
UNIT 17 PLANT SANITATION AND SAFETY

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17.1 INTRODUCTION

In Unit 16 we got a glimpse of what hygiene, sanitation and safety is all about. This unit will focus on this very important area particularly in food service operations, which aim at providing clean and wholesome food to its customers, visitors and staff. You may recall studying about the food safety issue in the Food Safety and Microbiology Course (MFN-003). You know how many cases of food poisoning are reported in the press every few months especially during the rainy season. This unit will tell you why this happens and how a food service can ensure zero cases of poisoning by following certain policies, standards and schedules in their establishments.

Objectives

After studying this unit, you will be able to:

- define sanitation and safety,
- discuss the three components of sanitation and safety,
- explain the importance of training people in hygiene, sanitation and safety,
- manage and conduct employee sanitation programmes in food operations,
- enumerate how strict adherence to policies, standards and schedules improve productivity and profits in food services,
- identify the government laws on sanitation and safety, and
- describe how food services formulate policies on sanitation and safety.

17.2 SANITATION AND SAFETY

You may recall studying in Unit 10 in the Food Microbiology and Safety Course (MFN-003) that sanitation means creating and maintaining hygienic and healthful

conditions. Let us here once again focus on the same issues in the perspective of food service institutions. Let us begin with definitions first.

17.2.1 Definitions

Sanitation is the quality of living that is expressed through a clean home, clean establishment, clean surroundings all leading to a clean community and country. It is a way of life that comes from within people to a conscious level, and gets reflected in their behaviour irrespective of where they are. This behaviour is encouraged by knowledge and grows to become an ideal that has far reaching effects on the physical, mental and social health of people in any environment in which they are placed.

Safety as related to sanitation implies freedom from infection and disease of any kind that may affect health of people. This signifies freedom from the agents of infection such as microorganisms like bacteria, viruses etc. which can be transmitted to man through soil, polluted air and water, ill people, insects, rodents and the like. Then, through man it gets carried to food they handle and then to people who eat that food. These carriers of infection may not always exhibit any symptoms of infections, but are effective in spreading them to others through food, which is a very rich medium for growth for all living organisms.

Let us now get to know about sanitation aspect in food service operations in our next sub-section.

17.2.2 Sanitation in Food Services

For all people working in a food service operation, whether managers, supervisors or operative staff actually handling food, it is vital to acquire knowledge and understanding of sanitation and make it a way of life for themselves.

It is only when a constant awareness is developed regarding the dangers that can occur due to lack of sanitation, that people can develop a positive attitude towards its practice. Practice has to be carried out day in and day out, till it becomes a habit that can be carried on as a routine throughout life, irrespective of where the person is.

Food service operators and handlers are morally responsible for the health of their customers, who eat out completely unaware of the practices followed in production areas. Since they are unsuspecting of any ill-effects of eating the food served to them, the responsibility of providing safe and wholesome food, falls entirely on the food service provider. In that sense they contribute towards public health to a very large extent, as more and more people depend on eating outside their homes today. Not only that, because of their busy, hurried and tiring routines they even carry food from outside to eat it with the family at home.

Basically the causes stem from ignorance about clean food handling practices and the methods by which diseases can be transmitted to others. The danger lies more when, people themselves do not suffer from any serious symptoms of illness, but are unaware that they can act as carriers. This holds good even for customers who eat in the food service environment and can act as carriers. Figure 17.1 shows how food handlers and customers too can act as a vehicle for transmission of diseases in a food service environment.

Whenever you go out to eat just notice the way waiters are dressed. Do they look neat and clean? How are the tables cleaned when another customer just leaves? If you have access to the kitchens or washrooms, see whether cleanliness is maintained therein, the state of hygiene will tell you whether to eat there at all or not. This is because unclean and haphazardly kept areas become a source of microbes, and staff can become carriers of infection that is then spread to the customer.

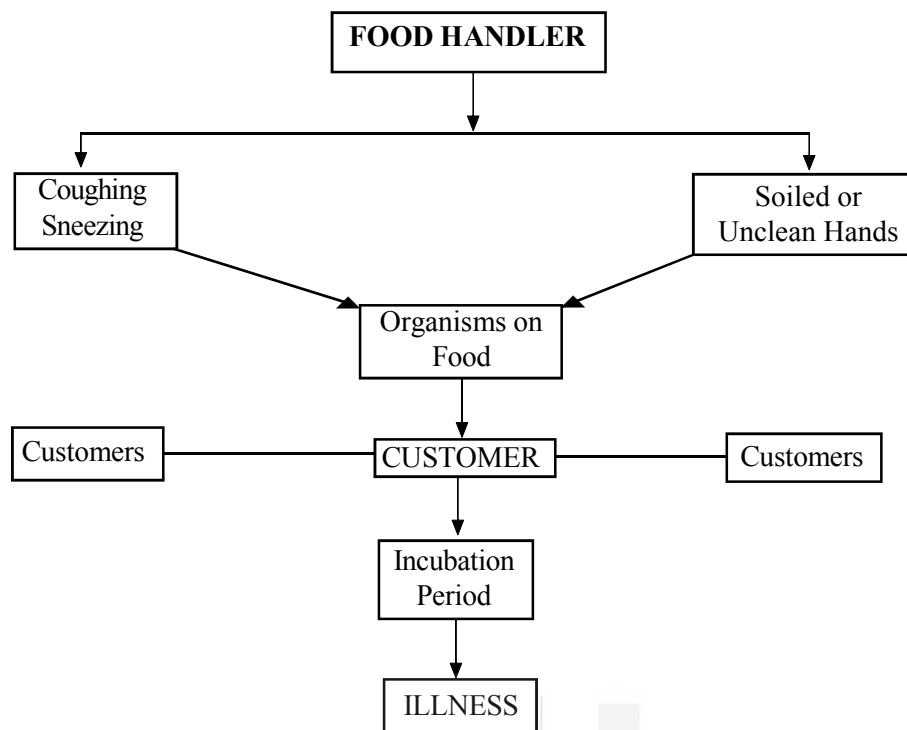


Figure 17.1: Modes of transmission of infection in food services

So, how can outbreaks of illness are controlled? Can you list them down? You may recall reading about the control measures earlier as well in the Food Microbiology and Safety Course (MFN-003). Well, so let us recapitulate. A few tips are:

- Persons who have been recently suffering from respiratory, intestinal or other contagious diseases should not handle food.
- Staff should be medically checked and cleared before returning to work to ensure that they are not only symptom free but are not carriers of any infection.
- Displayed food should be kept covered at all times and protected from contact with customers unless served to them for consumption.
- Hands must be washed thoroughly before handling food.

Other modes of transmission of disease are indicated in Figure 17.2.

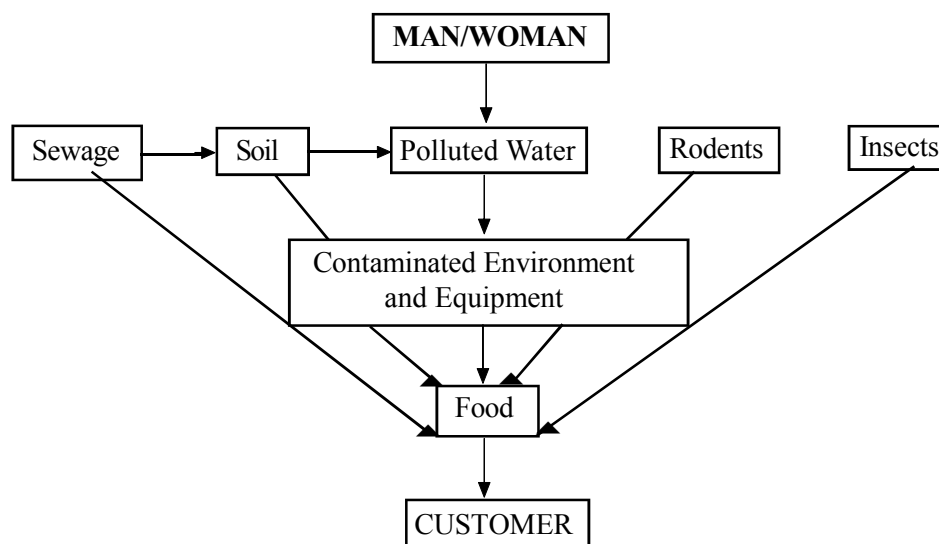


Figure 17.2: Other modes of disease transmission

Let us now take up each of these modes of disease transmission one by one. What makes each of these a potential source of microbial hazards in a food operation? What does each of these modes consists of that can lead to safety and sanitation hazards? What all diseases can it lead to? Let us read and find out. We shall start with sewage first.

