often relapsing. Lasts from several days to several months.
Giardiasis ***Giardia lamblia*** 	Most frequently associated with consumption of contaminated water. Have been found in vegetables including carrots. May be transmitted by uncooked foods that become contaminated while growing or after cooking by infected food handlers. Cool, moist conditions favor organism's survival.	Onset: 1-3 days. Symptoms: Sudden onset of explosive watery stools, abnormal cramps, anorexia, nausea, and vomiting. Especially infects, children, travelers, and institutionalized patients.
VIRAL ILLNESSES		
Hepatitis A 	Outbreaks have been associated with raspberries, strawberries, lettuce, mollusks (oysters, clams, mussels, scallops) and other foods that become carriers when untreated sewage pollutes them. Raw shellfish are especially potent carriers, since cooking does not always kill the virus.	Symptoms and Onset: Begin with malaise, appetite loss, nausea, vomiting, and fever. After 3-10 days patient develops jaundice with darkened urine. Severe cases can cause liver damage and death.
Norwalk-like viruses	Generally associated with poorly cooked shellfish however can be transmitted through ready-to-eat foods touched by infected workers, salads, ice, fruit.	Onset: 24-48 hrs. Symptoms: Nausea, vomiting, watery large-volume diarrhea, fever rare.

Adapted from:

Centers for Disease Control and Prevention. 2001. Diagnosis and Management of Foodborne Illnesses: A Primer for Physicians. MMWR, Vol. 50. RR-2

FDA. 2001. Foodborne Illness: Ten Least Wanted Foodborne Pathogens. U.S. Food and Drug Administration-Partnership for Food Safety Education - The Fight BAC!™ campaign. Available via the Internet at: http://www.fightbac.org/10least.cfm

Table 2 – Outbreaks of Foodborne Disease Associated with Fresh Fruits and Vegetables*

Agent	Implicated/suspected food	Reference
Bacillus cereus	Sprouts	Portnoy ***et.al.*** (1976)
Campylobacter	Cucumber	Kirk et al. (1997)
Campylobacter jejuni	Lettuce	CDC (1998)
Clostridium botulinum	Vegetable salad	PHLS (1978)
Clostridium botulinum	Bamboo shoots	CDC (1999)
Cryptosporidium	Apple cider	CDR (1991)
Cyclospora	Raspberries	Herwaldt et al. (1997)
Cyclospora	Basil	CDC (1997)
Cyclospora	Raspberries	CDC (1998)
E. coli O157	Radish sprouts	WHO (1996)
E. coli O157	Apple juice	CDC (1996)
E. coli O157	Apple cider	Besser et al. (1993)
E. coli O157	Iceberg lettuce	CDR (1997)
E. coli O157	Alfalfa sprouts	CDC (1997)
Fasciolia hepatica	Watercress	Hardman (1970)
Giardia	Vegetables, incl. Carrots	Mintz et al. (1993)
Hepatitis A virus	Iceberg lettuce	Rosenblum et al. (1990)
Hepatitis A virus	Raspberries	Ramsey et al. (1989)
Hepatitis A virus	Strawberries	Niu et al. (1992)
Norwalk virus	Tossed salad	Lieb et al. (1985)
Salmonella agona	Coleslaw & onions	Clark et al. (1973)
Salmonella miami	Watermelon	Gayler et al. (1955)
Salmonella muenchen	Orange juice	CDC (1999)
Salmonella oranienburg	Watermelon	CDC (1979)
Salmonella poona	Cantaloupes	CDC (1991)
Salmonella saint-paul	Bean sprouts	O'Mahony et al. (1990)
Salmonella stanley	Alfalfa sprouts	Mahon et al. (1997)
Salmonella thompson	Root vegetables & dried seaweed	Kano et al. (1996)
Shigella flexneri	Mixed salad	Dunn et al. (1995)
Shigella sonnei	Iceberg lettuce	Kapperud et al. (1995)
Shigella sonnei	Parsley	CDC (1999)
Shigella sonnei	Tossed salad	Martin et al. (1986)

* Adapted from Beuchat, L. R.1998. Surface decontamination of fruits and vegetables eaten raw: A review. WHO/FSF/FOS/98.2. Available via the Internet at http://www.who.int/fsf/fos982~1.pdf

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Centers for Disease Control and Prevention. 1991. Multi-state outbreak of ***Salmonella poona*** infections – United States and Canada. Morbidity and Mortality Weekly Report 40(32): 549.

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Centers for Disease Control and Prevention. 1999. Foodborne botulism associated with home-canned bamboo sprouts – Thailand, 1998. Morbidity and Mortality Weekly Report 48(27): 437.

Centers for Disease Control and Prevention. 1999. Outbreaks of ***Shigella sonnei*** infection associated with eating fresh parsley – United States and Canada, July – August, 1998. Morbidity and Mortality Weekly Report 48(14): 285.

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Kirk, M., et al. 1997. A prolonged outbreak of Campylobacter infection at a training facility. Communicable Disease Intelligence 21(12): 57.

Lieb, S., et al. 1985. Norwalk virus gastroenterititis an outbreak assocaited with a cafeteria at a college. American Journal of Epidemiology 121(2): 259.

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Niu, M.T., Polish, L.B., Robertson, B.H., Khanna, B.K., Woodruff, B.A., Shapiro, C.N., Miller, M.A., Smith, J.D., Gedrose, J.K., Alter, M.J., and Margoles, H.S. 1992. Multistate outbreak of hepatitis A associated with frozen strawberries. Journal of Infectious Disease 166: 518.

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Public Health Laboratory Service. 1997. Outbreaks of foodborne illness in humans, England and Wales: Quarterly Report. Communicable Disease Rep. Weekly 7(24): 207.

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PART II
FDA Publications

The Guide at a Glance
The *Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables* In Brief

This *Guide* provides general, broad-based voluntary guidance that may be applied, as appropriate, to individual operations

The *Guide*

- Is intended to assist domestic and foreign growers, packers, and shippers of unprocessed or minimally processed (raw) fresh fruits and vegetables by increasing awareness of potential hazards and providing suggestions for practices to minimize these hazards
- Covers agricultural and postharvest water uses, manure and biosolids, worker health and hygiene, field and facility sanitation, transportation, and traceback
- Does not impose any new requirements or supercede existing laws or regulations
- Will be most effective when used to evaluate individual operations and to institute good agricultural and good manufacturing practices (GAPs and GMPs) appropriate to the individual operations

Basic Principles include

- Prevention of microbial contamination of fresh produce is favored over reliance on corrective actions once contamination has occurred
- Accountability at all levels of the agricultural and packing environments is important to a successful food safety program

Water

Wherever water comes into contact with fresh produce, its quality dictates the potential for pathogen contamination

Agricultural Water

- Identify source and distribution of water used
- Be aware of current and historical use of land
- Review existing practices and conditions to identify potential sources of contamination. Consider practices that will protect water quality
- Maintain wells in good working condition
- Consider practices to minimize contact of the edible portion of fresh produce with contaminated irrigation water. Where water quality is good, risk is low regardless of irrigation method

Processing Water

- Follow GMPs to ensure water quality is adequate at the start of and throughout all processes
- Maintain water quality, such as by periodic testing for microbial contamination, changing water regularly, and cleaning and sanitizing water contact surfaces
- Antimicrobial chemicals may help minimize the potential for microbial contamination to be spread by processing water; levels of antimicrobial chemicals should be routinely monitored and recorded to ensure they are maintained at appropriate levels
- As organic material and microbial load increase, the effectiveness of many antimicrobial chemicals will decrease. Filtering recirculating water or scooping organic material from tanks may help reduce the build-up of organic materials

Cooling Operations

- Maintain temperatures that promote optimum produce quality and minimize pathogen growth
- Keep air cooling and chilling equipment clean and sanitary

- Keep water and ice clean and sanitary
- Manufacture, transport, and store ice under sanitary conditions

Manure and Municipal Biosolids

Properly treated manure or biosolids can be an effective and safe fertilizer.

- If manure is used as a fertilizer, it should be managed to minimize microbial hazards
- Federal regulations address the requirements for use of biosolids in the U.S.. Some states also have specific requirements for the use of biosolids. Foreign growers should follow these or similar requirements

Manure

- Use treatments to reduce pathogens in manure and other organic materials. Treatments may be active (e.g., composting) or passive (e.g., aging)
- Manure treatment and storage sites close to fresh produce fields increase the risk of contamination
- Consider factors such as slope and rainfall and the likelihood of runoff into fresh produce production areas
- Use barriers or physical containment to secure storage and treatment sites
- Protect treated manure from being re-contaminated
- When purchasing treated manure, get information about the method of treatment
- Maximize the time between application of manure to production areas and harvest
- Use of raw manure on produce during the growing season is not recommended

Animal Feces

While not possible to exclude all animal life from fresh produce production areas, many field programs include elements to protect crops from animal damage.

- Domestic animals should be excluded from fields and orchards during the growing and harvesting season
- Follow GAPs to ensure animal waste from adjacent fields, pastures, or waste storage facilities does not contaminate fresh produce production areas. Where necessary, consider physical barriers such as ditches, mounds, grass/sod waterways, diversion berms, and vegetative buffer areas
- Control of wild animal populations may be difficult or restricted by animal protection requirements. However, to the extent feasible, where high concentrations of wildlife are a concern, consider practices to deter or redirect wildlife to areas where crops are not destined for fresh produce markets

Worker Health and Hygiene

Infected employees who work with fresh produce increase the risk of transmitting foodborne illness.

- Train employees to follow good hygienic practices
- Establish a training program directed towards health and hygiene – include basics such as proper handwashing techniques and the importance of using toilet facilities
- Become familiar with typical signs and symptoms of infectious diseases
- Offer protection to workers with cuts or lesions on parts of the body that may make contact with fresh produce
- If employees wear gloves, be sure the gloves are used properly and do not become a vehicle for spreading pathogens
- Customer-pick and road-side produce operations should promote good hygienic practices with customers – encourage handwashing, provide toilets that are well equipped, clean, and sanitary and encourage washing fresh produce before consumption

Sanitary Facilities

- Poor management of human and other wastes in the field or packing facility increases the risk of contaminating fresh produce
- Be familiar with laws and regulations that apply to field and facility sanitation practices
- Toilet facilities should be accessible to workers, properly located, and well supplied
- Keep toilets, handwashing stations, and water containers clean and sanitary
- Use caution when servicing portable toilets to prevent leakage into a field
- Have a plan for containment in the event of waste spillage

Field Sanitation

Fresh produce may become contaminated during pre-harvest and harvest activities from contact with soil, fertilizers, water, workers, and harvesting equipment.

- Clean harvest storage facilities and containers or bins prior to use
- Take care not to contaminate fresh produce that is washed, cooled, or packaged
- Use harvesting and packing equipment appropriately and keep as clean as practicable
- Assign responsibility for equipment to the person in charge

Packing Facility

Maintain packing facilities in good condition to reduce the potential for microbial contamination.

- Remove as much dirt as practicable outside of packing facility
- Clean pallets, containers, or bins before use; discard damaged containers
- Keep packing equipment, packing areas, and storage areas clean
- Store empty containers in a way that protects them from contamination

Pest Control

- Establish and maintain a pest control program
- Block access of pests into enclosed facilities
- Maintain a pest control log

Transportation

Proper transport of fresh produce will help reduce the potential for microbial contamination.

- Good hygienic and sanitation practices should be used when loading, unloading, and inspecting fresh produce
- Inspect transportation vehicles for cleanliness, odors, obvious dirt and debris before loading
- Maintain proper transport temperatures
- Load produce to minimize physical damage

Traceback

The ability to identify the source of a product can serve as an important complement to good agricultural and management practices.

- Develop procedures to track produce containers from the farm, to the packer, distributor, and retailer
- Documentation should indicate the source of the product and other information, such as date of harvest, farm identification, and who handled the produce
- Growers, packers and shippers should partner with transporters, distributors and retailers to develop technologies to facilitate the traceback process

Once good agricultural and management practices are in place, ensure that the process is working correctly. Without accountability, the best efforts to minimize microbial contamination are subject to failure.

Copies of the *Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables*, October 1998, are available from:
Food Safety Initiative Staff (HFS-32)
U.S. Food and Drug Administration
Center for Food safety and Applied Nutrition
200 C Street SW
Washington, DC 20204
Or on the Internet at:
http://vm.cfsan.fda.gov/~dms/prodguid.html

The Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables is available in English, Spanish, French, and Portuguese

U. S. Food and Drug Administration
Center for Food Safety and Applied Nutrition
April 6, 2000

Farm Investigation Questionnaire

The following form has been used in the domestic survey follow-ups, the imported survey follow-ups and outbreak tracebacks. This questionnaire has been developed by CFSAN and ORA for use on investigations of farms implicated in outbreaks or farms that grew produce that was found positive for pathogens by FDA testing.

General Information:

Name of Farm Owner:

Farm Address:

Phone Number:

Location of Suspect Fields:

1. Date of Farm visit:
2. Outbreak Name/Location/Number:
3. Implicated Food:
4. Agent in Outbreak:
   Reservoir(s) for this agent:
5. Planting date for implicated field:
6. Harvest date(s) for implicated field:
7. Interim steps (with dates) between planting and harvest (fertilizing, pesticide applications, irrigation):
8. Other crops/ foods raised on this or adjoining fields:

Farm Diagram:

9. Obtain or draw a map of the farm layout. Use the farmer's or one you draw to identify any possible sources of contamination on the farm or in close proximity: e.g. slope of the land, type of soil, feedlots, sewage treatment plants, sewage disposal systems/latrines/cesspools, areas that would collect drainage, ponds/streams/rivers/ irrigation ditches, water wells, animal grazing/housing, manure storage/composting, accumulations of trash, waste, debris that would attract pests, housing for people. Attach the map to this report. Take photos to further document the layout. Use a geological survey map or global positioning device to describe the longitude and latitude of the suspect field(s).
   Take pictures of everything possible during your investigation.

