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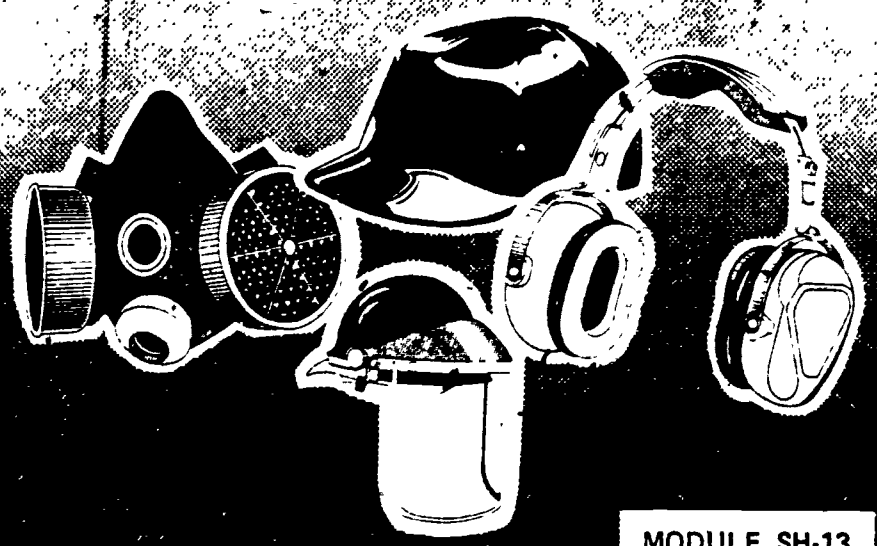
ABSTRACT

This student module on industrial sanitation and personal facilities is one of 50 modules concerned with job safety and health. This module deals wth many facets of industrial sanitation and the facilities industries should provide so that proper health procedures may be followed. Following the introduction, 14 objectives (each keyed to a page in the text) the student is expected to accomplish are listed (e.g., Identify two methods of water purification). Then each objective is taught in detail, sometimes accompanied by illustrations. Learning activities are included. A list of references and answers to learning activities complete the module. (CT)

SAFETY AND HEALTH

INDUSTRIAL SANITATION AND PERSONAL FACILITIES



MODULE SH-13

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INTRODUCTION

Sanitation is a subject that touches everyone on a daily basis. In industry, the health of workers can influence production rates, accident trends, morale, job performance, quality measurements, and even corporate profits. Since the subject of sanitation is such a broad one, it can be expected that some aspect of this field will undoubtedly affect operations during any workday. By becoming more informed about the principles of sanitation, workers will be more prepared to combat the enemies lurking in the workplace that can be detrimental to their health and well-being. Many of these enemies are "invisible" trespassers, in the form of bacteria and other disease-producing organisms.

As early as 400 B.C., Hippocrates taught lessons in sanitation by advising people to boil and filter polluted water before using it for drinking. Yet, it was not until 1675 that bacteria was actually observed and described by van Leeuwenhoek. Even today, the general principles of sanitation are not known to some workers, and are not practiced by many who do know them.

To enable mankind to control those factors in the environment that can harm health and shorten productive lives, an understanding of sanitation is necessary. This module deals with many facets of industrial sanitation and the facilities industries should provide so that proper health procedures may be followed. A discussion of water purification is included, as well as some of the requirements for safe plumbing. Septic tanks, garbage disposal, and the elimination of pests are discussed, as are general principles for the sanitary handling of foods.

OBJECTIVES

Upon completion of this module, the student should be able to:

1. List the five general industrial health areas. (Page 3)
2. Discuss the basic rules for good sanitation. (Page 4)

3. Describe the basic required features for five personal service facilities that contribute to employee health. (Page 6)
4. List three possible causes of worker intake of contaminated water. (Page 12)
5. Identify two methods of water purification. (Page 13)
6. Explain the functions of P-traps, stack vents, interceptors, and cleanouts in the drain and sewer system. (Page 15)
7. Identify at least three conditions that are considered in the placement of septic tanks. (Page 18)
8. Describe proper handling techniques for garbage disposal and refuse collection. (Page 20)
9. Describe three approaches that may be used to control or eliminate pest populations. (Page 22)
10. List and discuss five types of industrial food services. (Page 25)
11. Describe essential features of sanitary kitchen facilities. (Page 27)
12. List the health requirements for food handlers, and name five personal-hygiene practices food handlers should observe. (Page 29)
13. List four precautions for knife safety in the kitchen. (Page 31)
14. Explain the need for controlling temperature to prevent bacterial food-poisoning, and list five types of food that require special care in handling. (Page 33)

OBJECTIVE 1: List the five general industrial health areas.

Sanitation within the work environment is not only vital for the health and well-being of the employees, but is necessary to ensure maximum work efficiency. The comfort and performance of the workforce can be jointly improved by careful management of five general industrial health areas:

- Water purity.
- Personal facilities, such as showers, dressing rooms, or eating rooms.
- Sewage and garbage disposal.
- Food services.
- Heating and ventilation.

To implement principles of sanitation in each of these five general industrial health areas, a manager should be appointed who is capable of objectively viewing the entire work environment. Industrial sanitation problems do not fit neatly within departmental bounds; therefore, the industrial sanitation manager needs to have a "big picture" of the whole company or plant.

ACTIVITY 1:*

Which of the following would be considered part of the general industrial health areas. (Select all that apply.)

___ a. A factory cafeteria.

___ b. The shower facilities in a fiberglass plant.

___ c. The ventilation system in a tobacco factory.

___ d. Noise reduction in an automobile manufacturing plant.

___ e. Toilet facilities in a high-rise office building.

*Answers to Activities appear on Page 35.

___ f. The "break room" of a bank.

___ g. The use of goggles for welding.

OBJECTIVE 2: Discuss three basic rules for good sanitation.

Basic rules for sanitation in industry are threefold, and should include:

- Good housekeeping thoughout the work environment.
- Personal cleanliness of all employees.
- An effective sanitation inspection system.

GOOD HOUSEKEEPING

Good housekeeping means keeping all areas of the workplace as clean as is "reasonably" possible. The nature of some operations may necessarily limit the extent to which this mission can be accomplished. During some production processes, scrap materials and tools may become scattered and disorganized. On a construction site, materials are often unloaded and used on a daily basis. If no plan has been established for cleanup between operations, an accumulation of clutter soon creates many hazardous conditions. A good housekeeping program must be set up on a routine basis. If workers postpone cleanup efforts until the job site has become too cluttered to walk through, an accident may be the unfortunate reminder that it is time to put things in order. The requirements for good housekeeping will vary with each workplace. Within any work environment, emphasis should be placed on maintaining a dry workroom floor. Adequate drainage is of primary importance in areas where wet processes are used and regular vacuuming is necessary where dust is in the work area. Holes, splinters, loose boards, or other defects in the flooring surface should be eliminated to facilitate cleaning.

