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ESSENTIALS OF FOOD HYGIENE - II

RSPH
ROYAL SOCIETY FOR PUBLIC HEALTH
VISION, VOICE AND PRACTICE

LEVEL II-STAFF - MANUFACTURING

ESSENTIALS OF FOOD HYGIENE – II For Staff - Manufacturing

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INTRODUCTION

The food processing and manufacturing sector is one of the largest industries in India in terms of production, consumption, export and expected growth. This sector actually comprises many different sub-sectors like large scale slaughter houses, meat and meat processing industries, fruit and vegetable processing, grain processing, poultry and dairy industry, packaged foods, beverages, packaged drinking water etc. It also includes small scale industries like pickles & chutneys, bread, confectionery, rapeseed, mustard, sesame & groundnut oils, ground and processed spices, sweetened cashew nut products, tapioca, sago and so on.

This book is the course book for a food safety training programme for food handlers working in these food manufacturing industries, and has been developed for the Food Safety and Standards Authority of India (FSSAI). It is written with the intention of providing food handlers in the food processing and manufacturing sector, with the essential, practical information to enable them to provide safe food to consumers. Emphasis has been placed on the measures necessary to control the most common reasons for food borne illness. It is a useful guide and can be read on its own or as part of the FSSAI's level II training programme.

The fundamental causes underlying food safety are the same in all food operations: food is contaminated with microorganisms which multiply to dangerous levels if given the right conditions for growth. In the retail and catering sectors, the main strategy for preventing food poisoning is temperature control. In addition to this strategy, the food processing and manufacturing sector uses other strategies. These include heat treatment, use of suitable packaging after processing and the concept of water availability. It is also important to follow good food processing and preservation practices for the production of safe foods in this sector.

In recent times, many important advances have been made with the development of new food manufacturing processes and new types of food products. Consumers now have the option of choosing from a

range of factory processed foods and ingredients. Despite these advances, as always, knowledge is the key to producing safe and wholesome foods; and it is through the application of knowledge that the food industry must try to satisfy customers as well as comply with the food safety and standards law.

Section 1: FOOD POISONING AND ITS CAUSES

This section describes food hygiene, food poisoning and food contamination.

Food safety is the assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use. Food safety is learnt through several good practices which are the consequence of human culture, history and lifestyle. These are concerned with reducing the acute and chronic hazards that make food injurious to the health of consumers. For food to be safe, it must be free from hazards to health.

A hazard is any agent in food, which can cause harm to the health of the consumer.

FOOD HYGIENE

Food Hygiene is the action taken to ensure that food is handled, stored, prepared and served in such a way, and under such conditions, as to prevent – as far as possible – the contamination of food. Good food hygiene is essential to ensure that the food prepared/sold by businesses is safe. Food safety and hygiene are important both to safeguard consumer health and the reputation of food businesses.

FOOD POISONING

Food Poisoning is a common, often mild but sometimes very serious illness resulting from eating contaminated food or drink. The main symptoms are diarrhoea and/or vomiting, often accompanied by nausea (feeling sick) and stomach pain. The onset of symptoms (diarrhoea, vomiting) is usually sudden and may start within 2 hours of food intake but sometimes there may be an interval of several days. The illness typically lasts 1 or 2 days but sometimes can continue for a week or more.

Food poisoning is weakening and extremely unpleasant for anyone. However, certain groups of people like **infants, pregnant women, elderly people and those with weak immune systems** are at higher risk of suffering serious consequences from food poisoning. Such groups are often referred to as 'at risk' groups.

There are more food poisoning cases being reported in the media every day. Some factors which may have contributed to this increase are:

- more intensive methods for growing or rearing of primary products;
- More food is cooked or partially cooked before it reaches the consumer as it proceeds along the distribution chain, there may be breakdowns in the strict temperature and general hygiene controls to keep the foods safe;
- more people buying processed foods, they may not necessarily be aware of the correct handling and storage processes;
- The culture of eating out – poor standards in food processing and catering businesses can cause illnesses to large numbers of people.

CONTAMINATION OF FOOD

Food contamination occurs by substances (contaminants) not intentionally added to food. Contaminants are the factors responsible for unhygienic food. They compromise food safety, and cause harm to the health of a consumer. Such substances may be chemical, physical or biological.

CHEMICAL (For example, chemical poisons like insecticide)

Chemical poisons such as insecticides get into food, and toxic metals may enter food during processing. Poisonous plants (and fungi) like some types of mushrooms and seafood produce chemicals or toxins which can cause illnesses if consumed incorrectly.

PHYSICAL (For example, undesirable substances in food)

Reports of ‘foreign bodies’ such as dead rats, insects and pieces of glass in food get wide publicity although they are rare events. Physical contaminants such as these are usually detected by the consumer and the food is not consumed. However, substances like glass or staple pins used for packing can be dangerous. These incidents rarely cause food poisoning but are, of course, highly undesirable.

BIOLOGICAL (for example, bacteria and their toxins and viruses)

Biological contaminants include microorganisms/ microbes which are small organisms that can be seen only through a microscope. The most common types of microorganisms are bacteria and viruses.

Bacteria

Bacteria are the most common cause of food poisoning. They are small living organisms often known as ‘germs’. They are so small that it is impossible to see them without a microscope. Bacteria are everywhere: in soil, dust, water, the air around us and on our bodies. It may take only a small number of bacteria to cause illness such as typhoid fever or food poisoning. Some food poisoning bacteria release toxins, which are poisons produced as the bacteria grow in food or in the intestine.

Most bacteria are harmless and some are even beneficial to man like those in our intestines that aid digestion. Certain bacteria are needed to manufacture products such as cheese, curd and for the fermentation of batter used in the preparation of *dosas* and *idlis*. Another family of bacteria, called food spoilage bacteria, can cause food to smell, to lose texture, flavour, and generally to decay. The food becomes so unpleasant that people will not eat it.

Spores

Some kinds of bacteria are capable of forming protective coverings called **spores**. This protection enables bacteria to remain alive, but inactive, in situations that normally would kill them. Later, if conditions become suitable, the spores change into the usual form of bacteria that then multiply rapidly. Spores can withstand high cooking temperatures and are able to survive situations where nutrients or moisture are not immediately available.

Some people have symptoms of illness when they eat certain non-contaminated food because they suffer from allergic reaction to these particular foods (e.g. groundnuts).

Viruses

Viruses can be seen only under a very powerful microscope as the viruses are even smaller than bacteria. They multiply in living cells, not in food. Some viruses can cause foodborne illness; examples include gastroenteritis and hepatitis A. Although viruses are not considered in detail in this book, it should be noted that many of the measures that prevent contamination by bacteria also reduce the risk of viral infection.

How Bacteria Grow

Bacteria must have the following FOUR conditions to live and grow:

FOOD	MOISTURE	WARMTH	TIME
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1. Food

Certain foods - mostly those with high protein content – are particularly rich in nutrients and contain moisture. When kept in warm conditions these foods provide a perfect environment for bacterial growth. When these foods are ready to eat without further treatment such as cooking which would kill bacteria, they are known as the ‘high risk foods’ (more details given in section 9). High risk foods are implicated in most cases

of food poisoning. Examples of such foods are cooked rice, meat, sea food, milk, eggs, and their products.

Foods containing sugar, salt or acid - such as jam or pickles - discourage the growth of bacteria. Some foods have preservatives (chemical substances) added to them to restrict the growth of bacteria.

Bacterial growth may also be affected by the presence or absence of oxygen.

2. Moisture

To grow, bacteria need moisture and this can be found in many foods.

Bacteria are less likely to survive in dried food such as powdered milk or dried eggs but any bacteria that do survive under such dry conditions begin to grow again if fluids are added to the food. One of the reasons why sugar and salt discourage the growth of bacteria is that they take up the moisture that is then not available to the bacteria. Similarly, when food is frozen its moisture turns into ice and is not available to the bacteria.

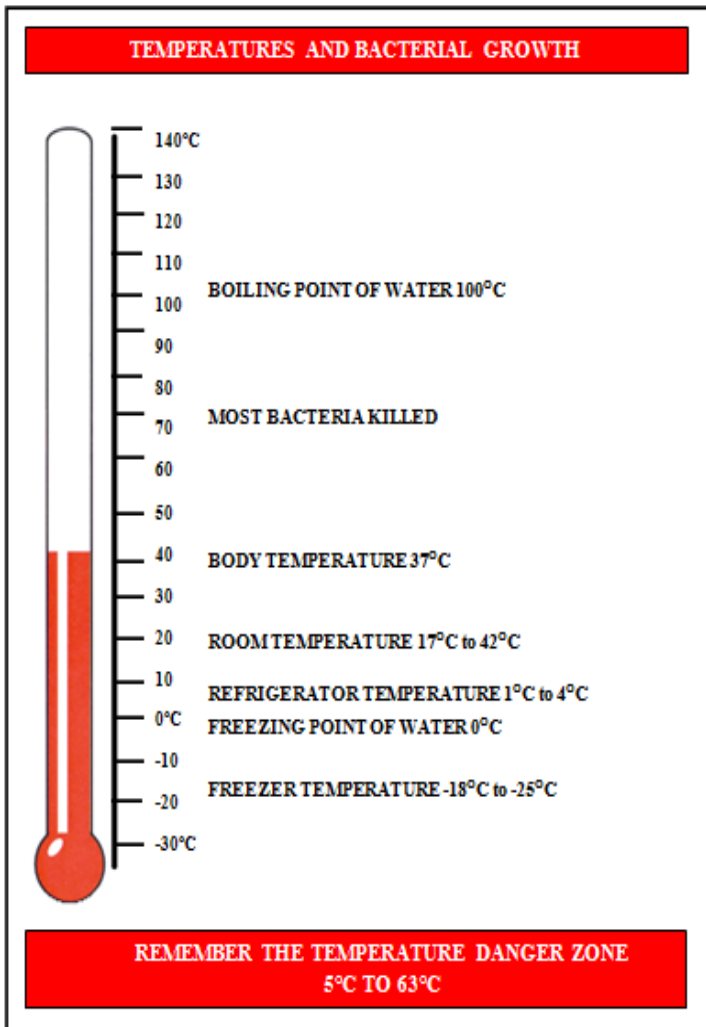
3. Warmth

Bacteria that cause food poisoning will grow at temperatures between 5° C and 63° C; they grow most quickly at a temperature of around 37°C, which is the normal temperature of the human body.

