EDES

SAFE FOOD IN ACP
A PROGRAMME FUNDED BY THE EU

HANDBOOK 6.2

TOPIC 6
Self-Assessment Systems

2

HACCP METHOD: PRINCIPLES AND IMPLEMENTATION

COLEACP

The handbooks are tools designed for civil servants in charge of restructuring the food safety system, and for all operators involved in drawing up the food safety policy and organising official controls (qualified civil servants, heads of laboratories, heads of departments in official organisations, those in charge of official controls, trainers, technicians, researchers, experts or company executives). They aim to provide an overview of the main points of a specific subject. All of the topics addressed by EDES during the training sessions are covered in separate handbooks.

The handbooks have been designed and drawn up by the EDES Training Unit in cooperation with the Consortium members.

EDES is a European cooperation programme managed by COLEACP. COLEACP is an international network promoting sustainable horticultural trade. It is funded by the European Union and was implemented at the request of the ACP (African, Caribbean and Pacific) Group of States. EDES aims to promote food safety in African, Caribbean and Pacific countries. EDES operates in all sectors in response to a request filed at national level by any public or private stakeholder involved in the food safety process.

EDES c/o COLEACP
130, rue du Trône • B-1050 Brussels • Belgium
Tel : +32 (0)2 627 52 90 • Fax : +32 (0)2 627 52 99
Email : edes@coleacp.org
www.coleacp.org/edes

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HACCP METHOD: PRINCIPLES AND IMPLEMENTATION

Content

The texts in this handbook are taken from PIP Manual No. 1 - PRINCIPLES OF HYGIENE AND FOOD SAFETY MANAGEMENT (COLEACP/PIP, Brussels, 2011).
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1. Scope and significance of the HACCP method

1.1. Origin, definition and strategy of the method

For many years, methods such as '*Hazard and Operability*', or '**HAZOP**' studies, based on the idea that 'prevention is better than cure', were used in the chemical, nuclear and aerospace industry.

It is on these basic principles that the 'HACCP system' was established.

The agri-food sector soon adopted this system, particularly for managing the hazards of food supply contamination in the NASA space programmes. HACCP was first used by the Pillsbury Company and NASA to ensure food safety in the first manned space missions.

HACCP stands for:

H Hazard
A Analysis
C Critical
C Control
P Points

HACCP is a systematic and rational strategy for controlling hazards in order to ensure the safety of a product. It is based on a simple principle: **'Prevention is better than cure'.**

HACCP introduced a **new approach** to managing food safety and quality, with an emphasis on **inspection and improvement during production,** rather than on **finished product inspection.**

The strength of the system lies in the fact that HACCP:

- i**dentifies and analyses the hazards** associated with different stages of food production and processing;
- **specifies the resources required to control them;**
- **ensures that these resources are implemented efficiently and effectively.**

As such, HACCP uses a logical scientific approach to identify specific hazards and indicate the measures to be taken to manage and guarantee food safety. HACCP is a tool that assesses hazards and implements management systems focused more on prevention than on analysis of the finished product.

1.2. HACCP in regulations and standardisation

The HACCP strategy[1] is currently recognised by many international bodies as the most reliable tool for guaranteeing food safety.

The ***Codex Alimentarius*** **(FAO/WHO) Commission**, an international body responsible for harmonising food safety regulations, decided to use the **HACCP system as a reference standard**.[2] **European regulations** on food hygiene therefore apply the HACCP system as the **reference standard for food safety management.**

The European Economic Community (EEC), following the recommendations of the *Codex Alimentarius*, introduced the HACCP method in Directive 93/43/EEC of 14 June 1993 on the hygiene of foodstuffs. More recently, Regulation (EC) No 852/2004 of the European Parliament and of the Council on the hygiene of foodstuffs, which supersedes Directive 93/43 EEC and which entered into force on 1 January 2006, requires food business operators to develop, implement and maintain a permanent procedure based on HACCP principles.

Regulation (EC) No 852/2004 states that the HACCP system is an appropriate tool for controlling hazards in food industry companies, particularly those engaged in operations that may pose a hazard if they are not performed properly.

In the United States, the Food and Drug Administration (**FDA**) introduced a series of legal and technical measures which made application of **HACCP** mandatory at all food-processing establishments.

However, it is important to note that HACCP is not a 'standard' as such, in the strict sense of the term!

It is a method or approach for implementing a system which, in the case of food, aims to produce safe food by controlling hazards that are unacceptable and which may damage consumer health.

This has since inspired several countries to establish standards.

For example:

- the Danish standard DS 3027 (*Management of Food Safety based on HACCP*)
- the Moroccan standard NM 08.0.002 (*HACCP management system – requirements*)

Internationally, ISO published **ISO 15161:2000** (based on ISO 9001), a standard concerning management of the quality, rather than the safety, of food. Given the growing number of standards incorporating HACCP principles and given a real need to harmonise practices in a global marketplace, in 2005 the ISO published a further standard, I**SO 22000, which integrates HACCP into ISO 9001**.

Thus, a company may have its food safety management **system** (FSMS) **certified** based on HACCP principles. However, it should be noted that certification of a HACCP system is a voluntary procedure (e.g. for commercial reasons or due to a customer requirement), rather than a regulatory requirement

1 The terms 'approach', 'strategy', 'system' and 'method' are used interchangeably in literature on HACCP.
2 In 1993 the *Codex Alimentarius* proposed the first '*Guidelines for the application of the HACCP system*'.

1.3. The advantages of the HACCP method

Application of HACCP offers many advantages:

- HACCP can be applied throughout the food chain, from primary production all the way to the consumption stage.
- HACCP offers a **systematic approach** that addresses all aspects of food safety, based on scientific evidence.
- It **identifies hazards and focusses** on those for which management is essential for food safety (risk assessment: severity of damage and likelihood of occurrence).
- HACCP enables compliance with legal requirements for ensuring and managing the safety and quality of products sold (principle of due diligence).
- HACCP helps businesses meet customer requirements. Large retailers are increasingly sensitive to hazards and their control and request this type of strategy.
- Having a HACCP system boosts the confidence of trading partners, thus making international trade more straightforward.
- HACCP can be easily integrated into existing quality management systems; it provides a clear methodology for developing a specific food safety plan.
- Through its prevention-based approach at all stages of the production process, HACCP helps reduce the risks of non-conformity that may arise during inspections of the finished product.

