

Chapter 2

General principles of food hygiene

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2.1. Importance of hygiene for product quality and safety

2.1.1. How is food hygiene defined?

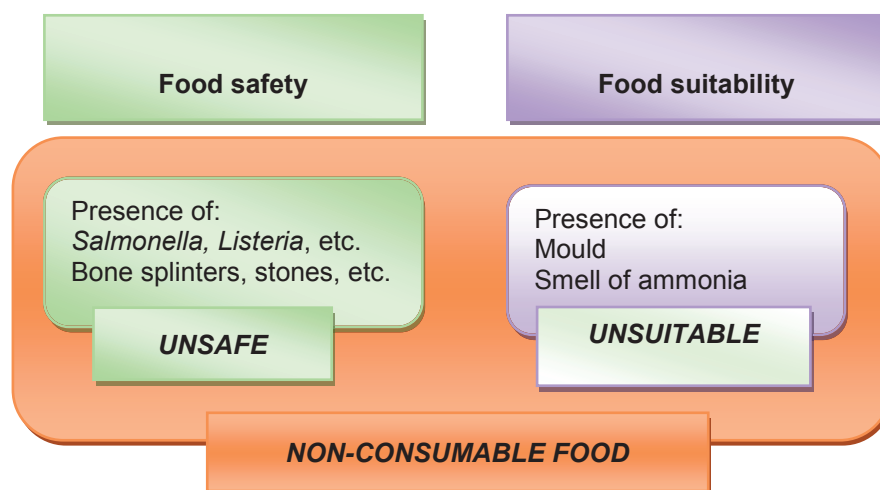
European regulations define hygiene as: *'the measures and conditions necessary to control hazards and ensure fitness for human consumption of a foodstuff taking into account its intended use'*.

Food hygiene comprises two components:

- ▶ **food safety**, which guarantees the harmlessness of food, the absence of adverse effects for the consumer's health when prepared and/or consumed in keeping with its intended use;
- ▶ **food suitability**, which concerns the intrinsic characteristics of the product, namely taste, smell, texture and presentation, characteristics that can change with the presence of spoilage microbes (bacteria, yeast and mould). Suitability is the assurance that the food is 'acceptable' for human consumption.

Food safety and **suitability** must be assured at every link of the food chain¹.

Food hygiene diagram (based on O. Boutou, 2008):



¹ A distinction should be made between 'food hygiene' in the sense used here and the dietetic concept of 'food hygiene', which refers to the deliberate selection of foods consumed in the daily diet: the latter concerns nutrition or dietetics, which relates to consumers' health and dietary habits. It should nonetheless be borne in mind that dietary habits are also related to 'food safety'. Exposure (to contaminants) is in fact related to consumption (nature, quantities, frequency) as will be seen in Chapter 3.

The concept of safety is therefore stronger than that of suitability although both can have the same result: **losses of products** (unsuitable food) or **markets** (unsafe food). These two components of hygiene are inseparable and the consequences of a lack of hygiene can be very serious because fruit and vegetables can present numerous risks² of:

- ▶ chemical origin (pesticides residues, excessive concentrations of nitrate, etc.);
- ▶ biological origin (food viruses, bacteria, pathogenic moulds or fungi);
- ▶ physical origin (glass shards, etc.).

2.1.2. Who is responsible for food hygiene?



Food safety begins on the farm!

Applying effective hygiene rules reduces the risk of food poisoning for consumers.

Producers are the first who need to apply by these hygiene rules.

Regulation (EC) 852/2004 on the hygiene of foodstuffs³ establishes (Article 3) the following general obligation: **'Food business operators shall ensure that all stages of production, processing and distribution of food under their control satisfy the relevant hygiene requirements laid down in this Regulation.'**

However, hygiene rules also concern exporters, wholesalers, transport operators, distributors and so on, and **in general any operator along the food chain**. In the end, the consumer is also responsible for ensuring that food remains edible and does not present any danger of food poisoning, by handling and storing it in suitably hygienic conditions.

Through a lack of resources or appropriate qualifications, **small producers** are often unaware of or inadequately evaluate the chemical, biological or physical **risks** that can occur at different stages of the production process.

Although certain sources of microbial or chemical contamination cannot be kept totally under control, such as airborne germs or air pollution, it is possible for operators to **limit risks to a large extent** during production and packing by applying a set of measures related to basic hygiene principles.

² The nature and origin of these risks will be developed in Chapter 3.

³ Regulation (EC) 852/2004 of 29 April 2004 on the hygiene of foodstuffs, OJ L139/1 of 30.4.2004.

2.2. General principles of food hygiene

2.2.1. The basic rules

Controlling sanitary risks in the production and packaging of fruit and vegetables requires **compliance with a few basic rules** related to the production environment and the staff and facilities available. The following rules should be kept in mind:

Rule no 1

Fruit and vegetables can be contaminated at any point in the process: during production, handling, transport, packaging or storage of products. Hygiene measures therefore apply at every link in the chain and concern all operators involved in the process, from the field to the consumer. Each is responsible for practicing the hygiene measures recommended where he/she can control the situation.

Rule no 2

Concerning chemical, physical or microbiological contamination of fruit and vegetables, preventive measures are always preferable to corrective measures. For products consumed fresh, without cooking or post-harvest processing, the quality of the harvested product is absolutely crucial to the conformity of the finished product.

Rule no 3

An effective food safety management system must include a monitoring and control programme covering the entire production process (farm, packing areas, storage areas, distribution centre and transport sector). This requires the use of qualified personnel capable of observing recommended good practices and putting in place the necessary supervision.

Rule no 4

The good hygiene practices of employees and sanitary practices at production sites are essential factors in preventing contamination of fresh fruit and vegetables. In terms of biological risks, human or animal excrements are the leading source of contamination of these products by pathogens.

Rule no 5

Depending on its source and quality, water can contaminate fresh products that enter into contact with it. This risk of contamination must be kept to a minimum.

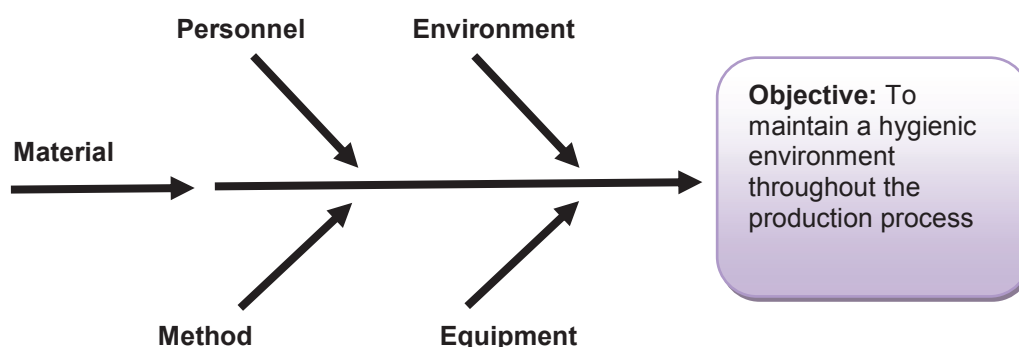
Rule no 6

The qualification of personnel is a precondition for controlling chemical risks. Where chemical risks are concerned, observance of good agricultural practices and correct use of inputs (fertilisers and plant protection products) are guarantees of compliance with standards.

Hygiene and safety problems for fruit and vegetables are complex and **require an integrated approach** due to the multitude of risks to be managed.⁴

To analyse hygiene problems, the industry often uses the Ishikawa diagram. This method is used to answer the following question:

Which elements of the process determine the risk of contamination?



