FOOD SAFETY AND GOOD HYGIENIC PRACTICES HANDBOOK FOR GAMBIAN YOUTH ENTREPRENEURS

International Trade Centre

YEP YOUTH EMPOWERMENT PROJECT

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Foreword

Food, with water and air, is the very basis of life. It is our source of nutrition, growth and health. It not only has socio-cultural significance, but also considerable economic and developmental ramifications. The United Nations Sustainable Development Goals 1, 2, and 3 (No poverty, Zero hunger, and Good health and well-being) depend directly on the sufficient availability and affordability of safe and nutritious food.

Due to its universality, and relatively lower start-up costs and investments involved, food offers enormous opportunities for entrepreneurs, and business start-ups in food are very common. At the same time any food operator or business has the responsibility to ensure that the food it supplies will not cause harm to the consumers . Unsafe or unhygienic food can make people very sick, spread diseases, and may even cause death. Due to this, food is also a highly regulated sector where governments assume the responsibility to safeguard the health and safety of their population through laws that set down conditions and parameters for food business operators and their operations. The cost of disease, sickness and premature death takes a heavy toll not only in terms of medical care, but also socially and economically in terms of lost productivity and potential.

Food safety is the foundation of trust in the food business. Entrepreneurs can establish a good reputation built on food safety and quality and derive profit. Small and medium-sized businesses very often do not realize that not applying food safety and quality improvement measures turns out to be more expensive than applying them. In this regard, while hindsight may be good, foresight is better. This means not leaving this important element to chance, or ignoring it, but to actively and alertly plan, implement and pursue food safety from the initial stage of food production, inputs, processing, packaging, storing, distribution.

This guide on food safety has been prepared for Gambia's youth entrepreneurs to support employment generation, micro and small-sized enterprise creation and growth efforts under the Youth Empowerment Project. The programme,

financed by the European Union, is being implemented by the International Trade Centre in partnership with the Government of Gambia.

The project aims to contribute to the economic development of The Gambia through direct support to the development of the local economy by enhancing employability and self-employment opportunities for youth. With 60% of Gambia's population below 25 years of age, the project focuses on vocational training and the creation of micro and small-sized enterprises, and creating and improving employment opportunities for youth in selected sectors through value addition and internationalization.

We hope this guide will inspire young Gambians to adopt and implement a food safety and quality-based excellence approach to their food business endeavours, and contribute to their success.

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CHAPTER I: INTRODUCTION TO FOOD SAFETY

1. Introduction

People all over the world often get sick from the food they eat everyday. This sickness is called foodborne disease and is caused by dangerous microorganisms and/or toxic chemicals.

Foodborne diseases affect both developing and developed countries, and affect the elderly, and children most causing strain on the health system.

With more people travelling, and food supply chains increasingly becoming global, foodborne diseases, like other diseases, have the potential to spread widely.

However, most foodborne disease is preventable with proper food handling and attention to good practices and hygiene.

This chapter will allow you to acquire the basic concepts and terms associated with food safety and quality. It will then provide you with the fundamental hazard types and a preliminary introduction to risk assessement, main methods of food safety management, and why it is important to make safe food. Finally, the chapter with take you through the main steps involved in meeting food safety requirements, and the 5 keys to food safety.

2. Food safety

Food safety is about producing, handling, storing and preparing food in a manner that prevents infections or diseases and retains enough nutrients for a healthy diet.

Food safety is the assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use.

Unsafe food is that which has:

- been exposed to dirt and germs and is contaminated, or
- gone bad and is rotten, or
- contains toxic physical, chemical or biological substances, and
- can harm the health of the person while eating.

Eating unsafe food can make people very sick and can even cause death. Producing safe food is essential:

- to protect consumers from the hazards of foodborne illnesses
- to increase competitiveness in both the domestic and international markets.

3. Quality in food

Quality is a measure of excellence or a state of being free from defects, deficiencies and

significant variations.

Quality is not a result of chance, it is a choice. This means that choice in selection of raw materials, inputs, process control, workers' knowledge and skills, all determine quality.

Food quality is "a complex characteristic of foods that determines its value and acceptability by consumers" .

A good quality product is one that complies with the requirements specified by the client. This means quality is defined by the client based on a number of subjective and objective measurements of the food product. These may include measures of purity, flavour, aroma, colour, maturity, safety, wholesomeness, nutrition, or any other attribute or characteristic of the product.

Both stated parameters and implied parameters form part of food quality.

Food safety and food quality are among essential buyers' requirements, with other important requirements like plant / animal health, packaging and labelling.

These requirements, classified along technical, economic, and sustainability-related areas are presented in Figure 1.

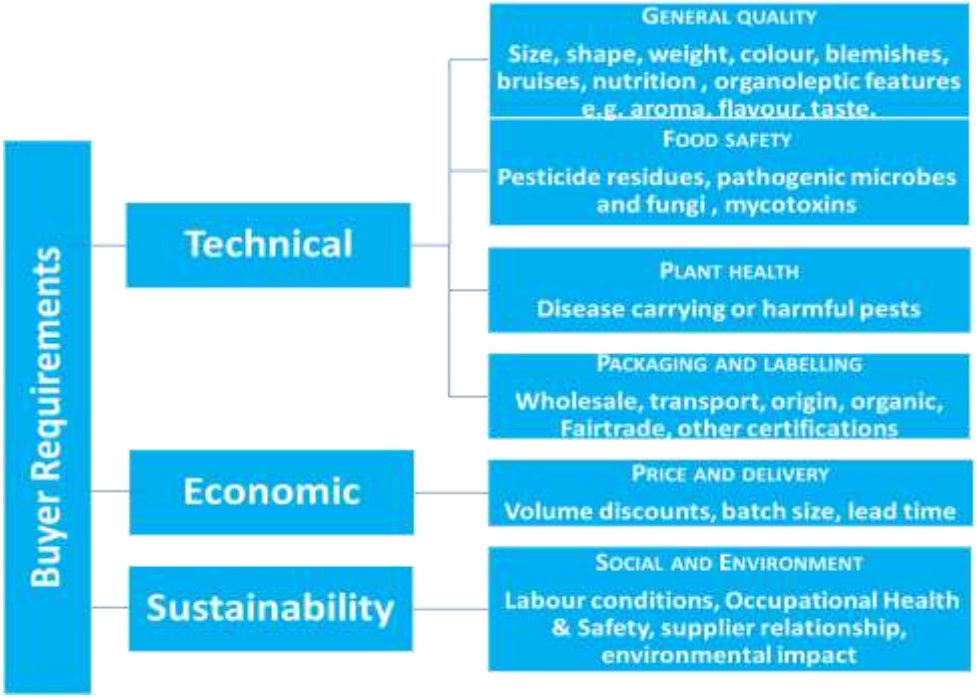

Figure 1: Categorization of buyers' requirements

Food safety is part of food quality

Safety is the most critically important component of food quality.