For this reason, the range of temperatures between 5°C and 63°C is known as the **Temperature Danger Zone**.

Bacteria that cause food poisoning will grow rapidly in food that is allowed to remain in the Temperature Danger Zone, for example, at room temperature.

Temperatures outside the Danger Zone are less suitable for these bacteria. Although bacteria grow in warmth they are usually killed by **heat**. Most bacteria are killed by temperatures of **at least 70°C** (at this temperature food is too hot to place in the mouth) provided this is reached at the centre of the food and is held **for a sufficient time**.



However, some bacteria and their toxins (poisons) require exposure to higher temperatures for longer periods of time before they are destroyed.

Pasteurization is a method of destroying bacteria by rapidly heating the food to a sufficiently high temperature for a specific period of time. Milk and milk products are examples of food treated in this way.

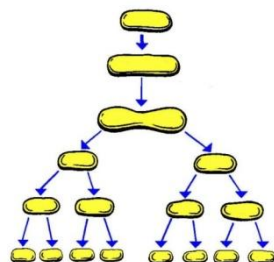
In **cold** conditions (the temperature inside the refrigerator), bacteria do not grow or grow only very slowly. At very low temperatures some bacteria will die, but many will survive and grow again if warm conditions return.

STORE READY-TO-EAT FOODS THAT MAY SUPPORT BACTERIAL GROWTH BELOW 5°C OR ABOVE 63°C

4. Time

Given moisture and warm food, bacteria simply need **time** to grow. It is often carelessness that allows them the time they need, such as when food is allowed to remain in the Temperature Danger Zone.

Each bacterial cell multiplies by splitting itself into two so that **1** bacterial cell becomes **2** bacterial cells. Each of these **2** bacteria then split to make **4** bacteria. Each of the **4** bacteria split into two again, making **8** bacteria, and so on.



Multiplication of bacteria

If the temperature is suitable, bacteria will reproduce in this way every 10–20 minutes. Some take even less time.

This means that after reproducing at around this rate for only 4 or 5 hours, one bacterium will have multiplied into many thousands of bacteria. In reality, the severity of food poisoning will be even greater because contaminated food usually carries considerably more than one bacterium at the outset.

Bacteria are invisible to the naked eye and do not usually cause any change to the appearance, smell or taste of food. An individual cannot therefore, rely on the senses to tell if food is contaminated by these bacteria.

SOURCES OF FOOD POISONING BACTERIA

If food is to be protected from bacteria it is important to know where they come from and how they come to be present in the food we eat.

Most bacteria come from animal and human sources.

1. RAW FOODS



Many bacteria live in the intestines of animals. The animals concerned usually have no symptoms and just carry the bacteria. Thus bacteria can be transferred to meat that will be used for eating, particularly during faulty slaughter, if the intestines/ stomach is ruptured.

For this reason, it is wise to think of all raw meat and poultry, as well as the juices that come from them, as already carrying many food poisoning bacteria before they arrive in the food area. Raw meat and raw poultry are frequent sources of food poisoning outbreaks.

Other raw foods that may carry food poisoning bacteria are eggs - both inside and on the shell - and seafood/ fish. Unpasteurized milk may also contain dangerous bacteria.

In fact, many raw foods, including those which are delivered to the factories for processing, are naturally contaminated by bacteria from the soil, for example, fresh vegetables, unprocessed milk, fruits and meat. When raw foods are handled or prepared, it is important to follow the rules for good hygiene practices.

2. WATER/ ICE



When used in the preparation of food (including ice), water may also be contaminated with biological, chemical or physical hazards. Contaminated

water is the usual source of many food related diseases such as cholera and other *diarrhoeal* diseases. Contaminated water will create a public health risk if it is used for drinking, cleaning, processing food, washing equipment and work surfaces.

3. PEOPLE

Bacteria that can cause food poisoning are carried in several areas of the human body – for example, skin, nose, throat, mouth, ears, hair and finger nails. Bacteria that cause food poisoning can also be present in intestines and thus in faeces (stools).

People infected with food poisoning bacteria often have no symptoms and are referred to as ‘carriers’ because, although not feeling ill themselves, they can transfer the infection to foods with their hands unless they are careful in their personal hygiene.

Careless food handling is one of the causes of bacterial contamination – with bacteria being transferred from hands, mouth, nose through sneezing, coughing, smoking, eating, drinking, touching or scratching sections of the body like hair, nose, mouth, ear etc. Bacteria are also present around cuts, grazes, scratches or boils.

4. PLACES

Bacteria can also harbour in places such as equipment and work surfaces/counters which may directly come into contact with food. When equipment is left dirty for long periods or are improperly cleaned, then bacteria, which may be naturally present in food residues or which have resulted from contamination, can grow.

5. OTHER SOURCES WITHIN THE ENVIRONMENT

Pests such as insects (flies, cockroaches, ants etc.), rodents (rat, mice) and birds (crows, pigeons), all carry bacteria on their bodies and in their urine and droppings. They can infect food or places where food may be placed. Prevention and control of these pests is essential.

Pets, too, carry bacteria on and in their bodies and should not be allowed into food areas.

Rubbish and waste food provide ideal conditions in which bacteria can live and reproduce because they are warm and are left undisturbed for several hours. Hence waste must be disposed of in a proper manner.



Rubbish as a source of bacteria

Section 2: HYGIENE CONTROL IN FACTORIES

This section gives details of action that should be taken to prevent food from becoming contaminated.

Hygiene control in factories which manufacture or process food is the adoption of practices which will reduce the risk of clean food becoming contaminated.

Direct contamination may occur when high risk food has close contact with a contaminated source, but more frequently **indirect contamination** takes place when something transfers the bacteria, for example, hands, cloths and other examples given in this section.

The transfer of bacteria from a contaminated source to an uncontaminated (clean) food is called **cross-contamination**.

The aim of hygiene control is to **prevent the spread** of bacteria and other microorganisms.

In order to maintain high standards of food safety the management will draw up a set of rules.

THE FACTORY ENVIRONMENT

It is essential that the factory is kept clean and tidy, both inside and out. The environment around the factory must be kept free from rubbish and waste material which could attract pests and allow moulds to grow. Pests breeding around the factory may find their way into the buildings. Roadways and pathways must be kept free for access and they must also be maintained and kept clean to prevent dirt being spread around the factory site and carried into buildings. Materials and equipment which are stored outside, such as pallets and cleaning chemical bulk

containers, must not provide shelter for pests or accumulate leaves or other refuse.

BUILDINGS: STRUCTURE AND MAINTENANCE

Ideally, a factory building should be designed and built to allow effective movement of people and vehicles and to exclude access or hiding places for pests. The maintenance of buildings to prevent the invasion of pests is crucial. Good maintenance avoids risks of contamination by bacteria and foreign bodies.

Damage to buildings and wear and tear can result in contamination of food products. Any signs of damage and disrepair, whether inside or outside should be reported to the management.

PROCESSING AND STORAGE AREAS: FLOORS, WALLS, CEILINGS AND DRAINS

All processing and storage areas must be kept clean and tidy. Floors must be kept clear to allow access by people and vehicles. Waste materials and food deposits must be cleared from floors as soon as possible. Floors must be washed when necessary and at specified intervals in accordance with management rules. Where dry conditions are required, as in the manufacture of milk powders, floors may be kept free from food residues by vacuum cleaning.

Walls and ceilings must be kept clean and free from food particles which allow bacteria to grow especially in moist conditions, for example, as a result of condensation.

Ideally, there should be no flat, horizontal surfaces such as window-sills and girders in the factory, where dust, food particles etc. would accumulate. Any such surfaces should be cleaned regularly so as to prevent the possibility of bacterial growth and the contamination of food products.

Drains should be kept free from accumulation of waste materials and food deposits. They should be kept clean, and ideally, in food processing areas, they should be capped when not in use.

PLANT AND EQUIPMENT: FIXED AND PORTABLE

The term **plant** refers to the machinery used in the manufacturing processes within a factory. Plant and equipment which becomes dirty through use can be a danger (hazard) to both food products and to the area where food is being manufactured. Fixed plant and portable equipment must be maintained in a clean and hygienic condition.

Plant and equipment which has been used should not be left standing for long periods of time but cleaned and, if necessary, disinfected. Spoilage bacteria and other bacteria which cause disease can grow readily on plant and equipment which is left dirty and such equipment may also be an attraction to pests.

THE MOVEMENT OF PEOPLE AND BARRIER HYGIENE PRACTICES

People can be one of the major sources of hazard to foods, carrying contamination from place to place around the food factory. Food handlers must not contribute to the hygiene and safety problems of the factory by entering areas other than those in which they are supposed to be.

The transfer of contaminants from unprocessed product areas to processed product areas can be particularly troublesome in food manufacturing. For this reason many food companies operate what is known as '**Barrier Hygiene**' practices, where only approved staff may enter certain areas, and then only wearing essential protective clothing. Food handlers must follow the restrictions placed on their movements by company rules which aim to ensure that the food produced is safe.