This method (material (products), personnel, work method, equipment and environment) consists of systematically reviewing the **factors** involved in the hygiene of the process:

- **Material (raw material)**
A number of aspects have to be taken into consideration, for instance the products': origin, cleanliness, conformity, labelling and characteristics (e.g.: temperature, water content). For our purposes, this concerns not only **harvested products** (raw material to be prepared for market), but also the **inputs used** (seed, water, fertiliser, soil improvers, packaging, plant protection products, etc.).
- **Personnel**
Every individual who handles products potentially carries **pathogenic micro-organisms transmissible through food**. Different precautions therefore need to be taken to minimize risks. The first essential step is for personnel to wash their hands. **Clothing** is another element to be considered. Most instructions on personnel hygiene have become common practice, such as having a **medical exam**, wearing an apron, using a hairnet and removing all jewellery before handling food.
- **Method**
This concerns all **processes** used for production (**technical protocol**, from seed to harvest), harvest, transport and packaging up to consignment of the product. The aim is to follow **Good Manufacturing Practices** (GMP).

⁴ Codex Alimentarius Commission - Code of hygienic practice for fresh fruits and vegetables (CAC/RCP 53 - 2003), 26 pages.

- **Equipment**
All equipment (**implements, utensils and packaging material**) can contaminate food if not adequately maintained or suited to use. Washing it properly is not enough. The duties of personnel must also include the tasks of maintaining machinery, application equipment, means of transport and cold storage rooms (defrosting, cleaning and disinfection).
- **Environment**
The workplace, whether a field or a packing station, must remain **clean and protected** from pests. It is essential, for example, to adjust and close doors and windows, check the hygiene of the premises and all work surfaces, maintain drain pipes and manage waste, ventilation and lighting.

2.2.2. General hygiene principles in the Codex

The *Codex Alimentarius* publication, '*General Principles of Food Hygiene*',⁵ identifies the essential principles of food hygiene applicable throughout the food chain (from primary production to the final consumer) to ensure that food is safe and suitable for human consumption.

For both the production chain and packing stations, the general hygiene principles dictated by the Codex primarily concern the **following six points**:

1. Hygiene measures related to **production conditions** (healthy operating premises and packing station);
2. Measures for **personnel hygiene** (health status, personal cleanliness, clothing, access to facilities, etc.);
3. Hygiene measures related to **facilities**: cleanliness of equipment and apparatus (storage material, sorting devices, grading devices, etc.);
4. Aspects related to **handling**, transport and storage of products;
5. Aspects related to **control of operations** (raw materials, water quality, etc.);
6. Aspects related to **maintenance, cleaning and waste** management.

Hygiene measures related to all these different aspects will be summarised below. General recommendations will also be added on **product traceability** and **personnel training**. Readers are advised to consult the Codex documents and codes of practice for further information. Lastly, the Codex 'general principles' recommend that producers use the HACCP system to improve the suitability of food and describe how to put hygiene principles into practice. HACCP will be discussed in Chapter 5 of this manual.

The Codex 'general principles' also provide instructions for drawing up specific 'hygiene criteria' that may be needed for certain sectors of the food chain, certain processes or certain products. There follows in this chapter a discussion of the usefulness for each sector of drawing up a 'Guide to Good Hygienic Practices' suited to its specific risks and appropriate implementing measures.

⁵ Codex Commission – Recommended International Code of Practice – General Principles of Food Hygiene, CAC/RCP 1-1969, Rev. 4 (2003), 29 pages.

2.2.3. Hygiene measures related to production conditions

Production is to be avoided in areas where the environment poses a threat to food safety.



Production areas (fields, orchards, tunnels, nurseries, etc.) and packing and storage areas (sheds, silos, cold storage rooms, etc.) must be kept clean at all times. They should be located in areas that have not been used to bury waste (the operator should therefore have access to a soil history); otherwise, soil analyses are needed to demonstrate the absence of risks of contamination from germs or heavy metals, for instance.

Example of clean fields (Photo B. Schiffers).

Unhygienic production areas and packaging stations present greater risks of contamination. Pathogens can be present either in the soil or in sorting, grading and packing equipment. In the absence of appropriate sanitary measures, **any surface in contact with food is a potential source of microbial contamination.**



Waste (crop residues, fruit on the ground, straw not worked into the ground, empty cans, bags, cords, damaged crates, used irrigation tubes, etc.) must be collected and removed from production areas regularly. Areas where waste is deposited and composted must be located at a sufficient distance from production and packaging areas.

Irrigation tubes abandoned in the field (Photo B. Schiffers).

Human and animal excrements are the leading source of contamination of fruit and vegetables from pathogens. Sanitary facilities must be available both in fields and in packaging stations to reduce sources of contamination from faecal matter.

Children should not be allowed in the fields due to the risks of faecal contamination from their excrements as well as risks to the children themselves!



Photo B. Samb

Toilets, compost and heaps of **manure** or organic soil additives should not be located near a source of irrigation water or in an area that may flood during heavy rainfalls. Run-off from poorly built or poorly located toilets can contaminate farm workers and animals, the soil, water sources and fruit and vegetables. Personnel must be informed about the correct use of toilets in order to maintain hygienic and healthy facilities.



Plant protection products and fertilisers must be **stored** in areas that meet safety requirements (premises suited to this use) and be well managed (prevention of leaks) to avoid any accidental spills or spreading. Appropriate measures must be planned and implemented to dispose of chemical waste and effluents safely (empty packages, time-expired products and any product left in the bottom of tanks).⁶ Water must be available for workers to wash their hands (see photo).



Photos B. Schiffers

⁶ See PIP Manual No 7 (Chapter 10) and No 9.

2.2.4. Measures for personnel hygiene



The sanitary measures applicable to anyone working in the food sector also apply to those in primary production.

Personnel hygiene begins in the field. Washing hands before and after harvesting decreases the risk of contamination of products harvested by the workers.



If products are sorted in the field in unsanitary conditions, their hygiene cannot be guaranteed!

Personnel hygiene rules apply to those assigned to the task of harvesting and sorting the products as well as to those in charge of applying plant protection products and fertiliser. **Specific training** in this area is necessary for risk-free handling of these products.



Good hygiene concerns not only personal hygiene but also correct maintenance of protective equipment (clothing, hairnets, etc.) and safety equipment (personal protective equipment or PPE).

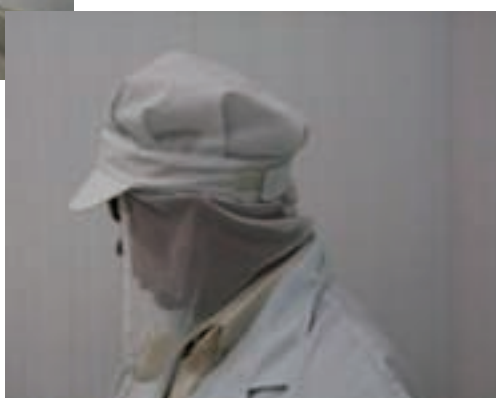
Hair covered, no jewellery on the hands and ears, and fastened garments diminish the risks of transmitting a foreign body.

Photos B. Schiffers.



Personnel cloakroom, separate from the packaging rooms. Work garments must stay in the cloakroom. Personnel must remove them during breaks.

The full equipment (headgear, apron and boots).



Hand-washing facilities (Kenya).

