

Lesson C11–4

Food Safety and Sanitation

Unit C. Basic Principles of Agricultural/Horticultural Science

Problem Area II. Understanding Food Science Technology

Lesson 4. Food Safety and Sanitation

New Mexico Content Standard:

Pathway Strand: Food Products and Processing Systems

Standard: I: Apply principles of food processing to the food industry.

Benchmark: I-B: Interpret and follow, develop and implement Hazard Analysis Critical Control Point (HACCP) procedures to establish operating parameters.

Performance Standard: 1. Conduct a hazard analysis. 2. Identify Critical Control Points (CCP). 3. Establish critical limits for each Critical Control Point (CCP). 4. Establish monitoring procedures. 5. Establish corrective actions. 6. Establish verification procedures.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Explain the causes of food-borne illness.
2. Describe methods for preventing food-borne illnesses.
3. Explain procedures used in food sanitation.
4. Explain the Hazard Analysis and Critical Control Point (HACCP) System

List of Resources. The following resources may be useful in teaching this lesson:

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Seperich, George, J., *Food Science and Safety*. Danville, Illinois: Interstate Publishers, Inc., 1998. (Textbook, Chapters 8 and 10).

Other Resources. The following resources will be useful to students and teachers:

Cooper, Elmer E., *Agriscience Fundamentals and Applications*. Albany, New York: Delmar Publishers, Inc., 1997. (Textbook, Unit 34)

Food Science, Safety, and Nutrition. Alexandria, Virginia: The National Council for Agriculture Education, 1993. (Curriculum Binder)

Morgan, Elizabeth M., et al. *AgriScience Explorations*, Second Edition. Danville, Illinois: Interstate Publishers, Inc., 2000. (Textbook, Chapter 16)

List of Equipment, Tools, Supplies, and Facilities

Writing surface
Overhead projector
Transparencies from attached masters

Terms. The following terms are presented in this lesson (shown in bold italics):

Cleaning
Food-borne illness
Food-borne infection
Food-borne intoxication
Food sanitation
HACCP (Hazard Analysis and Critical Control Point)
Metabolites
Pathogen
Personal hygiene
Sanitizing

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Ask the class to think about the items worn by workers in local fast food restaurants. Common items include hats and plastic gloves. Have them think about signs posted in the restaurant that relate to worker hygiene. Such signs often appear in the rest rooms used by workers. Use the discussion as a vehicle for introducing the concept of personal hygiene and the role it plays in food science.

Summary of Content and Teaching Strategies

Objective 1: Explain the causes of food-borne illness.

Anticipated Problem: How are food-borne illnesses caused?

- I. **Food-borne illness** is sickness in humans caused by a pathogen. A **pathogen** is a microorganism that inflicts illness in humans. A food-borne illness is rarely life threatening. It can, however, cause great discomfort in humans. Food-borne illness can be traced to two basic causes:
 - A. **Food-borne infection** is an illness caused by ingesting a microorganism in a contaminated food. The growth of the microorganism or its offspring in the body bring on the symptoms of the illness. It is the most common type of food-borne illness. Food-borne infections are classified into two categories:
 1. Those in which the food serves only as the carrier of the pathogen. When humans eat, the pathogen is carried into the body. The pathogens that cause tuberculosis and dysentery enter the body in this manner.
 2. Those in which food serves as a habitat and a carrier. In this case, the food not only carries the pathogen, it also provides a habitat where the pathogen can grow and reproduce. Microorganisms like salmonella and E. coli are carried in this manner.
 - B. **Food-borne intoxication** is an illness that is caused by consuming a food that contains harmful metabolites from a microorganism. **Metabolites** are waste products generated by microorganisms as they continually undergo physical and chemical changes. Most metabolites are harmless. Those metabolites that produce poisons are known as toxins. Food-borne intoxication is more serious and comes about faster than food-borne infections.

A variety of techniques may be used to help students understand this concept. Use TM:C11-4A to help students gain an understanding of the different illnesses caused by food-borne infection and intoxication. Students also need text references to understand the learning objective. Have the class read the section on Food-Borne Illness in the recommended reference. Lead students in a discussion of the main concepts.