2. Description of the HACCP method

2.1. HACCP basic principles

HACCP is based on **7 basic principles:**

Principle 1 : Conduct a hazard analysis

Principle 2 : Identify **Critical Control Points (CCP)**

Principle 3 : Establish **critical limit(s)**

Principle 4 : Establish a CCP **monitoring system**

Principle 5 : Establish corrective actions to be taken when monitoring indicates that a CCP is not under control

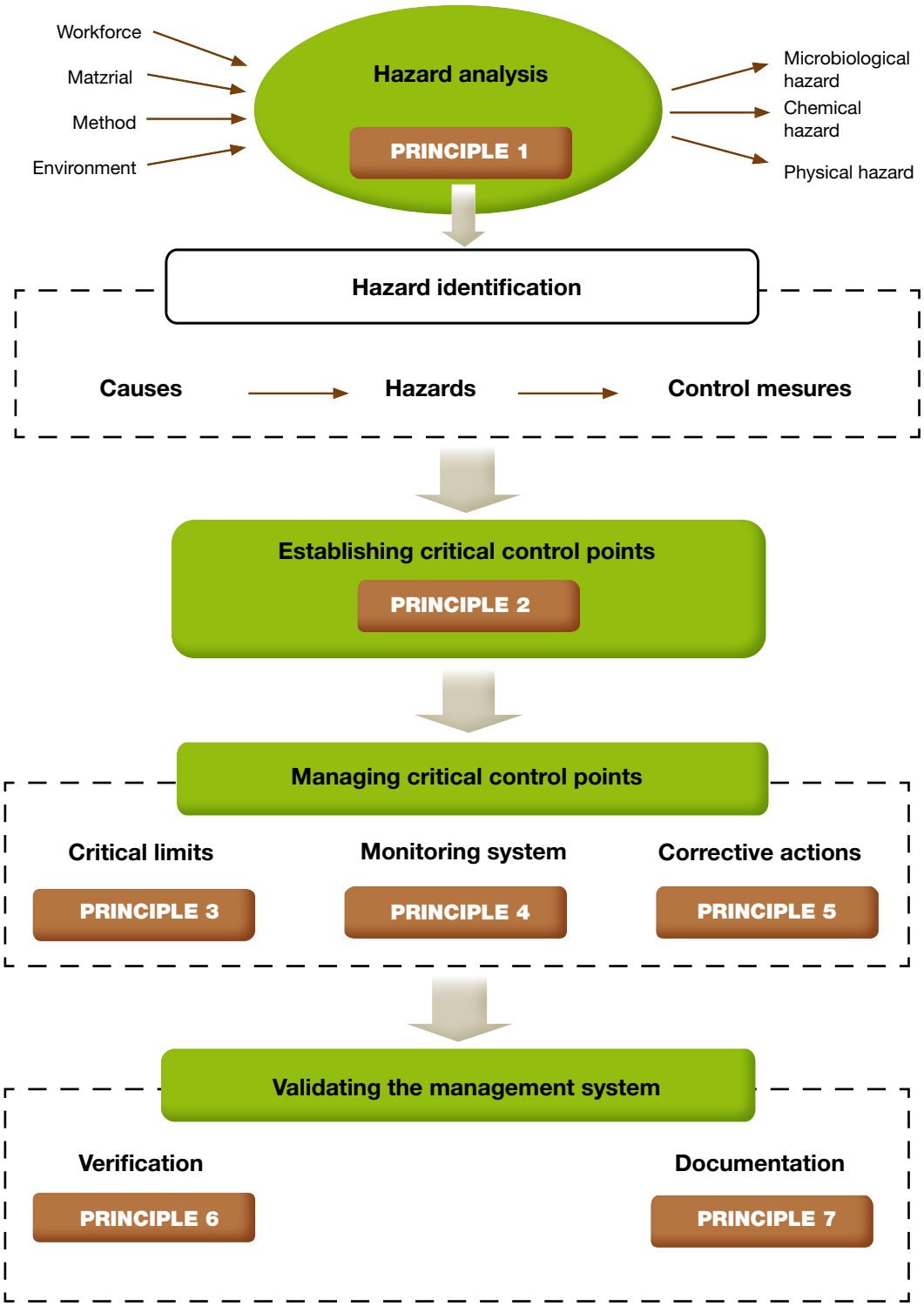
Principle 6 : Establish **verification** procedures for ensuring that the HACCP system is working as intended

Principle 7 : Establish **files** and maintain **records**

2.2. Flowchart for the HACCP method

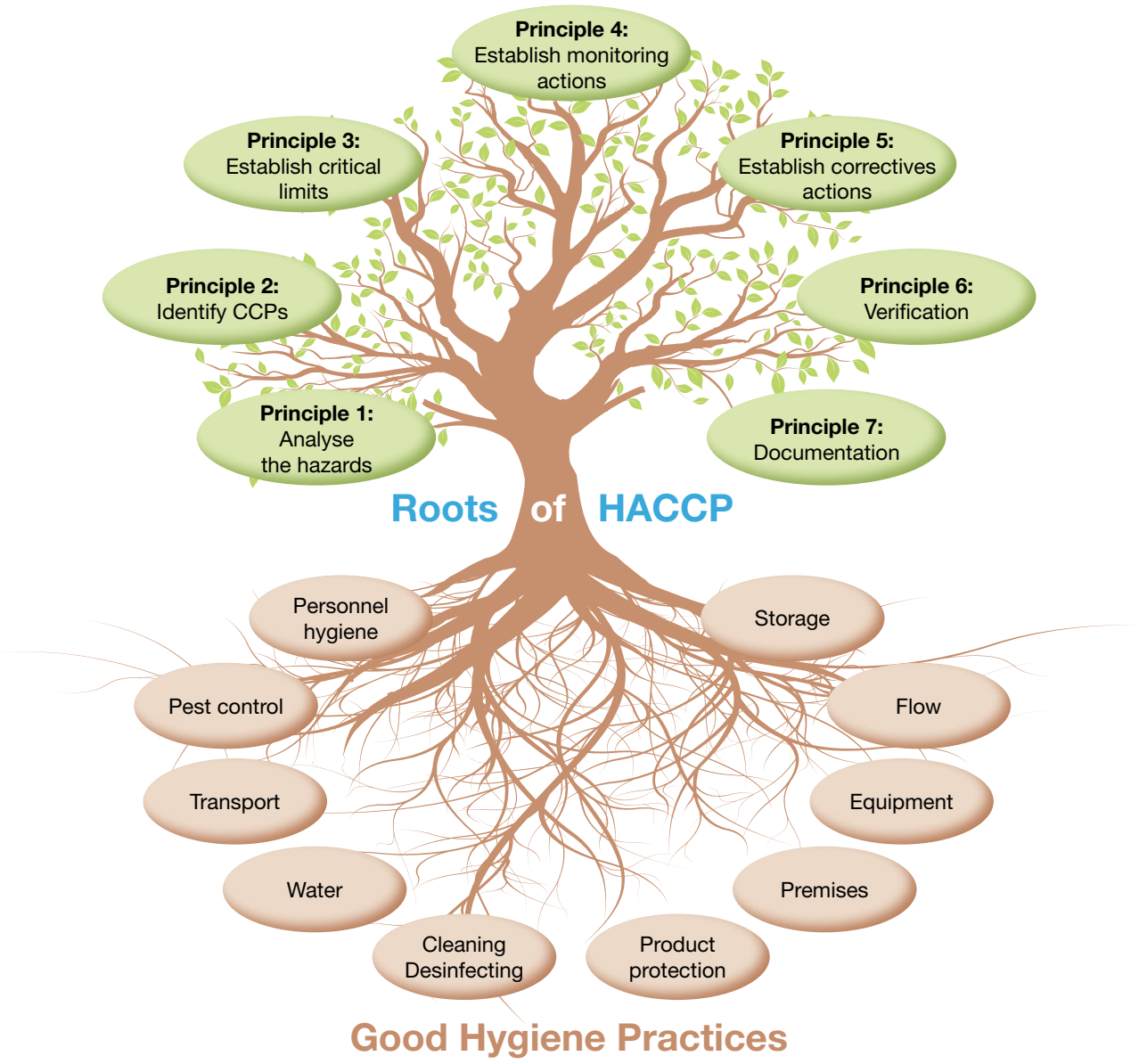
On a practical level, the HACCP method is implemented in a logical sequence based on **four points:**