A product with perfect appearance i.e. well-coloured, appetizing, flavourful could nevertheless be unsafe because it is **contaminated** with undetected pathogenic organisms, toxic chemicals, or physical **hazards**. Not all contaminants are hazards.

On the other hand, a product that seems to lack many of the visible quality attributes can still be safe.

Food safety is the level of security achieved by ensuring **food hygiene**. Food safety assurance starts at the "farm", the primary agricultural or fishery level. At all steps of the food chain, particular attention is given to potential food safety problems and how they could be prevented or controlled.

Contaminant is a biological agent, chemical agent, foreign matter, or other substances not intentionally added to food which may compromise food safety or suitability.

The maximum allowed limit of mycotoxins (and other hazards or contaminants) is called the Maximum Residue Limit (MRL).

Hazard is a biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health effect.

Food Hygiene is all conditions and measure necessary to ensure the safety and suitability of food at all stages of the food chain.

Food safety is non-negotiable

Whereas other quality characteristics like size, colour, shape etc. depend on the customers' choice and may

be negotiated, food safety is not negotiable due to legal considerations. Regulations are in place in most countries to protect health and safety of citizens, animal and plant life, and the environment.

Food safety systems and processes with skilled and committed people are the key element to achieving food safety. Having a strong food safety culture means that every employee knows how to, and will, do the right thing for food safety, even when no one is looking.

4. Food hazards

Foods can become unsafe and have the potential to cause harm through hazards.

Hazards arise from:

- improper agricultural practices
- polluted environment (mercury, cadmium, nickel)
- poor hygiene at all and any stage of the food chain (*E.coli*, *Listeria*, *Campylobacter*)
- lack of preventive controls in food processing and preparation operations
- untrained personnel
- misuse of chemicals (pesticides, weed inhibitors, growth hormones)
- use of banned dyes and flavours (Sudan, tartrazine, azo dyes, butter yellow)
- contaminated raw materials, ingredients and water (bacteria and viruses, mycotoxins)
- inadequate or improper storage or handling.
- adulterated food and food fraud (intentional addition of cheaper varieties, substitution with alternate substances, synthetic varieties, salt, sawdust, sand etc.).

Types of hazards

Three types of hazards:

- Biological (germs)
- Chemical (poisons)
- Physical (objects)

Hazards can be classified as follows:

Biological hazards (germs)

These are harmful micro-organisms such as bacteria, viruses, helminths, protozoa, algae, and certain toxic products they may produce.
For example, *Salmonella*, *Escherechia coli*, *Listeria*, *Yersinia*, *Clostridium*, *Staphylococcus*.

They cause harm by spoiling of food, or causing sickness, disease, or death in people consuming the food.

However, not all micro-organisms are harmful. Bacteria in yogurt, yeast in bread, or certain molds in cheese form part of the food production and play an important role to impart characteristic flavours.

Biological hazards are introduced into food primarily through contact with soil, contaminated water, incorrectly treated manure, sewage, air, persons, animals (farm animals, birds and pests), and transport.

Chemical hazards

These are fertilizers, pesticides, weed inhibitors, growth regulators added intentionally during production, waxes during post harvest, the residues of which are beyond safe or acceptable limits.

They may also be prohibited or unauthorized substances and colorants (like Sudan IV, tartrazine, azo dyes), adulterants or inappropriately used stabilizers and preservatives.

Chemicals from non-food grade packaging in contact with food can also leach into food.

Substances like heavy metals (lead, cadmium, zinc, cyanide), refrigerants etc may be present in food due to pollution.

Detergents and lubricants used by the food handler or processor may also contaminate food and present a hazard.

Chemical hazards exist also in natural form such as allergens, **mycotoxins**, alkaloids (glycoalkaloids in potatoes), enzyme inhibitors.

Mycotoxins are

- **poisonous chemical compounds**
- **produced by certain fungi**
- **associated with diseased or mouldy crops.**
- **found on seeds, nuts, grains, and fruits such as wheat, maize, barley, peanuts, apples etc.**

Physical hazards

These are pieces of metal, glass, plastic, wood, personal items, machinery and equipment. For example pins, nails, broken bulb or bottle, fragments, watch, jewellery, keys, stones, hair.

These hazards can cause choking, cuts and bruises in the mouth and gastrointestinal system.

Image 1: Examples of physical hazards

Risk is the probability of a hazard occurring.

Since food will always present some minimal **risk**, the approach used is to minimize the hazards and risks to a safe and acceptable level.

Food safety begins at farm

Hazards can enter the food supply chain at any point from production, harvesting, packing, transporting, storing to distribution.

Therefore hazards need to be controlled and minimized from production, across all the steps to the consumer. This approach is called “farm to fork”. Thus,

food safety is ensured through the combined efforts of all the parties participating in the food chain.

It may be difficult or even impossible to decontaminate food, once contaminated,. And for this reason, prevention is key. In order to prevent the hazard from getting in the food chain, it is important to identify the potential hazards at each stage. Proactively identifying, minimizing and eliminating risks (probability of hazard occurring) is the approach taken by all food safety systems. This is called hazard management.

Figure 2: Food safety must be managed across the supply chain

Managing hazards

Hazard identification

In any food safety system, all reasonably foreseeable hazards are identified along each stage / process.

Hazard identification is the identification of biological, chemical, and physical agents capable of causing adverse health effects and which may be present in a particular food or group of foods. - Codex

Hazard analysis

Each hazard is then analysed along the source, what can go wrong, how, when etc. and understanding the conditions that may cause the hazard to be present or to increase.

Hazard characterization

The qualitative and/or quantitative evaluation of the nature of the adverse health effects.

Risk characterization

The qualitative and/or quantitative estimation of the probability of occurrence and severity of adverse health effects.

Control measures

Necessary actions are identified and implemented to reduce or eliminate the hazard.