MANUFACTURING OPERATIONS: THE HANDLING AND STORAGE OF PRODUCTS

Usually food produced in a factory is manufactured in accordance with a **Product Specification**. This sets out a description of what is required to manufacture a product to the customers' satisfaction.

Tight controls of manufacturing operations, handling, storage and packaging requirements are needed in order to ensure that conditions laid down in the product specification are met. Food handlers involved with the production, handling and storage of food products must ensure they play their part by following the rules.

Even though strict controls are in operation, problems can occur when individuals allow personal standards to slip. Employees must be on guard to prevent anything which could lead to the contamination of plant, equipment, materials or ingredients, or to the deterioration of ingredients and materials.

The unfortunate outcome could be a defective or even dangerous product.

WASTE CONTROL

If they are not properly controlled, waste materials and waste products can be a major source of contamination in the manufacture of food products.

As well as the risk of direct contamination, spoilage bacteria and others which cause disease can grow on waste. Pests are attracted to waste. Thus, the danger to food products as a consequence is obvious.

Waste materials and waste food products should be placed in suitable waste bins which are clearly labelled for that purpose. These containers must be kept separate from the clean food products. They must be

emptied frequently and the waste disposed of in accordance with the company's arrangements. All garbage cans as well as any other equipment which has come into contact with the waste after disposal must be cleaned.

CHANGES TO FOOD PRODUCTION PROCESSES

Unauthorised changes to food production processes are a common cause of product contamination in food manufacture. Such changes can result in food being improperly processed. For example, foods may receive a heat treatment less than required to kill food spoilage and food poisoning bacteria. Alternatively, changes may cause failures in the cleaning of food production processes, particularly when Cleaning –in-place (C.I.P) systems are used. Process changes which result in dead-ends or blind-spots which are not cleaned and disinfected effectively can allow the growth of bacteria, yeasts and moulds which then contaminate food next time the process is used.

Food handlers should always follow the processing instructions laid down by the management.

FOOD PACKAGING

Deliveries of food packaging should be inspected on receipt to ensure freedom from contamination, pest infestation and damage which might place food products and factory hygiene at risk. Materials which are not acceptable should be rejected and securely kept in a separate and safe place until they can be returned to the supplier.

Food packaging materials should be stored under clean, dry conditions and safeguarded from contamination and damage while they await use. Clearly, packaging which is left in the open while being transferred from a delivery lorry to a store is at risk of contamination, for example by bird droppings. Bad practices in the handling and storing of packaging must always be eliminated.

Section 3: PERSONAL HYGIENE

This section explains why strict standards of personal hygiene are necessary and how these can be achieved.

PERSONAL RESPONSIBILITIES

Bacteria live in and on the human body and can enter into food in the workplace if people do not maintain high standards of personal hygiene. The food handler can be a direct source of contamination when bacteria spread through his/her hands, face, head, clothing and jewellery.

HANDS

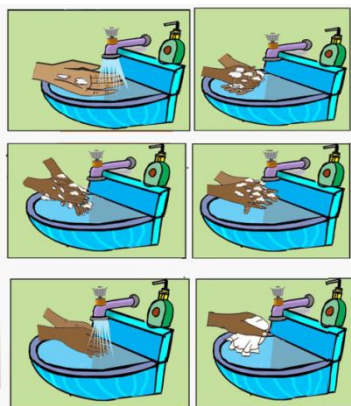
One of the easiest ways for bacteria to spread through the food area is from the hands of the **food handler**.

Hands come into direct contact with food more than any other part of the body. The food handler's hands also touch and can contaminate work surfaces and equipment which in turn may transfer the bacteria to food.

Thus it is important for the food handler to **always wash hands thoroughly** using hot water and soap (preferably liquid soap). All parts of the hands and wrists must be washed under running water. It is just as important to dry hands thoroughly.

The six steps of hand washing (shown in picture) are:

- using warm water and soap;
- making a lather;
- rubbing back of hands and fingers;



- rubbing in between fingers, around thumbs and fingertips;
- rinsing with clean water;
- drying hands thoroughly on a clean towel, and turning off the tap with a towel.

It is best to wash hands with warm water, but if not available cold or lukewarm water is acceptable when used with soap. Though it is ideal to wash hands with soap and water, several people do not have access to soap or even detergent. In their absence, it is acceptable to use coal ash as a substitute for soap to wash hands. A bucket and a pitcher can be used where running water is not available.

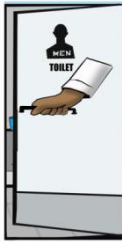
Hands must be washed:

- before entering the food area, before touching any food and often during food preparation;
- after handling raw meat, poultry, seafood/fish, eggs or vegetables;
- after using the toilet or touching any surface in a public place;
- after coughing into hands or using a handkerchief;
- after touching the face or hair;
- after handling waste or cleaning(handling chemicals);
- before and after eating;
- after changing a baby's nappy;
- after playing with pet animals;
- after touching any wound on the body; and
- after smoking.



HANDS MUST BE WASHED

**After
touching any
surface in
public area**



After Smoking



After Cleaning



After eating



After handling garbage



After playing with pets

Bacteria can collect under finger-nails. Nail polish may flake off and contaminate food and false nails may become ‘physical contamination’ in food. Thus, nails should be kept short and clean and no nail polish should be applied.

FACE AND HEAD

Bacteria live in the nose, mouth, throat and ears of humans and can be transferred to food, work-surfaces and equipment by the food handler.

Bacteria also live in hair and on the scalp. Unwashed hair carries more bacteria. Bacteria from the food handler’s hair can easily fall into food.

The food handler should:

- avoid coughing or sneezing into the food;
- avoid touching face and head particularly mouth, nose and ears;
- keep hair covered with a net or a cap;
- wash hair frequently; and
- never comb hair in a food area or while wearing protective clothing.

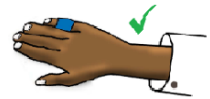
Food handlers must wear adequate, suitable, clean and protective clothing, head covering and footwear.



Protective clothing must be kept clean. Everyday clothes can bring bacteria into the food area. The purpose of protective over-clothing is to prevent contamination from this source. But bacteria can also be spread if the over-clothing or uniform is soiled.

Food can be protected from the risk of contamination if the food handler:

- wears clean protective clothing where appropriate;
- Does not wear the protective clothing away from work.



Visitors to the food manufacturing, preparation or handling areas should, where necessary also wear protective clothing and adhere to other personal hygiene behaviours.

JEWELLERY

It is not a good idea to wear jewellery in a food area. Bacteria and food can gather on items such as rings and bangles. The area of skin underneath the jewellery warms up thus further encouraging the growth of bacteria.



Similar rules apply to watches: if a watch must be worn, it should be removed before washing hands so that the wrists and forearms also can be washed.

Earrings, finger rings and gemstones may fall into food.

WOUNDS

Wounds - cuts, grazes, scratches and boils - can quickly become infected with germs. The best way to prevent them from spreading to the food that is being handled is to make sure that all such wounds are properly covered.

The food handler must:

- keep all wounds covered by waterproof Band-Aids;
- Inform supervisor about wearing a Band-Aid as they may not be allowed to handle food.

NO SMOKING OR CHEWING OF TOBACCO

One must not smoke cigarette/beedi, chew tobacco or spit while handling food, or in an area where food is manufactured. This may lead to contamination to food and thus each one has a duty to adopt good personal hygiene practices.



Hands can pick up bacteria either from the mouth or cigarette/beedi end. Bacteria can be transferred to a work surface when the cigarette is laid down. Cigarette ash can fall into food.

REPORTING ILLNESS

If the food handler feels unwell or suffers from a stomach disorder, cold or cough, eye or ear discharge, it is important to report this to the supervisor. If someone living in the same place as the food handler is suffering from diarrhoea this must also be reported to the supervisor or employer.



The employer may require other illnesses to be reported too.

Section 4: PEST CONTROL

This section describes pests and the preventive actions for controlling them.

PESTS AND FOOD

Three kinds of pests are commonly found in places where food for human consumption is prepared or stored:

- Rodents- such as mice and rats.
- Insects- such as houseflies, cockroaches, ants and a variety of other insects associated with food.
- Birds - such as crows, pigeons and sparrows.



These pests eat and spoil food. They also transfer to the food the food poisoning bacteria they carry on their bodies and in their excreta.

PREVENTING ACCESS

Pests seek food, warmth and shelter. Steps should be taken to keep them out.

The food handler should:

- keep doors and windows closed as far as possible;
- use fly screens on windows;
- inspect the delivery bags, boxes, cartons for signs of pests;
- find the routes by which pests gain access.

DENYING PESTS FAVOURABLE CONDITIONS

We can never be sure that pests will be kept out. But the pests' opportunities for contaminating food and infesting the workplace can be limited.

To do this, the following good working practices can be adopted:

- food particles and spillages should promptly be removed from work surfaces and floors.
- unclean equipment should not be left lying around;
- a high standard of general cleanliness should be maintained;
- any food that requires being left to 'stand out' should be covered;
- dried foods should be stored in containers with tight lids (this will also prevent moisture entering the food) and/or stacked away from walls and above the ground ;
- all food storage areas should be regularly checked;
- waste bins should be emptied regularly throughout the day and certainly at the end of each day.

FINDING PESTS

The following *signs should be looked for*:

- droppings;
- greasy trails at the base of walls and around equipment;
- marks on food or small mounds of food debris;
- nibbled wrappings, holes in cardboard containers;
- pest carcasses;
- unusual smells and noises; and
- damage to woodwork (mice and rats nibble).