- **Hazard analysis**
- Identifying **critical control points**
- **Managing critical control points**
- **Validating** the management system


Workforce
Matzrial
Method
Environment
Hazard analysis
PRINCIPLE 1
Microbiological hazard
Chemical hazard
Physical hazard
Hazard identification
Causes
Hazards
Control mesures
Establishing critical control points
PRINCIPLE 2
Managing critical control points
Critical limits
Monitoring system
Corrective actions
PRINCIPLE 3
PRINCIPLE 4
PRINCIPLE 5
Validating the management system
Verification
Documentation
PRINCIPLE 6
PRINCIPLE 7

2.3. Implementing the HACCP method

- **Prerequisite programmes (PRP)**



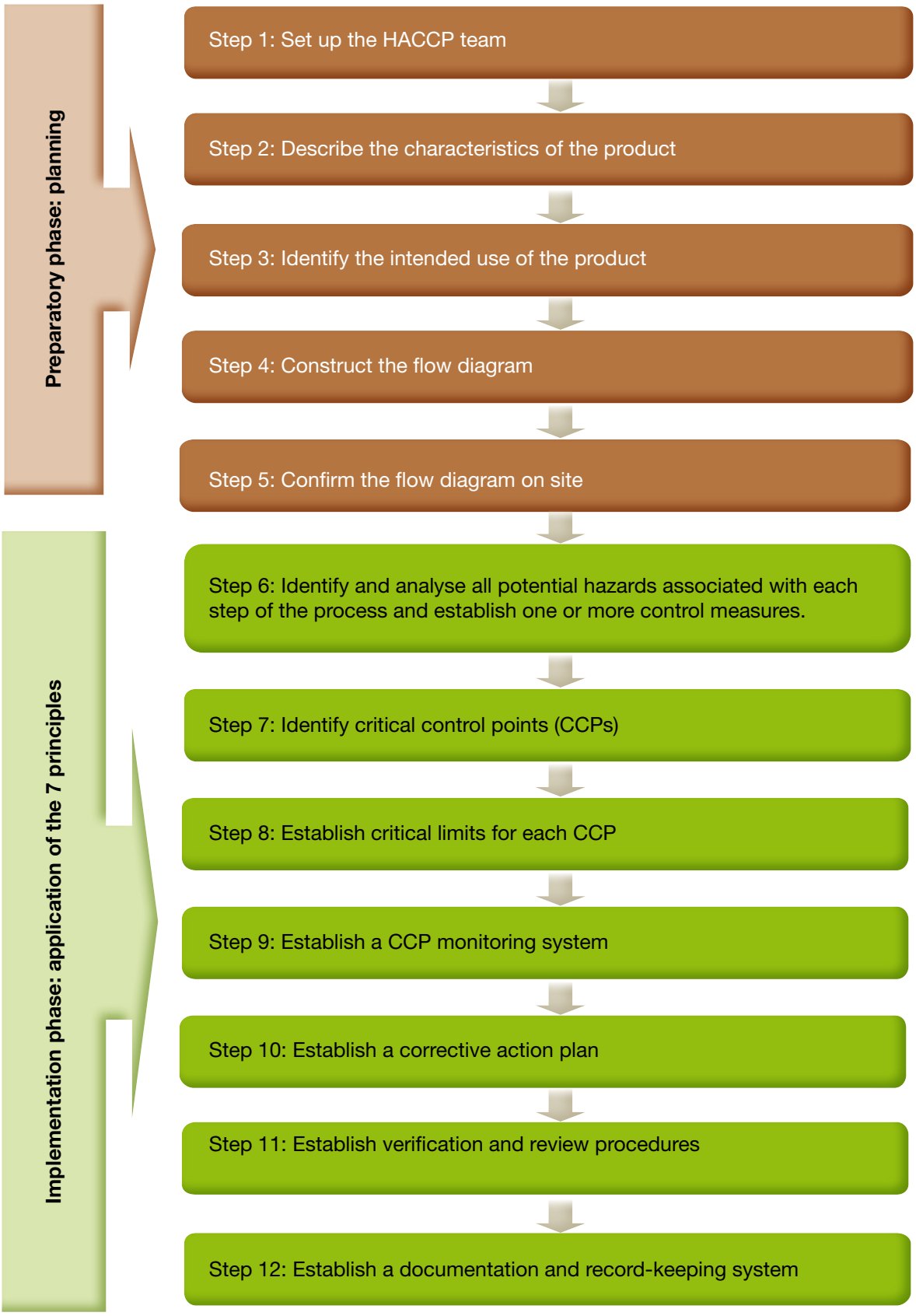
Before a HACCP plan is implemented, prerequisite programmes (PRP) must already be in place.

As such, implementing a HACCP system assumes that appropriate Good Practices have **already been established** for building and developing the tools and working methods that enable staff to implement the food safety system (see handbook No 6.1).

To verify application of the PRPs, it is recommended to use checklists to review the relevant Good Practices and implement corrective actions in the event of any non-conformity.

- **Applying the HACCP method**

According to the *Codex Alimentarius guidelines,* HACCP principles are applied using a **12-step strategy** consisting of two phases: a *preparatory phase* and an *implementation phase.*



- ***The preparatory phase:***

➤ **Step 1: Setting up the HACCP team**
Implementing HACCP requires a multidisciplinary team to develop, establish, maintain and review the system. The HACCP team should have experience and knowledge of the products, processes and hazards within the scope of the study. A HACCP team leader should be appointed. External experts may be used, in which case the expert's responsibility and authority in the HACCP system must be defined. In a small company, one person may have the skills required to carry out the HACCP study, but it is recommended that an external expert validates the system.