Proba-bility of occurance				
	High	minor	major	critical
	Medium	minor	major	major
	Low	minor	minor	minor
		Low	Medium	High
		Severity of adverse health effects		

Figure 3: Risk characterization matrix

Clearly, hazard analysis is always unique to a company, its products, processes, and cirmcumstances. No two companies will have the same analysis.

For example, refer to the work surfaces illustrated below (Figures 4 and 5).

Figure 4: Unclean work surface and low lighting poses a risk

Figure 5: Clean work surface and well lit interiors mitigate risk

In this example, hazard may be analyzed as follows:

Source of hazard: Unclean and unmaintained table.

Large sections of wood are chipped, most of the paint is peeling), low visibility (poor lighting) increases the risk, dirt is built up on the table.

Hazard identification: Contamination of food from following:

1. Paint is peeling - fragments of paint can fall into food. (chemical hazard)
2. Wood is chipped – pieces of wood may be introduced into food (physical hazard)
3. The table does not allow easy cleaning and disinfection - harmful bacteria (or other microorganisms) can be introduced into food since not possible to clean the table. (biological hazard)

Hazard classification: (Severity of impact)

High – can cause choking, poisoning, sickness.

Risk (likelihood of hazard): As shown in Table 1.

Control measure: Action taken to reduce risk / eliminate hazard:

1. Change table or repair table to cover work-surface and food contact surface with nontoxic and easily cleanable material e.g. steel or rustproof metal.
2. Improve visibility through added lighting.

Table 1: Assessing likelihood of hazard

Low risk if	High risk if
• Table is not in the vicinity of fresh produce / production area. • Produce is not packaged on this table. • Only pre-packaged (and sealed) produce is placed temporarily sometimes. • Unpacked food is not anywhere near this table / area. • Workers handling food are not in contact with this table.	• Table is next to fresh produce or in the productio area • Produce is customarily packaged on this table. • Raw/fresh produce is frequently kept on the table. • Workers handling fresh food are in contact with this table .

5. Food safety and quality systems

Food businesses also build their reputation and brands by meeting their food safety and quality responsibilities by implementing assurance systems such as Good Agricultural Practices (GAP), Good Hygienic Practices (GHP), Hazard Analysis and Critical Control Points

(HACCP), and Food Safety Management Systems such as ISO 22000.

If quality and food safety systems are not being applied in a food business, then resources (people, materials, equipment, money and time) are actually being devoted to producing risky or dangerous produce which would be rejected on the market or if accepted, may cause serious health problems to people.

Without food safety and quality systems, food businesses :

- are not in a position to provide confidence in food safety
- are unable to build a reputation
- can neither prevent errors and risks till problems occur, nor recall defective or unsafe products
- damage the reputation of the enterprise
- may face fines, legal action or even close down.

Benefits of quality systems in food

The cost of not applying quality systems is often much higher than that of applying such systems.

Quality and safety systems in food businesses

- prevent food-related diseases and deaths
- protect against false allegations, and loss of reputation
- improve yields and reduce post-harvest losses
- reduce costs and allow better resource utilization
- help meet standards and technical regulations
- enable producing to buyer's requirements reliably and consistently
- improve potential for growth and participation in international and regional trade.

Disadvantages of not applying quality systems

- When quality systems are not applied
- Your time & effort lost in first making a defective product and then repairing it.
- Your time and effort lost in recalling your product from customer/market/user.
- Your time and effort lost in resolving customer complaints.
- You may lose future business if your customer remains dissatisfied.
- In case of disease and death caused by your product, legal proceedings may be initiated against your company, with possible jailtime, and bankruptcy.

Reliance on final inspection and end product testing for quality has proven inadequate and ineffective because:

- contamination can still take place between the testing facility and point of consumption, e.g. during transit or interim storage.

- allows for carrying on work until problems are detected e.g. during testing, inspection (waste of time, effort and resources on faulty product)
- even by testing large numbers of samples, there is high probability of contamination. Alternately, each item/produce would need testing, which is not practical.

Implementing a systems approach to quality and food safety is therefore more beneficial than relying on end product testing.

A systems approach includes managing quality and food safety at all stages, throughout all components, processes, and during the interaction between these, in an integrated manner.

In this way, when a problem occurs it can be immediately investigated and analysed to:

Produce right, in time,

the first time, and every time!

- contain the issue and minimize further damage;
- develop prompt corrective action to solve the problem; and
- devise effective preventive action to eliminate recurrence of the issue.

Common food safety system requirements

Without a well-designed and documented programme that is properly implemented and maintained, the chances that a company will have a recall or have its products cause illness are significantly higher.

Following are the main practices and systems followed internationally.

Pre-requisite programmes (PRPs)

PRPs are codes of good practice that comprise the fundamental principles, procedures and means needed for safe food production.

PRPs are defined as basic conditions and activities that are necessary to maintain a hygienic environment throughout the food chain suitable for the production, handling and provision of safe end products and safe food for human consumption.

Good Agricultural Practices (GAP), and Good Hygienic Practices (GHP) are these essential preconditions and are together called prerequisite programs (PRPs) in food safety systems.

They form an integral part and the basis for implementing quality and safety assurance programmes such as HACCP, ISO 22000, BRC Global Standards and their audits.

Good Agricultural Practices (GAPs)

GAPs are practices that ensure environmental, economical and social sustainability for on-farm practices (and post production practices) resulting in safe and quality food and non-food agricultural products (FAO 2003).

These are applied taking into consideration food safety hazards from the following sources:

- Environment
- Agricultural inputs (soil, water, seeds, agrochemicals, organic / inorganic fertilizers, animals)
- Workers
- Growing practices
- Harvest and transportation
- Facilities (storage areas for produce, equipment, pesticides etc)
- Equipment, tools, utensils.

Good Hygiene Practices (GHP)

All practices regarding the conditions and measures necessary to ensure the safety and suitability of food at all stages of the food chain. (FAO). These include

- Suitable facility design and maintenance
- Thoughtful equipment design and maintenance
- Documentation that includes procedures, forms and manuals
- Process validation
- Corrective and preventive actions
- Control of non-conforming products
- Traceability
- Management of incidents and product recall

(See Annex 5: Food recall and withdrawal management)

- Job training and competence
- Hygiene and sanitation
- Waste removal
- Pest control
- Chemical and physical product contamination control
- Prevention of cross contamination.
- Dispatch and transport
- Allergen management
- Product packaging and labelling
- Personal hygiene
- Internal audits for hygiene, food safety and quality

Hazard Analysis and Critical Control Points (HACCP)

HACCP is a science-based system which systematically identifies, evaluates, and controls hazards which are significant for food safety. Food safety is addressed through the analysis and control of biological, chemical, and physical hazards from raw material production, procurement and handling, to manufacturing, distribution and consumption of the finished product.