Weather:

10. Were there any unusual weather conditions during the growing or harvesting period e.g. drought, heavy rains, fog or humidity? N ____ , Y ____ Explain:

Flooding:

11. Was the field exposed to flooding any time during the growing or harvesting period? N ____ , Y ____
    If yes when in relation to harvest:
    What was the depth:
    How long did the water cover crops:

12. Could heavy rainfall or flooding have contained or spread sewage, manure or other contaminants? N ____ , Y ____
    If yes list the sources and their distance from the farm:

Manure Management:

13. Has animal manure been used for fertilizer within the last year? N ____ , Y ____

14. What kind of animals is the manure from?
    ____ Cattle ____ Swine ____ Poultry ____ Unknown

15. What/who is the source/supplier?
    Name:
    Address:
    Telephone:
    (Investigator: obtain copies of invoices of manure shipments and attach)

16. What were the delivery dates:

17. What were the application dates:

18. Where was the manure stored prior to application:

19. When is manure applied e.g. before planting (how far), at the time of planting, between planting and harvest?

20. How close to harvest was the last application?

21. Can applied manure blow onto downwind crops? N ____ , Y ____ Explain:

22. How is manure applied e.g. topical, side dressing, plowed or disked into the soil?

23. How close is manure/compost stored to crop field?

24. Is it covered to prevent drift or contained to prevent runoff (e.g., manure lagoons)? N ____ , Y ____

The following questions may have to be asked of the manure provider/seller:

25. Is the manure composted? N ____ , Y ____

26. If manure is composted, for how long and how is the composting managed (e.g., is the manure turned to assure more complete breakdown?)?

27. Is manure treated? N ____ , Y ____
    If yes, how was it treated e.g. composted, heat dried, treated with lime, aged, anaerobic digestion, treated in a waste lagoon?

28. Was the treated manure tested? N ____ , Y ____
    If yes what was it tested for and what were the findings:

Animal Management:

29. Are farm animals or domestic animals, e.g. cattle, dogs, housed or grazed anywhere near the field? N ____ , Y _____

30. Is there a field lot or dairy farm within 1 mile of the field? N ____ , Y ____
    If yes to either question, what animals and how far away? Describe relevant topography (e.g., animal production uphill from fields):

31. Are there fences to keep them out of crops and away from water sources?
    N ____ , Y ____

32. Would animal production areas drain into the field or water source?
    N ____ , Y ____ If yes explain:

33. What wild animals have been observed in the area (e.g., deer and other mammals, birds):

34. Describe the number of animals and the frequency that they are in the area:

35. Are they excluded or discouraged in anyway? If so how?

36. Is there any evidence of animal feces in the field? N ____ , Y ____ Explain:

37. Are amphibians or reptiles (e.g. frogs, snakes, alligators) possible sources of contamination in the field or in agriculture water sources?
    N ____ , Y ____ If yes explain:

38. Are farm animals (e.g. horses, donkeys) used in the fields? N ____ , Y ____

39. Are Domestic animals intentionally introduced into crop production areas (e.g., for weed or pest control, to eat residual produce after harvest?) N ____ , Y ____
    If yes explain. Include time between animals in production area and subsequent harvest:

40. Are there any relevant health problems in the farm animals?
    N ____ , Y ____ Explain:

Further follow-up animal health may be required with the farmer that owns the animals.

Sewage Use:

41. Is human waste used as fertilizer? N ____ , Y ____

42. Is sewage (sewage sludge or biosolids) use on this crop?
    N ____ , Y ____ If so where is it from?

43. How was it treated (e.g., composted, heat dried, treated with lime, aged, anaerobic digestion, treated in a waste lagoon)?

44. On what crops are the sludge/biosolids used?

45. How close to harvest was it applied?

46. Is recycled (sewage plant treated) water used? N ____ , Y ____
    If yes when was it applied: How was it applied:

47. Is grey water e.g. non-human wastewater used for irrigation? N ____ , Y ____
    If yes, what is the source of the grey water, how is it applied and how close to harvest is it applied?

Treatments/Fertilizers/Pesticides:

48. Are chemical fertilizers used? N ____ , Y ____

49. How many days prior to harvest were the chemicals applied?

50. What crops are treated with chemical fertilizers?

51. How is it applied?

52. Was water used to mix with the chemicals applied?
    N ____ , Y ____ If yes what was the source of the water?

53. Are biological treatments used e.g. bees for pollination, mites for competitive exclusion, Bacillus thuringiensis for pest control? N ____ , Y ____
    If yes explain which ones are used, for how long, and how close to harvest:

54. Does the farm apply pesticides or herbicides to crops? N ____ , Y ____
    Explain:

55. How are they applied:
    ____ Truck or tractor mounted spray rig ____ Airplane ____ Manual spray
    ____ Other

56. What is the water source used for mixing and applying pesticides?

57. How close to harvest are pesticides applied?
58. Are pesticide mixing tanks, mixing paddles, spray tanks clean? N ____ , Y ____
    Explain:

59. Where is pesticide equipment stored when not in use e.g. on ground, protected from contamination?

Harvest Tools and Equipment:

60. Harvest method:
    ____ Bare hand ____ Bare hand with utensil (e.g., knife) ____ Gloved hand
    ____ Gloved hand with utensil ____ Automated/machine (no hand contact)
    ____ Other Explain:

61. What tools are used in harvesting the crop e.g. knives, clippers?

62. Are they designed and constructed to allow for cleaning? N ____ , Y ____
    Explain:
    Are they clean? N ____ , Y ____ Explain:

63. How are they cleaned and sanitized, by whom and how often?

64. Are re-usable harvest containers used? N ____ , Y ____

65. What materials are they made from?
    ____ Wood ____ Plastic ____ Cardboard ____ Other

66. How are they cleaned before and during use?

67. How and where are they stored when not in use (e.g., on the ground, in a shed)?

68. How is large crop equipment that comes in contact with eatable crops cleaned (e.g. blades, chutes, and conveyors)?

69. Is harvest equipment leased or contracted out? N ____ , Y ____
    If yes who is the contractor and what other crops are harvested with this equipment?

70. Answer the equipment design, condition, cleaning and sanitizing questions for this equipment.

71. Is equipment used to haul crops used for other tasks such as hauling garbage, manure? N ____ , Y ____ Explain:

72. How is this equipment cleaned prior to use for hauling harvested crops?

73. Are crops washed/processed in the field? N ____ , Y ____ Explain:

Packing Facility:

74. Characterize the size of the operation (e.g., number of employees, stability of work force, season of operation):

75. Draw a diagram and flow chart of the packing facility/shed and identify any possible sources of contamination (include location of restrooms, break areas, storage areas for equipment, chemicals, packaging, and personal items).

76. Is the packing equipment designed and constructed and maintained to facilitate cleaning and sanitization? N ____ , Y ____ Explain:

77. Is the packing equipment cleaned? N ____ , Y ____
And sanitized? N ____ , Y ____ If so how, how often, using what compounds? Explain:

78. Does the plant recycle water? N ____ , Y ____

79. Does recycled water flow go from relatively clean to relatively dirty operations? N ____ , Y ____ Explain:

80. Is the crop cooled? N ____ , Y ____
How is it cooled (e.g., is a water spray, hydro-cooler, hydro-vac, forced air used)? Explain:

81. Is water with a disinfectant used in the packing facility/shed? N ____ , Y ____
Where is it used, what chemical, and how much is used?

82. What residual of disinfectant is in the cooling water at the time of inspection? ____ ppm

83. How was the residual measured?

84. How does the operator monitor disinfectant residual in the process water? Are records kept of the test findings? N ____ , Y ____

85. How and how often is the hydro-cooler cleaned?

86. How and how often is the water changed in the hydro-cooler?

87. How and how often is flume water changed?

88. Measure the temperature of the product immediately before it is washed/processed by water. ____ degrees

89. Measure the temperature of the water when it is used to wash/process produce? ____ degrees
    Record the location where these temperatures were taken.
    (For some produce (e.g., tomatoes, celery, apples), it is recommended that the water be 10 degrees F warmer than the product to prevent uptake of the water by the produce.)

90. What is the source of ice used in the packing facility/shed?

91. Is ice produced, stored and used in a sanitary manner? N ____ , Y ____ Explain:

92. Describe how sewage and wastewater are disposed of.

93. Is there evidence of amphibians, reptiles, insects or other birds inside the packing area? N ____ , Y ____ Explain including proximity to product.

94. What is the temperature of product refrigeration rooms? _____
    What is the temperature of product under refrigeration? _____

95. How long has the product been stored?

96. Examine the refrigeration rooms for condensate problems, pest control, cleanliness:

Transportation:

97. Are vehicles used to transport produce from the field to the packing shed and from the farm to market also used to transport animals, manure or other sources of contamination? N ____ , Y ____ Explain:

98. Is someone assigned responsibility for ensuring trucks are: clean and sanitary? N ____ , Y ____ ; precooled (if appropriate for crop)? N ____ , Y ____
    Is someone aware of previous load hauled? N ____ , Y ____

99. Are the transport vehicles cleaned and sanitized prior to being used for produce? N ____ , Y ____ Explain:

100. Are transport vehicles inspected prior to each use? N ____ , Y ____ Explain:

101. Are the transport vehicles onsite at the time of inspection clean and sanitary? N ____ , Y ____ Explain:

102. Is the product temperature monitored while being transported? N ____ , Y ____

103. How is product temperature monitored in vehicles transporting the produce from farm to market (e.g., do they use temperature monitoring devices)?

Environmental and Product Sampling:

Prior to your visit determine whether the samples are for regulatory or epidemiological purposes or both. Determine with laboratory, regulatory and epidemiology consultants what should be sampled (e.g., produce, soil, water, workers, food contact surfaces, wild life, domestic animals) prior to visiting the farm. These discussions should also cover what tests should be run on samples, who has the expertise to collect and analyze the samples, how the sample findings will be interpreted, and what will be done with positive findings. If surface waters are used for irrigation or other product contact use, use Moore swab tests to identify the pathogen.

Water Sources:

Complete one copy of this form for each water source used for growing, processing or transportation.
Date:
Name of source:
How used (e.g., irrigation, cooling, and pesticide application)?:
Complete one copy of this page for each water source (e.g., use a separate page for agricultural and process water).
In addition complete the appropriate forms* from the attached forms for each water source:
Form G2 - "Record Review of On-site Investigations and Test Results Prior to and During Outbreak"
Form G3 - "Source and Mode of Contamination of Surface Waters"
Form G4 - "Source and Mode of Contamination of Ground Waters"
Form G5a - "Disinfection Failures That Allowed Survival of Pathogens or Toxic Substances"
Form G5b - "Source of Contamination and Treatment Failures That Allowed Survival of Pathogens or Toxic Substances"
Form G6 - "Sources and Modes of Contamination During Distribution and at Point of Use"

*From "Procedures To Investigate Waterborne Illness - Second Edition - 1996" International Association of Milk Food and Environmental Sanitarians Inc. Des Moines, Iowa.

104. Draw a diagram of the water systems using Form G1- "Illustration of Contamination Flow".

105. What are the state, local, regional water quality standards for agricultural water?

106. Does the water used on this farm meet the state standard? N ____ , Y ____
Explain:

107. If this water is used for irrigation, how is it applied e.g. drip, flood, overhead spray/sprinkler?

108. Does the agricultural water come in contact with the edible portion of the crop?

N ____ , Y ____ Explain:

109. Has the water been treated? N ____ , Y ____ If so explain:

110. Has the water been tested for bacterial contamination/indicators? N ___ , Y ____

111. What were the test results?

112. When was the test conducted?

113. What lab did the testing?
Attach a copy of the test report.

Worker Health and Hygiene:

Complete one form for field workers and one for packing facility workers. Investigators should speak with local/regional medical/public health officials regarding the following questions:

114. What kind of surveillance and reporting are conducted by local/regional public health authorities for the agent in this outbreak?

Investigators should request copies of summary surveillance reports from the local/regional public health authorities for the agent of concern for the past year or two. This will allow for an evaluation of disease trends.

115. Has there been any enteric disease in the farm workers or their families?
N ____ , Y ____ If so, explain what disease(s), and what testing was done.

116. Do workers seek medical attention when they are ill? N ____ , Y ____ Explain:

Investigators should ensure that any workers with enteric disease are tested for the agent of concern by a public health agency or the operator. Investigators should attempt to obtain isolates from recent positive worker tests performed by clinical labs. for comparison to isolates from outbreak victims.

117. What is the prevalence/incidence of enteric disease in the community and what agents are involved?

118. Are there cases of the disease under investigation among household contacts of workers? N ____ , Y ____ Explain:

Ask the following questions at the farm and packing shed. Complete one form for field and one for the packing shed.