The use of a central area for tool storage can aid in keeping scattered tools from becoming tripping hazards and in preventing accidents from falling tools. On all jobs, materials that are temporarily stored or stacked

should be stacked carefully so that they will not tip over or slide. Materials should never be stacked or stored in exit areas, in front of fire extinguishers, on stairways, or in hallways leading to exits, or within the path of normal foot traffic.

In areas where solvents are stored, handled, or used, good housekeeping is essential. Spigots and containers should be maintained in good conditions so that no drips or leaks can occur. Spills of solvents or any toxic substances should be cleaned up immediately by workers who are wearing the proper protective clothing. Procedures for cleanup of toxic spills should be taught to the workers who will be responsible for removal of spilled substances. Manufacturers will provide Safety Data Sheets that give information about cleanup and disposal of chemicals they sell.

PERSONAL CLEANLINESS

All employees should receive instructions in the personal cleanliness that is relative to their work activities. Although procedures will vary according to specific exposures to chemicals, dusts, and other substances, frequent washing is the basic preventive measure. In industries where workers are exposed to solvents, epoxy resins, insecticides, or other skin irritants, cleanliness must be practiced and supervised carefully. Facilities for showering and handwashing on the worksite will be discussed in Objective 3. Personal protective equipment (PPE) or clothing may be required to provide a barrier against skin irritants. Protective creams such as vaseline or cold cream may offer some protection to the skin and facilitate removal of dirt from the pores during washing. For some substance exposures, it may even be necessary for workers to shower and change clothing before leaving the workplace. In other industries, it may be necessary for workers to shower or use special cleaning agents before entering the workplace. Personal cleanliness is extremely important in food processing industries to prevent product contamination by disease-producing germs.

SANITATION INSPECTION

An effective sanitation inspection system must be established and used to maintain housekeeping and personal cleanliness at a satisfactory level. Sanitation is not a condition that can be achieved and then forgotten. Continued attention and regular monitoring is essential in preventing a reversion to old habits of poor sanitation. Workers perform an essential housekeeping task when they report to supervisors all inadequate sanitation procedures and equipment.

ACTIVITY 2:

1. List five aspects of good housekeeping.
   a. _____
   b. _____
   c. _____
   d. _____
   e. _____
2. List three types of substance exposures in industry that require workers to be especially careful about personal cleanliness.
   a. _____
   b. _____
   c. _____
3. In which industry would disease-producing germs brought into the plant by workers be of particular concern? _____

OBJECTIVE 3: Describe the basic required features for five personal service facilities that contribute to employee health.

Five types of personal service facilities contribute to employee health and comfort: drinking fountains, washrooms, locker rooms, showers, and toilets.

DRINKING FOUNTAINS

In hot work environments, or on jobs that require heavy manual labor, water must be readily available. One drinking fountain should be provided for approximately every 50 employees. Not all drinking fountains, however, can be considered sanitary or even safe. A fountain with a vertical jet rising through a cup-shaped apparatus is hazardous to health. Water that has come in contact with lips can contaminate the fountain opening and spread disease such as tuberculosis, diptheria, and other respiratory infections. For a drinking fountain to be sanitary, it must have an angle jet (see Figure 1) and a lip guard. These measures prevent contamination of the water jet by the lips, or by water that has contacted the lips. Also, it is important that the jet opening be positioned at a height above the rim of the bowl so that stoppage will not cause cross-connection or contamination of the opening.

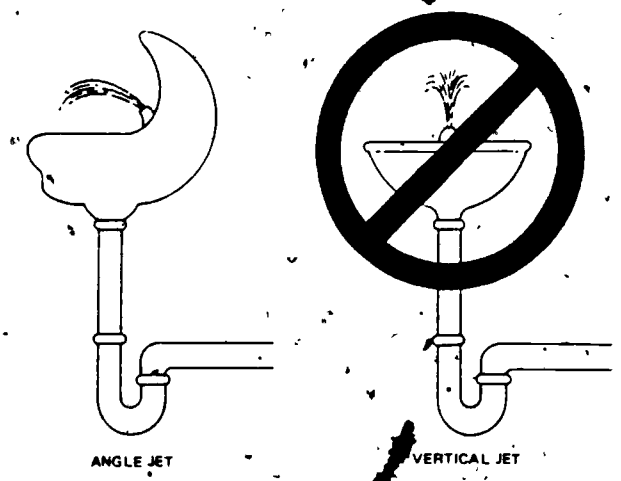

Figure 1. An angle jet on water fountains prevents contamination by the users.

On construction jobs, city water can generally be piped in and extended to the upper floors as the building is erected. On highway, pipeline, or power line construction, as well as in timber clearing, portable drinking fountains can provide needed drinking water. Containers for these fountains should be sterilized daily with steam, boiling water, or chlorine solution.

Vacuum bottles are occasionally found in offices and can be a hazard. Bacteriological tests should be done frequently to ascertain the quality of water from these bottles. Bottles should be rinsed daily and disinfected routinely to guard against contamination.

Common drinking cups are prohibited in all workplaces. Paper cups dispensed from a sanitary container should be used once and then thrown away.

WASHROOMS, LOCKER ROOMS, AND SHOWERS

An adequate number of washrooms and locker rooms supplying hot and cold running water should be provided throughout the industrial plant. One washbasin is recommended for every 10 employees, but a greater number may be necessary in certain industries, depending on the nature of the operation.

Circular washing fountains can facilitate sanitation in the washrooms. These fountains provide a center water spray that can be operated by a foot treadle, allowing a number of persons to wash at one time. (See Figure 2.)

Dirty wash water should never be allowed to stand in wash basins for any length of time. To prevent such an unsanitary condition, washbasins should not be equipped with stoppers.

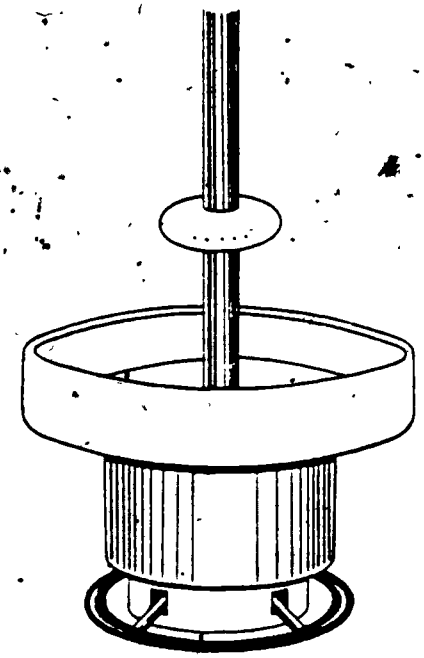

Figure 2. Circular washing fountain with foot treadle.