Pre-requisite programmes (GAP and GHP) must be working effectively within a system before HACCP is applied. If these pre-requisite programmes are not functioning effectively then the introduction of HACCP will not be effective.

ISO 22000: Food safety management systems

The development of ISO 22000 was based on the assumption that the most effective food systems are designed, operated and continually improved within the framework of an organization's structured management system. ISO 22000 thus carries some management system requirements that are not explicitly stated in HACCP.

These include a food safety policy and related objectives, planning and documenting the food safety system, effective external and internal communication arrangements, the assignment of specific responsibilities to the food safety team leader, internal audits, management reviews, continual improvement and updating of FSMS.

Briefly, the ISO 22000 requirements are a combination of the following four key elements:

- Interactive communications
- System management
- Prerequisite programmes
- HACCP principles.

Main steps in meeting food safety system requirements

1. Form a multidisciplinary team for food safety.
2. Train the team on food safety and system requirements.
3. Chart the processes and their flow:
4. Develop a food safety plan with responsibilities
5. Develop and document Standard Operating Procedures (SOPs) including stepwise actions for each task, its monitoring, corrective and preventives actions.
6. Train all personnel to implement the procedures
7. Implement and record: Record keeping provides evidence that procedures are being followed. They are also a good means for improvement and control.
8. Verify/audit: The objective of verification is to make sure the system is working as designed and the food safety and quality objectives are being met. Internal audit should be done to ensure the following:
    - Procedures are being followed
    - Documentation is being done and documents are up to date.
    - Training/education/competencies have been done and are up to date
    - Internal audit is carried out by people who are independent of the processes of the area being audited.
9. Review and update: Top management should review the food safety system at planned intervals to ensure its continuing suitability, adequacy and effectiveness. During the review, opportunities for improvement are assessed and the food safety plan updated.

6. Five keys to safe food[1]

Germs are widely found in soil, water, animals and people. They are carried on hands, wiping cloths and utensils, especially cutting boards, and surfaces like door handles and switches. Even the slightest contact can transfer them to food and cause foodborne diseases.

Keep clean

- Wash your hands before handling food and often during food preparation. Wash your hands everytime they are exposed to germs (after going to the toilet, blowing your nose, smoking, handling raw meat/poultry/eggs, touching unclean surfaces, handling trash etc.)
- Wash, and sanitize all surfaces and equipment used for food preparation.

[1] WHO Five Keys to Safer Food Manual

- Utensils especially those from which you eat, drink or in which you cook should not come in touch with raw meat/poultry/eggs.
- Protect kitchen areas and food from insects, pests and other animals.
- Keep food covered, in closed containers and wherever needed, refrigerated.
- Keep food preparation area clean and in good condition (repair cracks, fill holes, do not allow small spaces between fixtures that do not allow cleaning and where dirt and food can accumulate).
- Do not neglect the rubbish area. Keep it clean and tidy and remove rubbish daily. Clean and dry all equipment (including the cleaning equipment) as germs can grow fast in damp places.

Raw food, especially, meat, poultry and seafood and their liquids can contain dangerous microorganisms which may be transferred onto other foods during food preparation and storage.

Separate raw and cooked

- Separate raw meat, poultry and seafood from other foods at all stages from cleaning, storing, preparation, and cooking.
- Use separate equipment, utensils (including washcloth) for handling raw foods meats, poultry and seafoods. Use them for other foods always only after washing with hot water and soap.
- Do not let juices or liquids from raw meats, poultry and seafoods to spill or seep onto other surfaces or come into contact with cooked or other raw foods.
- Store foods in covered containers to avoid cross-contamination between raw and prepared foods.

Proper cooking can kill almost all dangerous microoranisms. Studies have shown that cooking food to a temparature of 70°C can help ensure it is safe for consumption.

Cook thoroughly

- Ensure food is thoroughly cooked through, especially meat, poultry, eggs and seafood.
- Juices from meats, seafood and poultry should not be pink, and should be clear.

Microorganisms can multiply very quickly if food is stored at room temperature. By holding food at temperatures below 5°C or above 60°C their growth is slowed down or stopped.

Store food at safe temparatures

- Do not leave cooked food at room temperatures for more than 2 hours.
- Refrigerate all cooked and perishable foods promptly
- Keep cooked food very hot (above 60°C) prior to serving
- Do not store food too long (more than 3 days) in the refrigerator
- Do not reheat refrigerator food more than once.
- Do not refreeze frozen food after thawing or cooking

Raw materials, including wather and ice, may be contaminated with dangerous chemicals or microorganisms. Toxic chemicals may be formed in damaged and mouldy foods. Select raw materials with care. Simple measures such as washing and peeling may reduce risk.

Use safe water and raw materials.

- Use safe water or treat it (by boiling, chlorination, and filtration) to make it safe for cooking, washing hands or utensils, and making drinks or ice.
- Select fresh and wholesome foods (not damaged or rotting) from clean stores / places
- Wash fruits and vegetables, especially if eaten raw
- Cut away damaged or bruised parts of fruits and vegetables, since bacteria can thrive in these places.
- Do not use food beyond their expiry date.

References:

1. *Food Safety Handbook, Schmidt, Rodrick*
2. *ITC, Export Quality Management: A guide for SMEs*
3. *WHO, Five Keys to Safe Food.*

CHAPTER II: GOOD AGRICULTURAL PRACTICES

1. Basic concepts in GAP

Good Agricultural Practices (GAP) are practices that ensure environmental, economical & social sustainability for on-farm practices (and post production practices) resulting in safe and quality food and non-food agricultural products. -FAO

GAP include practices that must be followed at the primary production in order to ensure a safe and wholesome product whilst also minimizing the negative impact of those practices on the environment and on workers' health. The overall intention of good agricultural practices is to address environmental, social and economic considerations in a sustainable manner in the production of safe and healthy food.

Implementing GAP is a joint responsibility of the enterprise, farmer, manager, and workers.