Note:

- *tap is turned on by pressing a button under the sink with the knee (no contact with dirty hands) (see detail);*
- *liquid soap dispenser (bars of soap are sources of micro-organisms);*
- *paper towel dispenser for drying hands (and not a blower, which would project droplets carrying germs into the air).*

Photos B. Schiffers





Personnel must be reminded of hygiene rules at all times through the use of written instructions or pictograms. These must be placed in such a way as to be visible **where and when they are really useful** (for example, on the door, at the toilet exit).

It is essential to make sure that the personnel **understand the instructions**: some pictograms can lead to confusion. Before they are posted, they need to be **explained to personnel**.

It is also important to **motivate** personnel to follow the instructions by explaining why a given prohibition is applied (removing jewellery, for example), or why an obligation is imposed (such as washing hands).

Photos B. Samb & B. Schiffers.

The personnel's state of health is an important factor, but **difficult to control**. The aim is primarily to avoid contaminating products from pathogens from infected wounds, discharges from the nose or mouth or people coughing or spitting.

2.2.5. Hygiene measures related to facilities and equipment

Establishments must be **located far from polluted areas**, flood plains or industrial areas that could represent a threat of contamination of food (e.g.: release of dust or fumes).

Depending on the nature of the operations and the associated risks, **premises, equipment and facilities** must meet the following characteristics:

- ▶ the arrangement and layout of the premises must be such as to keep food contamination to a minimum. **'Workflow from dirty to clean areas'** must be preferred to keep finished products from coming into contact with raw materials. The same principle applies to the layout of storage areas, where **finished products must be separated** from raw materials;
- ▶ the **design and layout of facilities** and equipment for sorting, grading and packaging fresh products must accommodate suitable maintenance, cleaning and disinfection and minimize airborne contamination;
- ▶ the surfaces of walls, floors, doors and ceilings, as well as the materials used to build them, especially if they come into contact with food, must be non-toxic. They must be **smooth and impermeable**, allow easy drainage, and be **easy to clean and maintain**. Work surfaces that come into direct contact with food must be in good condition, durable and easy to clean, maintain and disinfect. They must be made of smooth and non-absorbent materials and remain inert upon contact with food, detergents and disinfectants (for example, no tiles on work surfaces because their joints are very hard to clean and disinfect);
- ▶ it should be possible to **control** temperature, humidity, air circulation, etc. where necessary;
- ▶ **effective protection** must be installed to prevent pest access and harbourage in the premises. Windows must be easy to clean, built to minimize the accumulation of dirt and if necessary fitted with removable and cleanable screens to keep out insects. If necessary, windows must be sealed.



These factors and the way equipment is used can help to reduce the risk of cross-contamination of fresh fruit and vegetables.

A work surface in such poor condition it can no longer be cleaned effectively.

Photo B. Schiffers.



*Tables have a smooth work surface, are made of metal, and are edge-free and easy to clean. The floor and walls of the work room are also smooth.
(Packing station in Kenya).*

The quality of the lighting (powerful and well protected to avoid glass debris) contributes to good working conditions.



Tables have a smooth metal surface that is easy to clean (an opening in the edge facilitates cleaning).

The concrete floor is smooth and easy to clean. Waste and dust cannot become encrusted.

Brushes used to clean the floor must not be used to clean the work surfaces.



Empty and clean packages are stored separately from products in a room fitted with a screen to prevent contact with animals.

It is preferable to stack the boxes on a pallet.

(Packing station in Senegal).

Photos B. Schiffers.



Stock of ready-to-use packaging. The boxes are placed on pallets, not in contact with the floor.

Packaging storage takes a lot of room but flawless hygiene is essential, even when the boxes are empty.

It is important to make sure that birds cannot leave droppings on the boxes.



Another example of a packing station. In spite of more limited means for meeting hygiene requirements, the boxes are easily kept off the floor by being stacked on a clean pallet.



The finished products are stored separately, stacked on pallets in a cold room prior to consignment.

Photos B. Schiffers.

2.2.6. Controlling water quality

Water is used for **irrigation**, the **preparation of mixtures** for plant protection treatment and the application of fertilisers in fields. It is also used to **clean** not only **fruit and vegetables** but also **sorting tables, floors and harvesting containers**, and so on.

Two aspects therefore need to be considered:

- ▶ **water must be protected:** avoid polluting water during growing and packaging operations (discharges). Water sources in particular have to be protected: ground water, catchment areas, etc. The presence of livestock in direct contact with watering places (for instance, animals that enter the water to drink) increases the risk of contamination from faecal germs. Overuse of nitrate fertilisers leads to excessive concentrations of nitrates in ground water;
- ▶ **products must be protected:** avoid allowing water contaminated or polluted by pathogens or chemical products from coming into contact with products.

When **preparing mixtures**, avoid contaminating water points with plant protection products. Measuring and mixing tools, for instance, must be reserved for this use alone and water should not be drawn using a utensil contaminated by the products. The dregs of unused mixture, water used to rinse apparatus and protective equipment, and water used to wash protective equipment should only be poured out in a given area reserved for this purpose. Products should not be allowed to flow or penetrate deeply and pollute the water table.

Water in contact with fresh fruit and vegetables can be a major source of direct contamination. **It can spread many micro-organisms**, some of which are pathogens (*Escherichia coli*, *Salmonella*, etc.) and can survive on packaged products. It is essential to adopt irrigation methods that prevent or minimize contact between the water and fruit or vegetables (for example: use the drip method rather than sprinkling). **Caution is needed when using irrigation water:** the producer should assess the risk by analysing the location and quality of available water.



Washing fruit (Photo B. Samb).

Only **potable water** should be used for food processing (when water is involved in the process). This also holds true for ice or steam made from this water. For certain stages of the process (for instance, washing of vegetables but not blanching) and in certain conditions, it is possible to use **clean water** (namely, microbiologically clean, but not meeting all potability criteria). **Regular water quality analyses** are essential.

2.2.7. Transport and storage hygiene

Special attention should be given to product **transport conditions**. Measures must be taken during transport to **protect food** from potential sources of **contamination**.



Loading platforms and containers must be **cleaned**. Products must be **protected** against damage that could make them unsuitable for consumption (**cover lorries with a tarpaulin**; package products correctly; protect them from the sun and rain, dust, smoke, birds and other animals; avoid bulk transport which can crush products; avoid the use of used bags; etc.).



Transport vehicles must allow for effective separation of different foods or of food and non-food products.

The same vehicle should not be used to transport fruit and vegetables, fertiliser and plant protection products, or even people!



*When **transporting bulk products**, containers and vehicles must be used **exclusively for food transport** and marked accordingly.*

Photos B. Samb

Before each load, if the same vehicle or container is used to transport different foods or non-food items, it must be thoroughly cleaned and disinfected where necessary.



Products must be stored in an environment that prevents the presence of pathogens or micro-organisms that cause spoilage and produce toxins in food (order, cleanliness, maintenance of storage premises, organisation/rotation of stocks).

The premises must lend themselves to control of all required conditions of temperature, humidity, etc.

Photo B. Schiffers

The identification of lots contributes to **effective stock rotation** (based on the 'first in/first out' or FIFO principle) and **helps avoid overly long storage** (e.g.: risk of spread of micro-organisms on/in the product or risk of leeching of sulphur into lychee pulp). For fragile products (such as those that have to be kept in cold storage), **clear labelling** of the products showing maximum storage temperature will make it easier for operators to handle and store them correctly (e.g.: **maintaining the cold chain**). A lack of information on a product distributed can contribute to the spread of biological contaminants and the production of food unfit for consumption, even when appropriate hygiene control measures have been taken before shipment.