Objective 2: Describe methods for preventing food-borne illnesses.

Anticipated Problem: What procedures can be used to prevent food-borne illnesses?

- II. Preventing food-borne illness is fairly easy. Using common sense and a few basic procedures, both food processors and homeowners can enjoy safe foods.
 - A. Food temperature—it is important to store food at appropriate temperatures. Once the food is cooked, it should be refrigerated if it will not be eaten immediately.

- B. Cooking temperature—heating foods to appropriate temperatures is necessary to kill microorganisms. Beef that is served rare should have an internal temperature of no lower than 145°F. Whole poultry should be cooked to an internal temperature of 180°F.
- C. Separate cooked and uncooked foods—this involves avoiding cross-contamination. Platters used for uncooked and cooked meats should be washed in between uses.
- D. Wash hands and use utensils—microbes are everywhere. To avoid the chance of contamination, hands should be washed. Since microbes thrive less on plastics, metal, and wood, utensils should be used.
- E. Marinate in the refrigerator—cold marinating provides a more hostile environment for microbes than room temperature marinating.
- F. Eat only good food—when in doubt, throw it out! If a food does not look, feel, or smell right, do not eat it.

A variety of teaching techniques may be used to help students understand this objective. Use TM:C11–4B to help reinforce the simple procedures for preventing food-borne illness. Students also need text materials to gain a complete understanding of the learning objective. Have students read the Prevention of Microbial Food-Borne Illness section in the suggested chapter of the recommended reference. Use it as the basis for class discussion and reinforcement.

Objective 3: Explain procedures used in food sanitation.

Anticipated Problem: What procedures are employed to insure cleanliness in the food processing environment?

- III. **Food sanitation** is the overall cleanliness and hygiene in the food processing environment. This includes the cleanliness of the equipment used in a food processing plant and the hygiene of the workers using the equipment.
 - A. Environment—a clean food processing environment minimizes microbial contamination. It also protects the safety and health of workers. The environment is kept safe through:
 - 1. Waste removal—liquid and solid processing wastes are major sources of contamination. Food processors spend a great deal of money handling the wastes generated in food processing.
 - 2. Cleaning and sanitizing—**cleaning** is the removal of all dirt, grime, and grease from the environment. **Sanitizing** is placing an antibacterial shield on the surface of equipment. The shield delays contamination of the surface by microbes.
 - B. **Personal hygiene** is the preservation of the physical well being of people. In a food processing plant, the well being of every worker is dependent on the hygiene of the other workers. Personal hygiene involves keeping the following clean:
 - 1. Clothing can be a source of contamination. To reduce the chances for contamination from clothing, food processing plants require their workers to wear clean uniforms every day.

2. Hands—unclean hands of employees in a processing plant is the major cause of contamination. To reduce this cause, processing plants require employers to:
 - a. Wash their hands with soap—water alone may actually do more harm than good. Soap and the bubbles it produces, removes microbes from human skin.
 - b. Using gloves—clean gloves provide a barrier between hands and the source of contamination. In some jobs, workers wear disposable plastic gloves. Cloth gloves are not effective.
3. Hair—human hair is not a particularly good environment for microbes. However, they will hide in hair until a better environment is located. To reduce the chance of contamination from falling hair, head-wear such as hats and hair nets are used.
4. Footwear—street shoes can bring microbes into a plant from the outside. Processors typically issue boots to be worn in the food processing area. Disinfectant trays are provided where workers dip their footwear before proceeding to the processing area.
5. Floor and Work Surfaces—workers are taught not to use equipment that may be contaminated. This includes not picking up tools that have fallen to the floor.

A variety of techniques may be used to help students understand this objective. Use TM:C11–4C to reinforce an understanding of the role personal hygiene plays in food sanitation. Students also need text materials to fully understand food sanitation. Have the class read the Food Sanitation Section in Chapter 10 of the recommended reference. Use the information as the basis for discussion and reinforcement of this objective.

Objective 4: Explain the Hazard Analysis and Critical Control Point (HACCP) System.