Handwashing should always be done under running water with plenty of soap. Nonalkaline soaps in liquid or powder form are preferable. Soaps with mineral abrasives or strong alkali content can promote dermatitis (inflammation of the skin).

Common-use towels are prohibited. Paper towels or warm air blowers that are convenient to the washbasin should be provided. Blowers should provide air between 90 and 140 degrees F for quick and sanitary drying.

Floors of washrooms and locker rooms should be constructed from nonabsorbent material such as ceramic tile, glazed brick, or concrete. Walls should also be of nonabsorbent materials to a height of at least five feet. Flooring materials such as terrazzo and marble are very slippery when wet. Concrete floors, with a layer of abrasive grain or with abrasive strips, are much less hazardous.

Lockers should be well ventilated so that work clothing can be hung to dry or air. If lockers with sloped tops are provided, the tops cannot be used for storage of discarded articles. Two separate lockers will be required for employees working with toxic materials to keep street clothing from being contaminated by work clothing.

In industries where employees are exposed to high temperatures or dust, showers should be installed. Sanitation in shower rooms includes good ventilation, adequate lighting, and daily cleaning of shower floors with hot water and disinfectant. Mold and fungus can grow rapidly in damp, dark areas. Athlete's foot and ringworm infection can spread from one employee to another if disinfectants are not used on a continual basis.

Figure 3. Emergency flood shower.

Emergency Showers and Eyewash Stations

In areas where toxic or irritating chemicals are used, emergency flood showers (Figure 3), and eyewash fountains (Figure 4) should be provided. Emergency flood showers are designed to wash off a chemical before it has time to act. It is important that these showers be able to spray a great quantity of water quickly. In situations where portable showers are used, the connecting hose should be large enough to supply an adequate spray.

TOILETS

Flush toilets should be located not more than 200 feet from any workplace. Toilet paper with holders must be provided for each facility. For every three toilets, at least one washbasin should be installed in the toilet room. The Occupational Safety and Health Standards for General Industry specify minimum toilet requirements based on the number of employees in the plant. (See Table 1.)

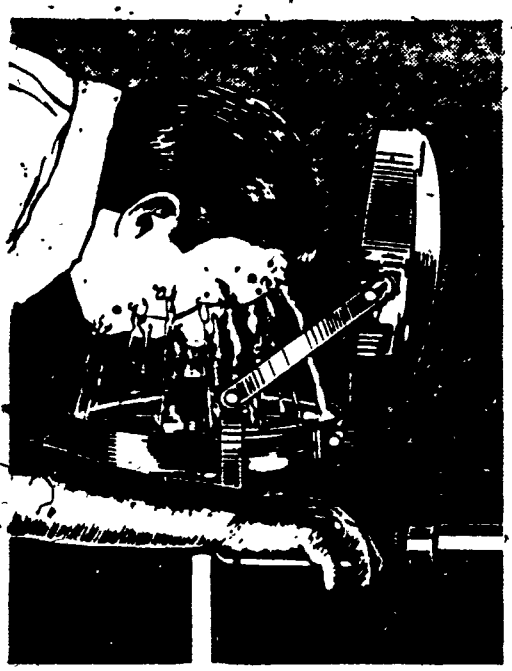

Figure 4. Emergency eyewash fountain.

Toilet rooms should be well ventilated with either six square feet of window ventilation or enough forced ventilation to change the air at least three or four times per hour.

Privies or chemical closets should not be used in industry unless no other method is feasible because of the remoteness of the worksite. Both privies and chemical closets are types of outdoor toilets. Privies are usually of concrete-slab construction over a wood pit. Chemical closets utilize a tank that is charged with water and caustic soda to reduce odor and bacterial growth. Neither of

TABLE 1. MINIMUM TOILET FACILITIES.

Number of employees	Minimum number of water closets*
1 to 15	1
16 to 35	2
36 to 55	3
56 to 80	4
81 to 110	5
111 to 150	6
More than 150	One additional fixture for each additional 40 employees.

*Where toilet facilities will not be used by women, urinals may be provided instead of water closets, except that the number of water closets in such case shall not be reduced to less than 2/3 of the minimum specified.

these facilities should be constructed without prior approval from appropriate health authorities.

ACTIVITY 3:

1. Which of the following is not a preferable characteristic for a drinking fountain?
   a. A vertical jet.
   b. A lip guard.
   c. An angle jet.
   d. Jet opening above bowl rim.
2. Which of the following should not be found in sanitary washrooms, locker rooms, or showers?
   a. Disinfectants for floor cleaning of shower rooms.
   b. Two separate lockers for employees who work with toxic materials.
   c. Common-use towels.
   d. Abrasive strips or coatings on floors of washrooms or locker rooms.
3. Which of the following is not an essential consideration for sanitary toilets?
   a. Good ventilation.
   b. Proper number of toilets based on number of employees in plant.
   c. Provision of toilet paper.
   d. Chemical air fresheners.

OBJECTIVE 4: List three possible causes of worker intake of contaminated water.

Potable water, or water approved for drinking, is usually supplied to industry from the municipal water supply. Because purity is controlled by local health officers, municipal water is considered safe for drinking,

washing, food preparation, and laundry. After potable water reaches the plant, however, there are numerous ways in which it may become contaminated.

Both potable and nonpotable piping systems may be located throughout the plant. Nonpotable water may be used in industrial processes for fire fighting purposes or for cleaning work areas. If piping systems and faucets are not clearly marked (see example in Figure 5), nonpotable water may be mistakenly used for drinking water. Workers should observe all warnings against drinking nonpotable water.

Drinking water can become contaminated through improper installation of plumbing, or improper maintenance of drinking water system.

Figure 5. Nonpotable water should be clearly marked.

A cross-connection in plumbing is any physical link or arrangement between two piping systems, causing potable water in one system to be contaminated by nonpotable water in the other. Cross-connections have caused outbreaks of typhoid fever, infectious hepatitis, and dysentery. These communicable diseases are easily transmitted when sewage of infected persons contaminates food or water. Disease-producing organisms may be spread by unwashed hands or flies, as well as directly through plumbing cross-connections. Adequate plumbing installation will prevent contamination through cross-connection.

Improper maintenance of the drinking water system can cause contamination, also. If sewage pipes are subject to impact, vibration, or corrosion, cracks or leaks in the joints may occur. Sewage may enter groundwater or the joints of pipes supplying potable water. Leaking overhead plumbing is often a source of contamination in basement storage areas.

Piping systems opened for repair may be contaminated if pipes are not flushed and disinfected after maintenance is completed.

Water should not pool or collect in any part of a piping system. Dead-end runs of pipe should be eliminated to prevent the occurrence of such an unsanitary condition.

ACTIVITY 4:

Which one of the following is not a likely cause of worker intake of contaminated water?

a. Inadequate labeling of nonpotable water.

b. A cross-connection in plumbing.

c. Unwashed hands or flies.

d. Opening pipes for repair and neglecting to flush and disinfect them afterwards.