**ANY FOOD THAT IS SUSPECTED TO HAVE BEEN
CONTAMINATED BY PESTS SHOULD BE GOT RID OF**

The food handler starting work early in the morning should be particularly vigilant in looking for the tell-tale signs - many pests do their work at night. If signs of pests are found or suspicion raised that the workplace is infested the supervisor must immediately be informed.

Any poisons and chemicals used to control pests must be handled with great care, kept away from food and be stored in a secure place.

Section 5: TEMPERATURE CONTROL

This section specifies the action needed to achieve correct temperature control.

TEMPERATURE AND BACTERIA

Bacteria will grow rapidly in foods like milk, *khoya*, *paneer* and meat that are left within the Temperature Danger Zone: **5°C - 63°C**.

Bacteria do not grow, or grow only very slowly, at temperatures ***below* 5°C**.

They do not grow at temperatures ***above* 63°C**.

Correct temperatures are important in controlling bacterial growth. The idea behind correct temperature control is to keep food out of the Temperature Danger Zone. Depending on the kind of food operations undertaken, temperature should be monitored at the time of receiving, processing cooking, cooling, storage, packaging, distribution and customer service.

CHILLED AND FROZEN FOOD

The chilling of foods to between 1°C to 4°C will slow down the growth rate of many germs, so chilling is used as a means to preserve numerous foods for short periods of time.

The suitability of a food for preservation by chilling and the length of time a food can be kept under chilled storage is dependent on the type and composition of the food. Soft fruit and salad vegetables can be kept in the refrigerator for only a few days before they become soft and soggy. Meat can be held for a little longer but the quality will decline.

REFRIGERATION

A refrigerator should operate at between 1°C and 4°C.

Placing food in a refrigerator does not kill the bacteria that the food may be carrying but the low temperature means that *warmth* - one of the requirements for bacterial growth - is not present. If the food is removed from the refrigerator into room temperature the bacteria will begin to grow again.

Foods should be refrigerated for only short periods of time, the duration varying from food to food. Most foods fall within the 1-5 days' range but a few can be refrigerated for longer. Package labels often mention the maximum periods of refrigeration. Food should not be refrigerated beyond its 'use-by' date.

FOOD	DAYS
Uncooked Meats	2-3
Cooked Meats	1-2
Gravy	2
Milk	1-2
Paneer	15-20
Greens	3
Salad vegetables	5
Soft fruits	2
Cheese (hard)	6 months

Examples of refrigerated storage periods

Foods such as raw meat, poultry and seafood/fish should be refrigerated.

Points to remember about refrigeration:

- Raw meat, poultry and seafood/fish are to be kept away from other foods - especially cooked meat and cooked poultry.
- The most perishable foods like meats should be in the coldest part of the refrigerator.
- Perishable foods should be returned to the refrigerator immediately after use.
- Nothing - particularly raw meat and poultry - should be allowed to drip on to food below. Cooked food should be placed above raw food, or separate refrigerators should be used for cooked and raw food, if possible.
- Cooked food should NEVER be placed in the refrigerator immediately after cooking: It should be allowed to cool first.
- All food should be covered as far as possible. Wrap refrigerated food in plastic wraps, foil, plastic bags or air tight containers to keep them from drying out.
- Food should not be crowded into the refrigerator - Enough room should be allowed for cold air to circulate (When packing refrigerated display units or freezers, care should be taken not to fill above the relevant 'load line' or obstruct air inlets).
- The temperature of the refrigerator should be checked regularly to see that it is between **1°C** and **4°C** (See Record Chart below).
- Refrigerator doors should be opened as infrequently as possible and quickly closed.
- The refrigerator should be defrosted regularly to prevent the build-up of ice. Frost free refrigerators should be used wherever possible.

TEMPERATURE RECORD SHEET				
Refrigerator No. _____				
Temperature range 1°C - 4°C				
Date	Time	°C	Comments	Signature

FREEZING

Freezers keep food at a temperature (-18°C to -25°C) well below freezing point. Domestic chest freezers operate at -18°C, but many commercial freezers are maintained at -25°C to -35°C and sometimes lower. Freezing denies bacteria the warmth they need to grow. The coldness also turns any moisture in the food into ice (water in a form that bacteria cannot use).

Some bacteria will die as a result of freezing but others will survive even though they will be unable to grow. Surviving bacteria will grow if the temperature rises towards the Temperature Danger Zone.

The length of time food can be stored in a frozen state depends on the type of food and the rating of the freezing unit. Although frozen food may not become contaminated it may deteriorate in flavour and character if stored too long. The supplier of the food can be checked with, if there is no knowledge on how long it can remain frozen.

Points to remember about freezing:

- The temperature of the food should be lowered in the freezer to -18°C;
- The temperature of the freezer must not rise above -18°C;

- All food should be wrapped, labelled and dated;
- Food should be stored neatly within the freezer and not overloaded; and
- Old stock should be used before new - maximum storage periods should be known.

STORAGE OF FOOD

All dry foods, such as flour, rice and pulses and all canned food, should be stored in a room or cupboard that is cool, dry, clean and ventilated.

Deliveries must be checked to ensure that goods that will be stored are free from odours, dampness or other forms of soiling and do not harbour pests.

Food should be stored on shelves – there should be no food at floor level – to reduce the risk of contamination by pests and to make the floor more accessible for cleaning.

‘First In, First Out’ is one of the ‘golden rules’ of stock control. Stock should be rotated so that the oldest food is used first, identifying the stock will be easier if the stocks are date labelled and are not crowded together on the shelves.

The storage temperature should be enough to maintain the safety and suitability of the product for its intended shelf life. If the temperature of the product is the main means of preserving it, it is important that the product be maintained at the appropriate temperature. Temperatures should be checked regularly and records maintained.

Section 6: CLEANING AND DISINFECTION

This section describes methods available for cleaning and disinfecting the workplace.

CLEANING THE WORKPLACE

Cleaning should achieve two things:

- the removal of grease, food debris and dirt; and
- the destruction of microorganisms (disinfection).

Cleaning of the workplace can be divided into two broad categories:

'clean-as-you-go' and *'scheduled cleaning'*.

CLEAN-AS-YOU-GO applies to cleaning that must be done very quickly after soiling occurs. The aim is to prevent cross-contamination or injury to staff, or simply to keep working areas clean and tidy. Examples of this type of cleaning are:

- cleaning up a floor spillage just after it has happened.



Clean floor spillage as soon as it occurs

It is vital that the surfaces of plant and equipment which come into contact with food are kept clean and bacteria-free for each new job. In addition to clean-as-you-go there may be a daily requirement to clean

the surfaces at the start of work. Work surfaces should be left clean and clear at close of work.

The stages of cleaning by hand are:

1. remove food particles and spillages using a damp cloth, brush or hose- whichever is suitable;
2. use a solution of detergent and hot water to remove grease and general soiling;
3. rinse the surface thoroughly using hot water;
4. apply a suitable disinfectant in hot water, allow sufficient time for the solution to do its work;
5. Rinse again using hot water and leave the surface to dry.
Alternatively, dry the surface using disposable paper towels.

Whenever possible, with plant and equipment follow clean-as-you-go. Leaving plant and equipment dirty for longer than is absolutely necessary can result in the growth of bacteria which might get transferred to clean plant and equipment or products. It will also make cleaning more difficult when done later. Many food materials have the habit of sticking and drying solid if left for any length of time. This can make the food deposits much harder to remove and increase the possibility that not all of the deposit will be removed. If bacteria have grown in the food before cleaning, then the chances of the bacteria being protected by the dried deposit and subsequently contaminating food are very much greater.

WET CLEANING AND DRY CLEANING

Wet cleaning and dry cleaning are the two common cleaning options in food manufacture.

Wet cleaning, as the name suggests, involves the use of water to carry cleaning chemicals and also for rinsing plant and equipment. Ensure that wet cleaning is confined to the process, plant and

equipment intended to be wet cleaned. In some instances wet cleaning can cause greater problems than it solves. Wet cleaning can result in water deposits being left on plant and equipment and in food production areas. The opportunity is then provided for bacteria to grow with the consequent possibility of food products being subject to cross-contamination.

Dry cleaning is the preferred cleaning method where the use of water could cause subsequent problems. Dry cleaning often employs vacuum cleaners as well as brushes, spatulas and other implements. It is particularly effective in removing powder deposits which might spread and stick with the use of water. Since detergents and disinfectants are not used in dry cleaning, particular care must be taken to ensure the hygienic condition of the vacuum cleaner. Any condensation forming in the vacuum cleaner will allow bacteria to grow in the food materials and dust collected.

SCHEDULED CLEANING refers to cleaning tasks carried out at regular intervals. Manufacturing factories should have a timetable which specifies all the details for every piece of equipment to be cleaned and all parts of the structure to be cleaned. Two of the standard types of scheduled cleaning are **Cleaning-out-of-place** and **Cleaning-in-place**.

CLEANING-OUT OF-PLACE (C.O.P)

Cleaning-out-of-place or C.O.P. is the cleaning practice employed when plant and equipment are removed from their place or point of use to be cleaned in another location. C.O.P. is mostly a hand-cleaning operation and, therefore, concerns plant and equipment of manageable proportions. A drawback of C.O.P. is that cleaned plant and equipment can easily be recontaminated whilst it is being taken back to its place of use and re-installed.

Operator error is possible in the preparation of cleaning chemicals and in observing the correct contact time, such that effective cleaning and disinfection may not always occur.

Care must be taken to ensure that cleaning chemicals are made up to the right strength, used in the right order and are given the required time to work (contact time).