➤ **Step 2: Describing the product characteristics**
A full description of the product under study must be given, in order to identify the factors that may influence its safety and quality. Information on the following aspects must be included, where these relate to hazards inherent to the product:

- Description of the raw materials
- Product data sheet (botanical variety, category, grade etc.)
- Chemical, physical and biological characteristics
- Origin
- Delivery method, type of packaging, storage conditions etc. This is where all available documentation about the product should be collated.

➤ **Step 3: Identifying the intended use of the product**
The potential users and/or consumers of the product should be identified, and any groups recognised as vulnerable should be indicated. Foreseeable deviations from normal usage should also be taken into account.

➤ **Step 4: Constructing the flow diagram**
This involves creating a **detailed schematic representation of all steps or operations** to be followed during the production process. It summarises the main stages of the production process, from receipt of the raw materials to shipping the finished product. The chart should be accompanied by a diagram illustrating the movements of materials, ingredients, packaging etc. This diagram should help to highlight any areas of potential cross-contamination at the premises (cloakrooms, toilets, waste collection area etc.).

There are no formatting obligations for this diagram. The aim is to provide a comprehensive yet concise description of the different stages of the process.

➤ **Step 5: On-site verification/confirmation of the flow diagram**
On-site verification serves to ensure that the flow diagram to be used to perform hazard analysis does indeed correspond to the production process concerned.

- ***Implementation phase :***

The implementation phase is when the **7 principles of HACCP** are applied.

➤ **Step 6: Conduct a hazard analysis (Principle 1)**
This involves identifying hazards (chemical, biological or physical) at the different stages of the process, assessing the likelihood of them occurring, and identifying control measures to be implemented to manage food quality and safety.

➤ **Step 7: Identify Critical Control Points (CCP) (Principle 2)**
A **CCP** is an operation which, **in the event of loss of control, no other operation would control the hazard** and this would r**esult in an unacceptable risk**. Of the hazards listed in the previous step, those whose control is critical to safeguarding the hygiene and safety of the product must be identified. Tools such as the *Codex Alimentarius* decision tree can be used.

➤ **Step 8: Establish critical limit(s) (Principle 3)**
Critical limits must be specified for each CCP so as to ensure their control. These limits can be numerical values, sensory parameters or measurements. A single CCP can have several critical limits (for example, the application rate and pre-harvest interval for the use of plant protection products).

➤ **Step 9: Establish a system to monitor control of the CCPs (Principle 4)**
This involves conducting analyses or taking measurements, recording observations or saving data to ensure that the CCPs are being controlled. The procedures followed must be able to detect any loss of control.

➤ **Step 10: Establish corrective actions to be taken when monitoring indicates that a CCP is not under control (Principle 5)**
Corrective actions should be developed for each CCP in order to rectify any deviations. This involves immediate actions that the operator responsible for the step in the process must implement in order to meet the control requirements of their process. These actions must ensure that the CCP has been brought under control and provide for management of the affected product: destruction, downgrading or recycling, identification and traceability.

➤ **Step 11: Apply verification procedures to confirm that the HACCP system is working effectively (Principle 6)**
This step involves verifying the effectiveness of the system but also its effective implementation. Verification and auditing methods, procedures and tests may be used, including random sampling and analysis to determine whether the system is working correctly. It must also ensure that any amendments to crop protocols or processes have been fully taken into account, and that the HACCP plan is up to date. For example, it should be verified that plant protection products used have been approved under relevant legislation.

This could involve **auditing procedures combined** with **continual improvement** considerations.

➤ **Step 12: Establish documentation (procedures and records) (Principle 7)**
Establish a documentation system which takes into account the various documents, procedures, operating modes and records. This is the last principle, but by no means the least, since these are documents that can be presented to authorities and to customers if necessary.

3. Example application of the HACCP method: production and packaging of fresh mangoes

Although its application in primary production i**s not mandatory**, HACCP identifies hazards and designs a food safety and quality management system that can be adapted to specific types of production and packaging of fresh fruit and vegetables.

This case study will illustrate how a 'HACCP Plan' is established for the production and packaging of fresh mangoes.

The production and packaging process for fresh mango as described in the case study may not reflect the specific processes used in all companies. It merely serves as a practical example to illustrate how the HACCP method can be implemented.

The potential hazards identified in the study may not be the only hazards associated with mango production and packaging in particular companies.

3.1. Prerequisite programmes (PRP)

The first step when mangoes are produced and packaged is to ensure that the prerequisite programmes are in place. The main PRPs to implement include:

- Staff training/education
- Good Agricultural Practices
- Good Hygiene Practices
- Good Production and Packaging Practices
- Good Storage and Transport Practices
- Product traceability and recall

➤ **List of prerequisite programmes (not exhaustive)**

- Staff training, information and/or education programme
- Plant protection strategy
- Register of plant protection treatments
- Procedure for cleaning and maintaining the premises, facilities and equipment
- Hygiene procedure for staff (employees and visitors)
- Water quality control programme (production and packaging station)
- Data sheets and/or labels for chemicals (detergents,
- Calibration procedure for pesticide application equipment
- Pest control procedure

- Register for monitoring the temperature of cold storage rooms
- Procedure for recall and withdrawal of non-compliant products

See attached example of an operating procedure for rodent control.

➤ **Verification and control of PRP implementation**

The implementation of PRPs should be permanent, and the procedures to control and verify their implementation must be available and applied. *See attached checklist for the verification and control of PRPs*.

3.2. Implementing the HACCP method

➤ **Step 1: Setting up the team**
In order to have skilled human resources able to provide the necessary information at the different stages of the production and packaging process, the HACCP team may be composed of:

- A site manager
- A quality assurance manager (team coordinator)
- A packaging station manager

The quality assurance manager will need to have been trained in HACCP and have sufficient knowledge about the principles and steps involved in its implementation.