Special safety rules are necessary for the transport and storage of plant protection products and fertilisers (see chapters 8 and 9 of the PIP Manual No 4).

2.2.8. Importance of a traceability system



The capacity to identify the origin and history of a product is a decisive factor for risk identification and control. Each container of food should **bear an indelible mark that identifies the producer and lot**.

The PIP Manual No 2 presents the different facets of traceability (types, advantages, tools, etc.).

Photo M. Delacollette

Traceability makes it possible to trace the food products back to their source (identification of producers, packing operators, etc.). Although it cannot always prevent an initial occurrence of microbial contamination and potential infection of consumers, it does represent a **valuable crisis management tool**. The information it provides can be used to **isolate and eliminate product lots that present a risk** to public health. Thanks to traceability, producers can withdraw or recall products not in conformity, where necessary. It therefore effectively supplements other preventive measures implemented in the field and in packing stations.

2.2.9. Personnel training

According to Codex, *'those engaged in food operations who come directly or indirectly into contact with food should be trained, and/or instructed in food hygiene to a level appropriate to the operations they are to perform'*.

All personnel (team leaders, full-time and part-time employees as well as seasonal workers) must be aware of their **role** and **responsibility** in protecting food from contamination or spoilage. An **'Awareness'** phase to motivate personnel is therefore essential prior to training per se. Food handlers must understand the risk of contamination to products that can result from a lack of foresight, or from negligence, unhealthy practices or poor personal hygiene.

All producers and employees must have **practical knowledge of basic sanitation rules and hygiene measures related to the work** they perform and the **responsibilities they hold**. 'Training needs' must therefore be analysed in terms of the **skills required** for a given position and are determined with respect to the operator's duties. The skills acquired must allow operators to **assume their responsibilities**, especially their capacity to take decisions in the event of a malfunctioning or crisis.

A training programme must be set up for all operators based on identified risks and the 'Good Practices' that concern them. Those who handle cleaning chemicals or other potentially **hazardous chemicals** (e.g.: plant protection products) should be instructed in how to handle them without risk to themselves (Good Hygienic Practices), the environment (Good Plant Protection Practices) or food products (Good Agricultural Practices).

It is important, for instance, to teach personnel: where and how to wash their hands properly; how to maintain premises and equipment; how to clean harvesting containers and work surfaces; how to calibrate equipment; when and how to wear personal protective equipment; how to keep them in good repair; how to keep records on the operations carried out; when to react in case of handling error or accident; how to store products; how to manage waste; precautions to be taken during transport of products; etc. (see PIP Manuals No 6 and No 8).

Training programmes must be based on a **needs analysis**, validated by the company's management, **regularly reviewed** and updated where necessary.

2.3. Implementing food hygiene principles

2.3.1. Prerequisite programmes (PRP)

□ Origin and definition of PRPs

The concept of **prerequisite programme** or **PRP** has emerged recently as the Hazard Analysis Critical Control Points (**HACCP**) system⁷ has come into general practice.

HACCP is formalised by the *Codex Alimentarius* and applies to all food production, transport, storage and distribution sectors. It is used by operators to identify the hazards that exist at every stage of the production process, and at the points of this process for which control is critical to guarantee product safety and suitability, thus the term Critical Control Points (CCP). For each CCP identified, limits must be established and followed to ensure product safety. A single CCP can even have several critical limits (e.g.: temperature and length of the pasteurisation process).

To be considered a 'CCP', a point in the process must be able to be **monitored continuously** so that the results of such monitoring can be compared to the critical limits set. Critical limits are criteria (quantitative or qualitative) used to distinguish between what is acceptable and what is unacceptable with respect to control of the food's safety and suitability. The cleanliness of operators' work garments, their knowledge of basic food hygiene rules or the effectiveness of a cleaning and disinfection plan **cannot be measured continuously**, however. Furthermore, it would be very difficult to set a critical limit for these factors. They are consequently not CCPs, yet their control is necessary **to guarantee food safety and suitability**. It consequently was important to **define a complementary concept**, namely prerequisite programmes (PRP).

With reference to ISO 22000, prerequisite programmes (PRP) are defined as the basic conditions and activities necessary to maintain a hygienic environment throughout the food chain suitable for the production, handling and provision of safe end products and food that is safe for human consumption.

The PRPs required depend on the type of business and the segment of the food chain in which it operates. As a general rule, the following terms are used to categorize PRPs: Good Agricultural Practices (GAP), Good Veterinary Practices (GVP), Good Manufacturing Practices (GMP), Good Hygiene Practices (GHP), Good Production Practices (GPP), Good Distribution Practices (GDP) and Good Sales Practices (GSP).⁸

⁷ The HACCP system will be presented and explained in chapter 5 of this manual.

⁸ ISO 22000:2005 – Food Safety Management Systems – Requirements for any organization in the food chain, ISO, 2005.

PRPs refer in general to **control measures that are not specific to a given point in the production process**. They are cross-cutting measures which, in accordance with ISO 22000, cover as a minimum the following 10 points:

- ▶ construction and layout of buildings and associated utilities;
- ▶ layout of premises, including workspace and employee facilities;
- ▶ supplies of air, water, energy and other utilities;
- ▶ supporting services, including waste and sewage disposal;
- ▶ suitability of equipment and its accessibility for cleaning, maintenance and preventive maintenance;
- ▶ management of purchased materials (such as raw materials, ingredients, chemical products and packaging), supplies (water, air, steam and ice), disposal (waste and waste water) and product handling (storage and transport, for example);
- ▶ measures for the prevention of cross-contamination;
- ▶ cleaning and sanitizing;
- ▶ pest control (rodents, insects, birds);
- ▶ personnel hygiene (personnel training, individual hygiene measures, dress rules, management of personnel work garments, etc.).

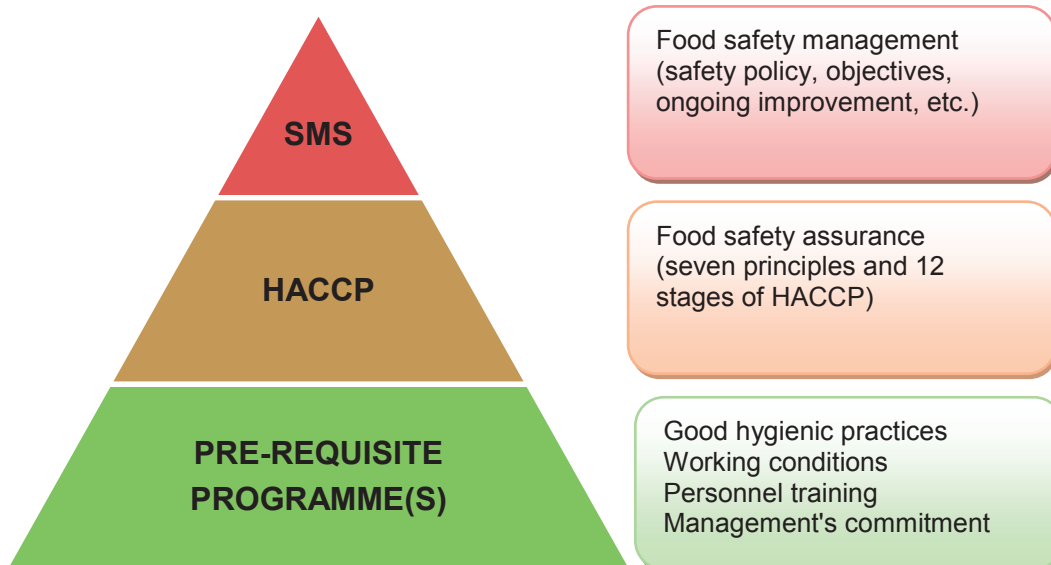
Although HACCP is the international reference for developing a food safety management system, its application **alone** in a company does not guarantee food safety control.