119. Is there health and hygiene training of workers in their own language?
N ____ , Y ____ Explain:

120. Is there training in sanitation practices for farm workers in their own language? N ____ , Y ____ Explain:

121. Is there supervisory oversight for worker health/hygiene/sanitation? N ____ , Y ____ Explain:

122. What toilet facilities are provided for workers (e.g., pit latrines, portable toilets, flush toilets)?

123. Does the worker housing area provide toilet facilities and handwashing facilities? Explain:
Are the toilets and handwashing facilities clean and supplied with soap, towels, toilet paper? N ____ , Y ____ Explain:

124. Is dirty handwash water collected in a waste tank or sewage system? N ____ , Y ____

125. Does dirty handwash water drain on to the ground? N ____ , Y ____

126. Are toilet facilities provided convenient for workers in the fields? N ____ , Y ____ Explain:
Are workers given time to use the facilities as needed? N ____ , Y ____

127. Is there any evidence that the toilet facilities are used? N ____ , Y ____

128. Where are portable field toilets serviced (e.g., emptied)?

129. Is this done in a way that protects crops from contamination? N ____ , Y ____ Explain:

130. How is the sewage collected from the holding tanks disposed of?

131. Is there evidence of human feces in or adjacent to the fields? N ____ , Y ____ Explain:

132. Are handwashing facilities provided for field workers and are they supplied with water, soap and drying devices? N ____ , Y ____ Explain:

133. Is there evidence that workers use the handwashing facilities after they use the toilet? N ____ , Y ____ Explain:

134. Is liquid hand sanitizer used in place of handwashing? N ____ , Y ____ Explain:

135. Do workers touch the produce with their bare hands? N ____ , Y ____ Explain:

136. Do workers wear disposable gloves when touching produce? N ____ , Y ____

Who provides them? Explain:

137. Are there children in the fields? N ____ , Y ____

138. Do they come in contact with the produce? N ____ , Y ____

139. Do they use toilet facilities vs excreting in the fields? N ____ , Y ____

140. Do they wash their hands? N ____ , Y ____ Explain:

141. Where are diapers changed and how are the soiled diapers disposed of?

142. Are worker's clothes, including mothers of small children, worn in the field or packing shed clean? N ____ , Y ____ Explain:

143. Do farm workers or other persons frequent the fields at times when they are not working on the crops (e.g., is there loitering in the fields by persons who could contaminate the crops? N ____ , Y ____ Explain:

144. Do the field or plant workers have animals at home? N ____ , Y ____
If yes, do they have any relevant health problems? N ____ , Y ____ Explain:

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Center for Food Safety and Applied Nutrition
Industry Activities Section
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Do Your Own Establishment Inspection

A Guide to Self Inspection for the Smaller Food Processor and Warehouse

Why This Booklet?

The Food and Drug Administration (FDA) considers establishment inspection one of its prime enforcement tools. During 1980, FDA made over 25,000 inspections of food plants and warehouses. Clearly, this is an important way of determining whether or not food firms are in compliance with the FDA's law and regulations. Many of the regulatory actions FDA takes against food firms are based on FDA's findings during inspections.

But inspecting your own establishment, you can see if your operation could face regulatory problems. This booklet will aid you in performing a check of your own operations so that the FDA inspection will not necessarily surprise you with its findings. While not a substitute for the FDA establishment inspection, conducting your own "self inspection" can help you to detect and solve compliance problems you might have before they get out of hand.

This booklet tells you --

- why you should be fully aware of your firm's problem areas
- what problems you will face as you conduct your inspection
- how to make your own establishment inspection

Why You Should Be Fully Aware of Your Plant's Problem Areas

· It's Good Business

No one wants to deal with poor merchandise. If your business gets a reputation for being shoddy, dirty or otherwise negligent, your prospective customers will seek greener--at least, cleaner--pastures. It makes good business sense to keep your operation healthy and reputable. Safe, quality foods help you do this.

· It's Your Responsibility

The food laws and regulations that FDA enforces apply to firms that receive or ship food in interstate commerce. The requirements place the prime legal responsibility for safe, quality foods, adequately labeled, upon you, the food processor. If you just store foods, you too are legally bound to prevent contamination of the food while it is in your possession. This is the law.

· It Can Keep You Out of Trouble

The FDA *does* enforce the law. If your facilities are found to be out of compliance with the Federal requirements for proper food processing and warehouse storage practices, you can face any number of Federal actions. These include:

Notice of Adverse Findings Letter: Issuance of this official correspondence, while not considered a regulatory action, indicates FDA's awareness of a violation that must be corrected.

Regulatory Letter: A formal notification that the FDA is prepared to take a legal action if the violations cited in the letter are not corrected immediately.

Seizure: This is a civil court action against a specific lot of goods to remove them from the channels of commerce. Seizure actions are concerned primarily with the confiscation of food products which are in violation of the law and with the condemnation and destruction or reconditioning of these products.

Prosecution: Criminal action taken against a firm responsible for causing the charged violations of law. A first offense can draw one year in prison, $1,000 fine, or both, on each count or proven violation. A second offense can mean a sentence of three years in prison and $10,000 for each count. A first offense with intent to defraud or mislead is subject to imprisonment for not more than three years, or a fine of $10,000, or both for each offense.

Injunction: A decree that restrains the defendants from engaging in violative food processing or warehouse practices and remains in force until termination. This would occur if the firm has a history of insanitary problems or when there is a health hazard involved with the operation.

· It Isn't That Hard

In terms of cost and manpower, self inspection is the most resonable means of helping to ensure a satisfactory food processing and storage operation, *and* a "clean bill of health" from the FDA. By taking the time and effort to inspect your operations on a regular basis, you have the opportunity to correct potential problems and safeguard your investment.

The Problem Areas: What You Are Up Against

There are seven problem areas that, if left unwatched and unchecked, can become severe hindrances in your efforts to maintain a sanitary food operation free of compliance problems.

First is the **rodent** (usually, rats and mice). Rodents carry many diseases and parasites which, because of their biological similarity to people, can be transmitted to man. These diseases and parasites include leptospirosis (Weil's Disease), salmonellosis, tapeworms, trichinosis and others.

Rodents will deposit excreta, urine and other filth on food products and around your facilities. They will also gnaw on materials in order to build nests. Rodents contaminate much more than they eat.

Against rodents, you cannot take the security of your plant or firm for granted. Some rodents can walk along telephone wires or leap horizontally 18 feet. They can squeeze through gaps the width of a pencil or drop 50 feet without being killed. Their instinct for survival is high, and they can deviate from "normal" behavior patterns to trick man. They are extremely prolific creatures, and once they've infiltrated your operations, your problems will multiply!

Birds also carry diseases and parasites potentially hazardous to people. They are capable of flying through any open window, door or other gaps in your building, and, like rodents, will leave insanitary droppings that can contaminate your plant and your food products.

Insects seek heat, moisture and darkness, and once in, can be even more elusive than rodents or birds. However, they aren't invisible--they leave trails in the dust, and can also be spotted around likely insect hideouts: holes, damp places, behind boxes and in seams in bags and folds of paper. Like rodents, some insects--notably cockroaches--have a highly developed survival instinct and they are adaptable--they can develop an immunity to poisons you use within a few insect generations. They are even more prolific than rodents. With their hairy legs, they spread dirt, debris and bacteria around your firm. They carry either within or outside of their bodies the causes for many serious diseases and ailments such as boils, food poisoning and typhoid fever.

In dealing with any of the above pest problems, you may want to try to cope with them on your own, but it is highly recommended that you seek the help of a good pest control operator, or "exterminator." The results will probably be better, and in the long run, this may be a more cost effective method.

If you were to take all the rodents and insects in the world, they would be outnumbered by the **bacteria** to be found in one vat of spoiled egg batter. Bacteria are a worse problem than any of the previously mentioned creatures because they can't be seen, yet they can sicken or kill just the same.

Bacteria cannot be eliminated, but they *can* be defeated. Like any creatures, bacteria need a combination of food, water and the proper temperature to survive. By regulating the availability of each, you can take a big step toward keeping their population down.

Molds will grow on almost anything, especially where there is moisture. The presence of mold in a product is an indication that the product contains excessive decomposed material and may also indicate insanitary practices on the part of the processor. Molds can make you ill, and scraping off mold or getting rid of the one "bad apple" doesn't always solve the problem.

While the other problem areas are active, aggressive opponents, **chemical contaminants** can only become a problem through misuse or neglect--yet the end result of their presence can be equally disastrous. Still, this is one of the easier problems to control. This brings us to the seventh problem area--ignorance and carelessness. As a problem, this can be just as dangerous as any of the preceeding, but it can combatted by applying the guidelines given in this booklet, and by just using common sense. Now, let's get on with the tactics for waging an offensive against the problems.

Police the Area--Know What's in Your Plant

Self-inspection is a most cost effective way for you to maintain a firm that is in compliance with federal requirements for food processing and storage. By assuming the role of an investigator, you can uncover potential problems and solve them before they become *big* problems.

Let's "walk" through an operation--your operation--using the following checklist to investigate major areas of concern. This checklist can serve as a basic guide to help you maintain or improve compliance with federal requirements and to ensure that only safe, quality products reach the consumers.

Here are some pointers for using the checklist:

9. Check the box to the left of each item to indicate a situation that is ok, or the box to the right of each item that “Needs Attention”.

10. At the end of each topic section to note what you intend to do to correct an identified problem, and to note any compliance problems you face that are not addressed by the checklist. This checklist is a *guide* to be developed according to the needs of your operation.

11. Feel free to photocopy this checklist and to use it regularly during your inspections.

Employees

We'll begin the check with your employees. They are your most important resource.

OK		Needs Attention
	Are the employees well-trained in what they do? You can avoid many problems by making sure that your employees clearly understand their functions.	

	In handling food products, do your employees wear the proper hair covering and clean uniforms?	
	Are your employees wearing jewelry, bandages, or have any illnesses, infections or injuries (i.e., boils, cuts) which can contaminate foods?	
	Do your employees wash after each visit to the toilet? · Do you have washing facilities available for your employees near their work stations, and do they use them when their hands become soiled or contaminated? · You must display "reminder" posters in your rest rooms for employees to wash their hands.	
	Do your employees maintain clean personal habits? They should keep their hands away from body surfaces, which are loaded with bacteria.	
	Is the traffic within your plant controlled to prevent contamination of the processing areas?	
	Have your employees been told the reasons why they should undertake the above precautions?	
	Other Employee practices that need attention:	

Plant/Grounds

OK		Needs Attention
	Is the area around your firm clear of weeds, grass and brush? This sort of foliage can be an effective cover for pests to infiltrate your firm.	
	Is there any standing water on your ground which also attracts pests?	
	Other outside **Plant** conditions that I want to look into:	

Building/Facility

OK		Needs Attention
	Do windows and doors seal tightly to ward off pests and contaminants?	
	Do windows have fine mesh screens to keep out insects?	
	Will a pencil pass under the door? That's all the space required for a rodent to enter.	
	Have all holes and cracks been filled so as not to provide hiding places or entry points for pests?	
	Not only should your firm be free of vermin and pests--there shouldn't even be evidence of the presence of domestic animals such as cats and dogs.	
	Are rest rooms cleaned regularly?	

	Are the hand-washing facilities furnished with paper or air hand dryers and soap? · The hand-washing facilities should be furnished with running water at a suitable temperature for washing hands. · They should provide effective hand-washing and sanitizing preparations.	
	Does the roof leak? This can add to the problems of humidity, standing water and product contamination.	
	Are the overhead lights covered with shields to prevent contamination of products by broken glass in case the lamps burst?	
	Other **Building/Facility** problems that need to be addressed:	

Equipment

OK		Needs Attention
	Is all equipment which comes in contact with food cleaned and sanitized as often as necessary to prevent contamination of the product? You should follow appropriate cleaning schedules for each piece of equipment.	
	Is the equipment designed, or otherwise suitable, for use in a food plant? For example, equipment for handling or processing foods cannot contain polychlorinated biphenyls (PCB's), which are very toxic (this does not apply to electrical transformers and condensers containing PCB's in sealed containers).	
	Is there a build-up of food or other static material on the equipment? This can serve as a breeding place for insects and bacteria.	
	Is there any build-up or seepage of cleaning solvents or lubricants on your equipment which can contaminate foods? All repairs on equipment should be of a permanent nature (e.g., no bobby pins in place of cotter pins), as temporary repair parts can break or rupture and get in the food product.	
	Is the equipment hard to disassemble for clean-up and inspection? The more difficult it is, the less inclined you or an employee will be to clean it.	
	Is there a lot of "dead space" in or around the machinery where food and other debris can collect as a nest for insects and bacteria?	
	Can the surface of the equipment be sanitized? Wood is one material that cannot.	
	Other **Equipment** cleaning and maintenance issues that should be covered:	

Housekeeping

OK		Needs Attention
	Are trash, debris, and clutter picked up so as not to provide hiding places for pests?	
	Do employees eat and smoke only in designated areas?	
	Is the food spilled or uneaten by employees cleaned up quickly so as not to attract pests or breed bacteria?	
	Has old rodent excreta been cleaned up so you can spot any new activity?	
	Additional **Housekeeping** duties that must be attended to:	

Garbage

OK		Needs Attention
	Is garbage quickly removed and dumped in appropriate bins? It should not sit around your facilities to attract pests.	
	Is the garbage kept covered? An open garbage pile is an excellent breeding ground for insects and rodents.	
	Other **Garbage**-handling problems that should be explored:	

Plumbing

OK		Needs Attention
	Is the water used in your firm from an approved source (either municipal supply or tested private source)?	
	Have you made sure there are no hoses left dangling in sinks or on the ground? Loss of pressure can cause a back flow that will contaminate your water supply.	
	Do your facilities have back flow and vacuum breaker valves to prevent contaminate your water supply?	
	Avoid standing water around your firm.	
	Other **Plumbing** needs that require attention:	

Humidity

OK		Needs Attention
	Does your building have dripping condensation or leaky plumbing which can contaminate foods?	
	Are you keeping the humidity in your operation low? Molds, insects and bacteria thrive in damp climate.	

	Other problems to attend to regarding **Humidity:**	

Temperature

OK		Needs Attention
	Are storage areas intended for room temperature subject to extremes of temperature, either hot or cold? This can damage foods. · For refrigeration storage, coolers should be kept at or below 40 degrees F. · For freezer storage, the temperature should be kept at or below 0 degrees F.	
	Are you keeping a record of temperatures for all storage areas on a regular basis?	
	Are you keeping your facilities at the proper temperature range? Insects love high temperatures, and their activity will pick up as the temperature goes up.	
	Additional **Temperature**-related difficulties to explore:	

Incoming Raw Materials

OK		Needs Attention
	Have you checked to see that the compartment door seals on the truck are intact?	
	Is there a clean smell when the compartment doors are opened, or are there signs of contamination such as petroleum distillate, putrefaction, or other off-odors?	
	Is any refrigerated compartment set at the proper temperature?	
	Are boxes properly stacked and intact?	
	Is there evidence of activity by insects, rodents or birds?	
	Is there evidence of the misuse of pesticides such as DDT tracking powder, 1080, or insect sprays?	
	Additional problems that should be dealt with on **Incoming Raw Materials**:	

The FDA publication *Inspecting Incoming Food Materials* will provide further information on conducting an inspection of incoming food materials.