➤ **Step 2: Key characteristics of fresh mango**
Appearance: according to the data sheet standard (class, grade etc.)
Storage and shipping conditions:

- Removal from the fields to the station by truck
- Temperature: 10-12°C
- Shipping by air or boat
- Packaging: 4 kg and 6 kg boxes

➤ **Step 3: Identifying the intended use of the product**

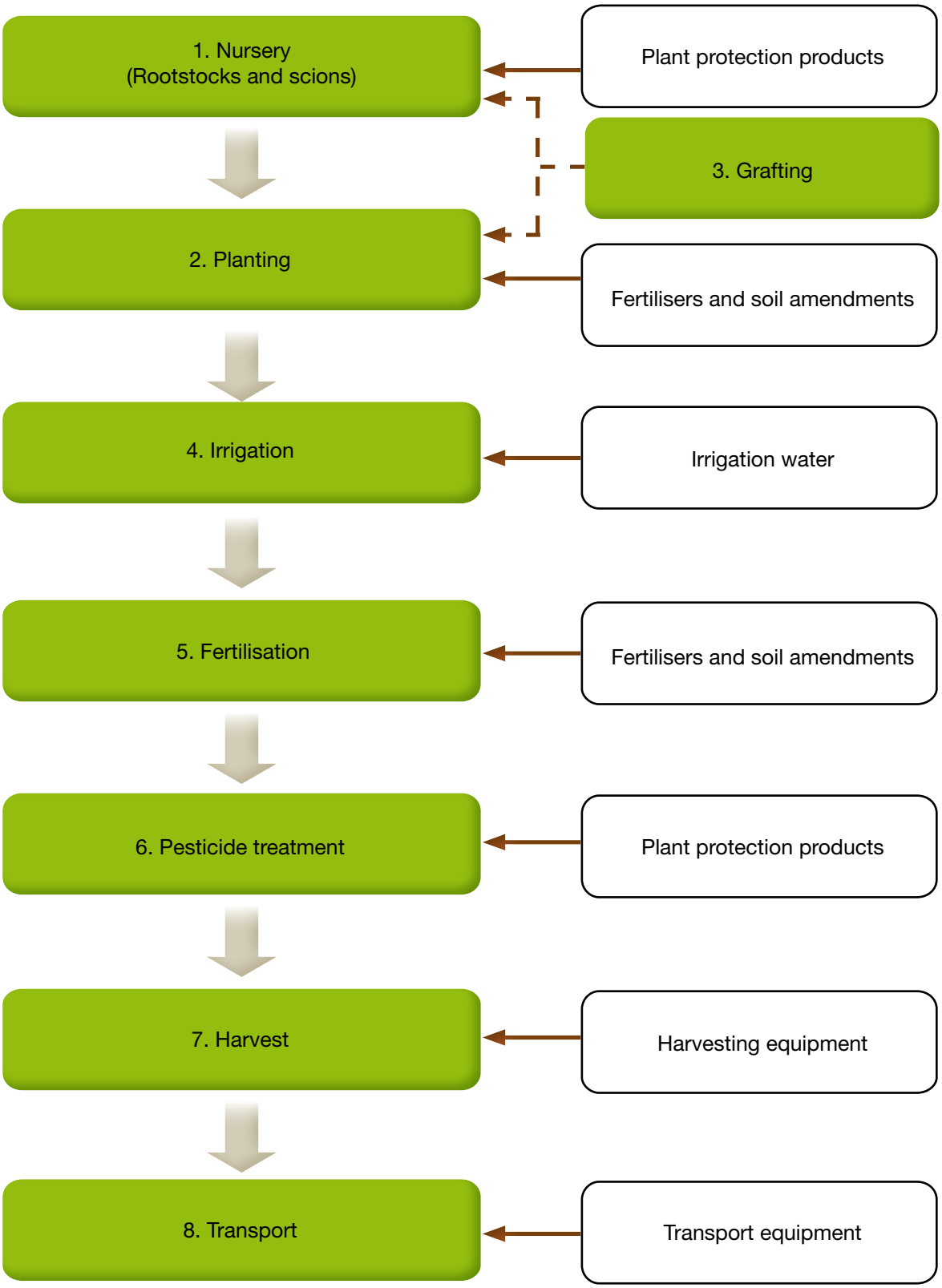
The mango is sold on the fresh fruit and vegetables market.

➤ **Steps 4 and 5: Construction and on-site verification of the flow diagram**

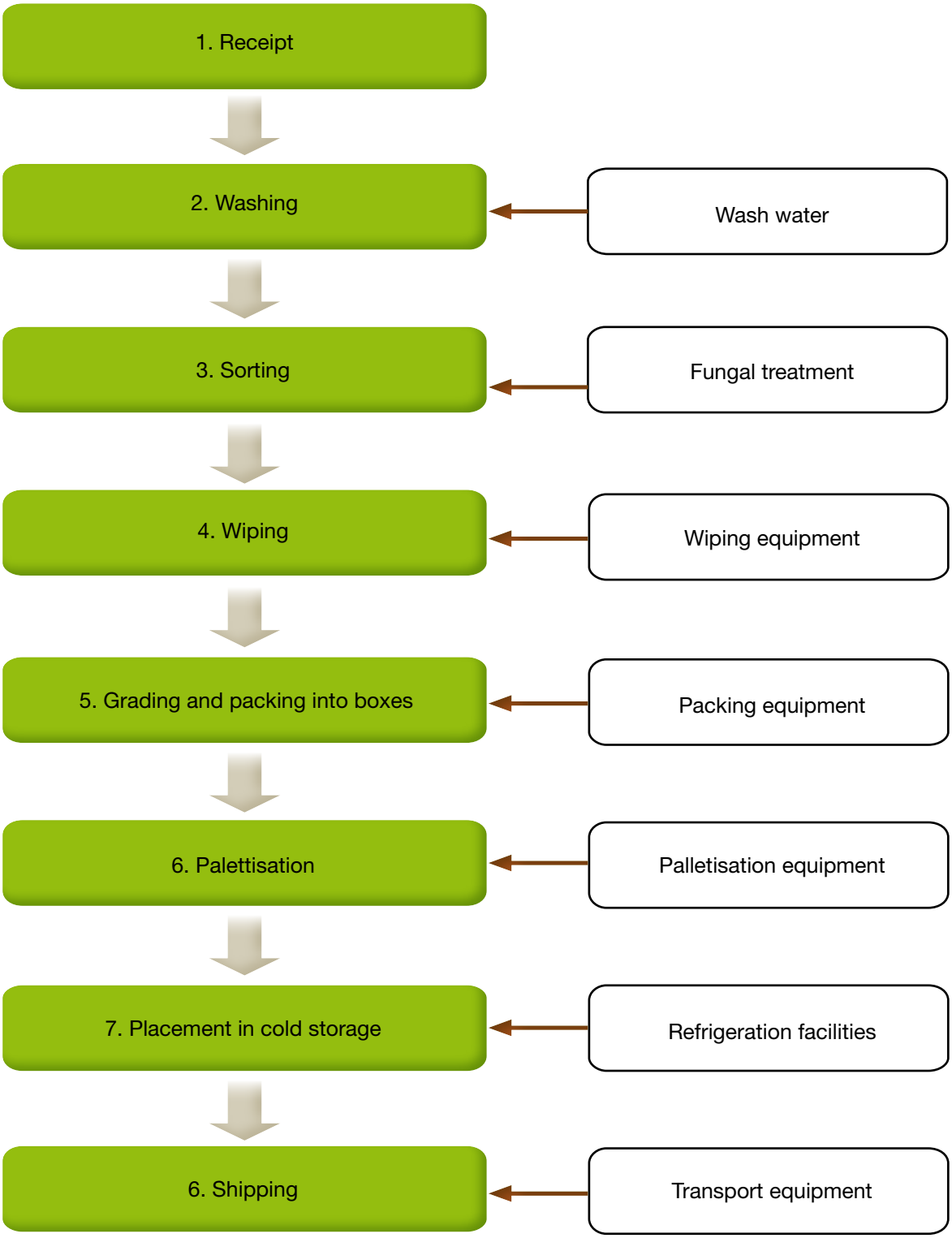
The flow diagram shows the stages of field production and packaging of the mango at a packing station. The shipping process does not fall within the scope of the study.