Before implementing the HACCP system in any food business, the operator must first have put in place the prerequisites based on the appropriate good practices (regulatory requirements in force and/or customers' commercial requirements), namely:

- ▶ the organisation of good practices (Good Hygienic Practices, Good Agricultural Practices, Good Harvest Practices, Good Transport Practices, Good Manufacturing Practices, Good Handling and Packaging Practices, Good Storage Practices, etc.);
- ▶ a set of other conditions that are prerequisites to food processing (premises, training, work organisation, personnel hygiene and health, water quality, maintenance of the cold chain, etc.).

PRPs constitute the basis for effective application of HACCP principles and must be organised before the HACCP system is developed.

PRPs and HACCP will work even better in the framework of a Safety Management System (SMS). The organisation of a SMS requires the unreserved commitment of management and personnel, a policy, objectives, data analyses and periodical review of the management system.



PRPs are **the foundation** on which to base specific control measures resulting from the hazard analysis. These are prerequisites in the strict sense.

The hazard analysis also serves **secondarily** to identify relevant hazards to be controlled, the degree of control that ensures food safety and the corresponding combinations of control measures.

In some cases, the hazard analysis can lead to a correction of PRPs already in place.

Effective implementation of PRPs facilitates the introduction and helps to reduce the number of CCPs during study of the HACCP plan.

□ Nature of PRPs

PRPs are divided into **two sub-categories**:

1. *Infrastructure and maintenance programmes*

The company must **have the infrastructure necessary** to ensure the safety of products and must **maintain if in good condition**. This implies that the design and construction of buildings and facilities, especially employees' work stations and facilities, are suitable for the operations to be performed (receiving, washing, sorting, packing, storing, etc. of food products). It also implies that product safety will not be affected by air, water and energy supplies or by equipment (installation of equipment and accessibility for maintenance). The company must practice **preventive maintenance** and have a cleaning plan and a plan for disposal of waste and waste water. Where necessary, the infrastructures or equipment must be modified to take account of hazard analysis results or of the capacity to implement control measures and ensure correct maintenance of the premises and equipment.

2. Operational prerequisite programmes (or OPRP)

Control measures contained in the OPRP must ensure **control of all hazards that are not controlled at a given CCP** under the HACCP plan or where no CCP can be identified for a hazard (ISO 22000). The following elements must be taken into account in the OPRP:

- personnel hygiene;
- cleaning and disinfection;
- pest control;
- measures to prevent cross-contamination;
- packaging operating modes and management of purchased materials (such as raw materials, ingredients, chemical products), supplies (water, air, steam, ice, etc.), disposal (waste and waste water) and product handling (storage and transport, for example).

Operational PRPs must be validated and documented in the form of instructions and procedures.

When the OPRP results in effective control of a hazard at an acceptable level, a CCP is no longer required for this hazard!

For example, if there is systematic analysis of the microbiological quality of water used to wash fruit and vegetables at the packaging station, the CCP associated with this operation is removed from the HACCP plan.

In small firms where it is difficult and complicated to organise HACCP, conformity with OPRPs is a valuable solution for guaranteeing product safety.

However, **the OPRPs must be sufficiently effective** to control the hazard at an acceptable level.

□ Putting PRP measures in place

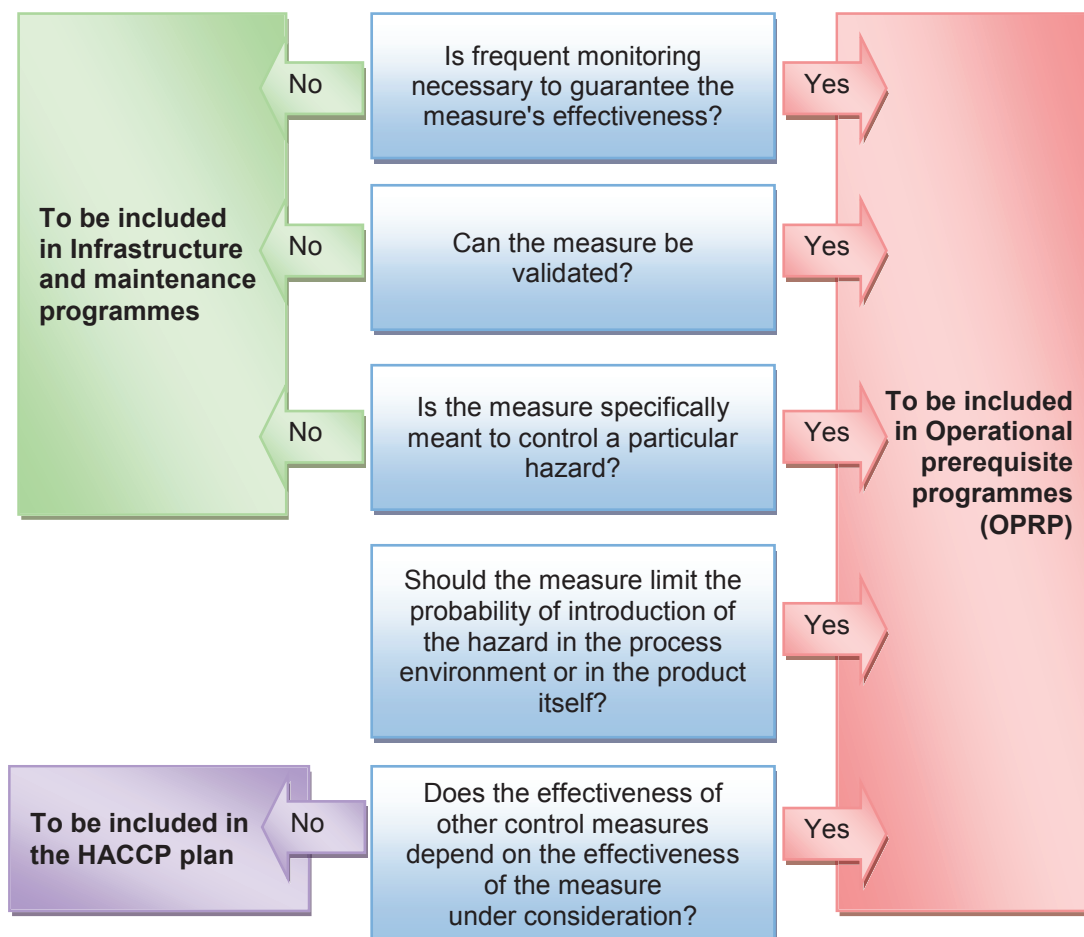
The PRP(s) must be designed and implemented **prior to** hazard analysis and organisation of the HACCP system.

Operators are free to choose the measures to be contained in the PRPs. They are also free to analyse and choose, from among the measures being considered, what comes within '*Infrastructure and maintenance PRPs*' and what comes within '*Operational PRPs*' in their facilities and processes.