Overview of GAP implementation points

Workers

Work conditions

Worker protection

Amenities for workers

Worker training
Hygiene

Land

Knowledge of land

Preventing land contamination

Preparing soil

Crop

Handling crops

Protecting crops

Water

Managing water use
Irrigation

Animals

Health

Access

Protection

Fertilizers and agro-chemicals

Applying

Protecting

Harvest and transport

Preventing contamination

Preserving freshness

Traceability

One step forward and one step back

Record keeping

2. Benefits of GAP

Some advantages of applying GAP are as follows:

- You produce safe, healthy and good quality products to improve nutrition;
- Workers are healthy, safe, know their work and motivated;
- Children go to school;
- You are in control of your production, and confusion and risk is minimized;
- Improved methods produce higher yields and reduce waste and loss;
- Better quality fetches higher price;
- Your farm enjoys a good reputation;
- Your products you stand a higher chance of accessing new markets.
- You improve sustainability.

3. Implementing GAP

Workers

Work conditions

- Provide workers with a work contract.
- Legal conditions of work and pay should be followed.
- Children should not work on the field and priority should be first given to their studies. They may help out in activities that do not harm their security or interfere with their study times.
- Train the workers on food safety, hygiene and GAP, handling agrochemicals and fertilizers, and their role and responsibility in preventing contamination and deterioration.
- Each worker should clearly know their job and have the necessary knowledge and skills to enable carrying out their job.

Worker protection

- Health of workers should be monitored and health certificates should be available.
- First aid kits should be available and must be well stocked to treat minor injuries.
- Emergency phone numbers should be clearly displayed.

Amenities

- Hand wash and toilets should be
  - sufficient in number
  - in clean and good condition;
  - easily accessible and ventilated;
  - have doors that close;

equiped with trash can, toilet paper, washbasin. Potable water, soap, towels are available.

- Water must be clean, without odours and not allowed to stagnate.
- Water must be stored in clean containers.
- Consider chlorination or boiling of water.

Worker hygiene

- Workers must maintain good personal cleanliness.
- Wash hands every time after using toilets and before handling produce.
- Not handle food if suffering from infectious disease.
- Smoking, eating, chewing gum should not be allowed in production or processing areas.
- Spitting, sneezing and coughing on the produce should be prohibited.
- Personal affects like jewellery, watches should not be allowed into the food producing area.

- Cuts and wounds must be covered with dressing.

- Adequate protective clothing and footwear must be used.

Land

Knowledge of land

- Know your field, its surroundings, and inform yourself of its past and present usage.

- Do not use land adjacent to chemical, industrial, effluent treatment or other such facilities from where toxins may leach into your land.

  Toxins may be dangerous chemicals, metals such as lead, cadmium, cyanide, zinc, residues of substances intentionally applied as inputs in

the management of crop production or processing contaminants (e.g. lubricants, cleaning agents, sanitizers, coatings, paints, refrigerants and cooling agents, water / steam treatment chemicals, pest control chemicals) and substances from packing material (e.g. plasticizers, vinyl chloride, adhesives, lead, tin).

Plants absorb these through their roots, or through leaves through air. These cause acute or chronic poisoning. For this reason the chemical environment in which food are produced needs to be ascertained to the extent possible.

Equally important is that produce should not be allowed to come into unintended contact with waste, or produced in proximity to landfills, sewage systems, or polluted water.

- Verify microbiological and chemical contamination of soil through laboratory analysis.

- Recognize more fertile lands and with availability of water.
- Be acquainted with types of pests, diseases and weeds in the crop area.
- Evaluate access of animals to your land.
- Signpost the place where the crop will be planted with the number of the lot or name of crop.
- Plan out your site ahead, such as for waste disposal area, storage facilities, toilets and

washrooms, agrichemicals mixing area, animal sheds etc.

- Toilets and washroom should not contaminate the fields.

Figure 6: Keep agrochemicals locked

- Plan for separate storage of produce, tools and equipment, chemicals, and waste disposal.
- Check for flooding and water logging in rainy season and at other times of the year.
- Evaluate access to transporatation and infrastructure.

Preventing contamination of land

- Do not plant in fields that are/ may have been chemically / biologically contaminated.

- The field should be free of trash, papers, cardboard, plastics, empty containers and any

other items that do not belong there and kept in clean state at all times.

- Check that there is no risk of water contamination.
- Check that there are no possible (faecal, chemical, environmental or biological contamination sources) from neighbouring plots or adjoining lands.

Preparing soil

- Analyse the type of soil and its depth for good growth of the roots.
- Work with the support of a technician you trust.
- Consider the slope of the field where the planting will be done.

- Avoid soil erosion and compression, use contour planning, terrace or strip cropping as appropriate.
- Practice crop rotation, avoid tilling the soil always to same depth, and change position of planting beds periodically.

Water

Irrigation and water use

- Identify the sources of water (municipality, re-used irrigation water, well, open canal, river) and test for contamination.
- With an expert identify frequency of testing based on source of water, risk of contamination, including intermittent Analyze the water at the correct frequency for contamination.
- Do not irrigate in excess, use only required amount of water for the crops.

- Do not use contaminated water for irrigate.
- Identify the source and test the quality of water used for irrigation.
- Keep water flow channels free of rubbish.
- Use the irrigation method recommended for your crop.
- Pay special attention to quality of water sprayed directly on exposed or edible parts of produce and specially before harvest time.

Preventing water contamination

- Avoid entry/access of animals, birds and pests to the water source.
- Protect water tanks and irrigation channels free of animals and birds.
- Do not store mix agro-chemicals or apply these near water source.
- Do not clean sprayers and equipment used for agrochemicals near the water source.

Crops

Seeds

- Use only seeds that are certified and have been analysed for sanitary conditions.
- Use seeds that can adapt to the soil of the field and suited to the conditions of the region.
- Select improved seeds and resistant to the most frequent diseases.
- Select healthy seedling and discard feeble or diseased.
- Develop practices to eliminate pests and diseases from the seeds.
- Select an adequate sowing date avoiding droughts.
- Sow at an adequate distance.
- Place rubbish bins at appropriate zones of the field to throw the rubbish into at end of each day.

Protecting crops

- Protect seedbeds from the sun and heavy rains.
- Take measures to obtain a good control of temperature and humidity in greenhouses.
- Control temperatures, humidity and wind considering the season of the year and needs of the crop.

Fertilizers, pesticides, agro-chemicals

Before applying

- Know the weeds, pests and diseases endemic to the area/region.