- a) *Sewage*: It largely comprises of man or animal wastes. Untreated wastes contain microorganisms that can cause outbreaks of typhoid, dysentery and even infectious hepatitis. This can happen in food service establishments where plumbing is defective. Sometimes sewage may be allowed to flow into rivers, lakes, ponds and find its way into wells and thereby drinking water. If this happens, fish harvested from such water sources can be toxic if eaten even after cooking. Septic tanks should therefore be situated far away from water sources such as wells, from which water is drawn for drinking and cooking, especially in distant rural areas.

It is important that all sewage be treated and disinfected before being directed into any water sources. Further, fish and shellfish should be harvested from unpolluted water.

- b) *Soil*: When untreated sewage is allowed to fertilize fields, the soil gets contaminated and thereby crops such as vegetables and fruits that are grown on it. The only control that users can exercise is to buy food from approved sources to ensure they are free from contamination and of certified quality.
- c) *Water*: Water is the most important vehicle for transfer of microbes and contaminants of any kind; therefore, it is the responsibility of government agencies to provide safe, drinking water to all people. This responsibility shifts to the food service provider especially in areas where water is hard and therefore unfit for consumption. Special equipment for softening and purification of water therefore needs to be installed to make food safe for customers.
- d) *Rodents*: Rodents like *rats* and *mice* can transmit disease if they come into the environment of a food service operation, as they carry microorganisms on their feet, fur and through their excreta or saliva left on food. The presence of rodent excreta is therefore a dangerous sign for any establishment, and the staff needs to be very vigilant about the quality of food received and used for production and service. Any indication of droppings in the flour, or other ingredients should be rejected straight away.
- e) *Insects*: Insects of all types find their way to food whether in garbage dumps around establishments or stored inside the institutions. The most common is the *housefly*, associated with eating places, toilets, manure, garbage and uncovered food. They can easily transmit contaminants from one food to another and can be a frequent source of cross contamination.

Cockroaches are a common sight especially in tropical summers, wherever there is unprotected food. They contaminate food in the same way as rodents and other insects transmitting agents through the mouth, feet and droppings.

Insects are of concern to food operations as they enter the grains of cereals and pulses, and are harder to remove than those feeding externally and visible to the naked eye.

- f) *Equipment*: Equipment and utensils get easily contaminated when touched by carriers, ill food handlers or those with unhygienic working habits and contaminated water which should be maintained in sanitary condition at all times to make it safe for everyone.

You have already learnt about food handlers and personal hygiene practices in Unit 16 along with causes of bacterial food poisoning, so you are aware of the need to keep monitoring cleanliness of people, work areas, equipment and the environment around food operations.

- g) *Food*: The food operator is more concerned with growth of spoilage agents that destroy product quality and appearance as their growth produces toxic reactions in customers. All food prepared, stored or displayed in a food operation needs to be kept covered at all times to protect it from any hazards. Every food needs to be stored at the right temperatures as well, according to their degree of perishability. No food should be held or stored for any length of time between 10°C and 65°C, as this is the *danger zone* and encourage maximum growth of microorganisms. As far as possible, foods should be served for consumption, delivery or take-home services, as soon as it is prepared.
- h) *Customer*: Customers must adhere to the same practices of cleanliness, hygiene and sanitation before they touch or eat food anywhere. Establishments can assist them by providing sanitary washing and toilet facilities for customers. It is important to choose equipment fitted with sneeze guards, between the foods and customers especially in self-service cafeterias.
- i) *Environment*: Cleanliness of the environment of the food and the establishment is extremely important. For this, schedules for cleaning, fumigation and pest control need to be followed and monitored strictly. Making hygiene and sanitation a habit is essential for all people associated with food services. Thus, *sanitization* is virtually *the process of destroying pathogens or harmful bacteria that survive the process of normal cleaning*. The cleaning process, therefore, primarily removes the soil deposits. *Sanitizing, on the other hand, destroys microbes that are left on the cleaned surfaces*. How then, can sanitation be maintained so that food operations are safe for everyone?

Well, a number of sanitizing agents are now available that can be used to effect, but only if enough knowledge about their composition and use is gained to enable selection of the most suitable products. Let us see what these sanitizers are!

A) **Sanitizing Agents**

Remember, we learnt about the sanitizers earlier in the Food Microbiology and Safety Course in Unit 10, sub-section 10.2.2. Can you recall which disinfecting agents are generally used in the food industry? Let us find out.

Sanitizing agents or sanitizers are *chemical compounds that destroy harmful microorganisms*. A number of formulations are now marketed, of which 5 types are generally used. These are:

- Chlorine based
- Iodine based
- Ammonium compounds
- Acid-anionic surfactants
- Phenolic compounds

Let us go through each of these briefly.

- *Chlorine based*: These comprise of chlorine compounds such as hypochlorites, chloramines and dichloro-dimethyl-hydantoin. These are inexpensive and therefore most extensively used as bactericides in food plants. Just before equipment and utensils are used, they are rinsed with a bactericide in large food operations.

These formulations are active against all microorganisms and spores at a concentration of 25 mg per litre at pH 10 or less, and at a temperature of about 50°C. Bacteria are destroyed in less than 15 seconds by a sodium hypochlorite solution containing 50 parts per million (ppm) of available chlorine. The concentrations increase as the temperatures fall although higher concentrations do not increase effectiveness.

Chlorination of water used in processing while reducing the total bacterial count also removes any slime. It kills vegetative spore cells and thereby reduces the number of bacterial spores. The sporicidal effect of chlorine is however influenced by the pH, temperature and chlorine concentration.

Chlorine compounds are unaffected by hard water and do not leave a residue but the odour of chlorine remains and the products have a short shelf life. As the pH increases over 8.0, the effectiveness decreases. Chlorine sanitizers are usually applied for one minute or more at 24°C or above. They can however, cause skin irritation. Besides, chlorine preparations do cause damage when used as a spray at regular intervals, as they can cause corrosion of light fixtures, switches, metal window frames, pipes etc.

- *Iodine based:* Iodine based products are stable and do not deteriorate easily, have long shelf life, destroy most bacterial cells but not spores. They are effective in hard water and non-corrosive. They leave no residues and are not irritating to the skin. They are brown in colour and their concentration is measured visually. The formulations work slowly at pH 5.0 or above and may stain some surfaces. The ideal concentration for use is 12.5 - 25 mg per litre at 24 - 49°C.
- *Ammonium compounds:* Also known as quaternary ammonium compounds (QUATS), these were developed to destroy organisms in food industries and they possess high germicidal activity, low odour when used in normal or specified concentrations. They are also highly stable, non-corrosive and have low toxicity. They are water soluble and lower surface tension of solutions, and therefore can contact and kill organisms that are not accessible to non-wetting germicides. These compounds are however, sensitive to pH or level of acidity or alkalinity, working best at pH 9.0-10.0.

In acid environments, quaternaries are most active against some bacteria (*Pseudomonas*) but in alkaline medium, they destroy *coliform* organisms. However, hard water inhibits their activity. But, the addition of inorganic sequestering agents and organic chelating compounds tend to restore their sanitizing effectiveness.

Quaternaries are however, not recommended for use in food service environments because their carry-over into foods is not fully known. On the other hand, these ammonium compounds are non-corrosive and non-irritating but also not as effective as bactericides. They, however, eliminate and prevent odours but are not compatible with other common detergents.

They are impractical for cleaning tableware although they can be used for cleaning refrigerators.

- *Acid-anionic Surfactants:* These are stable compounds, active against microorganisms, odourless, do not stain and are effective in hard water. Even when they leave a residual antibacterial film, it is low in toxicity. These compounds are most effective at pH 1.9 - 3.0, although they corrode metal surfaces, except stainless steel and aluminium. Spores survive their action even in concentrations of 100 - 200 mg per litre at temperatures of 24 - 43°C.
- *Phenolic Sanitizers:* These are more stable in combination with synthetic anionics. They act as deodorizers but have limited application in sanitizing food handling equipment.

Let us next move on to the cleaning agents. You have already studied about them in Unit 16. Let us here refresh your memory.