OBJECTIVE 5: Identify two methods of water purification.

If potable water for industry cannot be obtained through a municipal water system, water purification can be partially or completely accomplished by filtration and chemical disinfection.

Filtration is the purification of water by removal of suspended material (clarification). This can be accomplished by gravity, or with slow and rapid sand filters, or by pressure in a vacuum tank.

Rapid sand filters clarify water at a rate of about 3,000 gal per square foot of filter surface area, per day. If properly operated, this system is approximately 98 percent effective in removing bacteria.

Disinfection is the killing of pathogens (disease-producing organisms) in water. The term "sterilization" is often used incorrectly to describe the same process. Sterilization destroys all living organisms, while disinfection kills only those organisms that are capable of producing disease. Differences in the meanings of the two terms should be noted.

Even though a water supply has been filtered, it is important that it also be disinfected to assure that no pathogens are present. Of the many different agents which can be used to disinfect drinking water, chlorine is the most common. It is both economical and convenient to use. Chlorine

compounds are marketed in various strengths according to "available chlorine" content as follows:

Agent	Available Chlorine
Chlorinated lime or bleaching powder	33.5 to 39 percent
Calcium hypochlorite	70 percent
Sodium hypochlorite	10 to 16 percent

Chlorine, pressurized to become a liquid, is sold in drums and cylinders of various capacities. Liquid chlorine, which has an available chlorine content of 100 percent by weight, becomes a gas when the pressure is released. This gas is then introduced into the water supply by a gas chlorinator.

Powdered chlorine compounds are applied to water mechanically, by means of a hypochlorinator. Hypochlorinators are most commonly used to apply small quantities of chlorine. Larger quantities of chlorine are often fed by gas chlorinators.

Because of the deadly nature of chlorine gas, special precautions for storage and ventilation need to be taken when gas chlorinators are used. Liquid gas cylinders and the chlorinator should be housed in a room ventilated with forced air exhaust ducts at floor level. These ducts should be capable of changing the air within the room every two minutes.

A chlorine gas mask or a self-contained breathing apparatus should be accessible outside the chlorinator room, and the door to the chlorinator room should have a glass inspection panel.

ACTIVITY 5:

Fill in the blanks. (One word is used twice.)

1. _____ _____ _____ systems can be about 98% effective in removing bacteria.
2. _____ is the purification of water by removal of suspended material.

3. _____ can be accomplished by gravity, with slow and rapid sand filters, or by pressure in a vacuum tank.
4. _____ is the killing of disease-producing organisms in water.
5. _____ is a process that destroys all living organisms.
6. Gas chlorinators require special precautions because chlorine gas is _____.

OBJECTIVE 6: Explain the functions of P-traps, stack vents, interceptors, and cleanouts in the drain and sewer system.

The building sewer, also called the sanitary sewage system, is the drainage system that carries sewage and other liquid waste from the building or plant to the public sewer system. The building sewer begins inside the property line, and ends about five feet from the outside building wall, where it connects to the building drain. The building drain is located within the building wall line and is the main route for drainage of sewage and liquid waste. Openings are often left around drainage that go into the building through exterior walls; this is done in order to prevent damage to pipes when the foundation settles. Snugly fitting metal collars should be installed around these pipes to prevent rats and mice from entering the building through the openings.

Fixture drains (also called waste pipes) carry liquid, other than body waste, from a fixture to another drain pipe. Fixture drains must have proper traps to prevent sewer gases and rodents from entering the building. A trap provides a liquid seal in the drainage system without slowing or stopping the free flow of waste water. The P-trap (named for its shape) is probably the most practical trap for washbasins, sinks, and similar fixtures. (See Figure 6.) Venting of the P-trap is not necessary if it is properly located to receive air flow from a waste stack into which waste pipes discharge.

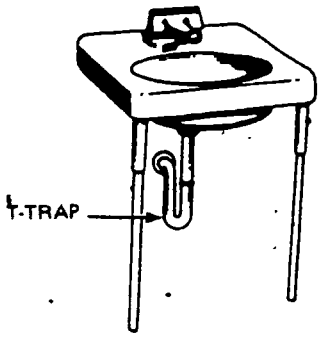

Figure 6. P-trap on sink.

Soil stacks receive wastes discharged from water closets. If the stack receives wastes from fixtures as well as water closets, it is called a soil and waste stack. Stacks must be vented to allow air to flow freely within the system and prevent back siphonage, which can cause a loss of seal. A stack vent extends from the soil stack (or soil and waste stack) up through the roof of the building. Local and national plumbing codes should be consulted for proper sizing of the vent system. It is important that stack vents be open to the outside air. If they open to an attic area or break off and vent into an enclosed space, dangerous sewer gases can accumulate, contaminating breathing air and providing possible fuel for an explosion or fire.

Interceptors, which are also called traps, are required in commercial or industrial buildings to remove objectionable substances such as grease, oil, lint, sand, hair, glass, and other material that can easily clog the drainage lines.

Service stations, carwashes, and other businesses where a lot of dirt and grease is disposed of and could enter the drainpipes, need to have interceptors to separate the dirt and grease from the water. Debris substances are collected in the interceptor trap, which should be of an appropriate size and type. Interceptors should be located for easy access so that they can be routinely cleaned. When interceptors are not provided where needed, or are not properly maintained, oil and dirt can create problems in the building sewer lines.

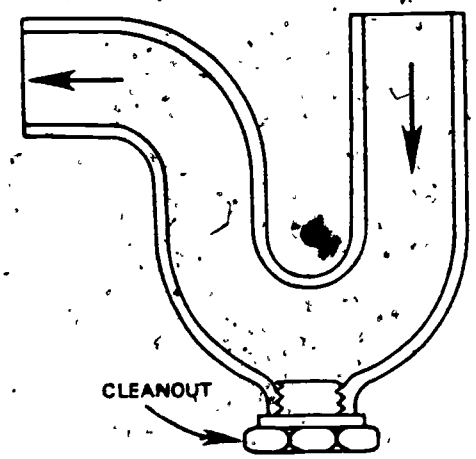

Figure 7. Cleanouts provide easy access to drainage pipes.

Cleanouts provide easy access to drainage pipes (see Figure 7). Cleanouts are required in buildings because all drainage pipes are subject to stoppages. Before cleanouts were required by plumbing codes, many unsanitary conditions resulted from makeshift repairs. Holes were cut in drainage pipes so obstructions could be cleared and then were patched with cement. Raw sewage often seeped out onto the ground through deteriorated patch jobs. Today, plumbing codes dictate location, size, and distance between cleanouts. These requirements should be carefully checked and adhered to.

ACTIVITY 6:

Match the correct definition on the right with the word on the left.