The production and packaging process flow diagrams are described below:

- **Fresh mango production process**



- **Fresh mango packing process**



➤ **Steps 6 and 7: Hazard analysis and identifying Critical Control Points (CCP)** (Principles 1 and 2)

Using the production and packaging flow diagrams, the potential hazards (chemical, microbiological and physical) have been identified at each stage of the process and the control measures to be implemented have been specified.

The results are shown in **Table 1 below**.

Table 1: Hazard analysis and CCPs (Principles 1 and 2)

1. Production process						
Step in the process	**Potential hazards introduced, controlled or increased at this step**		**Is the hazard likely to occur?**	**Why? (rationale for the decision taken in the previous column)[3]**	**What measures should be taken to prevent, eliminate or reduce the hazards addressed in the HACCP plan?[4]**	**Is this step a Critical Control Point (CCP)?**
1.1. Nursery	**Biological**	No	No	No risk because of the long crop cycle before production	-	-
	Chemical	No	No	No risk because of the long crop cycle before production	-	-
	Physical	No	No	-	-	-
1.2. Planting	**Biological**	No	No	-	-	-
	Chemical	Yes	Yes	Soil contamination by heavy metals	Keep production sites away from sources of chemical pollution (industrial sites) Follow Good Agricultural Practices (choice of soil, depressed areas etc.)	No (PRP)
	Physical	No	No	No risk	-	-
1.3. Grafting	**Biological**	No	No	No risk because of the long crop cycle	-	-
	Chemical	No	No	No risk because of the long crop cycle	-	-
	Physical	No	No	No risk	-	-
1.4. Irrigation	**Biological**	Yes	Yes	Possible contamination by pathogenic micro-organisms	Avoid using waste water and sludge Perform a microbiological analysis to ensure that the water quality is suitable	No (PRP)
	Chemical	Yes	Ys	Possible contamination by heavy metals	Avoid using waste water Perform a chemical analysis to ensure that the water quality is suitable	No (PRP)
	Physical	No	No	-	-	-

3 Justification based on the severity and likelihood of the hazard occurring.
4 List of control measures to be implemented at this stage or at a later stage.

1. Production process (continued)						
Step in the process	**Potential hazards introduced, controlled or increased at this step**		**Is the hazard likely to occur?**	**Why? (rationale for the decision taken in the previous column)[3]**	**What measures should be taken to prevent, eliminate or reduce the hazards addressed in the HACCP plan?[4]**	**Is this step a Critical Control Point (CCP)?**
1.5. Fertilisation	**Biological**	No	No	Negligible risk because of the long crop cycle before production	Avoid using human manure Follow Good Agricultural Practices	No (PRP)
	Chemical	Yes	Yes	Possibility of introduction of heavy metals due to poor quality or non compliance with fertiliser usage requirements	Verify the fertiliser composition Follow the prescribed doses and modes of application	No (PRP)
	Physical	No	No	-	-	-
1.6. Plant health protection	**Biological**	No	No	-	-	-
	Chemical	Yes	Yes	Application of non approved products Contamination by residues on the fruit that exceed the Maximum Residue Level (MRL)	Use only approved products Use suitable application equipment (grading, maintenance etc.) Observe the dosages of active ingredients Observe Pre-Harvest Intervals (PHI)	Yes **CCP 1**
	Physical	No	No	-	-	-
1.7. Harvest	**Biological**	Yes	Yes	Contamination by pathogenic micro-organisms	Observe Good Hygiene Practices: clean harvesting equipment and accessories. Staff observance of hygiene rules	No (PRP)
	Chemical	Yes	Yes	Contamination by chemicals	Observe Good Hygiene Practices	No (PRP)
	Physical	Yes	Yes	Possible introduction of foreign particles (grass, sand, insects, etc.).	Observe Good Hygiene Practices	No (PRP)
1.8. Transport	**Biological**	Yes	Yes	Contamination by pathogenic micro-organisms	Observe Good Transport Practices and Good Hygiene Practices: cleaning and maintenance of vehicles, staff hygiene	No (PRP)
	Chemical	Yes	Yes	Contamination by chemicals	Observe Good Hygiene Practices: no chemicals in the vehicle, cleaning and maintenance of vehicles	No (PRP)
	Physical	Yes	Yes	Possible introduction of foreign particles (grass, sand, insects, etc.).	Observe Good Hygiene and Handling Practices: covered vehicles, careful handling of products	No (PRP)

2. Packing process						
Step in the process	**Potential hazards introduced, controlled or increased at this step**		**Is the hazard likely to occur?**	**Why? (rationale for the decision taken in the previous column)**	**What measures should be taken to prevent, eliminate or reduce the hazards addressed in the HACCP plan?**	**Is this step a Critical Control Point (CCP)?**
2.1. Receipt	**Biological**	Yes	Yes	Product contamination due to poor staff hygiene and/or poor hygiene in the receiving area	Observe Good Hygiene Practices: cleaning and maintenance of the premises where the goods are received and observance of the hygiene procedures by staff. Educate staff about compliance with hygiene and safety procedures.	No (PRP)
	Chemical	Yes	Yes	Contamination through failure to observe Good Hygiene and Packaging Practices	Observe Good Practices for storing chemicals (pesticides, detergents etc.) and packaging. Educate staff about compliance with hygiene and safety procedures.	No (PRP)
	Physical	Yes	Yes	Possible introduction of foreign particles (grass, sand, insects, etc.).	Observe Good Hygiene and Product Handling Practices	No (PRP)
2.2. Washing	**Biological**	Yes	Yes	Contamination through use of unsafe water	Use drinking water Perform microbiological analyses of water.	Yes **CCP 2**
		Yes	Yes	Contamination of fruit due to non observance of the wash water replacement frequency	Establish a procedure to change wash water.	No (PRP)
		Yes	Yes	Contamination of fruit by to washing equipment (bowls, brushes, sinks etc.)	Establish a cleaning plan incorporating materials and equipment.	No (PRP)
		Yes	Yes	Fruit damaged by scratches (fingernails, cutting rings etc.)	Educate staff about observing basic hygiene rules	No (PRP)
	Chemical	Yes	Yes	Chemical contamination by cleaning products (for example, soaps used to wash latex).	Establish a procedure to verify the types of products authorised for foodstuffs	No (PRP)
				Chemical contamination of fruit during fungal treatments	Establish a procedure for post-harvest processing (use of approved and/or authorised products, correct dosages of the active ingredient)	Yes **CCP 3**
	Physical	No	-	-	-	-