B) *Cleaning Agents*

Cleaning agents are of varied composition and since they exert their effect on soiled surfaces they are sometimes called *surface active agents* or *surfactants*. The oldest

forms are *soaps*, which are still used today in solid, liquid and powdered forms. Some cleaning agents are called *detergents*, a term usually used for synthetic products which are more alkaline than soaps. Cleaning agents dissolve or disperse soil and hold odours although they may leave a residue on surfaces if not used properly. You may recall studying about the cleaning agents in the Food Microbiology and Safety Course in Unit 10, sub-section 10.2.1. The classification of cleaning agents is presented in Figure 17.3 for your convenience here as well.

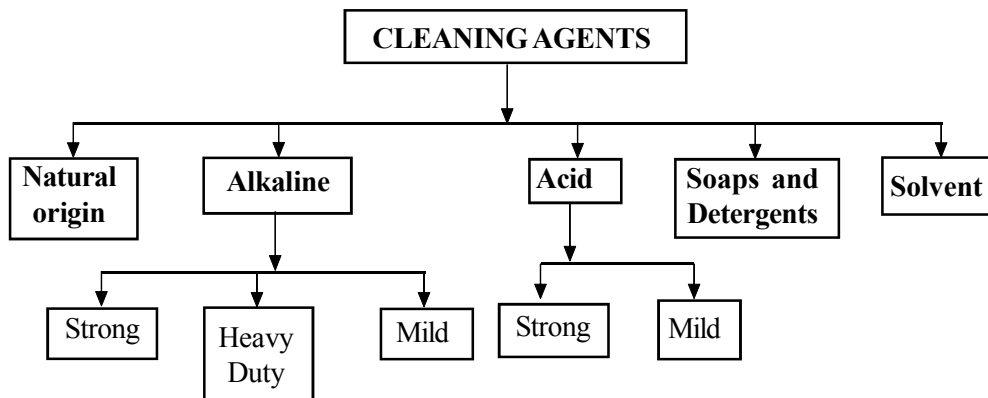


Figure 17.3: Classification of cleaning agents

Let us review these cleaning agents and other processes used for *maintaining plant cleanliness and sanitation* such as illumination, ultrasonic and oligodynamics.

- *Soaps*: Soaps are *alkaline salts of organic acids* used commonly for cleaning but they form insoluble deposits if used with hard water. A number of improved formulations are now marketed for different uses.
- *Alkalines*: Alkalines are cleaning compounds which have a pH between 7 and 14. These include phosphates, silicates, carbonates and borates. Trisodium phosphate (TSP) is the most used compound although it is less reliable and harsher than some of the newer materials. Alkalines are generally used because of their ability to prevent or remove hard water deposits.

Silicates are especially useful for cleaning tin and aluminium, where other alkaline materials may cause surface discolouration or etching. *Soda ash* and *sodium carbonate* are commonly available, as well as, they are cheap and good.

- *Iodophores*: These are *complexes of iodine and surface active agents in which the surfactants act as carriers and solubilizers for the iodine*. An iodophore solution has all the properties of iodine as a germicidal agent, but displays low vapour pressure, is practically odourless, low irritant and does not stain. It can be used wherever a general purpose sanitizer is required. Iodophores have a number of advantages. They:
 - are mildly acidic and prevent lime build up on equipment,
 - exert maximum germicidal action because of their pH and wide germicidal spectrum,
 - provide free rinsing and therefore easily mixes with surface active agent,
 - are completely water soluble,
 - possess reduced corrosiveness and toxicity, and
 - permit use of colour as an indication of iodine concentration.

However, there are some disadvantages of Iodophores too, such as:

- High iron content in water can inactivate iodine.
- Iodine is lost at temperatures above 30°C.
- Stains a few materials.
- Requires stringent control in use as low concentrations are effective.

Iodophore products with low foam properties have been formulated specifically for the beverage industry.

- *Oligodynamics*: This is the study of the movement of metallic ions in formulations that become active and exert an effect in minute amounts when active. The most ancient method of disinfection was the use of *sulphur* and *metal salts*.

The practice of storing water in silver or copper vessels produced an oligodynamic action from the metallic ions of the vessel, which was activated by very small amounts of the ions.

One-tenth gram of silver is fatal to 5000 colibacteria in one ml of water within a few hours. The traditional use of *vark* or a fine silver film on top of foods provided a bactericidal action against *E.coli*, *B.proteus* and *P.pyocyanea* strains that are particularly sensitive to gram-negative bacteria. Gram positive species of bacteria however, such as the pus forming *staphylococci* are more resistant and bacilli, fungi and tubercular bacteria are even less susceptible.

Tributyltin benzoate is however, particularly active against *staphylococci* far more effective than silver, copper or mercury salts. Newer sanitizing agents have since been developed for use and it is best to follow manufacturer's instructions if selected. One must however, be aware of the toxicity that certain chemicals can cause if not used correctly.

- *Ultrasonics*: These formulations are based on sound vibrations at frequencies above 20,000 cycles per second that are not audible to the human ear. The sound waves get converted into mechanical energy and create microscopic bubbles. These constantly form and collapse, beating against the surface or the part being cleaned. In this way, the soil is removed from the surface or cavities of the part being cleaned. The process is therefore, also called *cavitation*. The advantages of ultrasonic cleaning are:
 - Speed
 - Removal of soil from the smallest crevices or cavities
 - Cleaning precision
 - Ability to clean complete assemblies of equipment without removal of any parts.

The method provides complete safety in spite of vigorous agitation.

- *Illumination*: Satisfactory illumination is an important factor in maintaining plant cleanliness and sanitation. In designing therefore, it is common practice to double the amount of light needed because microbes and insects tend to thrive in dark corners and crevices. The light fittings however need to be kept clean at all times.

Let us now discuss handling of these cleaners and sanitizers. This, aspect has already been highlighted earlier too in Unit 16. Let us once again recapitulate here what we learnt in Unit 16.

Proper handling of cleaners and sanitizers

It is dangerous to mix cleaning and sanitizing compounds, as in combination they can produce a gas which can cause headaches, nausea and so on. Similarly, if QUATS are mixed with chlorine compounds, a lot of heat is produced that can be damaging to the hands or skin of the user.

It is important to follow manufacturer's instructions for proper dilution and application. Low concentrations may prove wasteful being ineffective, while high concentrations can prove harmful. Therefore, training and close supervision in the use of detergents and sanitizers is important to effective cleaning and sanitation. Then, how should you handle dangerous chemicals? The following tips will be useful:

- NEVER MIX compounds.
- Label each formulation clearly
- Keep locked and issue right amounts
- Store in original containers
- Never store with food materials
- Have distinctive packaging so they are not confused with food products
- Use under strict supervision

Let us next move on to the chemical toxicity associated with these cleaning agents.

Chemical Toxicity

Chemical toxicity can result from overuse of chemicals while at the same time, it is important to remember that using more of the sanitizers or their formulations does not necessarily lead to better cleaning and germicidal or bactericidal action. Toxic chemicals may be divided into those that:

- damage cell structure,
- interfere with cell respiration and energy supply, and
- block biosynthetic paths in the cell.

Their action is however, dependent upon the *concentration* of the chemical and the *temperature*, each varying their activity in a number of ways. For example, mercuric ions in low concentrations may inhibit enzymes involved with respiration and protein synthesis or may denature proteins in higher concentrations. Therefore, it is important to use chemical or synthetic sanitizers in the right dilutions, remembering that excessive use does not improve efficiency of sanitation.

Metallic contamination especially of lead and arsenic can also result from impurities in raw materials or from processing equipment. This however, is not so common now because especially in processed foods because of the strict controls used in handling of raw materials by the industry. The risk however, remains if equipment is made of materials other than aluminium, glass and stainless steel. Water, however, is the main source of contamination if its quality is not controlled.

Effective sanitizers are cationic and anionic detergents, phenol, cresol and alcohol. Some agents such as formaldehyde, acids, alkalis, ions of heavy metals and oxidizing agents such as halogens and hydrogen peroxide also cause protein denaturation.

Let us next focus on the public health perspective. What role does sanitation plays here? Let us read and find out this in the following sub-section.

17.2.3 Sanitation and Public Health

There is enough evidence to support that diseases transmitted through food have been on an increase in recent times, more so when food is cooked in large quantities and distributed to unsuspecting customers by unaware food handlers.

You must have read or heard so many reports about children falling sick and being hospitalized after eating *laddoos* or *sweets* distributed to them on festival days, or people having diarrhoea and other gastrointestinal infections after eating lunches in their office canteens and so on. What do you think are the causes of illness transmitted through food?