1.	P-trap.	a.	Allows sewer gases out, air flow in the system, and prevents back siphonage which would result in loss of the seal.
2.	Stack vent.	b.	Separates dirt and grease from water in industrial or commercial settings where a lot of dirt and grease is disposed of.
3.	Cleanout.	c.	Provides a liquid seal in wash basins and sinks.
4.	Interceptor.	d.	Places where repair persons can have easy access to drainage pipes.

OBJECTIVE 7: Identify at least three conditions that are considered in the placement of septic tanks.

Septic tanks are used when public sewers are not available for disposal of sewage. There is still controversy as to whether septic tanks are completely safe, and it must be recognized that septic tanks do not purify sewage. The waste material from a septic tank may still contain bacteria capable of causing disease. However, septic tanks are great improvements over cesspools and outhouses, which were commonly used not too many years ago. Untreated sewage from such sources was responsible for the spreading of diseases such as cholera and typhoid.

A septic tank is a large, airtight tank that receives the sewage discharged from a building drainage system. The tank serves as a settling place to separate solids from liquid waste. Sewage is held in the septic tank for at least 12 hours. This retention period for a given tank size is based on the anticipated flow of sewage for a 24-hour period. During this period, heavier suspended solids settle to the bottom of the tank to form a sludge layer, and lighter particles form a scum that floats at the tank top. Both sludge and scum begin to decompose due to the action of bacteria. The relatively small amounts of sludge that are not converted to gases or liquid during decomposition will continue to accumulate, and will require that the tank be cleaned at intervals by a certified firm. Sludge should not be permitted to accumulate to a level too close to the outlet opening.

Fiberglass or metal septic tanks can be purchased but these tanks are not suitable for all industries. Precast concrete or cast-in-place septic tanks are most commonly used and meet nearly all code requirements.

Septic tanks must be located at least 50 feet from any sources of water used for drinking. The physical features and high-water levels of the area must be studied to make certain that tank outlet pipes are at an elevation below surrounding water sources.

The septic tank waste material runs through a distribution box to ensure a uniform flow of waste through the disposal field lines. The distribution box should have a removable cover so the sewage can be visually inspected, on a regular basis, for sludge overflow. (See Figure 8.)

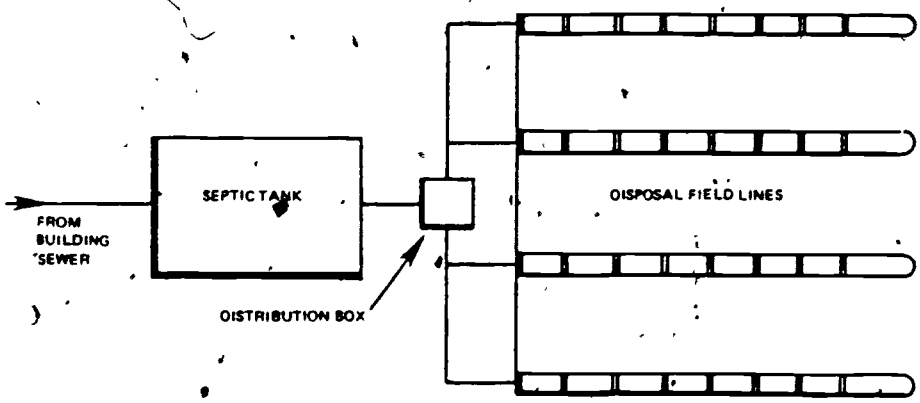

Figure 8. Septic tank, distribution box, and disposal field lines.

Disposal field lines may be made with jointed or perforated drain tile, block, plastic perforated tubing, or other approved materials. Liquid sewage flows through this piping material and seeps into the soil at a rate determined by the type of soil. The time required for water to be absorbed by the soil is called the percolation rate. Soils with high clay content provide very poor drainage. Limestone formations in disposal fields are also undesirable as they frequently crack and can cause contamination to enter well water or springs. Normally, disposal fields should be located at least 100 feet from any water supply as a precaution against accidental contamination.

Failures in the disposal field may occur because of unfavorable soil conditions or sludge that clogs the field lines. Proper monitoring of the waste materials at the distribution box can prevent such accidents from occurring. Cleaning agents containing sodium or potassium hydroxide should not be used to clean septic tanks. They can cause soil clogging that will allow water to stand in pools on the ground surface.

ACTIVITY 7:

Circle True or False.

True	False	1.	Septic tanks must be at least 50 feet from any water supply.
True	False	2.	Tank outlet pipes must be below surrounding water sources.
True	False	3.	Soils with high clay content provide very poor drainage.
True	False	4.	The distribution box should be inspected regularly.
True	False	5.	Sodium or potassium hydroxide are excellent cleaning agents for septic tanks.

OBJECTIVE 8: Describe proper handling techniques for garbage disposal and refuse collection.

Proper handling of garbage and refuse involves many areas of concern for industry. A sanitary environment cannot be maintained by merely providing containers for garbage and refuse collection. Careful planning is necessary to determine the type of container to purchase, the number of containers required, convenient placement of containers, separation of wastes, and routine cleaning schedules.

The term "garbage" is generally used to describe waste from various stages of food processing that will readily decompose and putrify. Wastes such as paper, glass, wood, and scrap metal that do not undergo putrification are referred to as "refuse."

Food waste disposers or garbage grinders are used by many businesses as a convenient and efficient method of garbage disposal. Food waste is ground and flushed into the municipal sewage system, thus eliminating any need for storage or collection. Kitchen employees should exercise care to keep silverware and other nonfood items out of garbage disposers. The trap and catcher on disposers should be cleaned daily. The disposer should be turned

off and the power disconnected before any attempt is made to clean or clear the trap.

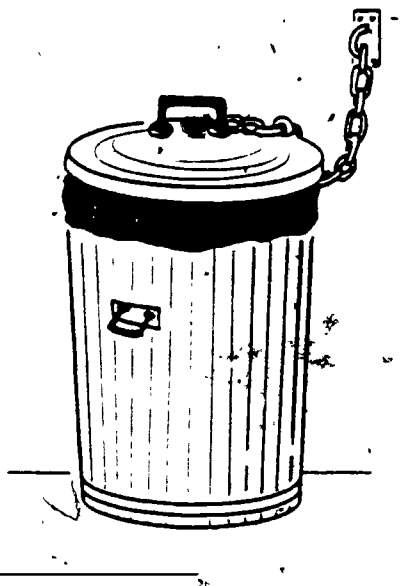

Figure 9. Garbage can with security chain attached to lid.

Storage containers used for temporary waste storage may be constructed of galvanized metal or plastic. Plastic is lightweight, but it can be easily gnawed through by rats. Garbage cans constructed of 26- to 30-gage galvanized metal are preferable for commercial or industrial establishments. The weight of the container and contents should not be so heavy that it cannot be easily handled by one person. Lids should fit tightly, and if a security chain is attached, lids will not be misplaced. (See Figure 9.) Paper or plastic liners in garbage cans can facilitate garbage collection and reduce cleaning time. Many industries use bulk containers or "dumpsters" of various sizes for refuse and garbage disposal. Most of these bulk containers are designed to be emptied mechanically by collection vehicles.