Anticipated Problem: What is HACCP and why was it established?

- IV. **HACCP (Hazard Analysis and Critical Control Point)** is a program designed to analyze every food processing system for its key production points and points of contamination. It helps make everyone aware of these critical points and creates a frame of mind that prevents product contamination. HACCP was developed jointly by the U.S. Army and The Pillsbury Company. It is administered by the United States Department of Agriculture.
- A. HACCP is guided by seven basic principles:
1. Assess all potential hazards from the growing stage through the preparation stage.
 2. Determine critical points where controls are necessary to reduce hazards.
 3. Establish requirements to be met at each critical point.
 4. Establish procedures to monitor each critical point.
 5. Establish corrective procedures when monitoring uncovers problems.
 6. Establish record-keeping procedures.
 7. Establish procedures to monitor the effectiveness of the plan.
- B. In establishing a HACCP program, a food processor's goal is to meet three basic objectives:

1. To destroy, eliminate, and reduce hazards. In order to accomplish this, hazards must be identified and ranked according to the following system:
 - a. Hazard A—applies to products designated for consumption by at-risk populations. At-risk populations include infants and the elderly.
 - b. Hazard B—applies to products containing ingredients known to be toxic.
 - c. Hazard C—the process used does not contain a step that effectively controls the toxin identified.
 - d. Hazard D—applies to products that are subject to recontamination after processing and before packaging.
 - e. Hazard E—applies to products that have a substantial potential for contamination in distribution or consumer handling that could render the product harmful.
2. To prevent recontamination of the food product.
3. Inhibit the growth and production of any toxins that may be present.

A variety of techniques can be employed to help students gain an understanding of this objective. Use TM:11-4C to reinforce the seven basic principles of HACCP. Use TM:11-4D to help students identify the five types of hazards associated with HACCP. Students also need text materials for a complete understanding of HACCP. Have the class read the HACCP System Section in Chapter 10 of the recommended reference. Use it as the basis for discussion and reinforcement.

Review/Summary. Concentrate the lesson's review and summary around the student learning objectives. Call on students to explain the content of each objective. Questions at the end of the chapter in the recommended resource may also be helpful.

Application. Application can involve the use of the activities in the Applying The Concepts section in the recommended resource.

Evaluation. Evaluation should focus on student achievement of the objectives for the lesson. A sample written test is also attached.

Answers to Sample Test:

Part One: Matching

1 = b, 2 = j, 3 = h, 4 = d, 5 = f, 6 = a, 7 = c, 8 = e, 9 = i, 10 = g

Part Two: Completion

- 1 = toxins
- 2 = Heating
- 3 = microbial
- 4 = hands
- 5 = U. S. Army

6 = five

Part Three: Short Answer

1. Food-borne infection and Food-borne intoxication
2. *Answer may include any of the following:*
 - It is important to store food at appropriate temperatures.
 - Heating foods to appropriate temperatures is necessary to kill microorganisms.
 - Avoid cross-contamination by separating cooked from uncooked foods.
 - Hands should be washed and utensils used since microbes thrive less on plastics, metal, and wood.
 - Marinating in the refrigerator provides a more hostile environment for microbes than room temperature marinating.
 - If a food does not look, feel, or smell right, do not eat it.
1. Waste removal—liquid and solid processing wastes are major sources of contamination.
 - Cleaning—removing dirt, grime, and grease.
 - Sanitizing—placing an antibacterial shield on the surface. The shield delays the contamination of the surface by microbes.

Test

Lesson C11–4: Food Safety and Sanitation

Part One: Matching

Instructions. Match the term with the correct response. Write the letter of the term by the definition.