Once a particular food item becomes a source of infection, the symptoms take on epidemic proportions and can pose a public health problem. This then, makes it difficult for the establishment to survive and has to close down. In this context therefore plant sanitation and safety is crucial which is discussed next.

17.2.4 Plant Sanitation and Safety

The various features/requirements, from the food safety perspective, that have to be considered in selection of the site, designing the premises, kitchen, selection of the equipment, food service area, storage and drainage, in the context of the food service establishment, you may recall have already been described in the Food Microbiology and Safety Course (MFN-003) in Unit 9, section 9.3. Please look up the unit once again now as it will provide a good overview on food safety measures in a food service set-up.

The importance of product related quality and food safety with respect to spoilage related effects has increased significantly. Every food processing or service operation has to ensure that food is not harmful and is fit for consumption. Wholesomeness implies that the products are of a quality that do not harm the health of people consuming it, and this can be ensured only through preventing its decomposition, adulteration, unhygienic handling during production by preventing its contamination in any way. Quality is therefore no more an option but an obligation that covers safety, hygiene, reliability, wholesomeness and acceptability.

Let us then get to learn about plant, equipment and food hygiene.

Plant Hygiene: There are a number of factors operating for maintaining plant hygiene such as removal of dust, soil, wastes, and cleaner sediments and so on from the food environment that will encourage microbial growth and or contamination. One basic reason for focusing on hygiene aspects in food processing plants is to strive for continuous improvement in quality of the products offered. This has been motivated by the global trade agreements that necessitate constant upgradation of product quality to meet international norms.

Food and Equipment Hygiene: The main sources of contamination in food products are equipment and utensils with which raw foods come in contact during production. Methods of cleaning and maintenance of equipment have been discussed in Unit 16. If precautions are ignored a variety of microorganisms can be introduced into products right from farms to plant levels. Cleaning and sanitizing equipment at all levels therefore, needs to become routine so that foods of high bacteriological quality can be produced each time. The aim is to remove all conditions which bacteria require for their growth, and destroy those which are present.

Detailed procedures and goals need to be developed for food contact, as well as, non-food surfaces to prevent cross-contamination at all stages of production and operation to achieve high standards of quality and capture customer confidence. The considerations necessary for an efficient cleaning programmes are described in section 17.3 next. But first we shall recapitulate what we have learnt so far by answering the check your progress exercise 1.

Check Your Progress Exercise 1

- 1) Define the term sanitation. Briefly discuss how it can be maintained in a food service operation.

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- 2) What are the different ways in which diseases can be transmitted?

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3) Fill in the blanks:

- a) Insects are of because they enter the and are hard to detect and remove.
- b) All foods prepared, or displayed need to be kept to protect them from
- c) Cleanliness of the and its is extremely important.
- d) Water is the most important vehicle for of microbes and

4) Briefly explain the following:

a) Alkalines

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b) Iodophores

.....

c) Ultrasonics

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Next, let us move on to discussing the importance of cleaning programme and considerations that must be kept in mind while planning an efficient cleaning programme.

17.3 CONSIDERATIONS NECESSARY FOR AN EFFICIENT CLEANING PROGRAMME

Both cleaning and sanitizing form the basis of food service sanitation as we have already mentioned earlier. It must be clear that *cleaning* removes visible soil, *sanitizing* reduces microbial load to a safe level.

The main purpose of cleaning and sanitizing dishes is *to remove visible surface dirt and reduce the level of bacteria to a safe level* so as to:

- 1) reduce health hazards by avoiding contamination,
- 2) prevent spoilage of food,
- 3) control odour, and
- 4) create a pleasing appearance.

Before any cleaning programme is implemented, it is necessary that all food service workers understand the importance of cleaning procedures. It is the duty of every employee to ascertain that all dishes and utensils used in the catering establishment are clean. Dishes are handled by various people like waiter, busboys, cooks and dishwashers. Dishes cleaned and sanitized by dishwashers may be mishandled and contaminated after washing. They may collect dust or get covered with a greasy film if they are not stored or handled properly.

You would appreciate that an act of carelessness on part of one person, can cancel the painstaking efforts of others and result in wastage of costly detergents, money

invested in machines, labour, etc. Therefore, it is important to note that no matter how well food is prepared and served, it is unacceptable if served in improperly cleaned dishes or accompanied by unclean crockery or cutlery, or crockery which retains the smell or remanent of the food served in it earlier.

All utensils, equipment, tableware and other food contact surfaces used in the food service operation must be cleaned and sanitized after every major use or at least once a day. Any utensil or equipment used in the storage, preparation and service of food and which touches the food directly, is a food *contact surface*. The methods employed to clean and sanitize these food contact surface are discussed in the subsequent sub-section. *Pots, pans, dishes, glasses, cutlery, trays, mixer bowls, slicing machines, chopping boards, work platforms and stainless steel table tops are food contact surfaces.*

Surfaces which do not touch the food directly are *non-food contact surfaces* like the top of the refrigerator, the bottom of work platforms and tables, floors, etc. These surfaces need to be cleaned regularly and sanitized occasionally.

There are three methods to wash, rinse and sanitize food contact surfaces. These are enumerated herewith.

17.3.1 Three Methods to Wash, Rinse and Sanitize Food Contact Surfaces

The three methods to wash, rinse and sanitize food contact surfaces include: the *three bucket method, the sink method and the dishwashing machine method*. The method to be used will depend on many factors, such as the surface to be cleaned and the size and nature of the food service establishment.

Even if all dishes are machine washed, workers should be trained in manual methods as well. All methods listed above follow three basic steps, namely, wash, rinse and sanitize. All these steps are necessary for proper cleaning and sanitizing. Let us get to know these three methods.

a) *The Three Bucket Method*

This method is used to clean and sanitize equipment which is too large to place in a sink or dishwashing machine or is stationery. Three separate buckets, containing a wash, rise and a sanitizing solution, are required. All buckets should have different colours. The procedure for the three bucket method is elaborated herewith.

Procedure for the Three Bucket Method

The three bucket method involves 3 steps. These include:

- 1) *Wash*: Remove food scraps from the surface to be cleaned. In the first bucket, mix detergent in warm water. Scrub surface with a scourer to loosen food, grease and dirt.
- 2) *Rinse*: Take clean warm water in the second bucket. Wipe the surface with a sponge to remove loosened soil and detergent till surface is clean. If surface does not look and feel clean, repeat these two steps.
- 3) *Sanitize*: Add chlorine in the correct concentration to warm water in the third bucket. With a clean sponge, wipe the entire surface lightly and allow solution to air dry. Do not dry surface with a dishcloth. Large equipment is sanitized by rising carefully with boiling water, or live steam from a hose in case of equipment in which steam can be confined.

b) *The Sink Method*

Dishes, pots pans, chopping boards, containers, knives, spoons and other small utensils are washed and sanitized in sinks. Sinks should ideally have three compartments so

that washing, rinsing and sanitizing can be done in separate sinks. A one or two compartment sinks is not very hygienic, as all steps are carried out in the same sink.

The equipment required for this process is enumerated herewith:

- 1) *Sinks*: Two or three compartments with a hot and cold water supply are required. The sinks should be large enough to hold washing baskets and allow dishes to immerse completely in wash solution. They should be made of a non-toxic, non-corrosive, smooth material like stainless steel or vitreous enamel. Galvanized iron sinks are recommended for washing large pots and pans. The sinks should have an overflow pipe to remove excess water. The pipe should be fitted with a strainer and funnel draining. The number of sinks required depends on the number and variety of meals served. Separate sinks should be used for crockery and cutlery and for pan washing.

Waste pipe traps should be removable, smooth, and easy to clean and easily fitted. Plastic, which is acid and hot water resistant, is preferred. A spray hose fitted to the sink is a desirable feature to wash down the sink and the draining boards.

- 2) *Drains*: They should be 10 to 15 cms (four to six inches) in diameter to remove all waste water without the risk of flooding. Grease traps should be cleaned regularly.
- 3) *Ware tables and drain boards*: They are necessary to hold soiled dishes before washing and to hold clean dishes after washing. They should be large enough, self-draining and should be so placed that they do not interfere with washing procedures.
- 4) *Ware washing baskets*: They are used for immersing soiled ware in the rinse and sanitizing compartments. They should have long handles and be large enough to handle the normal load of wares. They should ensure complete immersion of items and prevent contamination of cleaned and sanitized items by human hands.
- 5) *Booster heaters*: They should supply hot water between 74 to 82°C for sanitization. They should ideally be located under the final rinse sink to prevent water temperature from dropping.
- 6) *Thermometers*: They are meant for dishwashing and should be portable and accurate to within 2°C.
- 7) *Clock*: It is necessary to check immersion time during sanitization and the clock should have a second's hand.
- 8) *Cleaning tools*: Bristle brushes, scourers and abrasive pads in a good state of repair should be placed in a convenient place. Sponges should be avoided as they encourage the growth of microorganisms.