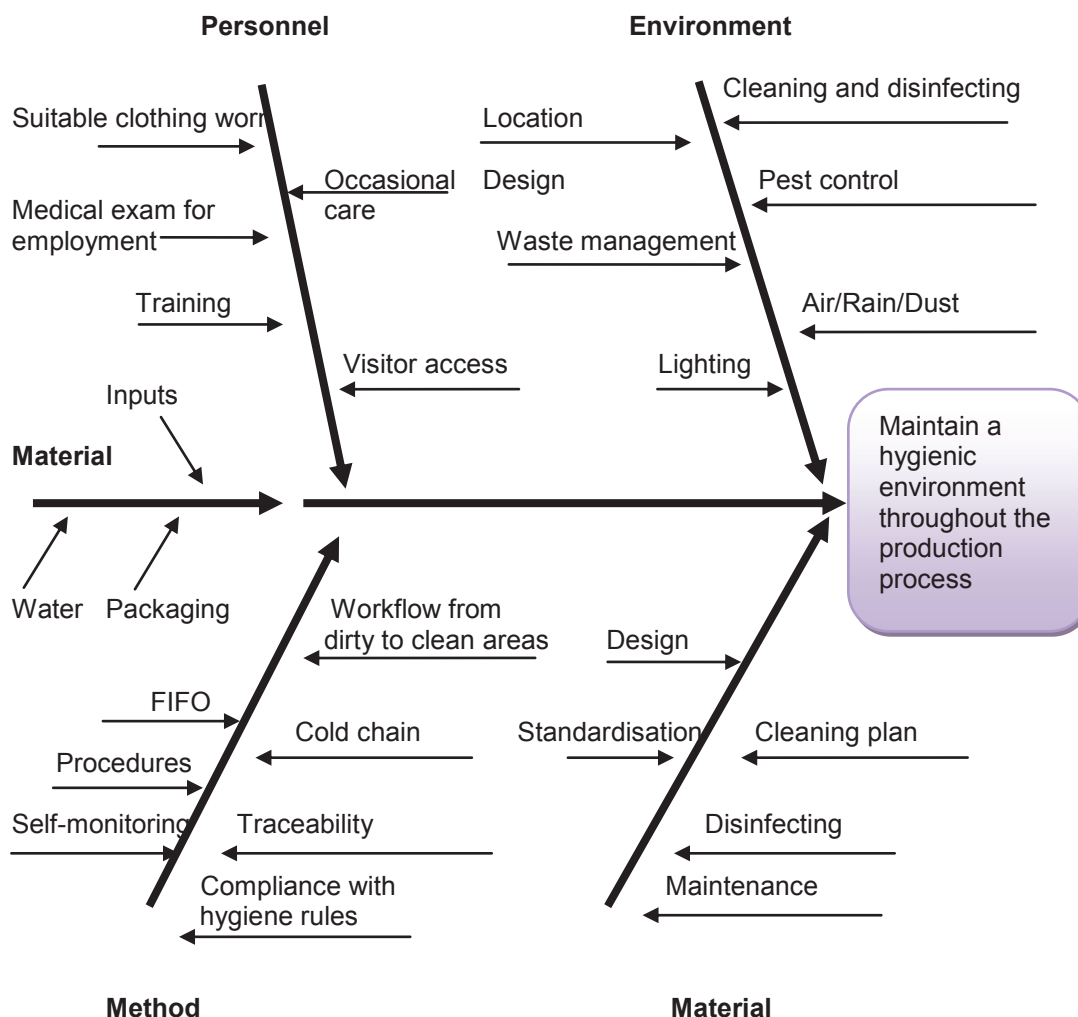
The main difference between the two types of PRP lies in the fact that operational PRPs involve in the workings of the system: OPRPs must therefore be systematically documented.

It is important to note that the PRPs that are categorised as infrastructure and maintenance programmes **are not based on hazard analysis and are not validated**.

Decision tree for categorising potential control measures in PRPs (based on ISO 22000):



The Ishikawa diagram can also be used to identify PRP measures (based on O. Boutou, 2008):

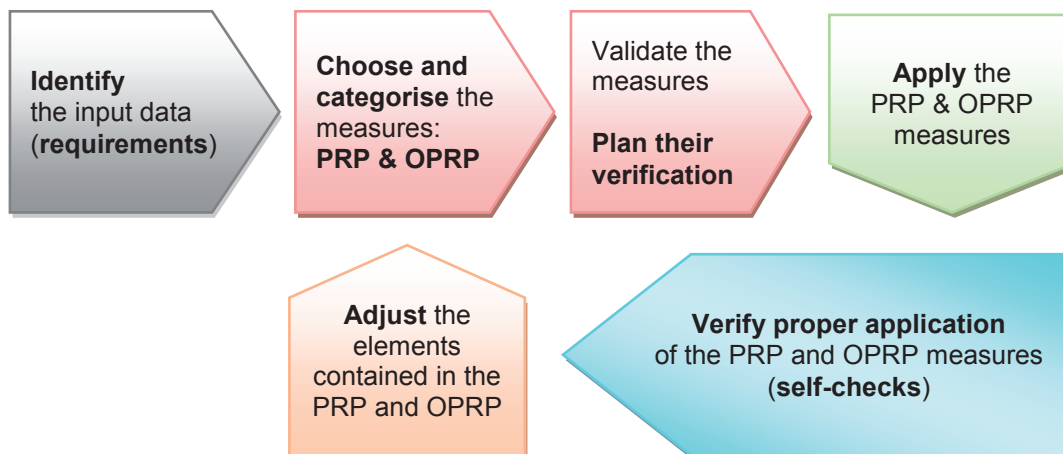


When setting up PRPs, the company must take account of and use relevant existing information (input data). For example: regulations (**requirements of Regulation (EC) 852/2004 on hygiene**), **customers' requirements**, food hygiene guidelines and general principles in the *Codex Alimentarius*⁹ and all existing '**Codes of Good Practice**', national, international and industrial standards, etc. (e.g.: ISO 22000).

It is therefore useful for producers to have '*Guides to Good Practice*' to help them to master PRPs.

⁹ *Codex Alimentarius* Commission - Hygiene of Foodstuffs. Basic texts. Fourth edition, Rome 2009.

PRPs must also form part of an **ongoing integrated improvement initiative** of the 'PDCA' type (*Plan – Do – Check – Act*) :



2.3.2. Guides to Good Hygiene Practices (GGHP)

Regulation (EC) 852/2004

*'The application of hazard analysis and critical control point (HACCP) principles to primary production is not yet generally feasible. However, **guides to good practice** should encourage the use of appropriate hygiene practices at farm level. Where necessary, specific hygiene rules for primary production should supplement these guides.'*

Article 1 of Regulation (EC) 852/2004 on the hygiene of foodstuffs states that: *'guides to good practice are a valuable instrument to aid food business operators at all levels of the food chain with compliance with food hygiene rules and with the application of the HACCP principles'*. Part B of Annex I of the Regulation contains recommendations for the drafting of Guides to Good Hygiene Practice (GGHP) by operators. They must include **appropriate information on the hazards that may arise** in primary production and associated operations and actions to control such hazards.

Among the hazards that concern **primary plant production** and measures that can be included are (*extract from the Regulation*):

- ▶ the control of contamination such as mycotoxins, heavy metals and radioactive material;
- ▶ the use of water, organic waste and fertilisers;
- ▶ the correct and appropriate use of veterinary medicinal products and feed additives and their traceability;
- ▶ protective measures to prevent the introduction of contagious diseases transmissible to humans through food, and any obligation to notify the competent authority;

- ▶ procedures, practices and methods to ensure that food is produced, handled, packed stored and transported under appropriate hygiene conditions, including effective cleaning and pest-control;
- ▶ measures relating to record-keeping.