2. Packing process (continued)						
Step in the process	**Potential hazards introduced, controlled or increased at this step**		**Is the hazard likely to occur?**	**Why? (rationale for the decision taken in the previous column)**	**What measures should be taken to prevent, eliminate or reduce the hazards addressed in the HACCP plan?**	**Is this step a Critical Control Point (CCP)?**
2.3. Sorting	**Biological**	Yes	Yes	Contamination of fruit due to poorly cleaned sorting tables	Use smooth-surfaced tables that are easy to clean Clean and maintain sorting tables regularly	No (PRP)
	Chemical	No	-	-	-	-
	Physical	Yes	Yes	Presence of broken glass or light bulbs in fruit	All lights at the station must have protective shields Prohibit the use of glass at the packaging station	No (PRP)
2.4. Wiping	**Biological**	Yes	Yes	Contamination of fruit due to the use of dirty cloths (towels)	Use cloths/towels that are clean or new Regularly change cloths/towels to reduce the growth of micro-organisms due to humidity.	No (PRP)
	Chemical	No	-	-	-	-
	Physical	Yes	Yes	Presence of debris from wiping materials (cloths, brushes etc.)	Check and maintain wiping materials	No (PRP)
2.5. Grading and packing in boxes	**Biological**	Yes	Yes	Poor hygiene of staff and/or materials (grading, packaging etc.)	Educate staff about observing basic hygiene rules Observe the cleaning procedure Use suitable packaging that is not a source of fruit contamination.	No (PRP)
	Chemical	No	-	-	-	-
	Physical	Yes	Yes	Introduction of foreign bodies (personal belongings etc.)	Educate staff about observing basic hygiene rules and Good Packaging Practices	No (PRP)
2.6. Palettisation	**Biological**	No	-	-	-	-
	Chemical	No	-	-	-	-
	Physical	Yes	Yes	Presence of metal parts in the fruit boxes (nails, staples etc.) inside the pallets.	Educate staff about observing basic hygiene rules (observing prohibitions)	No (PRP)
2.7. Placement in cold storage	**Biological**	Yes	Yes	Contamination of the pallets in dirty cold storage rooms	Implement the cleaning plan, including regular cleaning of cold storage rooms	No (PRP)
				Refrigeration defects (rotting due to non observance of temperature procedures and/or interruption to the cold chain and/or damaged temperature sensors)	Display temperature guidelines at the entrance to the cold storage roomsMaintain the cold chain Perform calibration, maintenance and control of the temperature sensors	No (PRP)
	Chemical	Yes	Yes	Chemical contamination of fruit due to disinfectants for the cold storage rooms	Use authorised disinfectants suitable for foodstuffs	No (PRP)
	Physical	No	-	-	-	-
2.8. Shipping	**Biological**	Yes	Yes	Dirty or poorly cleaned containers.	Implement the cleaning plan, including regular cleaning of the transport containers	No (PRP)

➤ **Steps 8 and 10: Establishing critical limits and CCP monitoring procedures** (Principles 3, 4 and 5)
For each CCP identified, critical limits, monitoring procedures and corrective actions to be implemented in the event of deviation have been established

The results are shown in **Table 2 below**.

Table 2: Critical limits (Principle 3), monitoring measures (Principle 4) and corrective actions (Principle 5)

Step in the process / CCP	Nature of the hazard	Critical limits	Monitoring procedures				Corrective actions
			What?	How?	Frequency	Who?	
1. Production process							
1.6. Plant health protection **CCP 1**	**Chemical**	Maximum residue levels (MRL) for pesticides exceeded	Approval of the product Observing usage instructions (application techniques and dosage, PHI etc.)	List of approved products Observing the chosen application technique/ application rate/ PHI	At each application	Plant health protection manager	Implement the procedure in the event a MRL is exceeded Train staff in Good Plant Protection Practices
2. Packing process							
2.2. Washing **CCP 2**	**Biological**	Biological WHO standards: undetectable E. coli in a 100 ml sample. Total Coliforms	Colour and cleanliness of the water Frequency of refreshing the basin water	Visual appearance Packaging planning	Each lot of mangoes	Station manager	Refreshing the basin water Second wash of the affected lot
CCP 3	**Chemical**	Maximum residue levels (MRL) exceeded for pesticides	Approval of the product Observing usage instructions (application techniques and dosage etc.)	List of approved products Observing the chosen application technique/ dose	On each lot	Station manager	Implement the procedure in the event the MRL is exceeded Train staff in Good Plant Protection Practices

➤ **Steps 11 and 12: Verifying and documenting the management system** (Principles 6 and 7)

• Verification:
The following verification procedures have been established. Internal audits of the HACCP system, including:
- Customer feedback in order to measure their satisfaction or any complaints.
- Pesticide residue analysis against MRLs on the mango at least once early in the season.
- Bacteriological analysis of wash water at the station early in the season.

• Review of the HACCP system:
- At least once early in the season.
- In the event of a change to the production crop protocol and/or packaging process (pesticide approval, new facilities, new practices etc.).

➤ **Step 12: Documentation and records**

• The following documents are kept in the archives:
- List and data sheets of the plant protection products and detergents used
- Water analysis certificates
- Certificates for pesticide residue analysis on the mango

- The following records are kept on file or in the archives:
  - Orchard monitoring register
  - Register of plant protection treatments
  - Register of fertiliser applications
  - Register of calibration of pesticide sprayer
  - Corrective actions undertaken
  - Wash basin monitoring register
  - Premises and facilities cleaning register

The results are shown in **Table 3 below**.