Next, let us learn about the procedure for the three sink method.

Procedures for three sink method

Check that sink is properly clean before starting work. The steps involved include:

- 1) *Scrape and pre-rinse*: This is to remove loose soil from dishes and keep wash water cleaner and free from bacterial build-up. A scraper or squeegee is used and food residue is transferred to a garbage container. Sometimes, soaking may be necessary to remove more stubborn residues.
- 2) *Washing*: The first contains a hot detergent solution at 43.5°C to 52°C. Dishes are washed in this sink with the help of cleaning tools. All visible soil is removed from the surface of dishes. As more and more articles are washed, the effectiveness of the detergent is reduced. The detergent solution is no longer effective if the detergent is reduced. The detergent solution is no longer effective when a scum or grease layer forms on water and should be changed.

Brushes and scourers should be cleaned, sanitized and dried. Grease is removed at 52°C.

- 3) *Rinsing*: The second sink contains water at 40°C. Rinse dishes till washing solution or other material is removed and dishes are clean to sight and touch. Rinse water should be changed when it becomes dirty. If a basket is used, dip the entire basket until all traces of detergent are removed. A basket must be used to sanitize dishes because: (a) it reduces hand contact with eating surfaces of dishes, and (b) temperature of water needed for sanitization is too high for the use of hands.
- 4) *Sanitizing*: This step removes any soil and microorganisms that remain after rinsing and has a bacteriostatic effect. Sanitizers used may be chemicals or water at specific temperature and pressure. The concentration and duration of immersion should be strictly followed.
- 5) *Drying*: No item should be touched on the food or mouth contact surface. All items should be air dried to retain the effects of sanitization. They can be left in the baskets to dry. Glasses should be inverted on a well ventilated drain board. Towel or dish cloth drying is not recommended.

Finally let us get to know about dishwashing, which is the third methods to wash, rinse and sanitize food contact surfaces.

c) ***Dishwashing***

Dishes are washed in sinks or in the dishwashing machine. Dishwashing is one of the most important tasks in any food service establishment. Unfortunately, it is one of the most neglected areas. The job is usually assigned to the lowest grade of employees who are inexperienced, unskilled and do not understand the importance of using the right amount of detergent, water or time for this work. It is the responsibility of the management to select correct methods of dishwashing and train employees accordingly. Let us understand this process in greater details.

Mechanical Dishwashing: A dishwashing machine is used to clean and sanitize all plates, glasses, cups saucers, knives, forks and spoons which are used in the dining area. Other equipment and utensils that fit in the machine can also be cleaned and sanitized. The machine works automatically and is extremely useful where quantity food preparation and service takes places as both time and labour are saved. For effective cleaning, it is necessary to follow the manufacturer's operating instructions *carefully and to maintain the equipment in good working condition.*

Before selecting a machine it is essential to have the following details:

- type of ware
- volume of dishes to be washed
- type of food service establishment
- space available for dishwashing

There are various types of dishwashers available. A brief review follows.

Types of dishwashing machines: Dishwashing machines are basically of two types: *stationary machines* and *conveyor machine*. What are these? Let us find out.

- 1) *Stationery machines*: These machines have a single tank. The articles to be washed are suitably placed in the rack and the racks are lifted and placed in the machine. The racks of dishes stays in one place while the wash and rinse solution circulates around the dishes. The timing is automatically controlled in most machines.
- 2) *Conveyor machines*: In the conveyor machine, the dishes move on a conveyor belt through the different cycles of washing, rinsing and sanitizing. The dishes are either placed in racks on the conveyor belt or directly on the pegged conveyor belt.

- a) A single tank where dishes are cleaned by the wash solution at one end and conveyed to the clean end of the machine where it is rinsed with fresh water at 82°C (180°F). Water is sprayed from nozzles above and below the dishes.
- b) Two tanks or multiple tanks: the first tank, i.e. the wash tank, contains the detergent solution. After the wash cycle, the rack is conveyed through the power rinse tank to rinse the dishes free of most of the detergent solution. The rack then passes through the final rinse for sanitization. The racks are transported through the machine on a pretimed conveyor at a speed set by the manufacturer. These machines are recommended for larger establishments.

Loading of dishes may be done from the top or side of the machine, depending on the model. Dishes are cleaned in a machine either by a jet or spray of hot water and detergent forcefully sprayed to remove soil; by revolving brushes that scrub soil off the dishes; or by mechanically agitating the detergent solution to help in removing soil.

The steps in dishwashing are highlighted next.

Steps in dishwashing: Before beginning the cleaning operation, it is essential that the machine, dish tables and work area is clean. Some preliminary steps which should be checked are:

- 1) Check the insides of the machine to ensure that no food soil, broken dishes or other foreign objects are present.
- 2) Overflow pipes should be free of debris.
- 3) Spray arms should be clean and properly installed.
- 4) Inspect final rinse nozzles and see that they are not blocked.
- 5) Make sure sufficient detergent in the dispensers.
- 6) Keep scrap bins and strainers in place.

The steps to be adhered for successful cleaning are enumerated next.

Operating procedure: The following steps should be adhered to for successful cleaning:

- 1) *Sorting:* Set aside any dishes that require special handling, as well as, heavily stained dishes which will not get cleaned by the routine cleaning process in the machine.
- 2) *Preliminary scraping and pre-rinsing:* Remove excessive loose food particles with the help of a rubber scraper. The purpose of scraping is to:
 - a) prevent the clogging of spray nozzles with food particles,
 - b) avoid frequent changes of wash water,
 - c) reduce bacterial contamination of wash water,
 - d) remove as much grease as possible prior to washing,
 - e) wet the soil remaining on the dishes, and
 - f) facilitate easy cleaning

Manual pre-rinsing is not required if the machine has a power pre-rinse attached.

- 3) *Soaking* : This may be necessary for dishes on which soil has hardened or dried, especially flatware may need soaking for sometime to loosen the soil. Soaking can be done in tubs placed under the counters or ware tables.
- 4) *Racking* : In this step, the dishes are arranged either in racks for conveyance through the machine or on a pegged conveyor for travel it. It involves proper placement of dishes to permit the wash and rinse solution to come in contact with all surfaces to be cleaned. Ensure that:

- a) there is no overcrowding of dishes,
 - b) similar sized objects are racked together, and
 - c) cups, glasses and other deep dishes are placed open end down to prevent water accumulation.
- 5) *Washing*: The purpose of washing is to remove all food soil from the dishes and dissolve the grease on dishware. This requires clean water, with correct proportion of detergent at the right temperature and pressure, in contact with the dishes for the proper amount of time. The detergent solution circulates at a specific rate the dishes pass through this tank. The temperature of the washing solution will vary according to the type of the machine and its specifications.
- 6) *Power rinse*: It completely removes most of the detergent-laden water and permits effective sanitization, because of the build-up of heat, it hastens the drying process. Hot pumped rinse water is sprayed over the dishes in the correct volume and with sufficient pressure to rinse.
- 7) *Final rinse and sanitization*: At this stage, any remaining detergent is removed and the dishes are sanitized. If water is used as a sanitizer, then it should be sprayed in adequate volumes and at a correct pressure with temperature varying between 77° and 82°C. Ideally, as it leaves the nozzles, it should have a temperature of 82°C. However, it should not exceed 90° to 93°C, as the water at the temperature under pressure would atomize and become vapour. The wash water temperature during different cycles of machine dishwashing is mentioned in Table 17.1.

Table 17.1: Wash water temperatures during different cycles of machine dishwashing

Cycle	Type of Machine	Temperature of Water	
		°C	°F
Pre-rinse		43 to 55	110 to 130
Wash	Single tank stationary	60 to 74	140 to 165
	Single tank conveyor	71	160
	Multiple tank conveyor	66	150
Power rinse		71 to 77	160 to 170
Final rinse and sanitize		82	180

- 8) *Drying*: Crockery and utensils must be left in racks to drain and air dry. Although dishwashing machines are a boon to us, they can create problems if not selected well. Some of the common causes of failure are:
- i) machines located in the wrong place,
 - ii) improper plumbing,
 - iii) machines are too small,
 - iv) untrained employees,
 - v) water is not adequately hot,
 - vi) water pressure is low, and
 - vii) wrong selection of detergent.