If refuse is not mechanically collected, care should be taken to ensure that broken glass, packing blades, or other sharp objects are disposed of in specially designated containers. This will prevent needless accidents during refuse collection. Refuse collection workers experience a high rate of injury due to the unintentional "booby traps" created by careless disposal of refuse.

Improper storage of garbage and refuse provides food, harborage, and breeding sites for disease-spreading insects and rodents. Garbage cans should be strategically placed for proper disposal of food scraps left from employees' lunches. Human carelessness can encourage pest problems in any industry.

ACTIVITY 8:

Fill in the blanks.

1. Garbage describes _____ waste.
2. _____ describes paper, wood, glass, and metal.
3. The power on a garbage disposer should be turned off and _____ before any attempt is made to clean or clear the trap.
4. _____ objects should be disposed of in special containers to prevent injury to refuse collection workers.

OBJECTIVE 9: Describe three approaches that may be used to control or eliminate pest populations.

Certain industries are more vulnerable to insect and rodent infestations because of their characteristic operations. The control of insects in food processing plants demands that floors, walls, and ceilings of the entire plant be kept scrupulously clean. All crevices and holes in floors and walls should be sealed with caulking compound to facilitate cleaning and prevent insects from entering buildings. Some structural conditions can encourage insect and rodent populations: false ceilings, cracks under door and window frames, screens with holes or improper fit, and enclosed areas under cabinets and stairs. Equipment placed too close to walls can hamper cleaning and provide a place for insects and rodents to hide.

Galvanized hardware cloth, sheet steel, or metal screens placed at the base of foundations can help to prevent entry by rats, skunks and other small animals. Where drain pipes enter the building, metal collars around the pipes prevent animals from entering. (See Figure 10.)

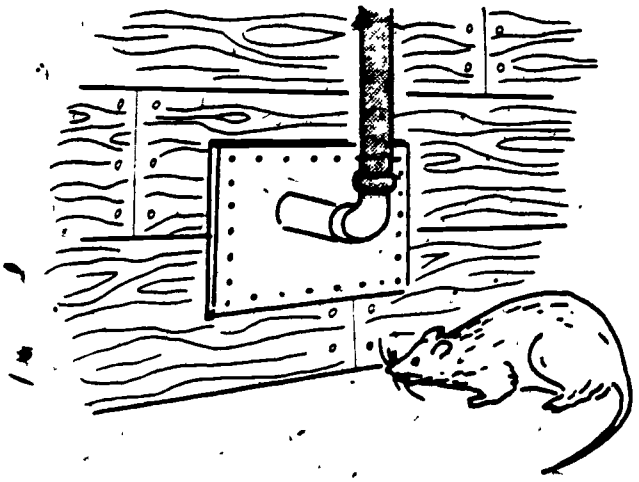

Figure 10. Sheet metal collar around pipe can help to prevent rodent entry.

Flies and rodents are a frequent problem in feedlots and slaughter houses. Large numbers of flies breed in manure, and rats flourish on feed that is intended to fatten cattle.

In foundries, flour is used in the manufacturing process (to seal molds). The flour provides both food and a breeding site for insects if it is not stored properly in sealed bins.

Mosquitoes lay their eggs in standing water. Even small quantities of water, such empty tin cans or discarded tires, provide inadequate breeding areas. Mosquitoes can find breeding sites around many industrial areas, especially cooling towers, settling basins, and waste water discharged from industrial processes. If breeding sites cannot be eliminated by filling or draining, they may need to be treated with chemical larvicides.

Several other types of animals can also create sanitation problems: raccoons, skunks, opposums, squirrels, rats, and mice. Some of these animals create problems by their presence alone. Careful study can determine structural entry points used by these animals, and entry points can be blocked. Animals such as rats and mice are sometimes more difficult to eliminate. Some rats, for instance, travel almost exclusively above ground level. These roof rats easily walk on electrical power lines from building to building and can enter through holes no larger than the size of a quarter ($0.25). Other rats are ground dwellers; however, they, too, can enter through extremely small openings. Dockside grain storage facilities, food storage warehouses, and animal and plant processing facilities are ideal habitats (living places) for various rodent pests.

The most effective way to control and eliminate rodent infestations is through proper housekeeping practices and structural modifications. If a colony is already established, an extermination procedure may need to be conducted.

Small scale extermination of rats can be accomplished with traps or anticoagulant baits, but large infestations warrant professional examination. Professional exterminators are better equipped and better trained to handle poisonous chemicals than are nonprofessionals, and are licensed to do so legally. Before extermination takes place, all plant departments and food vendors should be contacted, and necessary preparations should be made to protect food from contact with harmful chemicals.

Extermination is only the final step in the elimination of pest problems. To prevent reoccurrence of pest infestation, all of the following approaches should be considered:

- Isolate or eliminate the habitat of the pests. Determine where the pest lives and clean up that area. If the pest is entering from outside the building or area, determine points of entry and try to eliminate them.
- Isolate or eliminate the food supply. In some manufacturing processes, it may be possible to eliminate the food supply without stopping production. In that case, frequent and careful inspection, good housekeeping, and proper storage techniques should be used.
- Exterminate existing populations.

These ideas and approaches can be used with industrial and commercial facilities as well as in the home. Local county extension agents can also be contacted for assistance and answers to sepcific questions.

ACTIVITY 9:

Choose the best answer.

1. Isolating or eliminating the pest habitat would include all except which of these actions:

   a. Placing wire mesh or metal screens at the base of foundations.

b. Observing where the pest lives and cleaning that area.

c. Sealing holes and crevices in the inhabited area with caulking compound.

d. Placing poisonous substances in the food supply of the pests.

2. Extermination is best carried out by professionals because:

a. They are licensed to handle poisonous chemicals.

b. They have the equipment and training needed to handle poisonous chemicals.

c. Both a and b.

3. The food supply of pests may be able to be eliminated economically through all except which of the following actions:

a. Frequent and careful inspection.

b. Stopping all production.

c. Good housekeeping.

d. Proper storage techniques.

OBJECTIVE 10: List and discuss five types of industrial food services.

Special consideration should be given to nutritional needs of employees. Good nutrition can increase job performance and reduce accidents that are due to fatigue.

If a food service establishment is not located near an industrial plant, then the company should provide some type of food service for its employees. There are basically five types of industrial food services that can provide nutritional in-plant meals:

1. Cafeterias.
2. Canteens.

3. Mobile canteens.
4. Box lunch service.
5. Vending machines.

Cafeterias are, by far, the preferred form of food service. Well planned, hot meals can be prepared and served with strict adherence to sanitary procedures.