Guides to Good Hygiene Practices (GGHP) and to application of HACCP principles **are supplied as voluntary guidelines, evolving in nature and developed by and for operators in a sector** with the aim of helping them to meet the requirements of **Regulations (EC) 852/2004** and 183/2005.

They can also help businesses to establish food safety management systems in the framework of certification under **ISO 22000:2005**.



Ideally, the '*Guide to Good Hygiene Practices*' must be **submitted for validation** to a local authority with responsibility for food chain safety. This authority's role will be to:

- ▶ **verify that the analysis of hazards** recognised as relevant in the Guide has been carried out correctly and thoroughly, and that the operators have not overlooked or under-estimated any aspects;
- ▶ **approve the control measures** (e.g.: type and number of analyses, control points, traceability, etc.) that operators in a sector propose to implement on a voluntary basis to prevent, reduce or eliminate risks.

To achieve the high level of food suitability and safety required by Regulations (EC) 178/2002 and 852/2004, the Guides should be easy-to-use, **pragmatic** and **educational** tools for producers and other food chain operators. They should aim to:

- ▶ **build consensus among operators** in a sector over food risks and appropriate control measures (effective and economically justifiable) required to bring risk down to an acceptable level;
- ▶ serve as a basis for discussion among operators and representatives of the national competent authority or even the authority of the market of destination;
- ▶ inform and draw the attention of all operators to relevant hazards (foreseeable and significant) for the sector concerned;
- ▶ describe the general hygiene rules to be observed by operators in the sector;
- ▶ facilitate the hazard analysis to be carried out by operators by serving as preparation for it, possibly in the context of introducing HACCP;
- ▶ **secure recognition**, for example on the basis of a history, **of practices recognised by the sector as effective** in terms of hygiene (traditional methods, **professional know-how**, etc.);
- ▶ facilitate the organisation and updating of professionals' PRPs and HACCP plans;
- ▶ help to demonstrate the operators' mastery of hygienic practices;
- ▶ serve as evidence of compliance with regulations when a GGHP **validated by a competent authority** is applied by a business, and where necessary, as evidence of conformity with ISO 22000, both for Good Hygienic Practices (prerequisite programmes) and for application of the HACCP system;
- ▶ **facilitate certification** of operators' Safety Management Systems (SMS) (private safety standards: BRC, IFS, etc.).

Safeguarding and adding value to professional know-how!

The text of Regulation (EC) 853/2004 (point 16) underlines the importance of applying hygiene rules with some degree of 'flexibility':

*'Flexibility is also appropriate to **enable the continued use of traditional methods** at any of the stages of production, processing or distribution of food and in relation to structural requirements for establishments.'*

This point is especially important for small producers from ACP countries who encounter difficulties implementing HACCP.

The intent of European law is that means deployed should be **proportional to risks** on the one hand, and on the other that the value of **control methods used traditionally** by producers should be recognised if they guarantee a sufficient level of food safety. **The Regulation also states that 'good hygienic practices can replace the monitoring of critical control points'**. This is the meaning given to the PRPs described above in this text.

In particular for businesses that do not process food (primary production), hazards can be controlled through compliance with prerequisites alone.

The same regulation nevertheless stresses that *'flexibility should not compromise food hygiene objectives'* and, since all foods produced will be in free circulation throughout the European market, flexibility must be *'fully transparent'*.

Thanks to 'Guides to Good Hygiene Practices' (or 'Guides to Self-Monitoring Systems') professionals can demonstrate their capacity to satisfy regulatory requirements **through measures adapted to their socio-economic context**.



Appendices: Guides to Good Practices

In parallel with the Guide to Good Hygienic Practices, the *Codex Alimentarius* makes official recommendations that apply to all stages of the product cycle. These concern:

- ▶ Good Agricultural Practices (GAP);
- ▶ Good Processing (and Packaging) Practices (GPP);
- ▶ Good Distribution Practices (GDP);
- ▶ codes of practice and guidelines.

A.1. Recommended good practices

□ Good Agricultural Practices (GAP)

Objectives: to reduce the likelihood of introducing a hazard which may adversely affect the safety of food or its suitability for consumption at later stages of the process. Primary production should be managed so as to assure that harvested products are suitable for their intended use. Where necessary, this will include:

- ▶ avoiding the use of areas where the environment poses a threat to the safety of food;
- ▶ controlling contaminants, pests and diseases of animals;
- ▶ adopting practices and measures to ensure that food is produced under appropriately hygienic conditions;
- ▶ satisfying conditions for the use of plant protection products, in particular: dose, maximum number of applications, pre-harvest interval (PHI) and volume of mixture recommended per hectare.

□ Good Processing Practices (GPP)

▪ Establishment: design and facilities

Objectives: follow rules of good hygiene in the design and construction of buildings; appropriate location and adequate facilities are necessary to ensure effective hazard control.

Depending on the nature of the operations and the risks associated with them, premises, equipment and facilities should be located, designed and constructed to ensure that:

- contamination of food is minimized;
- design and layout permit appropriate maintenance, cleaning and disinfection and minimize air-borne contamination;
- surfaces and materials, in particular those in contact with food, are non-toxic in intended use and, where necessary, suitably durable and easy to maintain and clean;
- where appropriate, suitable facilities are available for temperature, humidity and other controls;
- there is effective protection against pest access and harbourage.

▪ **Establishment: maintenance and sanitation**

Objectives: to facilitate the continuing effective control of food hazards, pests and other agents likely to contaminate food. Effective systems must be established to:

- ensure adequate and appropriate maintenance and cleaning;
- control pests;
- manage waste and monitor effectiveness of maintenance and sanitation procedures.

▪ **Establishment: personal hygiene**

Objectives: people who do not maintain an appropriate degree of personal cleanliness, who have certain illnesses or conditions, or who behave inappropriately can contaminate food and transmit illness to consumers. It must be ensured that those who come directly or indirectly into contact with food are not likely to contaminate it. This requires:

- maintaining an appropriate degree of personal cleanliness;
- behaving and operating in an appropriate manner;
- providing personal hygiene facilities (cloakrooms, sanitary facilities, hand-washing facilities).

▪ **Establishment: Control of operation**

Objectives: to reduce the risk of unsafe food by taking preventive measures to assure the safety and suitability of food at an appropriate stage in the operation by controlling food hazards. To produce food that is safe and suitable for human consumption by:

- formulating design requirements with respect to raw materials, composition, processing, distribution and consumer use to be met in the manufacture and handling of specific food items;
- designing, implementing, monitoring and reviewing effective control systems.

□ **Good Distribution Practices (GDP)**

Objectives: food may become contaminated, or may not reach its destination in a suitable condition for consumption unless effective control measures are taken during transport, even where adequate hygiene control measures have been taken earlier in the food chain. Suitable measures should be taken where necessary throughout the transport and distribution process to:

- protect food from potential sources of contamination;
- protect food from damage likely to render the food unsuitable for consumption;
- provide an environment that effectively controls the growth of pathogenic or spoilage micro-organisms and the production of toxins in food.