Storage of Raw Materials and Products

OK		Needs Attention
	Is the storage area over-crowded? Such a condition prevents adequate inspection and clean-up and also increases the	

	likelihood of damage to products during handling.	
	Are products stored on pallets and at least 18 inches away from the walls? It is important to leave space for inspection aisles so that rodent and insect activity can be seen more readily. You might consider painting a white line on the floor along the walls to indicate inspection aisles.	
	Other **Storage** problems that should be corrected:	

Rotation

OK		Needs Attention
	Are products stored on a first-in, first-out basis to reduce the possibility of contamination through spoilage? · Are old products kept in front of the new to help in the rotation process?	
	Are all incoming products dated to ensure a proper rotation of stocks?	
	Are items overstocked? This increases the chances of spoilage and contamination.	
	When checking containers for contamination, are dusty, faded or discolored containers checked first? They are obviously the most suspect items.	
	Additional issues to address on the **Rotation** process:	

Quarantine

OK		Needs Attention
	Are all products spoiled by damage, insects, rodents or other causes stored in a designated "Quarantine Area" to prevent their contact with safe products?	
	Are such quarantined items disposed of quickly to prevent the development of pest breeding places?	
	Are incoming materials inspected for damage or contamination so that they can be rejected?	
	Other problems to address in the **Quarantine** procedure:	

Pest Control

OK		Needs Attention
If you hire an outside pest control operator you should:		
	Check regularly on what the pest control operator is doing. Don't accept what he's doing on faith.	
	Check to see what poisons he is using. Make sure the poisons do not contaminate foods.	
	Learn where and how many bait stations there are. · They should be placed so as not to present any chance	

	of food contamination. · They should be checked regularly.	
	Check to see if fumigators are being used. Do they represent a hazard to employees or food safety?	
If doing your own exterminating, you should:		
	Know there is no such thing as an all-purpose pesticide, especially where foods are concerned. Get qualified advice before using any poisons.	
	Make a map showing locations of all traps, bait stations, etc., and check them regularly.	
	Put money into building maintenance if that will help solve your pest problems. For instance, don't rely solely on rodenticides to control your pest problem and leave gaps in the doors for the rodents to enter. Make sure those gaps are sealed. Extermination is a poor second choice, and will cost you as much, or more, in the long run.	
	Other **Pest Control** situations to explore:	

Storage and Handling of Hazardous Materials

OK		Needs Attention
	Are materials such as pesticides, herbicides, cleaning solvents, lubricants and boiler compounds accessible for use only by authorized employees? This will help prevent accidents such as food contamination and employee injuries due to ignorance and misuse.	
	Additional situations to consider regarding **Hazardous Material Storage**:	

Labeling

OK		Needs Attention
	Are all hazardous materials kept in bottles, or drums, or boxes that reflect their dangerous nature?	
	Even non-hazardous materials should be labeled correctly. Several babies died in a hospital because salt was mistakenly used for sugar in their formulae.	
	Make sure that any labels you market comply with the Food, Drug, and Cosmetic Act and Fair Packaging and Labeling Act.	
	Other questions on **Labeling** that need to be considered:	
FDA does not have the authority to approve labels prior to marketing, but it does have jurisdiction once the label is in interstate commerce. FDA will take legal action if a product is not labeled in accordance with the law. FDA is willing to provide comments on your labeling prior to marketing, if you desire.		

Food Additives

OK		Needs Attention
	Make certain that the food additives you use are suitable and safe for the intended purposes.	
	Other issues regarding **Food Additives** to be resolved:	

Product Codes

OK		Needs Attention
	Do you have an effective recall procedure set up?	
	Other considerations on **Product Codes**:	

By completing this brief inspection "patrol," you now have an idea of what the FDA investigator will generally look for when he visits your firm. This "short course" is far from complete, but it should provide a foundation to help you maintain a safe, quality food processing and storage operation.

Here are some last-minute hints to help you in your inspection and sanitation efforts:

1. As you inspect, use the checklist to make a record of the problems you encounter so you won't forget them. You can then make corrections based on the checklist.
2. Formulate inspection, clean-up and maintenance schedules and stick to them.

3. Define your employees' responsibilities; make sure each one understands his duties so that no essential details are ignored.

4. Be diligent in your sanitation efforts. The struggle to control pests, bacteria and the other problem areas is a fulltime effort.

You've just taken your first *big* step in the campaign for better food processing and storage. By reading this booklet, you've gained an awareness of the problems you might face, tactics for dealing with them, and knowledge that FDA is ready to help you with advice and further information on how you can deal with specific problems you encounter.

By taking preventive measures now, you can avoid potentially costly, mandated adjustments that might arise when the FDA investigator pays you a visit--and you can ensure that only quality, safe food products find their way to the consumers...a move we all want.

Document available via the Internet at: http://www.cfsna.fda.gov/~dms/selfinsp.html

Food and Drug Administration
Center for Food Safety and Applied Nutrition
October 27, 1999

GUIDANCE FOR INDUSTRY

Reducing Microbial Food Safety Hazards For Sprouted Seeds[1]

All parties involved in the production of sprouts -- seed producers, seed conditioners, and distributors, and sprout producers -- should be aware that seeds and sprouted seeds have been recognized as an important cause of foodborne illness. The following recommendations identify the preventive controls that the Food and Drug Administration (FDA) believes should be taken immediately to reduce the risk of raw sprouts serving as a vehicle for foodborne illness and ensure sprouts are not adulterated under the food safety provisions of the Food, Drug, and Cosmetic Act (the act). Failure to adopt effective preventive controls can be considered insanitary conditions which may render food injurious to health. Food produced under such conditions is adulterated under the act (21 U.S.C. 342(a)(4)). FDA will consider enforcement actions against any party who does not have effective preventive controls in place, in particular, microbial testing. These recommendations are based on the recommendations of the National Advisory Committee on Microbiological Criteria for Foods (NACMCF, 1999) and elaborate on Compliance Policy Guide 7120.28 (CPG 7120.28).

Seed Production: Seeds for sprout production should be grown under good agricultural practices (GAPs) in order to minimize the likelihood that they will contain pathogenic bacteria. For more information on GAPs, see FDA's 1998 "Guidance for Industry: Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables". Copies of this guidance are available on the internet (http://www.foodsafety.gov/~dms/prodguid.html) or by calling the number listed in the references and resources at the end of this guidance.

Seed Conditioning, Storage, and Transportation: Seeds that may be used for sprouting should be conditioned, stored, and transported in a manner that minimizes the likelihood that the seeds will be contaminated with pathogens. For example, seed should be stored in closed or covered containers in a clean dry area dedicated to seed storage. Containers should be positioned off the floor and away from walls to reduce the possibility of contamination by rodents or other pests and to facilitate regular monitoring for pest problems.

Sprout Production: Sprouters should implement appropriate practices to ensure that sprouts are not produced in violation of the act which prohibits the production of food under insanitary conditions which may render food injurious to health (21 U.S.C. 342(a)(4)). In addition to seed treatment and testing for pathogens (see below), sprouters should maintain facilities and equipment in a condition that will protect against contamination. Facilities with poor sanitation can significantly increase the risk of

contaminating product. Sprouters should employ good sanitation practices as a standard operating procedure to maintain control throughout all stages of sprout production. Inadequate water quality and poor health and hygienic practices can all increase the risk of food becoming contaminated with pathogens. Sprouters may wish to review 21 CFR Part 110 which sets forth good manufacturing practices (GMPs) in manufacturing, packaging, or holding human food that cover these aspects of food production.

Seed Treatment: Seeds for sprouting should be treated with one or more treatments (such as 20,000 ppm calcium hypochlorite) that have been approved for reduction of pathogens in seeds or sprouts [2]. Some treatments can be applied at the sprouting facility while others will have to be applied earlier in the seed production process. However, at least one approved antimicrobial treatment should be applied immediately before sprouting [3]. Sprouters should carefully follow all label directions when mixing and using antimicrobial chemicals.

Testing for Pathogens: Because currently approved antimicrobials have not been shown to be capable of eliminating all pathogens from seed, sprout producers should conduct microbiological testing of spent irrigation water from each production lot to ensure that contaminated product is not distributed. Because testing for pathogens can be done with irrigation water as early as 48 hours into what is generally a 3 to 10 day growing period, producers who plan accordingly can obtain test results before shipping product without losing product shelf-life. Testing, whether done by the producer or contracted out, should be done by trained personnel, in a qualified laboratory, using validated methods. Additional information on sample collection and microbial testing, including how to sample and test sprouts when testing spent irrigation water is not practicable (as may be the case with soil-grown sprouts), can be found in a companion guidance document referenced below.

Traceback: Traceback cannot prevent a foodborne illness outbreak from occurring. However, being able to trace a food back to it's source quickly can limit the public health and economic impacts of an outbreak, if it occurs. Information gained in traceback investigations may also help prevent future outbreaks. Sprout producers, seed producers, conditioners and distributors should develop and implement systems to facilitate traceback and recalls in the event of a problem. All parties should test their systems in advance of a real problem.

References and resources:

1. Food and Drug Administration. 1982. Compliance Policy Guide Sec. 555.750 Seeds for Sprouting Prior to Food Use, i.e., Dried Mung Beans, Alfalfa Seeds, etc. (CPG 7120.28) can be viewed and printed from the WWW at the following address http://www.fda.gov/ora/compliance_ref/cpg/cpgfod/cpg555-750.html

2. Food and Drug Administration. 1998. Guidance for Industry -- Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables can be viewed and printed from the WWW at the following address http://www.foodsafety.gov/~dms/prodguid.html or may be obtained by calling 202-401-9725.

3. Food and Drug Administration, 1999. Press Release -- Consumers Advised of Risks Associated with Raw Sprouts. P99 - 13. http://www.fda.gov/bbs/topics/NEWS/NEW00684.html

4. FDA, 1999. "Guidance for Industry: Sampling and Microbial Testing of Spent Irrigation Water During Sprout Production" can be viewed and printed from the WWW at http://vm.cfsan.fda.gov/~dms/sprougd2.html
5. National Advisory Committee on Microbiological Criteria for Foods. 1999a. Microbiological Safety Evaluations and Recommendations on Sprouted Seeds. http://vm.cfsan.fda.gov/~mow/sprouts2.html
6. National Advisory Committee on Microbiological Criteria for Foods. 1999b. Microbiological Safety Evaluations and Recommendations on Fresh Produce. Food Control. 10:117 - 143.
7. Copies of Federal regulations in the Code of Federal Regulations (CFR) may be purchased from the U.S. Government Printing Office or by telephone at (202) 512 - 1800. The CFR is also available at local branches of U.S. Government Printing Office Bookstores. Information on location of regional branches is available on the WWW at the following address: http://vm.cfsan.fda.gov/~lrd/ob-reg.html
8. Sections of the CFR, such as 21 CFR Part 110 Current Good Manufacturing Practices in Manufacturing, Packing, or Holding Human Food, can be viewed and printed from the WWW at the following address: http://www.access.gpo.gov/nara/cfr/index.html.

Footnotes:

1. This guidance has been prepared by the Office of Plant and Dairy Foods and Beverages in the Center for Food Safety and Applied Nutrition at the Food and Drug Administration. This guidance represents the agency's current thinking on reducing microbial food safety hazards for sprouted seeds. It does not create or confer any rights for or on any person and does not operate to bind FDA or the public. An alternative approach may be used if such approach satisfies the requirements of the applicable statute and regulations. Following the recommendations in this guidance will not shield any person or any food from appropriate enforcement under the Federal Food, Drug, and Cosmetic Act if adulterated food is distributed in interstate commerce.
2. In 1998, the Environmental Protection Agency issued a "section 18" for the temporary use of 20,000 ppm calcium hypochlorite to disinfect seed for sprouting. In the fall of 1999, the exemption was renewed for another year. However, in order to ensure continued availability of this treatment, registrants should be actively pursuing a full registration under section 3 in 2000.
3. Antimicrobials are either pesticides chemicals or food additives, depending on where they are used. As such their use on seeds for sprouting must be approved by EPA or FDA. To find out what antimicrobials have been approved by EPA or FDA for use on seeds for sprouting, you can call 202-418-3098.

FOR IMMEDIATE RELEASE
P01-03
January 18, 2001

FOOD AND DRUG ADMINISTRATION
Print Media: 301-827-6242
Broadcast Media: 301-827-3434
Consumer Inquiries: 888-INFO-FDA

FDA PUBLISHES FINAL RULE TO INCREASE SAFETY OF FRUIT AND VEGETABLE JUICES

The Food and Drug Administration today announced a final rule designed to improve the safety of fruit and vegetable juice and juice products. Under the rule, juice processors must use Hazard Analysis and Critical Control Point (HACCP) principles for juice processing. Implementation of a HACCP system will increase the protection of consumers from illness-causing microbes and other hazards in juices.

"This rule will help ensure the safety of the juice that American families consume each day," said Jane E. Henney, M.D. Commissioner of Food and Drugs. "It is another step in protecting the public health through the safety of our food."

The rule comes after a rise in the number of foodborne illness outbreaks and consumer illnesses associated with juice products during the past several years, including a 1996 *E. coli* O157:H7 outbreak associated with apple juice products and two citrus juice outbreaks attributed to *Salmonella* spp. in 1999 and 2000. The apple juice outbreak sickened 70 people in the western United States and Canada, including a child who died from hemolytic uremic syndrome caused by the infection. The *Salmonella* Enteritidis outbreak in 2000 was caused by unpasteurized orange juice and resulted in 88 illnesses in six western states. The *Salmonella* Muenchen outbreak in 1999 was caused by unpasteurized orange juice and resulted in 423 illness in 20 states and 3 Canadian provinces and contributed to one death. Foodborne infections are especially dangerous for young children, older adults and those with weakened immune systems. FDA estimates that there are between 16,000 to 48,000 cases of juice-related illnesses each year. It is estimated that the action taken due to the rule will prevent at least 6,000 illnesses per year.