CLEANING-IN-PLACE (C.I.P)

Cleaning-in-place or C.I.P. is used when plant and equipment cannot be removed for cleaning elsewhere because it is either too big or because reassembly would present unacceptable hygiene risks, such as, operators handling cleaned and disinfected surfaces or such surfaces being exposed to the atmosphere and the possibility of aerial contamination. The C.I.P. process ensures that plant and equipment are washed and disinfected in their place of operation to stand ready for re-use without the risk of subsequent recontamination.

CLEANING AND DISINFECTION CHEMICALS

Chemicals are available to enable proper standards of cleaning and disinfection to be maintained. Usually the chemical is added to water to make the cleaning solution.

DETERGENTS are chemicals that will dissolve grease and assist in the removal of food debris and dirt. Detergents do not kill bacteria.

DISINFECTANTS are chemicals designed to destroy bacteria. They reduce the number of bacteria to a safe level. Disinfectants are not effective in removing dirt and grease. Disinfectants which have a very strong smell that might taint food must not be used on any surfaces or equipment that comes into direct contact with food. However, it is very

important that these surfaces are properly disinfected using a suitable chemical solution or steam or hot water (over 82°C).

SANITIZERS are chemicals combining the role of both detergent and disinfectant. They are designed to remove grease, dirt and destroy microorganisms by disinfecting at the same time.

Disinfection by HEAT is an effective way of killing bacteria for example, using very hot water (80°C-85°C). Chemical disinfectants and sanitizers can be used in addition or in situations where hot water is not available. However they are less effective in water that is not hot and on surfaces that have not received a preliminary clean using hot water and a detergent.

It is a popular myth that the use of disinfectants achieves perfect hygiene. They are useful in reducing the numbers of bacteria on surfaces that come into contact with food, as well as for floors and toilet areas. Disinfectants used must be suitable for work areas and must not taint food.

When using cleaning solutions the food handler should:

- Prepare solutions as per the concentrations/ dilutions mentioned under the instructions for use on the container.
- make up fresh, hot solutions frequently: dirty or cool water makes the chemicals less effective.
- wear rubber gloves or other protective clothing when necessary.
- not store chemicals within the food area or where they may warm up.
- NEVER mix different chemicals - they become less effective when mixed and poisonous gases may be produced.



CLEANING IMPLEMENTS AND PORTABLE EQUIPMENT

A variety of cleaning implements and portable equipment may be used for cleaning food processing plant and equipment, food processing areas and other areas of a food factory. The Food handler must ensure that the cleaning implements and portable equipment used are appropriate for each cleaning task and for use in the location to be cleaned.

Food handlers must be careful that cleaning implements and portable equipment are fit for use and are not so dirty that they prevent effective cleaning. Often implements and equipment are assigned for use in specific locations, so care must be taken not to cause problems by using the wrong tool for the job. One effective way of preventing cross contamination in the factory is by the implementation of a **colour code system**. For example, brushes may be colour coded to signify use on floors, use on the non-food contact surfaces of food processing plant or for use on food contact surfaces. Using a floor brush on food contact surfaces could spread more contamination than the cleaning itself prevents.

FLOORS, WALLS AND CEILINGS

Floors can be cleaned either by using a machine scrubber or by manual scrubbing using hot water and detergent. Where a hand scrubber or mop is being used, work with two buckets. One should hold the hot cleaning solution; the other should hold plain hot water for removing dirty water and soil from the hand scrubber or mop head as cleaning proceeds. Following scrubbing, the floor should be rinsed using a cloth, detachable-head mop or machine. Very hot water aids quick drying.

All areas of the floor should be cleaned paying particular attention to parts where food residues may have lodged.

Where cleaning is required during the day this can usually be done by mopping. Food spillages should be cleaned up as they occur.

A wet floor is a hazard to staff: during cleaning and drying a warning notice should be displayed.

It is important that a floor is left clean and free from food residues at the daily close of work. Dirty floors are an invitation to pests to take up residence.

Walls and ceilings should be free of dirt, litter, and moisture. Corners and places that are hard-to-reach should also be cleaned routinely. Most oil-based painted walls can be satisfactorily cleaned using very hot water and a detergent or sanitizer. A disinfectant should be used daily for wall areas where splashes and stains may occur such as behind sinks or work-surfaces.

Ceilings can be cleaned with a vacuum cleaner, ceiling broom or with the help of a broom tied with old flannel cloth. These devices can be used to dust the ceiling from one end to the other end. Stained areas can be cleaned with the help of a sponge and detergent.

DUSTING AND SWEEPING

Dry dusting and sweeping can fill the air with dust particles that may well be carrying bacteria. A moist cloth should be used - never a dry duster - for ledges and shelves. For floors, a clean damp cloth should be wrapped around the brush head if no better alternative exists.

SCRUBBERS, MOPS AND CLOTHS

Scrubbers, mops and cloths become contaminated with bacteria during cleaning. They must be thoroughly washed and disinfected frequently. Mop heads and floor cloths should be changed regularly.

WASTE BINS

Waste bins can become breeding grounds for insects and rodents, their contents providing the food and shelter these pests need.

WASTE BINS WITHIN THE FOOD AREA

Bins and bin stands must be washed down and disinfected regularly, as part of the cleaning schedule. The floor area around bins must be cleaned at least daily.

EXTERNAL WASTE BINS

'Outside' waste bins must be positioned as far away from the food area as practicable and must have lids or covers to limit access by pests.

The area around the waste bins should be kept tidy: waste material should not be left stacked up outside the bin. The area should be hosed down after each collection. During the summer months it may be necessary to disinfect the bins or to spray them with insecticides.

Section 7: PACKAGING, TRANSPORTATION AND LABELLING

This section describes the importance of and measures for safe packaging, transportation and labelling.

PACKAGING

Food packaging is the enclosing of food to protect it from damage, contamination, spoilage, pest attacks, and tampering during transport, storage, and sale. It is an integral part of food processing. It has two main functions: to advertise foods at the point of sale, and to protect foods to a pre-determined degree for the expected shelf life.

The package is often labelled with information such as amount of the contents, ingredients, nutritional content, cooking instructions (if relevant), and shelf life. The package needs to be designed and selected in such a manner that there are no adverse interactions between it and the food.

Packaging types include polythene or paper bags, sacks, cardboard boxes, bottles, cans, cartons, and trays. Sometimes manufactured food has to be protected and packed during transportation in corrugated fibre board cases, wooden or metal cases, crates, barrels, drums and sacks. Such containers are used not for marketing but for insulation and protection during transportation.

Points to remember while Packaging:

- Materials used for wrapping are not to be a source of contamination; they must be stored in such a manner that they are not exposed to a risk of contamination.
- Reusable wrapping and packaging material should be easy to clean and where necessary to disinfect.

- As far as possible all unpacking and packing should be carried out in areas separate from food production or preparation to prevent contamination of open food.
- String removed from sacks and ties removed from bags should be immediately placed in suitable containers provided specifically for the purpose.
- Paper sacks should be cut open, although care should be taken to ensure paper does not finish up in the food.
- Special care is needed to ensure that staples, which tend to fly considerable distances when boxes are opened, do not contaminate food.
- Suppliers should be requested to use adhesive tape to fasten boxes, instead of staples.
- Packaging materials and gases shall be non-toxic and not pose a threat to the safety of food. Certificates of conformity or other evidence may be used for verification.

LABELLING

Food labelling is a means of communication between the producer and seller of food on one hand, and the purchaser and consumer on the other. It can be written, electronic, or graphic communications on the packaging or on a separate but related label. The symbols used on package labels are generally internationally standardized.

Pre-packaged food must conform to compulsory standards on labelling and advertising. The details that must appear on packaging include the name under which the product is sold, a list of ingredients and quantities, potential allergens (products which may cause allergies), the minimum durability date and conditions for storage, processing and handling. A batch, code or lot number which is a mark of identification by which the food can be traced in manufacture and identified in distribution, should also be given on the label.

FOOD DISPATCH AND DISTRIBUTION

All packaged food products should carry a label to ensure that adequate and accessible information is available to the next person in the food chain to enable them to handle, store, process, prepare and display the food products safely and correctly and that the batch can be easily recalled if necessary.

“First in First Out” and “First Expire First Out” stock rotation system should be applied to release the food products from the store. This means that foods should be used in the order they are delivered and expire. For instance, the newest milk should not be used first if there are still several litres that are good from the last delivery. Expired material should be discarded and not entered into the dispatching process.

TRANSPORTATION

Damage during transport is one of the commonest problems in packaging. The type of the packaging methods used in this distribution system depends on the mode of transportation and method of handling and storage.

Points to Remember in Transportation:

- Vehicles used to transport foods must be maintained in good repair and kept clean.
- The temperature of food when transported in containers should be maintained at the required temperature.
- For bulk transport, containers and conveyances should be designated and marked for food use only and be used only for that purpose.
- Conveyances and containers for transporting food should be kept in an appropriate state of cleanliness, repair and condition.
- The vehicle used for transport should not carry animals, toxic substances or contaminating materials along with the prepared

food. Food and non-food should be suitably segregated during transportation. Where the same conveyance or container is used for transporting different foods or non-foods, effective cleaning and where necessary, disinfection should take place between loads.

- Food should be adequately protected during transport.

TRACEABILITY

Traceability is the ability to trace the history, application, or location of an item or activity with the help of documentation. Food businesses must be able to trace foods or any substance that is intended to be part of a food throughout all the stages of production, processing and distribution.

Several examples of food safety incidents show how a single source of food contamination can affect an entire business/industry because of lack of traceability. For example, in a case of food poisoning, if the origin of the contaminated food can be identified quickly, a much smaller quantity of the food could have been contaminated, less people affected, and consumers given the information much sooner. Food businesses must have written systems and procedures in place to identify all business to which they have supplied products or received products from, and be able to operate internal traceability systems to identify, isolate and correct food safety problems as quickly as possible. Records of recalled products should be maintained.