A.2. Examples of Codex codes of practice and guidelines

□ General

- ▶ CAC/RCP 1-1969, (Rev. 4-2003), Recommended International Code of Practice – General Principles of Food Hygiene; includes the Hazard Analysis and Critical Control Points (HACCP) system and guidelines for its application.
- ▶ Codes and guidelines for specific food products.

□ Fruit and vegetables

- ▶ CAC/RCP 22-1979, Recommended International Code of Hygienic Practice for Groundnuts (Peanuts)
- ▶ CAC/RCP 2-1969, Recommended International Code of Hygienic Practice for Canned Fruit and Vegetable Products
- ▶ CAC/RCP 3-1969, Recommended International Code of Hygienic Practice for Dried Fruits
- ▶ CAC/RCP 4-1971, Recommended International Code of Hygienic Practice for Desiccated Coconut
- ▶ CAC/RCP 5-1971, Recommended International Code of Hygienic Practice for Dehydrated Fruits and Vegetables, including Edible Fungi
- ▶ CAC/RCP 6-1972, Recommended International Code of Hygienic Practice for Tree Nuts
- ▶ CAC/RCP 53-2003, Code of Hygienic Practice for Fresh Fruits and Vegetables

A.3. Examples of PRPs for production and packaging of fresh fruits and vegetables

□ Good production/processing practices

1. Location, layout and equipment of establishments
 - Environment
 - Potential sources of contamination from the environment should be considered when drawing up prerequisite programmes (PRPs) and proposing the HACCP system.
 - Primary production must not take place in areas where the presence of potentially hazardous substances would lead to an unacceptable level of such substances in food.
 - Site limits must be clearly defined and an adequate drainage system must be provided around buildings or areas where unprocessed food is stored or processed.
 - The following factors should be considered: previous use of the site, nature of the soil, erosion, quality and level of groundwater, existence of sustainable sources of water and impact on nearby surfaces.
 - Access to the establishment's site must be controlled and any potential pest harbourage factors (burrows, substratum, rubbish) must be eliminated.

- Workflow layout
 - The internal layout and flow of production, products and personnel must be logical and designed to prevent contamination.
 - High/low risk areas (dirty areas, clean areas) should be determined and separated appropriately.
- Premises and rooms
 - Structures in food production establishments should be solidly built from durable materials and easy to maintain, clean and where necessary to disinfect.
- Storage
 - Adequate facilities must be available to protect food, ingredients and packaging material from dust, condensation, run-off, waste, pests or any other source of chemical, physical or microbiological contamination.
 - Storage areas should be dry and well ventilated.
 - Non-food chemical products (cleaning/lubricating products, fuel, plant protection products, etc.) must be stored separately and in holding tanks.

2. Basic facilities

- Water supply
 - An adequate supply of potable water with appropriate facilities for its storage, distribution and temperature control should be available whenever necessary.
 - Irrigation water must be monitored and be of adequate quality; the use of untreated waste water must be prohibited.
 - Water used for post-harvest washing must be potable and, where necessary, monitored at appropriate intervals for the presence of contaminants.
- Lighting
 - Adequate natural or artificial lighting must be provided to enable the undertaking to operate in a hygienic manner.
 - Are bulbs used above sorting, weighing and storage areas unbreakable or fitted with a protective device?

3. Drainage and waste disposal

- Drainage and waste disposal
 - Adequate drainage and waste disposal systems should be installed for the separation, storage and disposal of waste.

4. Adequacy, cleaning and maintenance of equipment

- Equipment
 - Equipment in contact with food should be made of appropriate materials and designed and laid out to be easy to clean and maintain. It must be regularly examined and cleaned.



- Maintenance
 - Workplaces and equipment must be suitably maintained and kept in a state of good repair to facilitate all sanitation procedures.

5. Management of raw materials (inputs)

- Incoming material
 - No raw material or ingredient should be accepted if known to contain parasites, undesirable micro-organisms, pesticides or toxic substances, or decomposed or extraneous substances that cannot be reduced to an acceptable level by normal sorting and/or processing procedures.
 - Any incoming material that may have an impact on food safety must be approved for the intended use (cleaning/lubricating products, fuels, pesticides and other substances).
- Selection and management of suppliers
 - Procedures to control food safety hazards should be set up for the selection, approval and continuous monitoring of suppliers.
- Stock rotation
 - Products must be managed on the basis of either the 'First In, First Out' (FIFO) or the 'First Expired, First Out' (FEFO) principle.

6. Measures to prevent cross-contamination

- Separation and isolation of products
 - Different types of products must be separated to avoid cross-contamination.
- Microbiological cross-contamination
 - Buildings should be designed and built to minimize the accumulation of dirt and debris.
- Physical contamination
 - Appropriate measures determined on the basis of hazard analysis must be taken to prevent the contamination of food by foreign bodies (glass or metal shards, dust, etc.).
- Chemical contamination
 - Chemical products (pesticides, additives, cleaning products, etc.) must be stored separately in holding tanks and used by trained personnel.
 - Records must be kept on the use of chemical products in primary production.

7. Cleaning and disinfection

- Cleaning
 - Cleaning and disinfecting operations performed to remove food residues and dirt should not represent a risk of contamination.
 - Chemical heavy-duty cleaning products must be handled and used carefully in accordance with the manufacturer's instructions.



8. Pest control

- Adequate measures for cleaning, inspection and monitoring of raw materials should be taken to minimize risks of harbourage and consequently to limit the need for pesticides.
- Buildings should be kept in good repair and condition. Holes, drains and other places where pests may gain access should be kept sealed to prevent access and to eliminate potential breeding sites.
- A bait plan should be available.

9. Control of operation

- Time and temperature control
 - In terms of the nature of the operations, adequate systems should be available for heating, cooling or storage of food.

□ Good hygienic practices

10. Personal hygiene

- Rules of hygiene and personal behaviour
 - Food handlers should be correctly trained and maintain a high standard of personal cleanliness. Where necessary, they should wear appropriate clothing, headgear and footwear.
 - Documented hygiene rules based on the nature of the activities and potential hazards must be drawn up and communicated to personnel through pictograms and signs posted at the workplace.
- Sanitary facilities
 - Sanitary facilities that include appropriate hand-washing areas, toilets and cloakrooms must be available to guarantee an appropriate level of personal hygiene and to prevent the contamination of food.
- Health status and injuries
 - Medical surveillance procedures should be used so that persons known or suspected to be suffering from or to be a carrier of a transmissible disease or illness will not be authorised to enter any food handling area if there is a likelihood that they will contaminate food.
- Personal behaviour
 - People engaged in food handling activities should refrain from behaviour that could result in contamination of food (smoking, spitting, eating, chewing, sneezing or coughing over unprotected food).
 - Personal effects such as jewellery, watches, pins or other items should not be worn or brought into food handling areas and fingernails should be short, clean and unpolished.

- Hand washing
 - Personnel should always wash their hands before handling food, after handling contaminated material and after using the toilet to prevent contamination of the product.
- Visitors
 - Visitors to food processing, handling or manufacturing areas should wear protective clothing if there is a risk of contact with products.

☐ **Good transport practices**

11. Transport

- Food must be adequately protected during transport to ensure its safety.
- Where appropriate, vehicles and containers should be designed and built to allow easy and effective cleaning.

☐ **Good packaging practices**

12. Packaging

- Packaging design and materials should provide adequate protection for products to minimize contamination, prevent damage and accommodate proper labelling.
- Packaging materials must be non-toxic and not pose a threat to the safety or suitability of food under the specified conditions of storage and use.
- Reusable packaging should be suitably durable and easy to clean.