HACCP systems call for a science-based analysis of potential hazards, determination of where the hazards can occur in processing, implementing control measures at points where hazards can occur to prevent problems, and rapid corrective actions if a problem occurs. Firms will be required to maintain records in association with implementation of their HACCP plans and verification of those plans. HACCP systems are already federally required for seafood, meat processors and poultry processors.

The juice HACCP regulation applies to juice products in both interstate and intrastate commerce. Juice processors will be required to evaluate their manufacturing process to determine whether there are any microbiological, chemical, or physical hazards that could contaminate their products. If a potential hazard is identified, processors will be required to implement control measures to prevent, reduce, or eliminate those hazards. Processors are also required to use processes that achieve a 5-log, or 100,000-fold, reduction in the numbers of the most resistant pathogen in their finished products compared to levels that may be present in untreated juice. Juice processors may use microbial reduction methods other than pasteurization, including approved alternative

technologies (such as the recently approved UV irradiation technology) or a combination of techniques.

Citrus processors may opt to apply the 5-log pathogen reduction on the surface of the fruit, in combination with microbial testing to assure that this process is effective.

Processors making shelf-stable juices or concentrates that use a single thermal processing step are exempt from the microbial hazard requirements of the HACCP regulation. Retail establishments where packaged juice is made and only sold directly to consumers (such as juice bars) are not required to comply with this regulation.

Large companies will have one year after publication of the regulation to implement HACCP programs. Small companies must comply 2 years after publication and very small companies must comply 3 years after publication. Processors must continue to use the previously required warning label statement until they implement HACCP programs. In the interim, FDA will continue to inspect juice processing facilities to assure that they are producing safe juice and juice products.

This is a mirror of the page at
http://www.fda.gov/bbs/topics/NEWS/2001/NEW00749.html

Part III
Disinfecting Contaminated Wells

When microbiological analysis indicates that a well is contaminated, a disinfecting procedure should be carefully applied. An example of the decontamination procedure recommended by the California Strawberry Commission (1998) is described in the following steps. The procedure is placed in this manual for educational purposes; however, in the event of a contamination the trainer is advised to recommend that the grower contact regional government authorities for information on procedures that may need to be adjusted for specific needs or country requirements.

- **Step 1**- Addition of Chlorine Solution. Contaminated water sources should be treated with a dose of at least 50mg/L (parts per million) of available chlorine. Visual IIII.1-20 indicates the quantities of various commercial chlorine compounds required to treat 100 feet (30 meters) of a water-filled casing with 50 ppm chlorine for diameters ranging from 2-24 inches (5-60 cm). Some authorities recommend a minimum concentration of 100 ppm available chlorine. To obtain that concentration, the amounts indicated in the visual can be doubled.

Visual III.1-20

Chlorine compound required to dose 100 ft (30 meters) of water-filled casing at 50 mg/L (ppm)[1]

Diameter of Casing		70% Calcium Hypochlorite (dry weight)[2]	25% Chloride of Lime (dry weight)	5.25% Sodium Hypochlorite[3] (liquid measure)
inches	**Cm**	**Amount**	**Amount**	**Amount**
2	5	7 g	14 g	59 ml
4	10	28 g	57 g	266 ml
6	15	57 g	113 g	0.6 L
8	20	85 g	0.2 Kg	1.0 L
10	25	113 g	0.3 Kg	1.7 L
12	30	0.2 Kg	0.45 Kg	2.4 L
16	40	0.3 Kg	0.9 Kg	3.8 L
20	50	0.45 Kg	1.4 Kg	6.3 L
24	60	0. 7 Kg	1.8 Kg	8.8 L

[1] Water pH should be 6.5-7.5
[2] Commercial brands include HTH, Perchloron, Pittchlor, etc.
[3] Commercial household bleaches such as Chlorox, Purex, etc.

Note: If dry chloride is being used, it should be mixed with water to form a chloride solution prior to placing it in the well. Dry chloride should always be added slowly to water, not vice versa, to prevent a violent chemical reaction. (The exothermic reaction can produce sufficient heat to boil and splash added water.)

- **Step 2**- Rinsing of the pump column. It is recommended that the pump column or drop pipe be rinsed with the chlorine solution as it is lowered into the well.

- **Step 3**- Mixing the disinfectant with water in the well. The pump should be turned on and off several times (surged) to mix the chlorine with the water in the well. Repeat this procedure several times at one-hour intervals until the water discharged has the odor of chlorine. Heavily chlorinated water should not be dumped into sewage disposal systems (septic tanks). Such strong disinfectants can inactivate the bacteria used to treat the sewage and can also damage the soil absorption system. Chlorination can be an effective sanitation measure, but may represent a source of chemical contamination, if misused.

- **Step 4**- Allow enough time for disinfecting. The well should be allowed to stand without pumping for 24 hours.

- **Step 5**- Test for residual chlorine. The water should be pumped to waste until the presence of chlorine is no longer detectable. The absence of chlorine is best determined by testing for available chlorine residue using a test kit designed for this purpose. Test kits can be obtained from chemical supply houses, swimming pool suppliers, etc. and they are relatively inexpensive.

- **Step 6**- Collect a sample for microbiological analyses. A sample should be collected according to the previously described sampling procedures and submitted to a laboratory for analysis.

- **Step 7**- Repetition of the disinfecting procedure if the contamination persists**.** When the laboratory analysis indicates that the water is not free of contamination, the process should be repeated. If repeated attempts to disinfect the well are unsuccessful, a detailed investigation should be undertaken to identify the cause of contamination.

PART IV

COMPOSTING FACILITY

NATURAL RESOURCES CONSERVATION SERVICE

CODE 317

DEFINITION

This is a treatment component of an agricultural management system for the biological stabilization of organic material.

PURPOSES

To reduce the pollution potential of organic agricultural wastes to surface and ground water.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where:

- Organic waste material is generated by agricultural production or processing;
- A composting facility is a component of a planned agricultural waste management system; and,
- A composting facility can be constructed, operated and maintained without polluting air and/or water resources.

CRITERIA

General Criteria Applicable To All Purposes

Laws and Regulations. The installation and operation of the composting facility shall comply with all federal, state, and local laws, rules, and regulations.

Safety. Safety and personal protection features and practices shall be incorporated into the facility and its operation as appropriate to minimize the occurrence of equipment hazards and biological agents during the composting process.

Facility Siting. The bottom elevation of the composting facility shall be above the seasonal high water table and on soils with an acceptable permeability that does not allow materials to contaminate the ground water, and meets all applicable regulations, or the facility shall be installed on concrete slabs or other appropriate liners.

Ideally, compost facilities should be located outside of floodplains. However, if site restrictions require location within a floodplain, they shall be protected from inundation or damage from a 25-year flood event, or larger.

Locate compost facilities so prevailing winds and landscape elements such as building arrangement, landforms, and vegetation minimize odors and protect the visual resource.

Direct surface runoff away from the compost facility. Direct contaminated runoff from compost facilities to an appropriate storage or treatment facility for further management.

Compost Mix. Develop a compost mix that encourages aerobic microbial decomposition and avoids nuisance odors.

Carbon-Nitrogen Ratio. The initial compost mix shall result in a Carbon to Nitrogen ratio between 25:1 and 40:1. Compost with a greater carbon to nitrogen ratio can be used if nitrogen immobilization is not a concern.

Carbon Source. A dependable source of carbonaceous material with a high carbon to nitrogen ratio (C:N) shall be stored and available to mix with nitrogen rich waste materials.

Bulking Materials. Add bulking materials to the mix as necessary to enhance aeration.

The bulking material may be the carbonaceous

material used in the mix or a non-biodegradable material that is salvaged at the end of the compost period. If a non-biodegradable material is used, provision shall be made for its salvage.

Moisture Level. Provision may be made for maintaining adequate moisture in the compost mix throughout the compost period within the range of 40 to 65 percent (wet basis).
In high precipitation climatic regions, care shall be taken to prevent excess moisture from accumulating in the compost. Facility covers may be required to provide for a suitable product

Temperature of Compost Mix. Manage the compost to attain and then maintain the internal temperature for the duration required to meet management goals.
When the management goal is to reduce pathogens, the compost shall attain a temperature greater than 130°F for at least 5 days as an average throughout the compost mass.
This temperature and time criterion may be achieved during either primary or secondary composting stages or as the cumulative time of greater than 130°F in both stages.

Turning/Aeration. The frequency of turning/aeration shall be appropriate for the composting method used, and to attain the desired amount of moisture removal and temperature control while maintaining aerobic degradation.

Facility Type. Selection of the composting facility/method shall be based on the availability of raw material, the desired quality of final compost, equipment, labor, time, and land available.
Facility structural elements such as permanent bins, concrete slabs, and roofs shall meet the requirements of Conservation Practice Standard 313, Waste Storage Facility.

Facility Size. Size the compost facility to accommodate the amount of raw material planned for active composting plus space required for curing.

Dimensions selected for elements of the compost facility shall accommodate equipment used for loading, unloading, and aeration

Sizing of facilities for composting dead animals shall be based on normal mortality loss records for the operation. Or, if not available, locally established mortality rates for the type of operation shall be used.

Compost Period. Continue the composting process long enough for the compost mix to reach the stability level where it can be safely stored without undesirable odors. It shall also possess the desired characteristics for its use, such as lack of noxious odor, desired moisture content, level of decomposition of original components and texture. The compost period shall involve primary and secondary composting as required to achieve these characteristics.
Test the finished compost as appropriate to assure that the required stabilization has been reached.

Use of Finished Compost. Land application of finished compost shall be in accordance with Conservation Practice Standards 590, Nutrient Management, and 633, Waste Utilization.

CONSIDERATIONS

Develop an initial compost mix with a Carbon to Nitrogen ratio of at least 30:1 to reduce most offensive odors.

Minimize odors and nitrogen loss by selecting carbonaceous material that, when blended with the nitrogenous material, provides a balance of nutrients and porous texture for aeration.

Maximize solar warming by aligning piles north to south configured with moderate side slopes.

In humid areas, do not locate piles (windrows) across the slope to prevent ponding and sogginess.

Protect compost facilities from the wind in cold climates. Wind protection may help prevent excess drying of the compost in dry climates.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use.

OPERATION AND MAINTENANCE

Develop an operation and maintenance plan that is consistent with the purposes of this practice, and the life of the composting facility. Recipe ingredients and sequence that they are layered and mixed shall be given in the plan.

Safety requirements for operation of the composting facility shall be provided.

Manage the compost piles for temperature, odors, moisture, and oxygen, as appropriate. Make adjustments throughout the composting period to insure proper composting processes.

Closely monitor temperatures above 165°F. Take action immediately to cool piles that have reached temperatures above 185°F.

The operation and maintenance plan shall state that composting is a biological process. It requires a combination of art and science for success. Hence, the operation may need to undergo some trial and error in the start-up of a new composting facility

Source: Natural Resources Conservation Service, Conservation Practice Standard 317 (March 2001), “Composting Facility” in National Handbook of Conservation Practices. Available via the internet at: ftp://ftp.ftw.nrcs.usda.gov/pub/nhcp/pdf/317.pdf (accessed 7/01).

PART V

Storage Conditions for Fruits and Vegetables*

	Temperature F	% Relative humidity	Precooling Method	Storage Life Days
Apples	30-40	90-95	R, F, H	90-240
Apricots	32	90-95	R, H	7-14
Asparagus	32-35	95-100	H, I	14-21
Avocados	40-55	85-90		14-28
Bananas	56-58	90-95		7-28
Beans, snap	40-45	95	R, F, H	10-14
Beans, lima	37-41	95		7-10
Beets, root	32	98-100	R	90-150
Blackberries	31-32	90-95	R, F	2-3
Blueberries	31-32	90-95	R, F	10-18
Broccoli	32	95-100	I, F, H	10-14
Brussel sprouts	32	95-100	H, V, I	21-35
Cabbage	32	98-100	R, F	90-180
Cantaloupe	36-41	95	H, F	10-14
Carrots, topped	32	98-100	I, R	28-180
Cauliflower	32	90-98	H, V	20-30
Celery	32	98-100	I	14-28
Cherries, sweet	30-31	90-95	H, F	14-21
Corn, sweet	32	95-98	H, I, V	4-6
Cranberries	36-40	90-95		60-120
Cucumbers	50-55	95	F, H	10-14
Eggplant	46-54	90-95	R, F	10-14
Endive	32	90-95	H, I	14-21
Garlic	32-34	65-75	N	90-210
Grapefruit	50-60	85-90		28-42
Grapes	32	85	F	56-180
Kiwifruit	32	95-100		28-84
Leeks	32	95-100	H, I	60-90
Lemons	50-55	85-90		30-180
Lettuce	32	85-90	H, I	14-21
Limes	48-50	85-90		21-35
Mushrooms	32	95		12-17
Nectarines	31-32	95	F, H	14-18
Okra	45-50	90-95		7-14
Onions, bulb	32	65-70	N	30-180
Onions, green	32	95-100	H, I	7-10
Oranges	32-48	85-90		21-56
Peaches	31-32	90-95	F, H	14-28
Pears	32	90-95	F, R, H	60-90

* Adapted from Bachmann, J. and Earles, R. 2000. Postharvest handling of fruits and vegetables. Appendix 1. Appropriate Technology Transfer for Rural Areas (ATTRA). Available via the Internet at http://attra.ncat.org/attra-pub/postharvest.html

Peas, in pods	32	95-98	F, H, I	7-10
Peppers, bell	40-55	90-95	R, F	12-18
Peppers, hot	45-50	60-70	R, F	14-21
Pineapple	45-55	85-90		14-36
Plums	32	90-95	F, H	14-28
Potatoes, early	50-60	90	R, F	56-140
Potatoes, late	40-50	90	R, F	56-140
Pumpkins	50-60	50-75	N	84-160
Raspberries	32	90-95	R, F	2-3
Rutabagas	32	98-100	R	120-180
Spinanch	32	95-100	H, I	10-14
Squash, summer	41-50	95	R, F	7-14
Squash, winter	50-55	50-70	N	84-150
Strawberries	32	90-95	R, F	5-10
Sweet potatoes	55-60	85-90	N	120-210
Tangerines	40	90-95		14-28
Tomatoes	62-68	90-95	R, F	7-28
Turnips	32	95	R, H, V, I	120-150
Watermelon	50-60	90	N	14-21

F = forced-air cooling, H = hydrocooling, I = package icing, R = room cooling, V = vacuum cooling, N = no precooling needed.