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|----------------------------|--------------------|
| a. metabolites | f. cleaning |
| b. food-borne illness | g. food sanitation |
| c. food-borne infection | h. pathogen |
| d. food-borne intoxication | i. sanitizing |
| e. personal hygiene | j. HACCP |

- _____ 1. Sickness in humans (rarely life threatening) caused by a pathogen.
- _____ 2. A program designed to analyze every food processing system for its key production points and points of contamination.
- _____ 3. A microorganism that inflicts illness in humans.
- _____ 4. An illness that is caused by consuming a food that contains harmful metabolites.
- _____ 5. The removal of all dirt, grime, and grease from an environment.
- _____ 6. Waste products generated by microorganisms as they continually undergo physical and chemical changes.
- _____ 7. An illness caused by ingesting a microorganism in a contaminated food.
- _____ 8. The preservation of the physical well being of people.
- _____ 9. Placing an antibacterial shield on the surface.
- _____ 10. Overall cleanliness and hygiene in the food processing environment.

Part Two: Completion

Instructions. Provide the word or words to complete the following statements.

1. Metabolites that produce poisons are known as _____.
2. _____ foods to appropriate temperatures is necessary to kill microorganisms.
3. A clean food processing environment minimizes _____ contamination.
4. Unclean _____ of employees in a processing plant are major cause of contamination.
5. HACCP was developed jointly by the _____ and The Pillsbury Company.

6. The HACCP system ranks hazards into one of _____ categories.

Part Three: Short Answer

Instructions. Provide information to answer the following questions.

1. Name the two basic causes of food-borne illness.

2. Name and describe some methods of preventing food-borne illnesses.

3. Name and describe some ways the food processing environment is kept safe.

TM: CII-4A

Type of Micro-organism	Type of Food-Borne Illness	Microorganism Involved	Disease
Bacteria	Food-borne infection	<i>Salmonella</i> spp.	Salmonellosis
Bacteria	Food-borne infection	<i>Streptococcus pyrogenes</i>	Throat infections
Bacteria	Food-borne infection	<i>Shingella</i> spp.	Shigellosis
Bacteria	Food-borne infection	<i>Escherichia coli</i>	Food illness
Bacteria	Food-borne infection	<i>Listeria monocytogenes</i>	Listeriosis
Bacteria	Food-borne infection	<i>Yersinia enterocolitica</i>	False tuberculosis
Bacteria	Food-borne intoxication	<i>Clostridium botulinum</i>	Botulism
Bacteria	Food-borne intoxication	<i>Clostridium perfringens</i>	Food illness
Bacteria	Food-borne intoxication	<i>Staphylococcus aureus</i>	Food illness
Bacteria	Food-borne intoxication	<i>Bacillus cereus</i>	Food illness
Bacteria	Food-borne intoxication	<i>Vibrio parahaemolyticus</i>	Food illness
Mold	Food-borne intoxication	<i>Aspergillus</i> spp.	Food illness
Mold	Food-borne intoxication	<i>Claviceps purpurea</i>	Ergotism

Sources: Adapted from Ayres, Mundt, and Sandine, from Ockerman, and from Frazier and Westhoff.

Factors to be Considered in Personal Hygiene

- **Clothing**
- **Hands**
- **Hair**
- **Footwear**
- **Floor and Work Surfaces**

TM: CII-4C

1. Assess potential hazards in all stages of food production from growing/harvesting to manufacturing and preparation for consumption.
2. Determine critical points where controls are necessary to eliminate or reduce hazards.
3. Establish requirements or limits to be met at each critical control point.
4. Establish procedures to monitor each critical control point.
5. Establish corrective actions when monitoring uncovers deviations from production plan.
6. Establish record-keeping procedures that document HACCP plan.
7. Establish procedures to monitor effectiveness of HACCP plan.

Source: Adapted from USDA.

TM: CII-4D

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| Hazard A | This special class applies to products designated and intended for consumption by at-risk populations—e.g., infants, elderly persons, or individuals who are infirm or immunocompromised. |
| Hazard B | The product contains ingredients known to be potential sources of toxic chemicals, microbiologicals, or dangerous physical hazards. |
| Hazard C | The process does not contain a controlled step that effectively prevents, destroys, or removes toxic chemicals, microbiologicals, or physical hazards. |
| Hazard D | The product is subject to recontamination after processing and before packaging. |
| Hazard E | There is substantial potential for biological, chemical, or physical contamination in distribution or in consumer handling that could render the product harmful when consumed. |

Source: Adapted from USDA.