Figure 7: Know the weeds and pests particular to your region and to your crop

- Analyze the possibility of applying biological controls instead of chemical ones.
- Consult a technician for recommended agro-chemicals for your crop and in accordance with the pests, diseases and weeds affecting your crop.

- Use only agro-chemicals that are registered in your country. For products intended for exports, check if the agrochemicals you will use are approved also in the country to which you will export.

- Use fertilizers that are free from toxic substances, and specially heavy metals.

Figure 8: Only use approved pesticides

- Avoid chemical contamination of ground water with nitrates.

- Consult with a technician or expert to define the amount of nutrients required at different stages of growth and the time, quantity and spots/areas on the plant that should receive the sprays / avoid the sprays.

- Read the label to verify you have all the necessary equipment and tools.

- Verify the use by date. Never use expired agro-chemicals.

- Write down the application details.

- Respect the waiting time between applications.

- Cordon off the area being sprayed and place “DANGER” / “POISON” signs.

- Persons, children and animals should not be able to access the sprayed area.

Applying / spraying

- Spraying should be done only by trained and experienced workers.

- Follow precisely the manufacturer’s instructions.

- Sprayers should be calibrated to control the accuracy of rate of application.
- Apply only the dose required as recommended.
- Do not apply more than is necessary to avoid contamination of waters and soils.
- Water used for spraying should not be contaminated.
- Write down the applications of fertilizers /chemical being done, dose (quantity), concentration, date and person applying.
- Do not enter sprayed area immediately after application.
- Observe crops periodically for timely detection of any problems.

Protecting against exposure

- Children, pregnant women and old aged persons must not be anywhere near where agrochemicals are being mixed or applied.
- Mix only with and in inert containers like plastic, and not metals that can react/ corrode.

Figure 9: Workers must use protective gear while mixing and applying agrochemicals

- Use protective gear (face mask, eye protection lenses, rubber gloves and boots and water proof suit) while mixing and applying.
- Avoid spraying during windy periods.
- After completion of application, the workers should shower and wash all the protection elements at a place away from potable and irrigation water sources, and the fields.

Storage and handling

- Agrochemicals must be stored in a separate facility and not with tools, equipment, seeds or harvested produce.
- Place them out of reach of children and animals, and limit access to only relevant workers.
- The store must be locked, secure, fresh and ventilated.
- The store should be well lit and with appropriate facility to measure and mix.
- Store pesticides in their original package and do not mix different pesticides (or old with new).
- Place warning signs «POISON» «NO SMOKING» etc.

Figure 10: Limit access to chemicals and keep locked

- Avoid spillage and splashing while mixing.
- In case of an accident seek medical assistance immediately.

Organic manure

- Analyse if it is possible to use organic manure.
- Wrong use of manure is one of the main sources of contamination.
- To eliminate pathogens, adopt proper treatment procedures (e.g. composting, pasteruization, heat drying, UV irradiation, alkali digetion, sundrying of a combination of these).
- Where possible, obtain documentation from the supplier that identifies the origin, treatment used, tests performed and the results obtained.
- Minimize direct or indirect contact of manure, biosolids and other natureal fertilizers with the crop and especially close to harvest.
- Use only stabilized manure.
- Use only manure with a previous composting treatment.
- Always apply organic manure before planting the crops.
- Manure should be prepared in places far away from the crop area and water sources.

Disposing empty containers

- Empty containers must be washed thrice with water.
- Use gloves.

- Wash water should not mix with drinking or working waters. Do not clean out the containers in streams, rivers, or lakes.
- Empty containers should not be reused again.
- Break or perforate the containers so that they cannot be used again.
- Keep the washed and perforated containers in a closed bag and deliver them to the reception centres of the containers / destruction or recycling centres.

Animals

- Verify that the animals for work are healthy.
- Animals on the farm should be fed correctly, hygienically, and have fresh water.
- They should be correctly housed in an enclosed space with adequate space.
- Animals should not have access to the field or storage areas.

- All workers should be informed that no animals can be brought in. Use signposts.

Harvest

Prevent contamination

- Workers harvesting must have clean hands, clipped nails, tied hair.
- Eating food, smoking, drinking, chewing are not allowed on the field during harvest.
- Only freshly picked produce should be used. Produce that fell off the plant eariler must not be included in the harvest.

- Avoid bruising and knocking of products.
- Only use clean tools (scissors, knives, pruning shears) and tables / work surfaces.
- Equipment should be in good working condition and maintained hygienically.
- Use freshly washed and clean containers.
- Neither the produce nor the containers should come in direct contact with soil or dirty surfaces.
- Do not use containers that previously contained any chemicals, or fertilizers.
- Containers and equipment must be made of non-toxic material and of a design that allows easy cleaning and maintenance.
- Water used to rinse produce, if needed, should be of potable quality.
- Store packaging material hygienically.

Freshness

- Place harvested produce in shadows, away from animals, and stored chemicals and fertilizers.
- Storage must be in a clean and covered area, free of dust where pests including birds cannot enter.
- Store at appropriate temperature and humidity.

  (Seen Annex 8: Good Storage practices)
- Use clean and appropriate packing material.

Transport

- The driver, persons loading and unloading containers with produce should maintain good hygiene and be in good health.

- Load must be covered to protect against rain, sun, dust, and sources of contamination during transport (e.g. smoke and fumes from other vehicles).
- The vehicle used to transport produce should preferably be used only for this purpose. If that is not possible, clean and dry the vehicle well before transporting produce.
- Do not transport animals, chemicals, equipment, or people with the produce.

Traceability

- Traceability is the ability to identify the origin of food and feed ingredients and food sources.
- It is also called 'one-step-back-one-step-forward' principle.
- A traceability system allows to document and locate a product through the stages and operations involved in the manufacture, processing, distribution and handling of feed and food, from primary production to consumption.
- If necessary, traceability facilitates identification of cause of nonconformity of a product, and improves the ability to withdraw or recall such product and prevent unsafe products from reaching the customers. (See Annex 5: Food recall and withdrawal management)

- Register:
  - the harvesting date
  - the type and amount of product loaded;
  - the time and date of loading;
  - name of the worker/s loading;
  - person driving the transport;
  - time and date of delivery;
  - name of person unloading;
  - name and signature of person accepting the delivery.