Sources: USDA Agricultural Marketing Service, Kansas State University Cooperative Extension Service

PART VI
Fundamentals of HACCP

A food safety assurance program often used by the food processing industry is the Hazard Analysis Critical Control Point (HACCP) system. Pillsbury Co. and Natick Laboratories along with the US Armed Forces for the NASA (National Aeronautics and Space Administration) space project developed this concept in the 1960's.

Use of the HACCP system in production agriculture is limited and is not recommended by the U.S. FDA. When fruits and vegetables are to be consumed fresh, there are no control steps that can eliminate or reduce biological hazards to acceptable levels after contamination. Basically, controlling contamination through the application of Good Agricultural Practices and Good Management Practices are the only ways to reduce hazards.

Although the total HACCP concept is generally not used in production agriculture, it is important for the agricultural safety trainer to learn the basics of HACCP methodology and to understand how these processes can be applied in improving the safety of fresh produce. This knowledge is considered vital to assist produce industry personnel in understanding the safety requirements that may be requested by "clients" such as processing facilities, supermarket chains, distributors and the food service industry.

Prerequisite programs provide the basic environmental and operating conditions that are necessary for the production of safe, wholesome food. Many of the conditions and practices are specified in federal, state and local regulations and guidelines (i.e. GMPs and Food Code).

Preliminary Steps for HACCP

In order to develop a HACCP system, five preliminary tasks are required. They are important fundamentals that precede the implementation of the seven HACCP principles. These preliminary steps include:

- Form a HACCP team
- Describe the product
- Identify the consumer (or end user) of the product
- Develop a process flow diagram
- Verify the process flow diagram

Form a HACCP Team

The HACCP concept is a systemic approach, which involves all the process steps in the production chain for a specific product. The design of the system requires the expertise of a multidisciplinary team.

Management involvement and commitment to the development and implementation of the HACCP system is necessary. Management should designate one of the team members as the general team coordinator. This person is responsible for coordinating the work of the HACCP team for the daily operation and implementation of the system. As the HACCP program is implemented, an education component should provide training on the program to all employees throughout the organization, although the training levels will vary.

Describe the Product

A detailed description of each product should be written. Included should be a description of composition, processing, packaging, storage conditions, distribution requirements, retail conditions and usage instructions. HACCP methodology proposes the following format for the description of the product.

Figure 1 - Suggested Product Description Outline

PRODUCT DESCRIPTION	
▫ Name of the product	
▫ Characteristics (pH, Water activity, humidity, protein content, fat, additives, etc.)	
▫ Use by the consumer	
▫ Type of package	
▫ Shelf Life	
▫ Point of sale	
▫ Instructions for use in the label	
▫ Special distribution conditions*	

*This point is included in reference to instructions for retail stores and the conditions for proper transportation and handling, the label is directed towards the consumer.

The development of this description is very important. Information on product characteristics such as water activity (A_w), pH, etc, will indicate the barriers (or lack of them) that are in place to assure safety. In raw products there are few ways to control microbiological growth and product deterioration however in processed foods a number of control methods exist. Some examples are the use of chemical preservatives, heat treatments, modification of the product package and atmosphere, and temperature control.

Fresh fruit and vegetables generally have a high moisture content, which makes them very susceptible to decay, and microbial contamination. Although many of the protection barriers listed above do not apply to fresh produce, temperature control does.

It is recommended that barriers be identified on the product label and on the containers used for transportation and storage of the product. Barriers, such as temperature control for fresh produce, constitute the basis for the handling, distribution and commercialization logistics of the product. Protection barriers should also be considered later during development of the HACCP plan when determining the critical control points of a process.

Figure 2 - Sample Product Description

PRODUCT DESCRIPTION	
NAME: **Sliced Carrot** 300 gms.	
CHARACTERISTICS	Sliced Fresh Carrots, without additives
USAGE BY THE CONSUMER	Direct Consumption by the General Public
PACKAGE	Flexible Bag with some oxygen permeability
PACKAGE INSTRUCTIONS	Expiration Date, Lot and a legend of “Refrigerated Storage Required”
SHELF LIFE	15 days
RETAIL AND DISTRIBUTION INSTRUCTIONS	Inventory Rotation (first in, first out), product that arrives first should go out first Maintain temperatures of 2-4°C (35.6-39.2ºF) throughout the chain Instructions on hygiene practices through transportation
PRODUCT POINT OF SALE	Retail Food Stores Convenience Stores
RETAIL STORE INSTRUCTIONS	Storage temperature of 1- 7°C (33.8- 44.6°F) Maintain cold chain during storage, handling and merchandising

Identify Consumers and Mode of Use of the Product

The identification of target consumers and their use of the product are important in identifying population groups that may be at higher risk for a particular hazard. For example, infants, children, pregnant women, the elderly and immune-compromised individuals (including HIV, cancer and transplant patients, among others) are at higher risk for certain biological hazards. For all of these groups the use of a particular product may cause harm even if it is safe for the normal consumer.

The way the consumer uses a product is another important consideration, because it is directly related to the severity of a particular hazard. For example, potatoes are generally consumed cooked, a step which could eliminate many potential biological hazards. Some fruits such as oranges and bananas, are consumed by removing the outer layers. In these commodities there is little risk unless there is cross-contamination of bacteria from the peel to the edible tissue. With products like apples, tomatoes and leafy vegetables where the outer, periderm tissue is eaten, a higher risk to the consumer may occur if the product has not been handled properly throughout production and distribution.

Develop a Process Flow Diagram

In the HACCP system, a complete production flow diagram should be developed for each product. It should include all the process steps in the production of the product.

The flow diagram should contain information on all of the production steps from farm to table including:

- Field activities
- Packaging/transportation
- Processing
- Distribution
- Commercialization
- Final use at the consumer table

Although the flow diagram considers the whole production process, the implementation of a HACCP system involves considering only those steps where adequate controls can be applied. This concept is an essential point in understanding the limitations of HACCP methodology when implemented for fresh fruit and vegetable products.

Verify the Flow Diagram

After the flow diagram has been constructed, the HACCP team should inspect the production facility and verify that the flow diagram is accurate. Any discrepancies should be corrected.

Once the preliminary tasks have been completed, the HACCP team then evaluates prerequisite programs, GAPs and GMPs then proceeds with the steps described in the seven principles of HACCP.

Figure 3 - The 7 Principles of HACCP

Principle 1: Conduct a hazard analysis.
Principle 2: Determine the critical control points (CCPs).
Principle 3: Establish critical limits.
Principle 4: Establish monitoring procedures.
Principle 5: Establish corrective actions.
Principle 6: Establish verification procedures.
Principle 7: Establish record-keeping and documentation procedures.

HACCP Principle 1. Conduct a Hazard Analysis

This first principle involves the development of a list of all possible hazards associated with the product. This is done considering each individual step of the flow diagram, product description and additional information.

As it was discussed in Section 1 Module 1, hazards can be classified into three major categories:
1) Biological hazards (pathogenic bacteria, parasites and viruses)
2) Chemical hazards including among others: pesticides, fertilizers, cleaning substances, antibiotics, metals, intentional and incidental additives, etc. and
3) Physical hazards such as metal, glass fragments, stones, wood pieces, etc.

When all possible hazards have been identified, control measures should be defined for each type of hazard. This is an important step since the HACCP system is focused on prevention rather than correction.

Control measures are any action or activity that can be used to prevent, eliminate or reduce a significant hazard. Generally, these actions are implemented through GAP and GMP programs, but some will be considered critical and will receive a different classification within the HACCP plan.

The identification of hazards in a process is a valuable tool to identify any control measures that can be implemented; in many instances these measures are already in place or are common sense practices. However making a conscious effort to strengthen preventative actions can minimize or prevent the hazard from occurring.

HACCP methodology proposes systematically identifying hazards throughout the process. A proposed format to use as an aid in the hazard description is shown in the sample with sliced carrots below.

Figure 4. Sample Hazard Identification

Sliced Carrots

STEP	HAZARD	TYPE (B,C,P)*	PREVENTIVE MEASURE
Washing	Prevalence of pathogenic bacteria	B	Use of potable water in washing step and change it often if it is not a continuous system. Monitor the efficiency of washing procedure.
Sorting of raw material	Presence of foreign material (stones, plastic, etc)	P	Inspection of raw material and removal of foreign objects
Sorting of raw material	Microbiological contamination due to handling by sorting personnel	B	Follow GMP's, training of employees, and use of hand sanitizing station
Sorting of raw material	Contamination due to contact with equipment	B	Equipment washing and sanitizing following established procedures
Sorting of raw material	Contamination with foreign material by sorting personnel	B, P	Follow GMP's as they refer to removal of jewelry and other accessories that could fall into the product
Slicing	Microbial contamination by equipment	B	Equipment washing and sanitizing following established procedures
Sanitizing	Prevalence of pathogenic bacteria	B	Control water chlorine levels and pH of washing water. Change periodically or filter to remove organic solids

* B=Biological Hazard, P=Physical Hazard and C=Chemical Hazard

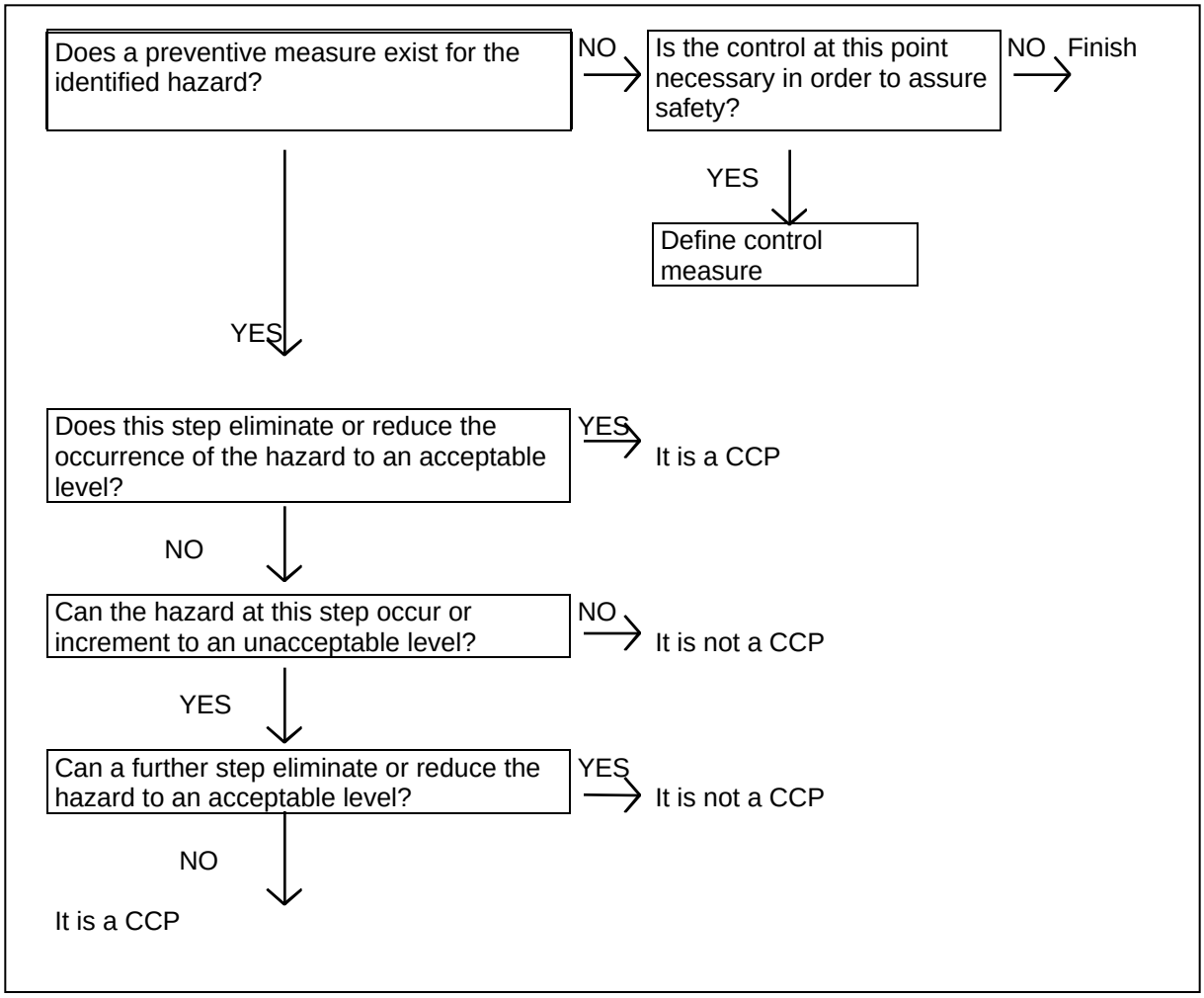
HACCP Principle 2. Determine the Critical Control Points (CCPs)

After identifying and evaluating potential hazards associated with a product, the next step is to focus on the process(es) that represent greatest risk to the consumer and how to control the occurrence of these hazards. Within the HACCP system, such steps are called Critical Control Points (CCP) and are defined as "***steps or procedures in a process that when under control can prevent, eliminate or reduce a hazard to an acceptable level***"

To aid in the identification of CCPs, a HACCP decision tree is used (FAO, 1998). This consists of asking a series of questions that aid in the differentiation

between critical control points (CCPs) and control measures. Remember this decision tree, cannot be applied blindly. It is necessary to consider the step within the context of each individual process.