All food products placed in the market must be adequately labelled or identified to enable full traceability. Food businesses have a legal duty to withdraw products from the market that they identify as unsafe and carry out a full recall of these products.

Section 8: FACTORY DESIGN AND LAYOUT

This section describes the importance of good factory design and layout to improve food safety.

FACTORY LOCATION

Ideally, the factory should be located in an area suitable for food processing but this may not always be so. Food factories should be sited away from other industries which might affect the quality and safety of the food products. Examples of industries which do not make good neighbours for food manufacturers are mining operations and cement manufacturers, where dust may be carried by the air into the factory and onto ingredients, packaging and foodstuffs.

Apart from dust, other airborne contaminants can be a nuisance, for example odours carried on the wind from chemical processing plants. Some foods are very good at absorbing odours, especially foods which contain fats. The close proximity of farms can also cause difficulties.

Food factories should also be located away from rivers and streams where there is a possibility of flood waters invading the site, or, at the very least, the factory site should be at a level above that of possible flooding. Rivers, streams and farms can be sources of pest problems, attracting and providing harbourages and breeding grounds for rodents and insects. Close proximity of some food factories to residential properties can give rise to complaints of noise, odour or traffic.

MATERIALS AND PRODUCT FLOW

The efficient flow of products through the factory can have a significant effect on the maintenance of hygiene and prevention of damage or deterioration to products. Ideally, the factory design and layout should ensure that raw materials, ingredients and packaging travel as short a distance as possible when passing from one stage of the food

manufacturing process to the next. Also, they should be handled as little as possible, not only to reduce the costs of handling, but also to reduce the risks of contamination, damage and deterioration.

The factory design and layout should ensure that raw materials, ingredients and packaging are received into handling and storage areas which are suitable for preventing the possibility of dust, dirt and other contaminants, which might be carried with deliveries, from being distributed to other parts of the factory. The inspection of deliveries should ensure that obviously contaminated products are rejected.

At times, materials and packaging may be stored in buildings set apart from food manufacturing processes. In such cases, precautions should be taken to protect against the introduction of contaminants into food processing areas when materials are transferred. For example, bird droppings may fall on materials being transported across a factory site.

The flow of food storage and manufacturing activities should prevent the possibility of raw materials from accidentally entering processing areas, with the risk of contamination of finished products. For example, the accidental transfer, on the footwear and clothes of process operators, of raw milk from storage areas, increases the possibility of spreading microorganisms that spoil food or cause disease to milk processing areas: with the consequent risk that pasteurised products may become contaminated.

The factory design and layout should also ensure that intermediate products and final products are stored in designated areas and that these are for preventing contamination, damage, deterioration and misidentification. Storage areas should be appropriate to maintain products in the required condition. For example, dry stores should be clean and dry and kept at the correct temperature for the products stored. Refrigerated stores and freezer stores should be operated within the required temperature range and should be clean and free from

condensation which might affect the quality and integrity of stored products.

DRAINAGE SYSTEMS - RAIN WATER, EFFLUENT, FOUL WATER, RIVERS AND STREAMS

The factory layout and buildings should be so designed and constructed to allow the flow of rainwater, effluent (outflow of liquid waste) and sewage away from buildings, storage and production areas.

Gutters, storm drains and process water drains should be kept free from accumulations and blockages which might cause the leakage or backflow of foul water into storage and production areas.

Sewerage systems should not open into storage and production areas. The premises' design should also prevent any chance overflow from sewerage systems into storage and production areas. Storm water drains should be appropriately located and of a suitable gradient to prevent any backflow from rivers and streams onto the factory site during times of flood.

EFFLUENT TREATMENT

The potential for other industries to cause problems for food manufacturers was discussed earlier. However, food factories can cause problems of their own for local residents, particularly if the effluent treatment plant is not controlled satisfactorily.

The content and quality of the liquid wastes (effluents) that flow out of a food factory are dependent on the process taking place. In some cases objectionable smells can arise, for example, from the effluents of milk factories and confectionery factories. The aim of effluent treatment is to remove, as far as possible, any nuisance or potential damage to the environment. Some factories ship out effluent or it enters the local sewerage system to be handled by the local water authority.

When a food factory site includes an effluent plant, care must be taken to control the plant adequately. This is necessary to ensure the effective treatment of effluent, to avoid the nuisance of odour to the factory and local residents, and also to avoid the possibility of contaminating the factory with fine sprays (known as aerosols) containing microorganisms and effluent solids.

Effluent plants can attract pests such as rats, mice and wasps. Precautions must be taken at all times to prevent pests from finding sanctuary in and around effluent plants.

Section 9: HIGH RISK FOODS & STORAGE OF FOOD

This section gives examples of high risk and low risk foods and how to store them.

Food categories include those with high level of public health risk and those that represent a low level of risk. Food handlers should recognize them so that necessary action can be taken to prevent illness.

LOW-RISK FOODS

Low risk foods are those that are rarely implicated in food poisoning and may be stored and suitably packaged, at ambient temperatures. They do not support multiplication of food poisoning bacteria.

Some examples include:

- Preserved food such as jam;
- Dried foods or food with little moisture, such as flour, rice bread or biscuits. However, once liquid has been added to powdered food, such as milk, the food becomes high risk;
- Acid foods such as vinegar or products stored in vinegar;
- Fermented products;
- Foods with high fat/sugar content, such as chocolate;
- Canned foods, whilst unopened.

HIGH-RISK FOODS

High-risk foods are ready to eat foods that under unfavourable conditions support the multiplication of harmful bacteria and are intended for consumption without further treatment that would destroy such organisms. , High risk foods are most likely to be involved in cases of food poisoning. They are usually high in protein and moisture, requiring strict temperature control and protection from contamination. According to the Food Safety and Standards Authority of India, the high risk foods in India include the following:

- Cut fruits/ salads, fresh juices and beverages;
- Confectionery products;
- Meat, poultry and fish products;
- Milk and dairy products;
- Water based chutneys, sauces etc;
- Food transported to point of sale from point of cooking;
- Food with gravy;
- Fried foods;
- Post-cooked mixing; and
- Thawing of frozen products.

1. Cut fruits/ salads, fresh juices and beverages

The practices that can be used to keep fresh cut fruits and vegetables and their juices safe are:

- Food should be used immediately; however, if stored for short time it should be under refrigeration and should be kept in clean and properly covered vessels.
- Uncooked vegetables and fruits should be washed thoroughly with potable water before being cut and mixed with other ingredients. Uncooked, ready to eat fruits and vegetables should be washed with 50 ppm chlorinated water before cutting, peeling or serving.
- Water used for juices and beverages, including that used for making ice, should be potable.
- Food or beverages should not be stored in the same container used to store the ice intended for consumption.
- Juice concentrates must be checked regularly for any fungal growth / change of colour, odour or gas formation in the bottle.
- Juice dispensing machines should be cleaned and rinsed with water regularly.
- Containers made of food grade material should be used for

collecting juice.

- Clean and intact utensils/crockery & cutlery/disposables should be used for serving.

2. Confectionery products

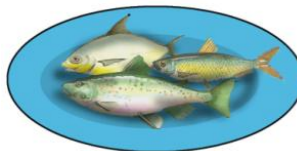
The following good hygienic practices should be followed for confectionery products:

- Prepared confectionery products should be kept in airtight containers and displayed hygienically;
- The cream to be used in these products should be stored covered under refrigeration;
- Finished products should be refrigerated with proper labels indicating date of expiry;
- Products should be properly wrapped/ packaged after proper cooling.; and
- Only permitted food additives (colour, preservatives, flavouring agents etc.) should be used.

3. Meat, poultry and fish products

The following are important dos and don'ts for meat, poultry and fish products:

- Non-vegetarian products/raw materials should be purchased (chilled products temperature should be at 5⁰C or below and frozen products at -18 ⁰C or below) from authorized/licensed slaughter houses/vendors.
- Processing area should be cleaned and disinfected promptly.
- Preparation and processing of meat, poultry and marine products should be separate.
- Non-vegetarian products should be washed with potable water before use.



- Non-vegetarian. products are cooked thoroughly (core temperature 75°C) for at least 15 seconds or an effective time/temperature control e.g. 65°C for 10 minutes, 70°C for 2 minutes.
- Non-vegetarian products should be stored covered in refrigerator below the veg. products.
- Raw and cooked products should be stored physically separated with cooked products at the top.
- All refuse/waste should be promptly removed from preparation area.

4. Milk and dairy products

Milk and dairy products can be kept safe through the use of the following practices:

- All equipments and utensils should be thoroughly washed and rinsed with potable water before starting of work and at the end.
- All mechanical equipments should be routinely cleaned, checked and maintained.
- All products should be routinely checked for spoilage/contamination and shelf life.
- Any spoiled/contaminated product should be promptly removed and discarded..
- Milk should be received in clean and hygienic conditions at temperature below 5°C .
- Milk and milk products should be used immediately or pasteurized and refrigerated.

5. Water based chutneys, sauces

The following good hygiene practices should be used to keep chutneys, sauces and other items that are water based.

- All fruits/vegetables should be washed properly before processing.

- Clean and disinfected chopping boards/grinding stone/machine should be used.
- Personal hygiene of food handlers need to be ensured.
- Water used in the chutneys should be safe and potable.
- Only permitted food additives should be used, if required, and added in recommended quantities only.
- Spoiled products should be discarded immediately after confirmation of spoilage (change in colour/ texture/ odour).
- Sauces and chutneys should be stored in glass/food grade plastic containers with proper lids.
- Clean and intact containers should be used for storing sauces and chutneys.
- Sauces and chutneys should be stored in refrigerator when not in use.
- Perishable/uncooked chutneys should be consumed immediately.