- Maintain records of :
  - Soil and water analyses test results.
  - Seed source, quality, date of purchase, certifications and treatments.
  - Sowing dates, varieties, plots and names of workers sowing / planting.
  - Fertilizer application (also see applying fertilizers in the previous section).
  - Monitoring and observation records of pests, infestations.
  - Recommendation for pesticide application, weed control, treatments and sprays done, reason / against which pest/disease, dates, and person spraying (both crops and storage areas).

- Cleaning and maintenance programmes.
- Calibration records (date of calibration, name of calibration body, and date of next calibration) of measurement equipment, sprayers.

Standard operating procedures (SOPs)

- Develop SOPs incorporating the step-by-step procedures on how each task is accomplished and includes how tasks will be monitored and corrective and preventives actions taken.
- A Standard Operating Procedure is a document which describes the regularly recurring operations relevant to the quality of the investigation. The purpose of a SOP is to carry out the operations correctly and always in the same manner. A SOP should be available at the place where the work is done. (FAO)
- A SOP is a compulsory instruction. If deviations from this instruction are allowed, the conditions for these should be documented including who can give permission for this and what exactly the complete procedure will be.

SOPs aim to achieve efficiency, quality output and uniformity of performance, while reducing miscommunication and failure to comply.

Resources:

1. *Food and Agriculture Organization of the United Nations – Guidelines "Good Agricultural Practices for Family Agriculture" www.fao.org/3/a-a1193e.pdf*
2. *International Trade Center, "Traceability in Food and Agricultural Products", 2015 http://www.intracen.org/itc/exporters/quality-management/quality-publications-index/*
3. *Canada GAP Audit Checklist http://www.canadagap.ca/tools/audit-checklist/*
4. *India IndGAP: http://www.qcin.org/CAS/INDGAP/*
5. *European Union GAP http://www.globalgap.org/uk_en/for-producers/crops-for-processing/*
6. *United States GAP https://www.ams.usda.gov/services/auditing/gap-ghp/audit.*

CHAPTER III: GOOD HYGIENIC PRACTICES (GHP)

1. Introduction to GHP

Safe food originates from its source, the farm. At this stage Good Agricultural Practices (GAP) are applied to ensure food safety. Subsequent to the farm, Good Manufacturing Practices (GMP) ensure products are consistently produced and controlled according to quality standards at the various stages of processing, storage and transportation till food reaches consumers.

General Principles of Food Hygiene apply to both GAP and GMP through the implementation of Good Hygiene Practices (GHP). GHP recommends a HACCP-based approach to reduce risks

Good Hygiene Practices aim to implement the essential principles of food hygiene applicable throughout the food chain (including primary production through to the.final consumer), to achieve the goal of ensuring that food is safe and suitable for human consumption.

This chapter illustrates the application of GHP to achieve food safety goals.

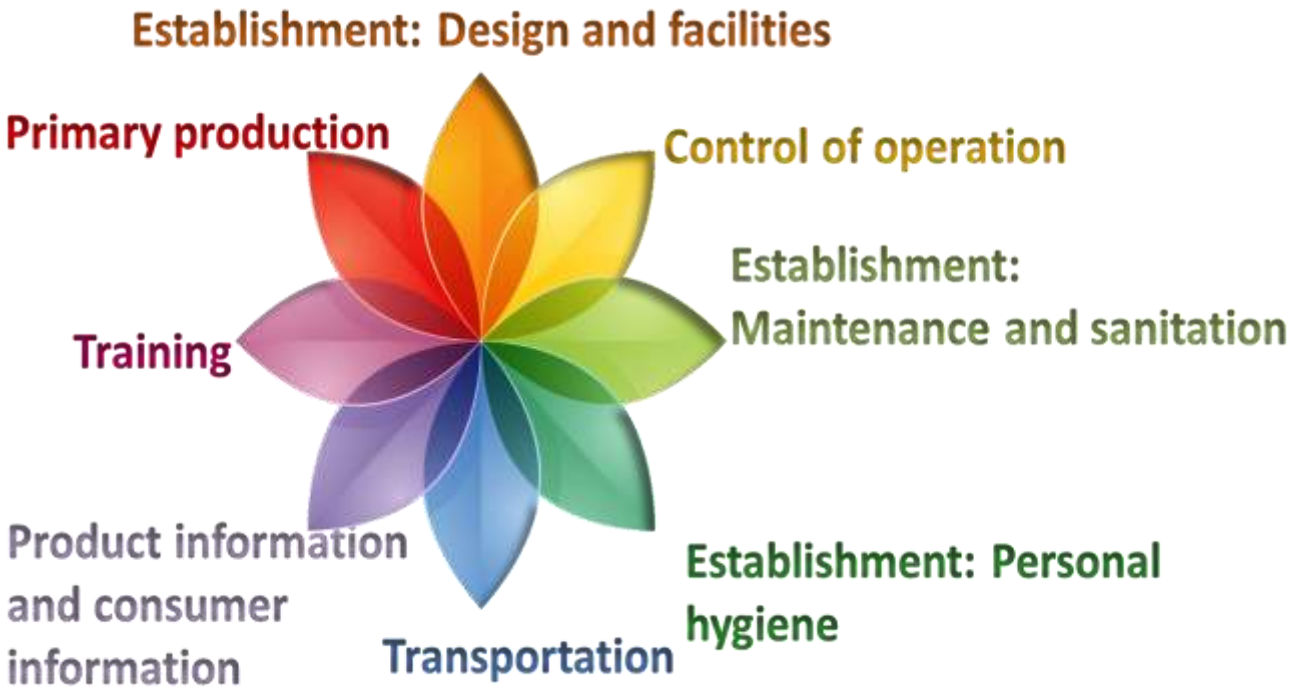

Figure 11: Main categories in GHP implementation

Figure 12: Detailed categories in GHP implementation

2. Building and equipment

Location of premises

Appropriate location of building and equipment 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 food chain. This may help control many hazard factors that may not be in your control once the building and equipment are already set up.

Prevent contamination by locating premises away from areas that:

- Are polluted
- Contain industrial activities nearby
- Prone to flooding or pest infestation
- Make it difficult to remove waste efficiently

Pest is any species, strain or biotype of plant, animal or pathogenic agent injurious to plants or plant products (FAO, 1990; revised FAO, 1995; IPPC, 1997).

Figure 13: Toxic fumes, dust can contaminate food.

Figure 14: Areas where wastes cannot be efficiently removed pose a threat to food safety.