Figure 5. CCP Decision Tree



During the design of a HACCP plan it is often a debate whether or not a certain step in the process is a CCP. A great deal of confusion is generated when some steps of the process are critical for the product, but are not involved in assuring safety and wholesomeness. It is important to keep in mind that HACCP is geared towards food safety assurance. When there's a quality assurance program integrated with HACCP, those steps that are not critical to assure a product's wholesomeness and food safety are called control points (CP) and are often related to product quality.

HACCP Principle 3. Establishment of Critical Limits (CL) for each CCP

Once a CCP has been identified, limits should be established for every variable that is going to be monitored. In a HACCP system these are referred to as Critical Limits.

These critical limits are physical and chemical parameters, which can be extracted from bibliographic sources, regulatory standards, scientific investigations, experimental studies, etc. Again it is important not to confuse quality specifications with process operating conditions. CLs are exclusively set for a CCP.

Figure 6 – Sample Critical Limits

CCP	VARIABLE	CRITICAL LIMIT
Sanitizing control (chlorination of water)	Total Chlorine Residual chlorine	100-150 ppm chlorine 2-7 ppm residual chlorine
	pH	6.0 –7.0 (over 7.5 chlorine looses is bactericidal properties)

Examples of critical limits in processed foods are cooking temperatures, cooling times, pH, water activity, concentration of chemical additives etc. When HACCP is used for fresh produce and the sanitation operation is considered a CCP for a biological hazard, critical limits are generally set for wash water temperature, chlorine concentration, pH of the solution, etc.

HACCP Principle 4. Establish Monitoring Procedures

The monitoring procedure has a preventive focus, it should be able to detect any deviation outside the critical limits. The idea is to detect a deviation in a process or buildup of a trend before the finished product reaches the end of the line. As it will be discussed in Principle 5, corrective actions will be established, and should be applied when monitoring indicates that a particular CL is out of control.

When establishing a monitoring system variables to be defined include:

- Place
- Frequency
- Sample size
- Procedure
- Necessary material
- Responsible person
- Training and knowledge

Figure 7 - Example of monitoring procedure for a produce washing step:

CCP	VARIABLE	CRITICAL LIMIT	MONITORING PROCEDURE	CORRECTIVE ACTIONS	RECORDS	PERSON RESPONSIBLE
Sanitizing control (water chlorination) CCP	Total chlorine Residual chlorine	100-150 ppm chlorine 2-7 ppm residual chlorine	Sample every hour. Chlorine measurement kit	Adjust total chlorine. Desinfect product again.	RECORD-03-HACCP	Quality assurance supervisor
	pH	6.0–7.0 (over 7.5 chlorine looses bactericidal properties)	Measurement of pH every hour. pH meter.	Adjust pH with acid/base chemicals.	RECORD-03-HACCP	Quality assurance supervisor.

When it is not possible to monitor a CCP on a continuous basis then it is necessary to establish sample frequency intervals short enough to keep the hazard under control. It is important to establish the monitoring procedures as rapid methods in order to apply an immediate corrective action and reestablish control in the process. Microbiological assays or other analyses that can take a long time are generally used for verification that the HACCP plan is working and not as monitoring procedures.

HACCP Principle 5. Establish Corrective Actions for each CCP to be applied when a deviation from a particular CL takes place.

In a HACCP plan, corrective actions are ways to proceed to reestablish control when the monitoring procedure indicates that a CL is out of its boundaries. Corrective actions also describe ways to dispose of or reprocess the product that was produced outside the CLs.

Corrective actions may include activities such as stopping the production line until the problem is solved, reprocessing a product that was manufactured outside of the CL boundaries or applying an additional treatment. Other actions may call for utilization of the product in a manner different than the one stipulated or even destruction of the product.

When a deviation occurs and corrective actions are taken to correct the problem, the source of the problem should be investigated and registered in the correction action log to prevent future occurrence.

Figure 8 - Examples of corrective actions implemented to minimize biological hazards in a produce-washing step

CCP	VARIABLE	CRITICAL LIMIT	MONITORING PROCEDURE	CORRECTIVE ACTIONS	RECORDS	RESPONSIBLE PERSON
Sanitizing control (water chlorination) CCP	Total chlorine Residual chlorine	100-150 ppm chlorine 2-7 ppm residual chlorine	Sample every hour. Chlorine measurement kit	Adjust total chlorine. Desinfect product again.	RECORD-03-HACCP	Quality assurance supervisor
	pH	6.0–7.0 (over 7.5 chlorine looses bactericidal properties)	Measurement of pH every hour. pH meter.	Adjust pH with acid/base chemicals.	RECORD-03-HACCP	Quality assurance supervisor.

Corrective actions should be written as detailed procedures, and the person responsible of implementing such actions should have enough authority and knowledge to be an efficient decision-maker. The flow of information should be efficient enough to allow for the action to be taken in a rapid manner. Corrective actions should be documented in the general logbook, defining clearly how the CCP was brought back to control within the CLs.

HACCP Principle 6. Establish Verification Procedures for the HACCP System

Verification is defined as those activities, other than monitoring, that determine the validity of the HACCP plan and that the system is operating according to the plan. It may involve doing microbiological, physical and chemical analyses, which are more complex and take longer turn-around times. These analyses are done with the purpose of verifying that the HACCP system is designed correctly and working properly.

Initial and subsequent validation activities are part of the verification schedule and may include designing experiments and tests to determine if the HACCP plan is correct and operating as planned. An example would be the inoculation of a bacterial pathogen and verifying the ability of a CCP to eliminate it or reduce it to safe levels.

Additional verification activities include audits of the CCP records, deviations of CL, taken corrective actions, equipment and instrument calibration among other things. The frequency of verification should guarantee that the HACCP system is preventing safety problems.

Figure 9 – Verification of corrective actions

CCP	VERIFICATION	FREQUENCY	CORRECTIVE ACTIONS	RECORD	RESPONSIBLE PERSON
Water chlorination control. (desinfection) CCP	Chlorination record review RECORD-03-HACCP	Weekly	Correct chlorine levels and/or re-train operator	RECORD-06-HACCP	Operations Manager
	pH meter calibration record review RECORD-09-HACCP	Weekly	Correct calibration and/or re-train operator	RECORD-06-HACCP	Operations Manager
	Microbiological assay of product after washing step. Aerobic mesophilics, Total coliforms, fecal coliforms	Daily 1 sample per product	Correct the problem, wash equipments, change water and apply other measures	RECORD-10-HACCP	Operation Manager

HACCP Principle 7. Establish Record-Keeping and Documentation Procedures

Records must include conditions at every CCP and all necessary information to assure the system is functioning properly. This information is the evidence of the performance of the process in case of internal or external audits.

When a HACCP system is implemented, documentation and records usually include:

- A summary of the hazard analysis, including the rationale for determining hazards and control measures.
- HACCP Plan
    - Listing of the HACCP team and assigned responsibilities.
    - Description of the food, its distribution, intended use, and consumer.
    - Verified flow diagram.
    - HACCP Plan Summary Table that includes information for:
        - Steps in the process that are CCPs
        - The hazard(s) of concern
        - Critical limits
        - Monitoring
        - Corrective actions
        - Verification procedures and schedule

- Record-keeping procedures
- Support documentation such as validation records.
- Records that are generated during the operation of the plan.

HACCP methodology recommends the use of a Master Format in which all information regarding CCPs is collected and organized.

Figure 10 – HACCP Master Format

Step of the process	CCP	Type of hazard	Critical limit	Monitoring procedure / Frequency / Responsible	Corrective action / Responsible	HACCP Record	Verification procedure / Responsible
		B P C					

Having records means having evidence that the system is working properly.

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Part VII
Choosing the Correct Training Aids

A visual aid is anything the audience can see that helps the speaker get the message to the audience (Cheek and Beeman, 1991). Visuals, such as flipcharts, overhead transparencies, posters, slides, etc. are an important part of effective presentations.

In addition to improving the effectiveness of communicating the message to the audience, good visuals serve a number of other important functions. These include:

- Helping focus the audience's attention on the presentation
- Making the presenter more persuasive, concise, and interesting
- Increasing the receiver's retention of the information
- Transmitting the message more effectively
- Adding variety and emphasis to the presentation

Finally, today's audiences tend to be visually oriented and have come to expect visuals with presentations. In many cases, they tend to be less accepting of talks presented without some sort of visual enhancement.

When choosing a training aid, the following should be considered:

- Course objectives. If there are specific points to be highlighted, a transparency or word slide may be appropriate. Sometimes a picture is essential and most effective in conveying the idea. For example, if discussing types of pesticide application equipment or types of pests common to stored grains it may be best to support the message with pictures/photos.
- The physical setting. Room size, seating arrangement, and lighting in the presentation site are major considerations in selecting visual aids. It is important to assure visibility of the aids by all training participants.
- Availability of materials to make the aid and to support its use, e.g. electricity supply, chalk, pens.
- Nature of the audience. The audience's familiarity with the topic can help determine the types of aids needed. For a presentation on diseases of vegetables to a group of homeowners with limited knowledge about gardening, it might be appropriate to have live plant specimens and slides. For a presentation to commercial vegetable farmers with good knowledge of plant diseases, slides might be the best way to illustrate the points.
- Experience of the trainer and comfort with using the selected aid. It is important that trainers practice using the selected aids before the actual presentation so that the aid does not draw attention away from the main focus of the presentation. Proficiency in using an audio-visual aid cannot be learned from a book, it comes only with practice.

Care needs to be taken to ensure that training aids are used as aids and do not take over the training session. Carefully planned and properly used training aids can improve the audience's perception of the speaker as they demonstrate skill as a trainer. They serve to maintain the audience's interest and strengthen the message. Unsuitable aids or ones that are not properly used can at best distract or mislead the audience.

Some aids are more suited to a particular objective than others. For example, if accurate detail is needed, a photograph, slides or a drawing may work well. If, on the other hand, the objective is to highlight the structure of a talk or the main points and conclusions of a discussion, a blackboard or overhead transparency may be more suitable.

The following table describes some of the most commonly used training aids and provides some considerations for preparing and using them.

Effective Training Aids

Charts and Posters	· Useful for highlighting the main points of a presentation and to show complex processes, diagrams, pictures, etc. · In the training room can be placed on the wall for reference throughout the training and can be easily transported to the field · In certain circumstances can convey a message faster and more clearly than words. · Are particularly useful where the trainees may be illiterate since messages may be conveyed visually · Also useful to show a detailed drawing that the trainees will need to examine closely
Flipcharts	· Can be prepared in advance or developed during the training session · May include words, pictures or both words and pictures · Must have a well-functioning support stand and good pens that will produce clear lettering visible to the audience. · Like charts/posters, they can be displayed as a reference for later training sessions and can be easily transported · Works better with a small audience
Overhead transparencies	· Perhaps the most commonly used training aid · Can be prepared by hand using different colored pens or generated by a computer · Pictures/diagrams/text can be photocopied onto

	a transparency · With care in the location of the projector and the size of the lettering on the transparency, can be visible to a large group. · Often are prepared in advance and therefore serve as notes to the trainer. · Transparencies can be easily inserted or deleted to adapt a presentation to the needs of a particular group · Does not work well if too much information is put on a transparency so that lettering is too small to be read easily · Trainers must ensure that the projector is available and properly functioning and that there is a reliable supply of electricity · Practicing prior to the actual presentation will help trainer to know where to stand and how to change transparencies
Color Photographs/Slides	· Strengthen the message by showing illustrations, for example a field of crops, equipment, etc. · Photographs have the advantage of showing real life situations and therefore making the topic very practical for the trainees. · Photographs can be passed among the group or projected on to the wall as slides. Slides require reliable equipment, an electricity supply and the room must be darkened
Blackboards/Whiteboards	· Widely available and easily adaptable · Useful for writing down the main points of a talk, for sketching simple drawings and diagrams and noting the main points raised in a discussion · Whiteboards require special water-soluble erasable pens. In general, whiteboards are easier to use than blackboards since the pens flow smoothly over the surface and the colors are clearer to read than chalk on a blackboard · A disadvantage of these techniques is that the speaker has their back to the audience while writing on the board

Videos	· May be used to supplement and add a real life dimension to a training session · Should be kept short – approximately 10 minute is considered a good length · Trainer should introduce the content and state its relevance to the overall training session. Trainees may be asked to watch for certain issues that will be discussed at the end of the video · Often introduce a welcome break when trainees have taken in a lot of new information. Can also summarize the main points of the session · Enable trainer and trainees to enter a different environment while in the training room - for example a video may allow a visual tour of a facility that is far away from the training site
Computer Slides	· Require laptop computer or other equipment to run 'slide show.' Unless audience is small enough to view the presentation from the computer screen, an LCD projector or other projection device is needed · Hard copy print-outs can be made and used as lecture notes and/or handouts · Speedy production schedule and greater consistency of output · With practice, easy to change and/or re-organize presentation at the last minute

PART VIII
Glossary of Terms

Agricultural worker – any person that undertakes cultivation, packing, and/or harvesting of fresh fruits and vegetables.

Biosolids – sludge and other residue deposits obtained from residual water treatment plants and from treatment applied to urban and industrial wastes (food industries and other types of industry).

Chemigation - the application of chemicals through irrigation systems. Chemicals applied in this method include pesticides and fertilizers (sometimes called fertigation).

Cleaning – the removal of all foreign material (such as soil, organic matter) from objects. Cleaning is normally accomplished with water, mechanical action, and detergents or enzymatic products. Failure to remove foreign matter (such as soil) from an object before disinfection or sterilization is likely to render the process ineffective.

Composting – a managed process in which organic materials, including animal manure and other wastes, are digested aerobically or anaerobically by microbial action.

Contaminant – any biological or chemical agent, foreign matter, or other substances not intentionally added to that when found on or in produce can cause human illness or injury.

Critical Control Point – a point, step or procedure at which control can be applied and food safety hazard can be prevented, eliminated, or reduced.

Cultivation – any agriculture action or practice used by growers to allow and improve the growing conditions of fresh fruits and vegetables grown in the field or in protected facilities (hydroponic systems or greenhouses)**.**

Deterioration – for produce, deterioration can be used interchangeably with spoilage. When applied to non-food products such as packaging materials, deterioration is a physical or chemical change in the material that may adversely affect the safety of the product.