Canteens serve a limited variety of foods that are usually prepackaged, such as a variety of sandwiches. Hot and cold beverages are also dispensed.

If mobile canteens are utilized, care should be taken that food is eaten in designated areas only. This will prevent contamination of food by hazardous materials in the work environment, and will reduce the possibility of attracting insects and rodents throughout the plant.

Box lunch services are prepared meals served in individual boxes. The food is often nutritious, but is usually served cold.

Vending machines have become a familiar sight in most industries. It has been estimated that 80 percent of industrial plants use vending machines of some kind, and one-fourth of these are utilized as the only food service within the industry. Vending machines are often chosen because they can be conveniently located, and are completely self-service. To adequately fulfill the need for mid-shift nourishment, vending machines should be stocked with a variety of nutritional foods.

ACTIVITY 10:

Which type of industrial food service is the one most preferred for serving nutritious, hot meals?

a. Vending machines.
b. Box lunch service.
c. Canteens.
d. Cafeterias.

OBJECTIVE 11: Describe the essential features of sanitary kitchen facilities.

If an industry has in-plant kitchen facilities, every effort should be made to keep this area as clean as possible. Only authorized food handlers should be allowed in the kitchen area. Layout and equipment should allow for separation of clean and soiled operations. Dishwashing rooms are often located adjacent to kitchen areas, but separated by a wall or partition. Food products and supplies should enter the kitchen through a receiving room or area. This procedures will prevent boxes or cartons that have contacted floors from contaminating clean preparation tables. Also, as supplies are unpacked, cleaning agents and nonfood items can be sorted for separate storage.

Ranges should be hooded and ventilated, and frequent cleaning should be done to prevent grease from accumulating in the duct work. Hoods should be equipped with automatic fire extinguishers because of the danger of grease ignition (catching on fire).

Refrigerators should be cleaned routinely with a disinfecting agent to prevent mold from growing. Food should never be stored on refrigerator shelves, against refrigerator walls, or so that raw foods come in direct contact with prepared foods. Covered plastic containers are preferred for food storage. Acid foods should not be stored in galvanized or cadmium-plated cookware. Grey enamelware is also unsuitable as it contains antimony that can poison foods.

Cutting boards, meat slicers, grinders, utensils with wooden handles, or dishes with cracks or chips are frequent sources of contamination in kitchens. Wooden cutting boards are very unsanitary, and should be replaced with a molded plastic type. Raw foods and cooked foods should not be cut on the same board without thorough cleaning between operations. Meat slicers and grinders should be scrubbed between operations when different kinds of meat are prepared, and after each usage. Any chipped or cracked dishes

should be discarded, since the cracks provide spaces for germs to collect and multiply.

All possible entries for rodents or insects should be eliminated. Any spilled food or trash should be cleaned up immediately so that it does not attract pests. A professional exterminator should be called if any evidence of rodents or insects is noticed in the kitchen.

If dishwashing machines are used they should be kept clean and in good operating condition. Dishes and utensils should be scraped, pre-rinsed, and loaded loosely into trays so that all surfaces can be thoroughly washed. Dishes must be immersed in water at least 170 degrees F for 2 minutes to be effectively sanitized. If water temperatures cannot be maintained, chemical sanitizing agents should be used.

The surfaces of all preparation tables, cabinets and similar parts of the kitchen can be a major factor in the spread of bacteria, with the consequent risk of disease. All surfaces should be cleaned with an effective germicide before and after use every day.

The best flooring for a kitchen is probably a concrete subfloor covered with a generous coating of polyurethane resin; this is a continuous, easy to keep clean, attractive in appearance, and has a good nonslip surface, even when wet or greasy. Floorboards of ordinary softwood are quite unsuitable. They shrink, resulting in open joints, and in these gaps food waste and grease can collect. Bacteria multiply in the pores of the wood, and vermin such as roaches can live in the subfloor cavity and come up through the cracks between the boards.

Sinks should be of stainless steel or porcelain, as should drainboards. Pieces of wood should not be used as edging, as they often become miniature cesspools in which food residues collect and bacteria and roaches breed.

Preparation tables should always be movable, and if they are set against a wall no backboards should be used. It is far better for a small amount of food to fall onto the floor from the back of a preparation table (where it will be seen and cleaned) than for scraps to collect behind a backing board.

ACTIVITY 11:

(Fill in the blanks.)

1. Layout and equipment arrangement of sanitary kitchen facilities should allow for separation of _____ and _____ operations.
2. Food products and supplies should enter the kitchen through a _____ _____ or area.
3. Ranges should be _____ and _____.
4. Hoods should be equipped with automatic _____ _____ because of the danger of grease fires.
5. Refrigerators should be cleaned regularly with a _____ agent to prevent _____ from growing.
6. Wooden cutting boards are very _____.
7. Chipped or cracked dishes should be _____.
8. The best flooring for a kitchen is probably a _____ subfloor covered with _____ _____.
9. Sinks should be made of _____ _____ or _____.
10. Preparation tables should always be _____, so food scraps will not collect.

OBJECTIVE 12: List the health requirements for food handlers, and name five personal hygiene practices food handlers should observe.

Most state laws require food handlers to have health certificates indicating they are free from tuberculosis and venereal disease, and are not carriers of typhoid fever or diptheria. Examinations and tests are usually required annually for renewal of certificates.

Food handlers with infected cuts, sores, pimples, eye inflammations, sore throats, nasal discharges, or diarrhea should not work in food preparation areas until released by a physician.

All food handlers should practice good personal hygiene by scrubbing hands with soap and water after using the restroom, smoking, or touching soiled objects. Food handlers should shower daily, and wear clean clothes; nails should be kept short and clean; hair should be washed frequently and secured either with a hat or net; and aprons should be changed frequently. It is also important that handlers wash their hands between operations to prevent cross-contamination. For example, hands should be washed between handling raw meat and serving cooked products.

ACTIVITY 12:

1. Name the two diseases food handlers must be free of and the two of which they must not be carriers.
   a. _____
   b. _____
   c. _____
   d. _____
2. Fill in the blanks.
   Food handlers with _____ cuts, sores, pimples, eye inflammations, _____ throats, nasal _____, or _____ should not work in food preparations until released by a physician.
3. List five good personal hygiene practices for food handlers.
   a. _____
   b. _____
   c. _____
   d. _____
   e. _____

OBJECTIVE 13: List four precautions for knife safety in the kitchen.

Experience shows that knife safety can realistically be obtained by supervisors stressing the basic control measures that should be applied in the kitchen. Some of these measures are:

- Proper selection, shaping, and guarding of knives.
- Proper sharpening and maintenance.
- Proper storage of knives at all times.
- Safety training in the proper use of knives.