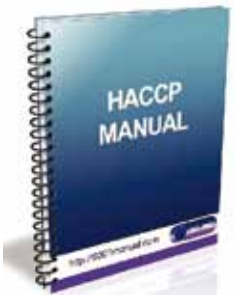


Table 3: Verifications and records (Principles 6 and 7)

Step in the process (CCP)	Nature of the hazard	Verification of the activities	Records – Procedures
1. Production process			
1.6. Plant health protection **CCP 1**	Chemical	Verification of the list of approved products Verification of the register of fertiliser applications	Staff training file Register of sprayer calibration List of approved products Register of plant protection applications
2. Packing process			
2.2. Washing **CCP 2**	Biological	Microbiological analysis conducted in accordance with sanitary risk assessment Observance of the procedure to refresh wash water	Microbiological analysis results Washing basin monitoring register
CCP 3	Chemical	Verification of the list of approved products Verification of the register of fungal treatments	Action plan in the event of exceeding MRL Pesticide residue analysis results

4. Appendices

4.1. Example procedure for rodent control

1. Purpose

The aim of this procedure is to describe the rodent control measures implemented.

2. Scope

This procedure applies:

- To the packing station
- To the storage premises for the finished products, raw materials and packaging.

3. Description

Rodent control consists of the following steps:

- Install rat traps according to the map of the premises (receiving, sorting, grading and packing areas, packaging storage area etc.)
- Identify the different traps using serial numbers on a map and lay the bait
- Ensure that the rat traps are well protected to avoid contamination of the products or staff
- Check the traps daily and ensure the bait is replenished as needed
- Enter the results of the captures in the table below:

Date	Trap number	Results	Comments	Inspector's signature

If using bait, ensure it is appropriate and is not a source of contamination for products or staff.

Quality assurance manager **Station manager**

4.2. Checklist for control and verification of PRP implementation

Training/education	Yes	No	N/A	Corrective actions
A staff training, information and/or awareness programme on food safety must be available	☐	☐	☐	.....
Each staff member must be trained in the good practices applicable to their role (Good Agricultural Practices, Good Hygiene Practices, etc.).	☐	☐	☐	.....
At least one member of the supervisory staff must be trained in the HACCP principles and method	☐	☐	☐	.....
Transport staff are educated about observing hygiene and safety procedures	☐	☐	☐	.....
Good Agricultural Practices	**Yes**	**No**	**N/A**	**Corrective actions**
The origin and nature of the grafts of the seedlings are known	☐	☐	☐	.....
The applications (pesticides and irrigation) carried out at the nurseries are known	☐	☐	☐	.....
Pesticide applications at production plots are justified (based on plant health observations)	☐	☐	☐	.....
Pesticide applications are carried out in accordance with the requirements for operator protection, the environmental requirements and based on the information provided on the label	☐	☐	☐	.....
Chemical control	**Yes**	**No**	**N/A**	**Corrective actions**
All chemicals are kept separate from food products (either at separate storage premises or at a store away from the food)	☐	☐	☐	.....
There are practical arrangements for ensuring chemicals are kept separate from the food.	☐	☐	☐	.....
The material safety data sheets (MSDS) can be accessed for each chemical stored	☐	☐	☐	.....
Disinfectants used are approved and suitable for food products	☐	☐	☐	.....

Good Hygiene Practices				
Cleaning and decontamination	**Yes**	**No**	**N/A**	**Corrective actions**
A cleaning plan involving regular cleaning of the cold storage rooms is available	☐	☐	☐	.....
The cleaning and disinfection procedures for the equipment and facilities are available and documented	☐	☐	☐	.....
The cleaning and disinfection procedures are followed (implemented)	☐	☐	☐	.....
A cleaning and decontamination schedule is available	☐	☐	☐	.....
A schedule for cleaning the harvest crates is available	☐	☐	☐	.....
A schedule for cleaning the vehicles transporting the harvested crops is available	☐	☐	☐	.....
Clean and/or new cloths (towels) are used and changed frequently	☐	☐	☐	.....

Staff hygiene	Yes	No	N/A	Corrective actions
Written hygiene policies and procedures for staff, employees and all visitors are available and documented	☐	☐	☐	.....
The staff hygiene policies and procedures are observed by every person who enters the production or work area	☐	☐	☐	.....
Hand washing facilities are available and accessible to employees	☐	☐	☐	.....
Mandatory hygiene and safety warnings are displayed at appropriate places	☐	☐	☐	.....
Water	**Yes**	**No**	**N/A**	**Corrective actions**
Written procedures for water purification are available and implemented	☐	☐	☐	.....
Microbiological and chemical analyses of the water are performed to test the potability of the water used at the packaging station	☐	☐	☐	.....
A procedure for changing the sink water for washing the post-harvest mango is available and implemented	☐	☐	☐	.....
Waste management	**Yes**	**No**	**N/A**	**Corrective actions**
Written waste management procedures are available	☐	☐	☐	.....
The waste has been classified and a collection, storage, recycling or disposal system exists	☐	☐	☐	.....
Pest control	**Yes**	**No**	**N/A**	**Corrective actions**
A pest control programme is available	☐	☐	☐	.....
Pest control is carried out by a qualified operator	☐	☐	☐	.....
Documentation of the pest control procedures is available	☐	☐	☐	.....

Good production and packaging practices				
Supplies, facilities and maintenance	**Yes**	**No**	**N/A**	**Corrective actions**
The facilities are correctly installed	☐	☐	☐	.....
Maintenance schedules for the facilities are available and documented	☐	☐	☐	.....
Schedules for calibrating production apparatus (pesticide application, irrigation etc.) are available and documented	☐	☐	☐	.....
A calibration, maintenance and inspection programme exists for temperature sensors	☐	☐	☐	.....
Smooth-surfaced, easy-clean tables are used	☐	☐	☐	.....
All light bulbs at the station have protective shields.	☐	☐	☐	.....
Suitable packaging that is not a source of contamination for food products is used	☐	☐	☐	.....
Chilling and temperature control	**Yes**	**No**	**N/A**	**Corrective actions**
The temperatures of the mangoes in the cold storage rooms are maintained and monitored	☐	☐	☐	.....

Good storage and transport practices				
Storage	**Yes**	**No**	**N/A**	**Corrective actions**
All products are stored in sanitary conditions	☐	☐	☐	.....
All products are stored in areas with suitable temperature and humidity conditions	☐	☐	☐	.....
FIFO-based stock rotation is observed	☐	☐	☐	.....
Transport	**Yes**	**No**	**N/A**	**Corrective actions**
The products are transported in customised refrigerated trucks/vehicles/containers, in compliance with hygiene and safety conditions	☐	☐	☐	.....
Traceability and recall	**Yes**	**No**	**N/A**	**Corrective actions**
Traceability and recall procedures	**Yes**	**No**	**N/A**	**Corrective actions**
A traceability system in order to identify and trace the origin of the products is available and implemented	☐	☐	☐	.....
A documented recall procedure to manage the withdrawal of products if necessary is available	☐	☐	☐	.....

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