Disinfection – the reduction, by means of chemical agents and/or physical methods, of the number of microorganisms in the environment, to a level that does not compromise food safety or suitability. The effectiveness of disinfection is affected by a number of factors, each of which may nullify or limit the efficiency of the process. Some of the factors that have been shown to affect disinfection effectiveness are the previous cleaning of the

object, the organic load on the object, the type and level of microbial contamination, the concentration of and exposure time to the disinfectant, the physical configuration of the object (e.g., crevices), and the temperature and pH of the disinfection process.

Farm – any premise or establishment in which fresh fruits and/or vegetables are grown and harvested and the surroundings under the control of the same management.

Field packing - packing produce directly from the field into market containers for commercial distribution and sale.

Foodborne disease – the occurrence of illness resulting from the ingestion of food, gastrointestinal tract symptoms are the most common clinical manifestations of foodborne illnesses. Foodborne illnesses can be caused by microorganisms and their toxins, marine organisms and their toxins, fungi and their related toxins, and chemical contaminants.

Food hygiene – all conditions and measures necessary to ensure the safety and suitability of food at all stages of the food chain.

Food quality – the composite of those characteristics that differentiate individual units of a product and have significance in determining the degree of acceptability by the buyer.

Food safety – the practical certainty that injury or damage will not result from a food or ingredient used in a reasonable and customary manner and quantity.

Food safety assurance program - preventive program for ensuring safety of food products.

Fresh fruit and vegetables – fresh produce that is likely to be sold to consumers in an unprocessed or minimally processed (i.e. raw) form. Fresh produce may be intact, such as strawberries, whole carrots, radishes, and fresh market tomatoes or cut during harvesting, such as harvesting, such as celery, broccoli, and cauliflower.

Fruit and vegetable operation - the whole process of fruit and vegetable production from farm to table. Its unit operations generally include production, post-harvest operations, packaging, transportation and storage. Large fruit and vegetable operations generally are vertically integrated and all unit operations are interconnected. In smaller or medium-size operations the controls are generally demanded as supplier specifications and handled as stipulations for doing business.

Good agricultural practices – The basic environmental and operational conditions necessary for the production of safe, wholesome fruits and vegetables.

Good management practices – general practices to reduce microbial food safety hazards. The term may include both “good agricultural practices” used in growing, harvesting, sorting, packing, and storage operations and “good manufacturing practices” used in sorting, packing, storage, and transportation operations.

Grower – the person responsible for the management of the primary production of fruits and vegetables.

HACCP – a system that identifies, evaluates, and controls hazards that are significant for food safety.

Handwashing – a vigorous, brief rubbing together of all surfaces of lathered hands, followed by rinsing under a stream of water. Handwashing with plain soaps or detergents (in bar, granule, leaflet, or liquid form) suspends microorganisms and allows them to be rinsed off; this process is often referred to as mechanical removal of microorganisms. Handwashing with antimicrobial-containing products kills or inhibits the growth of microorganisms; this process is often referred to as chemical removal of microorganisms.

Hazard – a biological, chemical, or physical agent in, or condition of, food with the potential to cause an adverse health effect.

Manure - feces, urine, other excrement, and bedding produced by livestock that has not been composted.

Material Safety Data Sheet (MSDS) - product safety information sheets prepared by manufacturers and marketers. An MSDS lists the ingredients in a hazardous product, its manufacturer, its hazards to safety and health, and precautions to follow when using it. These sheets can be obtained by requesting them from the manufacturer. Some stores, such as hardware stores, may have material safety data sheets on hand for products they sell.

Microorganisms include yeasts, molds, bacteria, protozoa, helminths (worms) and viruses. Occasionally, the term “microbe” or “microbial” is used instead of the term microorganisms.

Microbial hazard – occurrence of a microorganism that has the potential to cause illness or injury.

Pathogen – a microorganism capable of causing disease or injury.

Pest – any animal or insect of public health importance including, but not limited to, birds, rodents, cockroaches, flies, and larvae, that may carry pathogens that can contaminate food.

Primary production – those steps involved in the growing and harvesting of fresh fruits and vegetables such as planting, irrigation, application of fertilizers, application of agricultural chemicals, etc.

Risk – an estimate of the likelihood of occurrence of a hazard

Sanitize – to treat clean produce by a process that is effective in destroying or substantially reducing the numbers of microorganisms of public health concern, as well as undesirable microorganisms, without adversely affecting the quality of the product or the safety of the consumer.

Sanitize (food contact surfaces) – adequately treat clean food contact surfaces by a process that is effective in destroying or substantially reducing the numbers of microorganisms of public health concern, as well as other undesirable microorganisms, without adversely affecting the quality of the involved product or its safety for the consumer. It means the application of cumulative heat or chemicals on cleaned food contact surfaces that, when evaluated for efficacy, is sufficient to reduce populations of representative microorganisms by 5 log or 99.999%.

Spoilage – a process whereby food quality and/or food safety is rendered unacceptable through microbial or chemical reaction.

Traceback - a method used to determine the source(s) and distribution of food(s) implicated in a foodborne disease outbreak and to identify potential points where contamination could have occurred

Unit operations: Individual steps during the production and distribution of fruit and vegetables.

Water definitions –

Agricultural water – water used in the growing environment (for example, field, vineyard, or orchard) for agronomic reasons. It includes water used for irrigation, transpiration control (cooling), frost protection, or as a carrier for fertilizers and pesticides. Typical sources of agricultural water include flowing surface waters from rivers, streams, irrigation ditches, open canals, impoundments (such as ponds, reserviors, and lakes), wells, and municipal supplies.

Clean water – water that does not compromise food safety in the circumstances of its use.

Potable water – water that meets the quality standards of drinking water.

PART IX
Where to Find Additional Information

Guidance, Regulations, and Standards of the U.S. Government

Guidance for Industry: Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables, U.S. Food and Drug Administration, Center for Food Safety and Applied Nutrition, October 1996.
Copies available in English, Spanish, Portuguese, and French from:
Food Safety Initiative Staff, HFS-32
U.S. Food and Drug Administration
Center for Food Safety and Applied Nutrition
200 C Street S.W.
Washington, DC 20204
(Tel) 202-260-8920
(Internet) http://www.fda.gov

Copies of Federal regulations in the **Code of Federal Regulations (CFR)** may be purchased from the U.S. Government Printing Office or by telephone at (202) 512-1800. The CFR is also available at branches of the U.S. Government Printing Office Bookstores. Information on location of regional branches is available on the WWW at the following address: http://vm.cfsan.fda.gov/~lrd/ob-reg.html Sections of the CFR can be viewed and printed from the WWW at the following address: http://www.access.gpo.gov/nara/cfr/index.html**.**

Title 21, Code of Federal Regulations: 21 CFR 100-169 and 21 CFR 170-199
Sections of Title 21, such as 21 CFR 110.10 can be viewed and printed from the WWW at the following address: http://www.access.gpo.gov/nara/cfr/.
You may purchase 21 CFR 100-169 or 21 CFR 170-199 from the U.S. Government Printing Office or by telephone at (202) 512-1800.

OSHA Standards

OSHA General Industry standards, Title 29 CFR 1910, and OSHA Agricultural Industry standards, Title 29 CFR 1928, may be purchased through a U.S. Government Printing Office or by telephone at (202) 512-1800. 29 CFR 1910.141 and 29 CFR 1928.110 may be viewed and printed from the WWW at: http://www.osha-slc.gov/OshStd_toc/OSHA_Std_toc.html.

EPA Regulations

EPA regulations may be obtained by contacting:
U.S. EPA/NCEPI
P.O. Box 42419
Cincinnati, OH 45242-2419.
Telephone: 1-800-490-9198
FAX (513) 489-8695.
You must give the EPA catalog number for the publication.
Electronic versions of additional EPA documents, such as criteria and supporting documents, are available at http://www.epa.gov.

Additional Helpful Information from the U.S. Government:

USDA/FDA Foodborne Illness Education Information Center
http://nal.usda.gov/fnic/foodborne/foodborn.htm

U.S. EPA. Ambient Water Quality Criteria for Bacteria, EPA Office of Water Regulations and Standards, EPA 832-B-92-005, January 1986.

USDA. List of Proprietary Substances and Nonfood Compounds Authorized for Use Under USDA Inspection and Grading Programs.

U.S. EPA. Domestic Septage Regulatory Guidance, A Guide to the EPA 503 Rule. EPA, Office of Water Regulations and Standards, 832-B-92-005, September 1993.

“Food Safety Begins on the Farm: A Growers Guide Good Agricultural Practices for Fresh Fruits and Vegetables “ Good Agricultural Practices Program, Cornell University. Prepared under CSREES/USDA and USFDA, Agreement Number 99-41560-0821.

USDA Agricultural Marketing Service program "Qualified Through Verification for Fresh Cut Produce" is available from: Branch Chief, Processed Products Branch, Fruit and Vegetable Programs, Agricultural Marketing Service, USDA, P.O. Box 96456, Rm. 0726, South Building, Washington, DC, 20090-6456. (202) 720-4693.

USAID is an independent federal government agency that receives overall foreign policy guidance from the Secretary of State. The agency works in six principal areas crucial to achieving both sustainable development and advancing U.S. foreign policy objectives: Economic growth and agricultural development; Population, health and nutrition; Environment; Democracy and governance; Education and training, and; Humanitarian assistance. More information is available at http://www.usaid.gov

The National Agricultural Library (NAL), part of the Agricultural Research Service of the U.S. Department of Agriculture, is one of four National Libraries in the United States. NAL is a major international source for agriculture and related information. The Web site (http://www.nalusda.gov) provides access to NAL's many resources and a gateway to its associated institutions.

Codex Alimentarius Commission – FAO/WHO

The Codex Committee on Food Hygiene (CCFH) initiated work on a Code of Hygienic Practice for the Primary Production, Harvesting, and Packaging of Fresh Produce. A proposed draft code is currently being reviewed.

For information on this draft code of practice and other activities of the Codex Alimentarius Commission, please contact the Secretariat of the Joint FAO/WHO Food Standards Programme at:

Secretariat of the Joint FAO/WHO Food Standards Programme
Food and Agriculture Organization of the United Nations
Viale delle Terme di Caracalla
00100 Rome, Italy
Tel: 3906 52251
Telefax: 3906 52253152
Telex: 610181FAO1
E-mail (Internet): CODEX@FAO.ORG

Codex meeting agendas, reports and standards can be accessed from FAO's web page: http://www.codexalimentarius.net/

World Trade Organization

The World Trade Organization (WTO) is the only global international organization dealing with the rules of trade between nations. The goal is to help producers of goods and services, exporters, and importers conduct their business. Information on WTO and it's activities may be obtained via the internet at: http://www.wto.org

Food and Agriculture Organization

This Manual was prepared in collaboration with the Food Quality and Standards Service of Food and Nutrition Division (ESN) of FAO. More information on the work of the Division on food quality and safety matters, including fresh fruit and vegetable production is available on the ESN homepage (http://www.fao.org/waicent/faoinfo/economic/ESN/nutri.htm)

In addition, a number of related publications on water quality, extension training, food quality and safety can be obtained by contacting FAO through its web site: http://www.fao.org or by requesting a publication catalog from:

U.N. Food and Agriculture Organization
Viale de
lle Terme di Caracalla
00100 Rome, Italy
Tel: 39 06 5705-4608
Fax: 39 06 5705 3360
E-mail (INTERNET): publications-sales@fao.org

"Production Half the Battle: A Training Manual in Fresh Produce Marketing for the Eastern Caribbean". Written by Stephen Harris, FAO Bridegtown, Barbados, December 1988 A practical training manual developed for the Eastern Caribbean as part of a FAO/INPhO project. Available electronically at: http://www.fao.org/inpho/vlibrary/x0014e/X0014E00.htm

The Agro-Industries and Post-Harvest Management Service (AGSI) is one of four services of the Agricultural Support Systems Division at FAO. The work of AGSI focuses on post production issues, promotes value-added transformation technologies and covers a broad spectrum of activities which include advising governments. Publications of AGSI can be accessed through their homepage at http://www.fao.org/ag/ags/Agsi/AGSI.HTM

FAOSTAT is an on-line and multilingual databases currently containing over 1 million time-series records covering international statistics in the following areas:

- Production
- Trade
- Food Balance Sheets
- Fertilizer and Pesticides
- Land Use and Irrigation
- Forest Products
- Fishery Products
- Population
- Agricultural Machinery
- Food Aid Shipments

Databases can be accessed online at http://apps.fao.org/

World Health Organization

Related publications and a publication catalog can be obtained from WHO:

World Health Organization
Distribution and Sales Service
1211 Geneva 27
Switzerland
http://www.who.org

A key reference available from WHO's is "Surface Decontamination of Fruits and Vegetables Eaten Raw: A Review" Food Safety Unit, World Health Organization. WHO/FSF/FOS/98. Written by Larry R. Beuchat, Ph.D. Article is available via the internet at http://www.who.int/fsf/fos982~1.pdf

Trade Organizations

Fresh produce associations based in the United States offer food quality and safety publications. Contact the organization directly for lists of available resources.

International Fresh-Cut Produce Association
1600 Duke Street
Suite 440
Alexandria, VA 22314
Tel: 703 299-6282
http://www.fresh-cuts.org

Fresh Produce Association for the Americas
30 E. Hudgins
P.O. Box 848
Nogales, AZ 85628
Tel: 520-287-2707
Fax: 520-287-2948

Produce Marketing Association
P.O. Box 6036
Newark, DE 19714
Tel; 302 738-7100
http://www.pma.com

United Fresh Fruit and Vegetable Association
727 North Washington Street
Alexandria, VA 22314
Tel: 703 836-3410
Fax: 703 836-7745
http://www.uffva.org

Western Growers Association
17620 Fitch Street
Irvine, CA 92614
Tel: 714 863-1000