With drying we end our study of the steps to be adhered to for successful cleaning. Another area that require attention when we talk of plant and equipment sanitation is post cleaning care and cleaning of premises and surroundings. This aspect is described next.

17.4 POST CLEANING CARE AND CLEANING OF PREMISES AND SURROUNDINGS

Dishwashing operators must take the greatest care while removing sanitized dishes, utensils and equipments from racks, baskets or the conveyer itself. Contamination of cleaned and sanitized ware should be avoided. Drying clothes should be used only when necessary. They should be changed frequently and washed and boiled each day. The dish clothes themselves carry many germs and the wise operator will realize that the germs may be passed back onto cleaned and sanitized crockery and utensils. The use of disposable absorbent paper for final drying can be considered, if affordable. Clothes for mopping should, if used be boiled frequently or soaked overnight in a disinfectant solution.

Some important aspects related to post cleaning storage and cleanliness of premises and surroundings are highlighted herewith.

Cleaning of Premises and Surroundings

Cleanliness is an essential part of the daily routine in all areas and departments in any catering establishment. It is the key to good health and efficient work. The cleaning schedule should be carefully planned so that the premises, all equipment, furniture and surroundings are thoroughly cleaned everyday. The cleaning schedule should not interfere with or hamper the regular working in the establishment. The cleaners should be familiar with the work programme and should strictly adhere to the time-table. Any spillage or accidental mess should, however, be cleaned up promptly. This will prevent accidents and grease spots forming on floors.

A surface is clean when it is free from dust, dirt, grease, stains, cobwebs or any such unacceptable element. To remove soil from any surface, it is necessary to select the proper cleaning technique. This will depend on the type of soil present. Soil can be removed by:

- 1) Sweeping
- 2) Dusting or damp dusting with a cloth tightly wrung in a multipurpose cleaning solution.
- 3) Washing with water and a cleaning agent
- 4) Friction using an abrasive agent
- 5) Suction using a vacuum cleaner or wet pick-up machine
- 6) Pressure using a scrubber or polisher
- 7) Force by using water or air
- 8) Solvents for removing grease and stubborn stains.

The cleaning schedule is elaborated next.

Cleaning Schedule: The cleaning schedule should be prepared for daily, weekly and monthly cleaning. Special cleaning, like outside windows, light fixtures, walls which require white-washing polishing, distempering and painting of surfaces, is carried out a couple of times a year. The general rule for cleaning is that there should be no large-scale sweeping and cleaning while food is being prepared, as sweeping raises dust laden with microbes which contaminate food.

Let us next have a look at the constructional features and cleaning schedules and how cleaning can be done effectively in these areas.

Floor: Floors in areas where traffic is heavy, as in kitchens, bakeries, pantries, dishwashing rooms, walk-in-refrigerators, corridors, dining rooms, washrooms and toilets, should be cleaned everyday. Floors in areas where traffic is light can be cleaned weekly.

All washable floor surfaces should be washed. Wooden floors should be waxed or polished. Hot water, soap or detergent, a scrubbing brush and a mop is needed. Before cleaning the floor, all movable light equipment and furniture must be shifted. The floor is best washed at the end of the day. Floors in the pantry, dry food store and vegetable store should be swept daily and washed at least once a week. Fixed carpets and matting in dining rooms, passages, and stairways should be brushed or swept every working day, preferably by a vacuum cleaner. Loose mats and rugs should be vacuum cleaned or taken out into the open and beaten at least once a week. Carpets should be shampooed or dry cleaned at least once a year.

Walls and Ceilings: Walls and ceilings should preferably be non-porous and in good repair. This helps the cleaning procedure and prevents pests from breeding in cracks and crevices. While cleaning the walls and ceiling, follow the principle of cleaning the uppermost areas first. Walls, ceilings and fixtures should be cleaned at least once a week. Areas within reach should be dusted everyday. The method of cleaning will depend on the surface to be cleaned. Ideally, walls should be washed with warm water and a detergent. The ceilings should be brushed and swept. The girders, piping, electric fittings, etc. should be dusted. Dusting should be done carefully so that dirt is not shifted from one place to another. The best way of removing dust is by using a vacuum cleaner or by damp dusting as it prevents dust from flying about. All walls must be dusted. Walls that become heavily soiled or spattered daily should be washed. All walls should be free of dust, moisture, grease, cobwebs, grime and mildew. Light coloured walls make dirt more visible. Painted walls should be repainted regularly and papered walls kept in a good state of repair with no loose paper.

Kitchen Tables, Counters and Preparation Slabs: Kitchen tables, counters and preparation slabs should be washed at least once a day. All surfaces coming in contact with food should be cleaned after each service by the three bucket method. All metal surfaces should be cleaned with hot water, a non-scratching detergent and by a hand swab. Wooden and marble surfaces should be scrubbed with a scrubbing brush, hot water and detergent. The surfaces should be rinsed well and wiped with a clean cloth every time they are used. Such clothes should be washed well and boiled. They should not be used for wiping dishes. All parts of tables, including the framework and underside, all areas of the counter, like the hot cupboard, and all preparation areas including chopping boards and pastry slabs should be cleaned at least once a day. The bain marie (hot food serving counter) should be turned off and the water drained off. It should then be cleaned inside and outside with hot detergent, water, rinsed and dried everyday.

Shelves and Cupboards: Shelves and cupboards that are constantly in use should be tidied and cleaned once a week. Shelves and cupboards are mainly used for storing ingredients or utensils. They should be first emptied and then swept or dusted. The upper surfaces of the shelves should be scrubbed and lower surfaces should be dusted. While cleaning, always start with the topmost shelf. Cupboards which are used for storing reserve crockery, linen etc. long-term storage cupboards, should be cleared out cleaned at least once a month.

Surroundings and Drainage: The entire working premises should be thoroughly cleaned once a week. This should be done after the dining area is closed. All edible items should be covered and put away. All easily movable articles should be removed. The procedure helps in putting things back in place and prevents accumulation of rubbish. Cleaning is thus made easier.

All furniture should be thoroughly dusted at least once a day and table tops scrubbed clean. If table clothes are used, they should be changed. Walls, ceiling, fittings and fixtures should be swept or dusted at least once a week.

All passages and staircases, whether used to carry food or used by customers, should be cleaned frequently, and any spillage should be mopped up at once. All nooks and corners should be swept out and cleaned thoroughly once a month.

Any open space outside the building should be swept and washed everyday. No rubbish should be allowed to collect in the drains or else drains will get blocked, give off foul odours and encourage pests.

Drainage: Drains should be adequate to remove all wastewater without being overloaded. Each drain should have a water seal or trap which will prevent unpleasant odours rising from the pipe into the room. Drain pipes should have a diameter of 10 to 15 cms and should be cleaned regularly. They get blocked mostly because food accumulates on the sides and blocks the pipes. Blockages can be cleared by using a rubber water plunger. If not cleared then the cleaning eye at the bottom should be opened. The drain can be cleaned with a flexible wire or a cleaning liquid especially available for blocked drains.

Grease traps are necessary because they prevent grease from concealing in the drain pipes. The grease tray should be removed regularly and washed out.

From our discussion so far it is evident that safety of plant, equipment and premises should be the concern of all staff. In the next section we shall focus on the three E's of safety.

17.5 THE 3-E'S OF SAFETY

Safety problems differ with the nature of an operation, its size, skills and education of staff, their levels of awareness regarding the hazards that can occur due to negligence in hygiene, sanitation and safety. Managers too, tend to take sanitation and safety casually, usually monitoring surface cleanliness without much knowledge of the minor details of cleanliness or sanitation practices. They usually concentrate on prices and profits not realizing that all these can go down the drain if they do not have the right information about detergents and sanitizers in the market, and their effectiveness in use for keeping the food services safe from hazards of infection.

Safety, therefore, should be the concern of all staff, at all levels of an establishment. Problems that do arise from any source can basically be tackled in three ways, usually referred to as the *3 E's of safety* namely:

- Safety engineering
- Safety education
- Safety enforcement

These three components of safety are being separately discussed herewith to highlight their importance in *prevention* of hazards anticipated through any channel, in a food service operation. Let us start with safety engineering.