The selection of knives to be used in the kitchen must be carefully supervised. Without proper guidance, employees may select tools that are unsuitable for their work. Such practices will result in an uneconomically large inventory of many shapes, sizes, and flexes of knives. Therefore, it is desirable to establish uniform types of knives for work that has basic similarities.

By tradition, knife manufacturers sharpen knives to a needle point. Studies show that stab wounds are usually severe. The possibility of a stab injury can be greatly reduced by removing the point from the knife if it is not absolutely needed in the performance of the job. Therefore, it is important that the supervisor be vigilant and be sure that points are not resharpened once they have been removed.

Knives that are not in use should be stored in safe places, such as table slots or knife scabbards. Studies reveal that approximately 25 percent of a large group of knife injuries had their origin in the mishandling and improper sheathing or storing of knives.

Two knife workers should never work on the same block or piece of material, at the same time, on any kind of job setup, because of the hazard of cutting one another. Knife work always requires close attention and concentration to achieve accuracy. Workers cannot concentrate on two things - doing their job and not cutting their co-workers.

A history of very serious accidents and fatalities arises from the strong inclination of knife workers to pick up and position products with their knives. A typical example is the worker who used his knife to pick up a ham prior to boning. The knife slipped out, struck his eyeball, and pierced it, causing the loss of the sight in his eye. In another instance, a worker who was positioning a ham for sectioning, struck the bronchial artery of his left arm and nearly bled to death.

Efficiency can be increased and operating costs reduced by the proper training of kitchen workers who use knives as part of their job. Supervisors must demand complete compliance with the standard safety rules of the kitchen at all times.

ACTIVITY 13:

(Fill in the blanks.)

1. Studies show that stab injuries from knives can be greatly reduced by _____ the _____ of the knives.
2. Knives that are not in use should be stored in _____ places, such as table _____ or knife _____.
3. Two knife workers should _____ _____ on the same block or piece of materials.
4. Knife workers should never _____ up and _____ products with their knives.

OBJECTIVE 14: Explain the need for controlling temperature to prevent bacterial food poisoning, and list five types of food that require special care in handling.

Most bacteria thrive in warm temperatures. Disease-producing organisms that cause food poisoning grow at temperatures between 45 and 140 degrees Fahrenheit, which is referred to as the temperature "danger zone." If food can be kept hot or cold, bacteria are kept dormant. When foods are being

prepared at room temperature, any bacteria that enters the food will begin to grow. Growth is very slow for about four hours. This period is called the "lag phase" and is a very important factor in the control of bacterial growth. If foods can be handled quickly in the temperature danger zone, bacterial growth is kept to a minimum.

Bacteria is more likely to grow in certain foods that are low-acid, such as eggs, custards, milk, fish, meat, gravies, poultry, and salad dressings. These foods have been labeled potentially hazardous by health officials and should be kept refrigerated until they are to be used. If these foods are cooked, they should be heated to temperatures above 140 degrees F and served immediately. Any leftovers should be refrigerated immediately after the meal is served, and not held on a warmer for later meals.

Food poisoning bacteria produce a toxin (poison) that is released throughout the food at a slow rate during the lag phase. After the lag phase, rapid bacteria growth takes place, allowing the toxin to saturate the food. If the food can be refrigerated or thoroughly cooked early in the lag phase, the toxin production will be brought to a standstill. Whether a person becomes seriously ill after eating this food depends upon the amount of toxin in the food. Thorough heating will kill the bacteria, but the toxin will still remain in the food.

The internal temperature of meats should be checked with a thermometer. Even though meat may appear done on the surface, it may still be well below 140 degrees F internally.

Thawing of food is another process where variation in internal and external temperatures may not be readily apparent and bacterial growth could occur. Frozen foods should be thawed in the refrigerator, but this process is slow and takes preplanning. To speed up the thawing process, foods can be placed under cold running water, but warm or hot water should never be used. External food temperatures will be ideal for bacterial growth while internally the food will still be frozen.

Refrigerator temperatures should also be monitored. If refrigerator doors are opened frequently, the temperatures may not remain below the danger zone. Temperatures within the refrigerator should range from 34 to 45

degrees F. If a thermometer is placed near the door of the refrigerator, the temperature can be checked.

ACTIVITY 14:

1. What is the temperature "danger zone" for food?
   a. Below 40 degrees F.
   b. 45 to 140 degrees F.
   c. 32 to 212 degrees F.
   d. Above 160 degrees F.
2. Name five types of foods that are low-acid, and therefore provide good growing conditions for bacteria:
   a. _____
   b. _____
   c. _____
   d. _____
   e. _____

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ANSWERS TO ACTIVITIES

ACTIVITY 1

1. a; b; c; e; f.

ACTIVITY 2

(Any five.)

1. a. Cleanup between operations, so clutter will not accumulate.
   b Maintaining a dry workroom floor.
   c. Maintaining a clean workroom floor (vacuuming).
   d. Use of a central tool storage area.
   e. Cleanup of spills as soon as they occur.
   f. Keeping exits, or routes to exits, clear.
2. a. Solvents.
   b. Epoxy resins.
   c. Insecticides, or other skin irritants.
3. Food processing industries.

ACTIVITY 3

1. a. vertical jet.
2. c. common-use towels.
3. d. chemical air fresheners.

ACTIVITY 4

   c. unwashed hands or flies.

ACTIVITY 5

1. rapid sand filters.
2. filtration.
3. filtration or clarification.
4. disinfection.
5. pathogens.
6. a deadly gas.

ACTIVITY 6

1. c
2. a

3. d
4. b

ACTIVITY 7

1. True.
2. True.
3. True.
4. True.
5. False.

ACTIVITY 8

1. food.
2. refuse.
3. (the power) disconnected.
4. sharp.

ACTIVITY 9

1. d.
2. c.
3. b.

ACTIVITY 10

cafeterias.

ACTIVITY 11

1. clean; soiled.
2. receiving room.
3. hooded; ventilated.
4. fire extinguishers; ignition (catching on fire).
5. disinfecting; mold.
6. unsanitary.
7. discarded, or replaced.
8. concrete; polyurethane resin.
9. stainless steel; porcelain.
10. movable.

ACTIVITY 12

1. a. tuberculosis.

b. venereal disease.
c. typhoid fever.
d. diptheria.

2. infected; sore; discharges, diarrhea.

3. a. scrub hands with soap and water after using rest room or touching soiled objects.
b. shower daily.
c. wear clean clothes.
d. keep nails short and clean.
e. wash hair frequently.
f. secure hair with hat or net.
g. change aprons frequently.

ACTIVITY 13

1. removing the point(s).
2. safe; slots; scabbards.
3. never; work.
4. pick; position.

ACTIVITY 14

1. b.
2. (any five)
a. eggs.
b. custards.
c. milk.
d. fish.
e. meat.
f. gravies.
g. poultry.
h. salad dressing.