6. Food transported to point of sale from point of cooking

Food is cooked in one place and is transported to another. This may include many cooked items or, sweets etc. To give the example of how spoilage occurs, let us consider the rice based items. Bacterial spores can be found in dry rice. Once water is added to the rice during cooking the bacteria became active. Some of the bacteria may survive the cooking temperature. If, after cooking, the rice is not eaten immediately or not refrigerated; these particular bacteria will grow profusely and produce a toxin (poison) which may persist even if the rice is re-heated before being consumed.

The following should be practiced with such food:

- Reheating up to 70⁰ C before consumption; and
- Consumption within 4 hours of reheating.

7. Food with gravy

In the case of foods with gravy it is important that:

- Food products should not be stored at room temperature for more than 2 hours during display or sale;
- For prolonged storage, foods should be stored in refrigerators or kept for hot holding at or above 60 °C; and
- No water should be added after cooking/reheating/boiling.

8. Fried Foods

The following good practices should be adopted in the case of fried foods:

- Proper quality / branded oils/fats should be used for food preparation, frying etc.;
- Use packaged oil only;
- Use of oils with high trans fats (like vanaspati) should be avoided as far as possible; and
- Re-heating and reuse of oil should be avoided as far as possible. Therefore, avoid having leftover oil wherever possible.

9. Post-Cooked Mixing

When mixing ingredients after cooking, it is important to follow these practices:

- Ingredients added to the cooked food should be thoroughly washed/ cleaned.
- After cooking or post-cooked mixing, the food should be used immediately.
- Garnishes etc., if added should be prepared using fresh, thoroughly washed and freshly cut vegetables and used immediately.

10. Thawing of Frozen Products

- Frozen products should be thawed in refrigerator/microwave/convection oven or under running potable water well before cooking.
- Only required portion of the food should be thawed at a time.

Thawed products should be used immediately and not refrozen or kept in chillers.

DISTRIBUTION OF HIGH-RISK FOOD

Vehicles used for distribution of high-risk food must always be insulated and preferably refrigerated, even for short journeys. Insulation of the roof and floor is just as important as the insulation of the walls. Properly located thermometers should be fitted to all the vehicles.

DELIVERY AND UNLOADING OF RAW MATERIAL

- Effective documentation checking system should be in place for selecting suppliers and dealing with deliveries;
- Deliveries should be accepted from approved suppliers;
- All deliveries should be checked before storage;
- The delivery vehicle should be clean and if necessary refrigerated;
- All outer packaging should be in a good condition and not be discoloured or contaminated, example, from bird droppings;
- The food should be labelled and date coded;
- The food should have sufficient shelf life to enable it to be used;
- Chilled food is delivered below 5⁰C and frozen food at or below -18⁰C;
- A satisfactory delivery should be transferred within 15 minutes of unloading;

- High risk food delivered in a unrefrigerated vehicle should be rejected;
- If food comes from an unapproved source, out of date food, damaged packaging or food with evidence of pests should be rejected;
- The delivery area should be kept clean and staff should always be available to accept deliveries.

STORAGE OF FOOD

RAW MEAT AND POULTRY

Raw meat products should be stored between -1°C and $+1^{\circ}\text{C}$, with a relative humidity of 90%. They should not touch the wall surface and only approved suppliers should be used.

EGGS

Raw eggs are a source of Salmonella; it can be present both inside the egg and on the shell, especially if contaminated with chicken faeces. Manufacturers should store eggs at a constant temperature of 20°C . Fluctuations in temperature will result in condensation on the egg, leading to Salmonella being sucked into the egg from the surface. Stock rotation is necessary.

FRUITS AND VEGETABLES

Although different fruits and vegetables have their own optimal storage conditions, a general guide is to store cut or peeled fruits and vegetables under refrigeration. Usually dry stores are used to store fruits and vegetables. Fruit should be examined regularly and mouldy items are removed to prevent rapid mould spread.

A stock rotation system to ensure that older products are used first must be implemented. Vigorous washing, turbulence and brushing will all help to reduce the levels of bacteria as well as remove soil, dust, insects and chemicals.

MILK AND CREAM

They need to be stored under refrigeration (below 5⁰C) and should be placed in it or in a cold store as soon as they are received. Milk crates should not be stored below raw meat.

ICE CREAM

Ice creams need to be stored in a clean, dedicated freezer. They should be kept away from raw products. Ice cream that has defrosted should be discarded. Defrosted ice cream is a hazard, because at high temperatures it provides ideal conditions for Salmonella growth.

FLOUR AND CEREALS

They need to be stored in stainless steel containers with tight fitting lids. Large stocks of flour kept in original sacks must be stored clear of the ground and free from damp. Condensation can result on mould growth on wet flour.

STAFF RESPONSIBILITIES

Food handlers should open doors for as little, and for as short a time, as possible. The temperature of the refrigerator should be checked regularly. Spillages should be cleared up immediately.

UNFIT FOOD OR DAMAGED STOCK

All damaged stock should be thoroughly examined and segregated before use. The suspect food should be clearly marked as ‘unfit’ or ‘not to be sold’. A dustbin should be designated for this purpose.

Food with damaged packaging should not be used for food processing or offered for sale. Damaged packaging can expose food to physical or microbiological contamination.

Section 10: FOOD HYGIENE AND THE LAW

This section describes the Food safety and standards Act, 2006 and a preventive system of control in food hygiene.

Every country has its own food laws which Food handlers need to understand as they relate to their work and themselves. In India, a new era in Food safety began with the Food Safety and Standards Act, 2006 which became operational from August 5th, 2011 throughout the country. (More information on this act is available from the Food Safety & Standards Authority of India website <http://fssai.gov.in.>)

This section describes relevant points of the Act that are related to food hygiene.

The Food Safety and Standards (FSS) Act, 2006

The FSS Act consolidates the earlier laws relating to food. As part of the process of consolidation, the eight earlier food laws in the country have been repealed since this Act came into being on August 5th, 2011. It moves from a multi-departmental and multi-level control to a single reference point for all food safety and standards related matters. It lays more emphasis on science based and participatory decisions in both standard setting and implementation. The Act enables unidirectional compliance and addresses the need for a single regulatory body.

The Food Safety and Standards Authority of India

To this effect, the Act establishes an independent statutory Authority – the Food Safety and Standards Authority of India (FSSAI) with head office at Delhi. FSSAI and the State Food Safety Authorities enforce various provisions of the FSS Act. The Ministry of Health & Family Welfare, Government of India is the Administrative Ministry for the implementation of FSSAI.

The Act aims to achieve an appropriate level of protection of human life and health and the protection of consumer's interests, including fair practices in all kinds of food trade with reference to food safety standards and practices. Food business operators should thus ensure that the articles of food satisfy the requirements of this Act, at all stages of production, processing, import, distribution and sale within their business.

Prevention of Contamination of Food By Food Handlers

Under this act, sellers become liable for any article of food which is handled or kept in unsafe conditions. Thus, it becomes the responsibility of food handlers working in the industry to ensure safe handling and storage of food.

Food Safety Management System

The new act also emphasizes on Food safety, Good manufacturing practices and Process Control. To do this, food business operations that serve, process or sell food must have a food safety management system in place that guarantees safe food. Such a system is based on HACCP or Hazard Analysis Critical Control Point System principles i.e. established principles of hygiene management.

Food safety management is the application of food policies, systems and processes in a food operation in order to prevent foodborne illnesses and protect consumer health.

HACCP (Hazard Analysis Critical Control Point System)

HACCP was developed in the USA to ensure safe foods to astronauts. Essentially HACCP is concerned with identifying all the potential hazards associated with a food product and its manufacturing process.

A Hazard is defined as anything that can cause harm to a consumer.

A hazard may be:

- Biological for example, contamination by food poisoning organisms or by pests;
- Chemical for example, contamination by cleaning chemicals;
- Physical for example, contamination by foreign bodies.

Hazards may come in with purchased raw materials, ingredients and packaging, or they may arise in the, storage, or delivery stages.

When a hazard has been identified, a decision must be made as to at which stage in the process the hazard must be controlled. For example, a refrigerated product might accidentally be allowed to warm up and microorganisms may then grow.

When the hazards have been identified a decision is made as to where in the process each hazard can be controlled. The points or sections of the process at which hazards are controlled are known as Critical Control Points (CCPs), hence the Hazard Analysis Critical Control Point system.

Advantages of HACCP



Instead of waiting for a problem to arise and then take action, HACCP seeks to determine what problems might arise and to prevent them from happening in the first place. This is logical and sensible and reduces the need for time-consuming inspection of the finished food item.



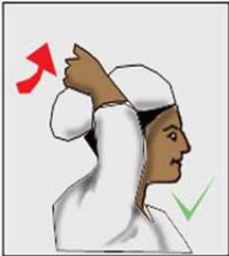
The seven principles of HACCP



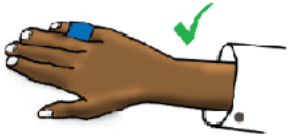

1. Conduct a hazard analysis - This helps to identify and evaluate the potential hazards that may occur at each step of food production from primary production hazards, processing and manufacturing, distribution, and preparation through to final consumption.