17.5.1 Safety Engineering

Safety engineering involves the building-in of safety features in the design of equipment, furniture and fittings and their proper placement in the spaces within work areas of the establishment. Particular emphasis must be laid on safety features in buildings meant for use by the handicapped whether inmates or customers. Some

examples are the need for a higher level of illumination, provision of lights in cupboards, adjustable working or seating heights as the case may be.

Equipment design: Safety needs to be built into the design of equipment selected for food services, such as the ability to dismantle parts that come in contact with food. This is essential in order to sterilize those parts and make it possible to maintain sanitation, through air-drying them, for use after refitting.

Equipment design should also ensure that the linings and insulation is well aligned and heat or other agents used and generated in kitchens do not produce a separation or lifting of laminates to allow microbial or insect infestation of any kind.

Next, let us review safety education.

17.5.2 Safety Education

Safety education involves gaining information on safety standards and methods, detergents, sanitizers and knowing the impact on the sanitation standards of the operation and the possible result of lack of sanitation and safety as well.

Most important is to be aware of the human factors in safety and make a continuous effort to inculcate proper working habits in staff handling food at all times. Let us elaborate further on this aspect.

Human factors in safety

A number of factors relating to the habits and behaviour of people at work affect their attitude to safety. These are improper working habits, psychological and emotional factors operating in the work environment. Let us understand them better.

Improper working habits: Proper working habits develop only when a sense of identity is established with the workplace, thereby placing caution foremost in the minds of the staff, who would want to protect, look after and preserve or extend their resources as much as possible. Some working habits which can be identified as safety hazards in catering situations are:

- Not wiping spillage immediately.
- Smoking while working.
- Unguarded coughing, sneezing or yawning during cooking and service of food.
- Not reporting gastrointestinal or other infections on returning to work from leave.
- Wearing street clothes at work in kitchens without using overalls or headgear.
- Using shortcuts for cleaning and not following procedures laid down.

These are only a few examples cited to indicate what a wrong working habit can do to destroy the safety of an establishment. Hence, it is wise to update one's knowledge of sanitizers, detergents, sanitary and cleaning equipment available from time to time along with methods for their proper use. Keeping in touch with newer research and products and using it for training and retraining staff in sanitation and safety will help to keep establishments ahead of others in terms of attracting customers, as well as, in generating profits.

Next, we move on to the third E of safety i.e. safety enforcement.

Enforcement is another term for *implementation* and *practice*. It is not enough to know about safety and its procedures, but more important to motivate staff to put the knowledge gained into practice. This does not come to everyone easily and therefore needs to be enforced by rule, law or custom and practice. Safety regulations set, need to be enforced through:

- Discipline
- Close supervision
- Vigilance
- Action

Let us review each of these next.

- 1) *Discipline*: Discipline at work involves an awareness of safety not only of self but of all people in the work environment, which includes customers and suppliers as well. The basic disciplines guiding safety are:

- Avoid overcrowding
- No smoking
- Not eating while preparing food
- Silence when handling food
- Personal neatness
- Correct working habits
- Orderliness and cleanliness in work areas

The above guidelines can be unending because each operation differs in its layout, nature of activities and so on. Further, the nature and behaviour of people in their job environment varies too depending on their education and level and extent of training acquired.

- 2) *Supervision*: Close supervision is necessary to ensure that staff follows safe work procedures that become routine with them in due course. This becomes easier, if supervisors are seen as examples of what they wish to inculcate in their staff. It is obvious that if a supervisor is well groomed and clean in his appearance and working habits, always leaving his work table neat, that staff will follow his example.
- 3) *Vigilance*: Every one in a food operation has however to be vigilant that there is no scope for contamination in and around them. Any hint of a cold or intestinal infection among staff should be brought to the notice of the manager. Also equipment should be checked for cleanliness before using them in case of an insect, dust or dirt in crevices. In such cases, it should be cleaned again before using it for food preparation or service.

Extra care is needed in tropical summers and during the monsoon season as the temperatures and humidity are very high, both the factors being conducive to microbial growth.

- 4) *Action*: Immediate action should be taken if proper procedures are not being followed, or if a particular sanitizer is not working well. Even if a single insect or rodent is seen in the environment action is necessary to eliminate it and prevent any breeding ground for it in the vicinity of the food service establishment.

With safety enforcement measure we end our study on the 3 E's of safety. Now answer the questions included in check your progress exercise 2 to recall what you have learnt so far.

Check Your Progress Exercise 2

- 1) What do you understand by the phrase 3-E's of safety?

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- 2) Discuss briefly the human factors in safety education.

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- 3) Differentiate between:

- a) Cleaning agent and sanitizer

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- b) Illness and poisoning

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- c) Food plant and food service operation

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- 4) List the four elements of a good enforcement programme.

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In our discussion so far it emerges that safety should be the concern of all staff, at all levels of an establishment. Further, it is also important to ensure that systems for regulating food safety are in place within the establishments. What are the standards, policies, schedules governing food service operations? The next section focuses on this important aspect. You may recall studying about HACCP as a food safety assurance system and about the food legislations, acts and standards operating in our country in the Food Microbiology and Safety Course (MFN-003), in Unit 13 and Unit 14. Here the specific standards, policies, schedules for good plant sanitation and food are further highlighted.

17.6 STANDARDS, POLICIES AND SCHEDULES

The setting up of standards, policies and schedules or procedures that can be religiously followed by all those working in food operations is essential for supervision and monitoring of effective production and customer satisfaction. Let us review them.

17.6.1 Standards

Standards of good plant sanitation require an examination of the built-in features of equipment, quality of water supply, waste collection and disposal practices, and planning of quality facilities.

In every country, laws are passed to safeguard the health and well being of people at work to which all food services too, must adhere. Standards for achievement in all areas are provided by the nodal institution for standards in India, called the *Bureau of Indian Standards* (BIS). These include standards for equipment, food, environmental hygiene and sanitation and so on.

The *Ecomark* was a standard launched by the BIS in an attempt to preserve the environment from pollutants. The mark ensures the consumer that products such as detergents, sanitizers and others do not produce hazardous waste materials, are biodegradable and can be recycled. The *ISI* certification mark on packaging and equipment also serves the same purpose.

The government has set up departments to monitor implementation of the standards in registered organizations and proper machinery for regular inspection of plant and premises exists.

The *Codex Alimentarius Commission* (CAC) appointed an ad hoc inter-governmental task force on foods and is in the process of developing standards, guidelines and other principles for such product traits, introduced into foods with respect to safety, keeping in mind consumer health. The government of India has taken the initiative to formulate a code and has laid down the internal norms for minimum residue levels (MRLs) for pesticides in water and foods.

The harmonization of food standards across countries is an important step in meeting challenges thrown up by the World Trade Organisation (WTO), to which India is a signatory. Under WTO agreement, all food standards imposed would have to be justified on socioeconomic and scientific grounds for export competitiveness.

The government has instituted a task force to look into the area of safety concerns such as, the risk of transferring toxins from one life form to another, or creating new toxins and allergenic compounds. According to the Ministry of Food Processing Industries, food standards are under review to include provisions on technical barriers to trade and sanitary and phyto-sanitary provisions and measures.

17.6.2 Policies

Every food operation should lay down their own policies for the operation to ensure efficient functioning, keeping in mind the goals of food safety to ensure staff and customer health. A good policy for every food service is to lay down an inspection routine that can be followed regularly by all managers responsible for their units. A sample is presented as a guide.

Sample Inspection Routine

- A daily quick cursory inspection of all areas.
- Detailed inspection starting from:
 - Refuse storage areas looking for condition of bins and areas for evidence of rodents, insects etc.
 - Outside drainage for leakages, blockages, overflows, yards etc.
 - Sanitary condition of staff restrooms, customer toilets and housing.
 - Food storages for ventilation, lighting, cleanliness, equipment maintenance, condition of foods and non-food items.

- Kitchen walls, floors, ceilings, ventilation, lighting and equipment.
- Staff inspection for personal hygiene and at work.

Supervisors or managers should then on the basis of inspection, make recommendations, offer praise or reprimand where required, offer guidance through constructive suggestions for improvement.

While routine inspection is important, what is lacking is proper communication with employees regarding their safety policy. It is good policy to have a weekly meeting with all employees on a fixed day and time, when the results of the inspection can be communicated to them visually through use of audio-visual aids. It can be an hour's meeting of free discussions over tea making them aware of the importance of maintaining sanitary working areas, as well as, the ill-effects that can occur if procedures laid down are not properly followed.

Instructional materials in the form of charts may be prepared for each area, with the help of staff concerned to increase knowledge and practice. The best area may be awarded and the list of award winners displayed to motivate others.

17.6.3 Schedules

Schedules are timetables set for cleaning and sanitizing all areas of the operation that the staff needs to follow to achieve a sanitary work environment. Such timetables need to be prepared for every staff member in each area of activity according to the special requirements of the equipment being used and the spaces in question. Each plant or operation should appoint a sanitation officer to ensure sanitary conditions prevail at all times.

The sanitary control methods are highlighted next.

Sanitation control methods

Control methods should aim at insect, fly and rodent control besides maintenance of hygienic and sanitary surroundings both within and outside the food establishments. Some guidelines are briefly enumerated.

Insect control: Depending on the type of infestation the right insecticide should be selected to eradicate insects. Sprays are also available but are not recommended for food processing facilities, as they may mix with or leave residues on food and ingredients. DDT emulsions are effective, but the disadvantage is that insects have a tendency to become resistant to them. Melathion, an organo-phosphorus insecticide is more dependable.

It must be remembered however, that insecticides control insects more effectively in clean premises. If processing areas are cleaned, scrubbed and flushed especially with hot water or steam at least once a day any insect eggs or microbes can be eliminated without use of chemical or other formulations.

Fly control: For flies and wasps, preventive measures in the form of fly proofing, or fixtures such as insect fly killers which attract with a dim blue light and then electrocute flying insects are useful equipment to fix at entrances to kitchens and dining areas above the doors or high up towards ceilings away from human contact.

Insect sanitation is one of the important goals of plant sanitation, and should be achieved by avoiding insect infestation by all possible means. This may include site selection for plants, fly-proofing or using perforated zinc sheets as a means of prevention of entry into food handling and storage areas or periodic fumigation.

Sites near rivers, streams, ponds, railroads, city dumps etc. should be avoided as they form breeding places for insects and pests. It is also dangerous to have storages

opening directly to open areas. All trolleys and trucks carrying waste materials act as vehicles for flying insects and should be sprayed with *pyrethrin* oil before entering food production and service areas. These days electromagnetic killer equipment for flying insects is available and can be fitted to entrances or walls to protect against flies.

Fumigation: Fumigation is a curative measure, but invaluable as a means of preventing insect damage to stored food. All dehydrated or dried foods can be fumigated safely and effectively.

Fumigants being volatile can penetrate large bulks of stored food and react with insects even inside grains. The fumigants work fast and ensure ultimate disappearance of poisonous residues from treated areas.

Schedules are necessary for the implementation of policies of the establishment, and desired standards maintained with respect to hygiene, cleanliness and sanitation. In fact *sanitation risk management* (SRM) programmes need to be planned with controls at various vulnerable points to ensure success. Any control programme should be based on *prevention*, rather than control, by keeping insects out and by adopting methods to ensure thorough cleaning, maintenance and sanitization of all areas.

You have already learnt in Unit 16, that the cleaning and maintenance encompasses many areas of day-to-day food service operations of which equipment care and maintenance are important facets.

Here we end our study on plant sanitation and safety. Do answer the questions included in check your progress exercise 3 to recapitulate what you have learnt so far.

Check Your Progress Exercise 3

1) a) What do the following abbreviations stand for?

- i) CAC
- ii) WTO
- iii) BIS
- iv) MRL

b) Write two or three lines about each abbreviation.

- i)
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- ii)
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- iii)
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- iv)
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- 2) Name three sanitation control methods.

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- 3) Visit your local area food service operations and compare them for hygiene and sanitation standards. Which do you think is the best and why?

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17.7 LET US SUM UP

In this unit, we learnt that plant sanitation and safety is an area of study important to food service operations because its maintenance and implementation ensures wholesome food to staff and customers. We got to know about a wide range of cleaners and sanitizers that must be used in a food service operation and these have been outlined along with their advantages and disadvantages, so that each operation can decide which is best for them.

Next, we learnt that the primary causes of food contamination are substandard or infected water, chemical compounds, disintegrated or infected food. We saw that plant sanitation and safety basically depends on three facets, safety engineering, education and enforcement. These can prevent hazards anticipated through any channels, be they soil, sewage, insects, rodents, pests or other. You would have realized that the food operator is more concerned with the growth of spoilage agents that destroy product quality and appearance, which is just as important as the growth of microorganisms that induce toxicity in man.

Next, we got to know that to ensure zero cases of food related health problems, certain policies have to be planned and standards well defined, on the basis of which schedules are prepared for implementation.

17.8 GLOSSARY

Fumigation	:	is the introduction of smoke or fumes or a gaseous chemical in an enclosed space in order to exterminate pests or disinfect.
HACCP	:	is an acronym that stands for Hazard Analysis Critical Control Point, a systematic, science-based approach used in food production as a means to assure food safety.
Pyrethrin	:	are natural organic compounds that have potent insecticidal activity.
Sporicidal	:	a substance used to kill spores.

17.9 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

- 1) Sanitation is the quality of living that is expressed through a clean home, clean establishment, clean surroundings all leading to a clean community and country.

Refer to section 17.2 and based on your understanding of the topic present a discussion on how sanitation can be maintained in a food service operation .

- 2) Disease can be transmitted through people when they cough, sneeze, yawn without covering their mouth and nose, and through soil, sewage, polluted water, rodents (rats, mice), insects, contaminated equipment utensils and food.
- 3)
 - a) concern, grains.
 - b) stored, covered, hazards
 - c) food, environment.
 - d) transfer, contaminants.
- 4)
 - a) Alkalines are cleaning compounds which have a pH between 7 and 14. These include phosphates, silicates, carbonates and borates.
 - b) Iodophores are cleaning compounds which are complexes of iodine and surface active agents in which the surfactants act as carriers and solubilizers for the iodine.
 - c) Ultrasonic is a processes used for maintaining plant cleanliness and sanitation. In this process the sound waves get converted into mechanical energy and create microscopic bubbles. These constantly form and collapse, beating against the surface or the part being cleaned. In this way, the soil is removed from the surface or cavities of the part being cleaned. The process is therefore, also called cavitation.

Check Your Progress Exercise 2

- 1) The three E's of safety refer to its three components engineering, education and enforcement, all of which are important for preventing hazards in food service operations and in the food processing environment.

Engineering refers to the design and construction aspects of a plant, spaces and equipment, while education teaches the staff handling food in any area of work to follow sanitary and safe practices, both at work and in their behaviour. The enforcement involves implementation of hygiene and sanitation in the operations and units, as well as, ensures that proper standards of personal and environmental sanitation are maintained. Education involves making people aware.
- 2) Human factors in safety education involve making people aware of proper and improper working habits and the results of both as far as hazards are concerned. The impact on food and environmental quality is highlighted along with their own and customer safety if proper working habits are adopted.
- 3)
 - a) A cleaning agent makes surfaces look neat and clean or hygienic removing soil, dust, dirt and waste materials. A sanitizer makes surfaces and equipment free from disease spreading bacteria or other microorganisms.
 - b) Illness from food contamination usually results in diarrhoea and other stomach disturbances which go away as the agents of infection are excreted through the human body. Poisoning on the other hand is more serious and results from toxic agents in food, requiring hospitalized treatment. If very severe it may even lead to death.
 - c) A food plant is usually a factory type operation which processes food continuously, while a food service operation is one which prepares food freshly and serves it to customers on demand as in a restaurant, café or even a dhaba.
- 4) The four elements of a good enforcement programme are discipline, close supervision, vigilance and action.

Check Your Progress Exercise 3

- 1) a) i) Codex Alimentarius Commission
ii) World Trade Organisation
iii) Bureau of Indian Standards
iv) Minimum Residue Level
- b) i) CAC is the international organization for setting food standards for all countries in the world.
ii) WTO regulates the trade agreements between countries by setting down quality standards and norms for export and import of goods of all kinds.
iii) BIS is the central agency set up by the government of India to set standards for all goods to safeguard the consumer. It is responsible for issuing standard marks for products. The marks of quality on a label show that the product quality is approved by the government.
iv) MRL indicates the minimum level of pesticide residues that are permitted in or on surface of products to consider them safe for consumption.
- 2) The three sanitation control methods used are insect control, fly control and regular fumigation.
- 3) Visit and present an opinion report.