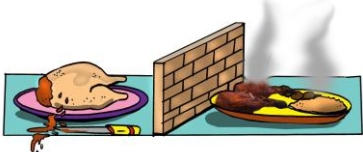
2. Identify critical control points - When the hazards have been identified a decision is made as to where in the process each hazard can be controlled. The points or sections of the process at which hazards are controlled are known as **Critical Control Points** (CCPs). It may be that hazards can be eliminated at CCPs, but in some instances they can only be reduced to an acceptable level.
3. Establish critical limits for each critical control point - Critical limits are values which are set for control measures (at each CCP) to ensure that the food is safe. The critical limits include time, temperature, size, weight and appearance.
4. *Establish critical control point monitoring requirements* - The monitoring systems should state **WHAT** the critical limits are; **HOW** monitoring should be undertaken; **WHERE** the monitoring should be undertaken; **WHEN** the monitoring should be undertaken and **WHO** is responsible for it.
5. Establish corrective actions - Corrective actions should be taken when a critical limit is breached. Manufacturers should ensure that all products are clearly labelled and traceable in the event of a recall being necessary.
6. Establish record keeping procedures - Documentation concerning all procedures and records appropriate to these principles and their application should be made.
7. Establish procedures for verifying the HACCP system is working as intended – Review the system and validate established critical limits.





Appendix: HYGIENE RULES





'WHAT SHOULD I DO?'		'WHY SHOULD I DO IT?'
<p>WASH YOUR HANDS</p> <ul style="list-style-type: none"> • Before entering the food area • After using the toilet • Between handling raw meat/ poultry/ seafood/fish/ eggs • Before and after touching food • After coughing into your hands or using a handkerchief • After touching your face or hair • After carrying out any cleaning or handling rubbish 		<p>To stop bacteria from spreading and contaminating food.</p>
<p>Avoid touching your nose or coughing or sneezing over food</p>		<p>Many of us carry <i>bacteria</i> in our nose and throats which can cause illness. Don't add your own bacteria to food</p>


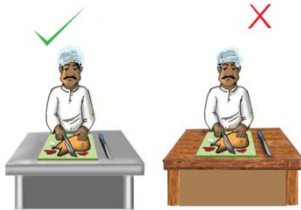
<p>Try not to touch food with your hands. Whenever possible use clean tongs to handle food and plates or trays to carry it</p>		<p>The less your hands are in direct contact with food, the less chance there is of contamination occurring</p>
<p>Avoid touching those parts of equipment and work surfaces that come into direct contact with food</p>		<p>Bacteria on your hands may be transferred to food via the equipment.</p>
<p>Keep your hair covered with a net or cap and do not comb your hair in a food area</p>		<p>Your hair and scalp carry many bacteria that can fall into food</p>

<p>Keep finger-nails short and clean and do not wear nail polish</p>		<p>Bacteria can collect beneath long nails and get into the food you handle. Nail polish can come off in the food</p>
<p>Do not wear jewellery (watches, bangles, earrings and rings with stones).</p>		<p>Bacteria can collect on items of jewellery or stones or metal may fall into the food. Hand/wrist washing is more thorough if you do not wear a watch or bangles.</p>
<p>Keep cuts, grazes and boils covered with a waterproof bandage</p>		<p>Wounds such as these are often infected with bacteria. They must be properly covered to prevent the spread of bacteria.</p>
<p>Inform your supervisor if you have:</p> <ul style="list-style-type: none"> • A stomach upset • Cough, cold or eye or ear discharges • A sore or a wound (even if it is covered by a waterproof dressing) <p>Family or close friends have diarrhoea</p>		<p>If you are suffering from any of these conditions you may contaminate food</p> <p>Often you carry germs before you get symptoms of illness, so you must report diarrheal diseases amongst your close contacts</p>

Wear clean protective over-clothing		Your own clothing may carry bacteria
Do not smoke or eat in a food area		Bringing cigarettes or food to your mouth contaminates your hands. This spreads to food. Also, cigarette ash may fall into food
Keep raw and cooked ready-to-eat foods separate, especially raw meat/poultry and cooked meat/poultry		Raw foods can spread bacteria to other foods that will be eaten without further cooking. Keep raw and cooked ready-to-eat foods apart when handling and storing them

<p>Keep food at the correct temperature during storage and preparation.</p>		<p>Ready-to-eat foods (e.g. meat, poultry, gravy etc.) provide bacteria with the nutrients and moisture needed to grow. Bacteria multiply at a very fast rate in the Temperature Danger Zone (5°C to 63°C)</p>
<p>Always ensure that the workplace is clean before preparing food</p>		<p>Thorough cleaning is necessary to kill any bacteria already present</p>
<p>Only use clean equipment and clean thoroughly, before and after use. Use clean wiping cloths</p>		<p>Equipment may have become contaminated by bacteria which can be transferred to food. Dirty cloths spread bacteria</p>
<p>Never mix different cleaning chemicals</p>		<p>This can make the mixture ineffective and may also produce poisonous gases</p>

<p>‘Clean as you go’. Any surfaces or equipment that have been in contact with raw food and any spillages must be cleaned up at once</p>		<p>To avoid the risk of contamination</p>
<p>Compile a cleaning schedule for the entire workplace</p>		<p>You should have a list of ALL tasks that must be done, how and by whom, and a timetable for doing them</p>
<p>Find out about food safety controls in your workplace and carefully follow instructions relating to hazard analysis and safe food handling procedures</p>	<div data-bbox="619 479 767 620">  </div> <div data-bbox="619 620 735 762">  <p>E. Coli</p> </div> <div data-bbox="804 474 995 680">  </div>	<p>All food handlers must play their part to reduce the risks of bacterial, chemical or physical hazards contaminating food because they could cause harm to the consumers</p>

<p>Vehicles used for distribution of high-risk foods must always be insulated and refrigerated even for short journeys</p>		<p>High-risk foods are high in protein and moisture, requiring strict temperature control and protection from contamination.</p>
<p>Do not use wood tables in the work area. Instead use metal tables</p>		<p>Wood wears quickly, is absorbent and can develop cracks and crevices in which bacteria can lodge. It is therefore unsuitable for use as floors, work-surfaces or as items of equipment.</p>
<p>Decide in a Hazard Analysis, where the hazard can be controlled.</p>	<p>HACCP</p>	<p>The Critical Control Points are points during which the hazards can be controlled and eliminated</p>

GLOSSARY

1. **Bacteria** are small living organisms often known as ‘germs’. They are so small that it is impossible to see them without a microscope. Bacteria are everywhere: in soil, dust, water, the air around us and on our bodies. It may take only a small number of bacteria to cause illness such as typhoid fever or food poisoning.
2. **Clean-As-You-Go** applies to cleaning that must be done very quickly after soiling occurs. The aim is to prevent cross-contamination or injury to staff, or simply to keep working areas clean and tidy.
3. **Contamination** is the presence of unwanted substances in the food. These can physical, chemical or biological contaminants.
4. **Critical Control Points** are points or sections of the process at which hazards are controlled.
5. **Cross-contamination** is the transfer of bacteria from a contaminated food to an uncontaminated (clean) food.
6. **Detergents** are chemicals that will dissolve grease and assist the removal of food debris and dirt.
7. **Disinfectants** are chemicals designed to destroy bacteria. They reduce the number of bacteria to a safe level. Disinfectants are not effective in removing dirt and grease
8. **Food Handler** is any person working in or for a food service establishment who engages in food preparation or service, who transports food or Food containers, or who comes in contact with any food utensils or equipment.
9. **Food Hygiene** is the action taken to ensure the safety and suitability of food at all stages of the food chain.
10. **Food labelling** is a means of communication between the producer and seller of food on one hand, and the purchaser and consumer of the other. It can be written, electronic, or graphic communications on the packaging or on a separate but related label. The symbols used on package labels are generally internationally standardized.

11. **Food packaging** is the enclosing of food to protect it from damage, contamination, spoilage, pest attacks, and tampering during transport, storage, and sale.
12. **Food poisoning** is a common, often mild but sometimes very serious illness resulting from eating contaminated food or drink. The main symptoms are diarrhoea and/or vomiting, often accompanied by nausea (feeling sick) and stomach pain.
13. **Food safety** is the assurance that food will not cause harm to the consumer when it is prepared and /or eaten according to its intended use.
14. **HACCP** (Hazard Analysis Critical Control Points) is a systematic approach to identification, evaluation and control of food safety hazards.
15. **Hazard** is defined as anything that can cause harm to a consumer.
16. **High-risk foods** are ready to eat foods that under unfavourable conditions support the multiplication of pathogenic bacteria and are intended for consumption without further treatment that would destroy such organisms.
17. **Hygiene control** is the adaptation of practices which will reduce the risk of clean food becoming contaminated.
18. **Low-Risk Foods** are rarely implicated in food poisoning and may be stored, suitably packaged, at ambient temperatures. They do not support multiplication of food poisoning bacteria.
19. **Microorganisms/microbes** are small organisms that can be seen only through a microscope. The most common types of microorganisms are bacteria and viruses.
20. **Pasteurization** is a method of destroying bacteria by rapidly heating the food to a sufficiently high temperature for a specified period of time.
21. **Sanitizers** are chemicals combining the role of both detergent and disinfectant. They are designed to remove grease, dirt and destroy microorganisms by disinfecting at the same time.

22. **Scheduled Cleaning** refers to cleaning tasks carried out at regular intervals. Food businesses should have a timetable which specifies all the details for every piece of equipment to be cleaned and all parts of the structure to be cleaned.
23. **Temperature Danger Zone-** The range of temperatures (between 5 to 63°C) at which most bacteria multiply rapidly. Keep food out of the temperature danger zone.
24. **Traceability** is the ability to trace the history, application, or location of an item or activity with the help of documentation. Food businesses must be able to trace foods or any substance that is intended to be part of a food throughout all the stages of production, processing and distribution.
25. **Virus** can be seen only under a very powerful microscope as the viruses are even smaller than bacteria. They multiply in living cells, not in food. Some viruses can cause foodborne illness; examples include gastroenteritis and hepatitis A.

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