Figure 15: Areas prone to flooding and water logging may result in seepage and pollution of drinking water.

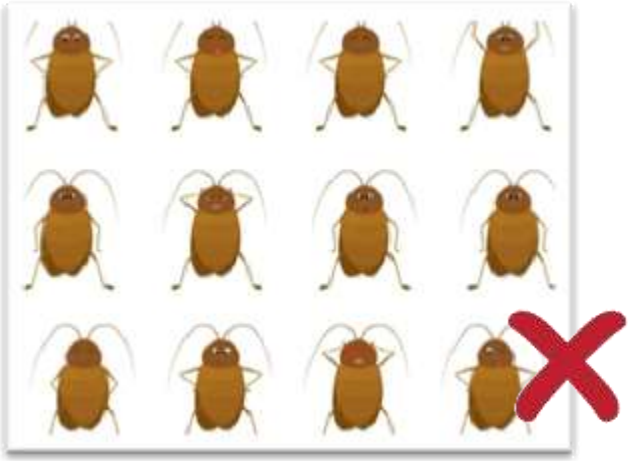

Figure 16: Areas susceptible to pest infestation are not suitable for food operations.

Location of equipment

Situate / install equipment to allow

- Adequate maintenance and cleaning outside and inside
- Correct functioning

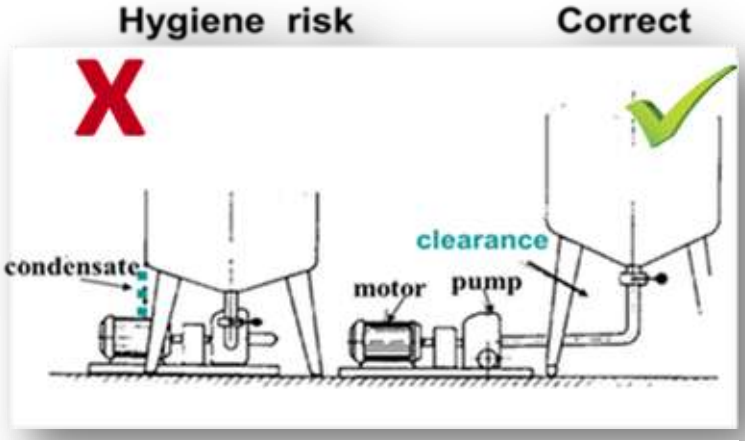

Figure 17: Placement of equipment as shown on the left hand side does not allow easy cleaning and maintenance

Internal structures and fittings

Walls and floors

Figure 18: Cracks, peeling paint, toxic material on walls/floors are hazards.

Figure 19: Cracks on walls can harbour germs and dirt that can contaminate food. They do not allow walls/floors to be cleaned appropriately.

Figure 20: Surfaces of walls, partitions and floors should have smooth and impervious surface.

Figure 21: Fungal growth (moss) on walls can release toxic spores and contaminate food.

Figure 22: Floors should allow adequate drainage and cleaning.

Work surface

To avoid build-up of micro-organisms and dirt or food, working surface should be

- easy to clean,
- maintain and
- disinfect, and
- made of inert (non-reactive) material

Figure 23: Smooth and inert work surfaces facilitate cleaning and help avoid build-up of food.

3. Design and layout of premises

Attention to

- good hygienic design and construction,
- appropriate location and the provision of adequate facilities,
- from the initial stages itself, is necessary to enable hazards to be effectively controlled.

It may be difficult to change the layout and basic design later when the operations are functional.

Internal design and layout of food establishments should permit good food hygiene practices, including protection against cross-contamination between and during operations by foodstuffs.

Layout

Internal design and layout of food establishments should

- permit good food hygiene practices, and
- protect against cross-contamination between and during operations by foodstuffs.

Flow of product should be linear and unidirectional i.e. from raw material to semi processed to processed. (Figure 24).

The production line must not cross through another stage or exit close to the raw material input stage. (Figure 25-3)

Food product must not be allowed to move back to the lower stage of processing for subsequent operations .

Flow of waste must be in the direction opposite to that of flow of processed food.

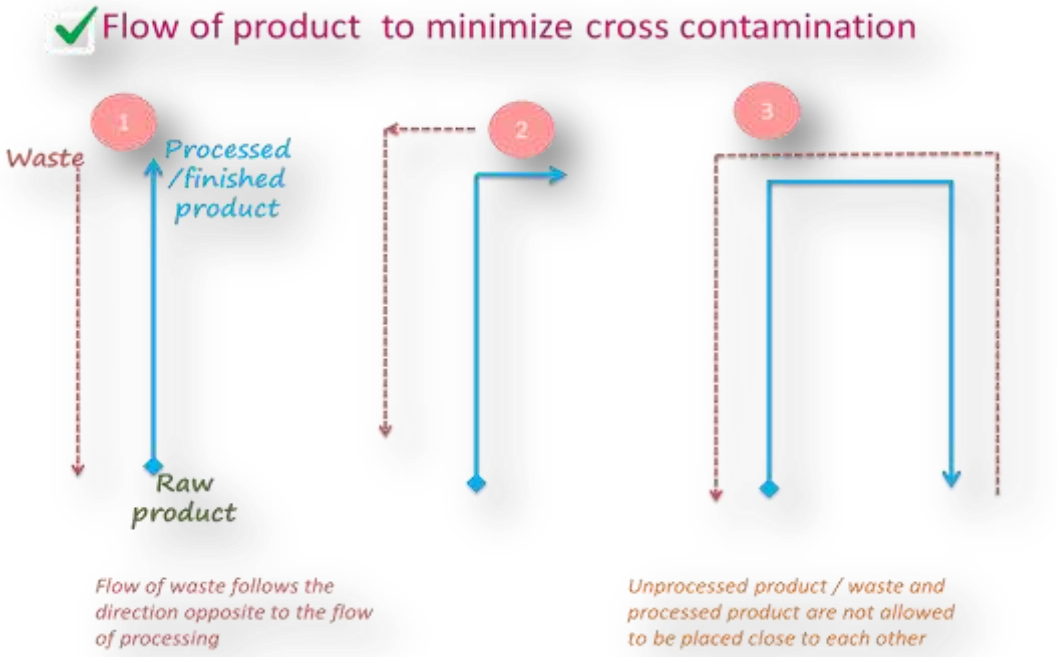

Figure 24: Examples of product flow that permit food hygiene

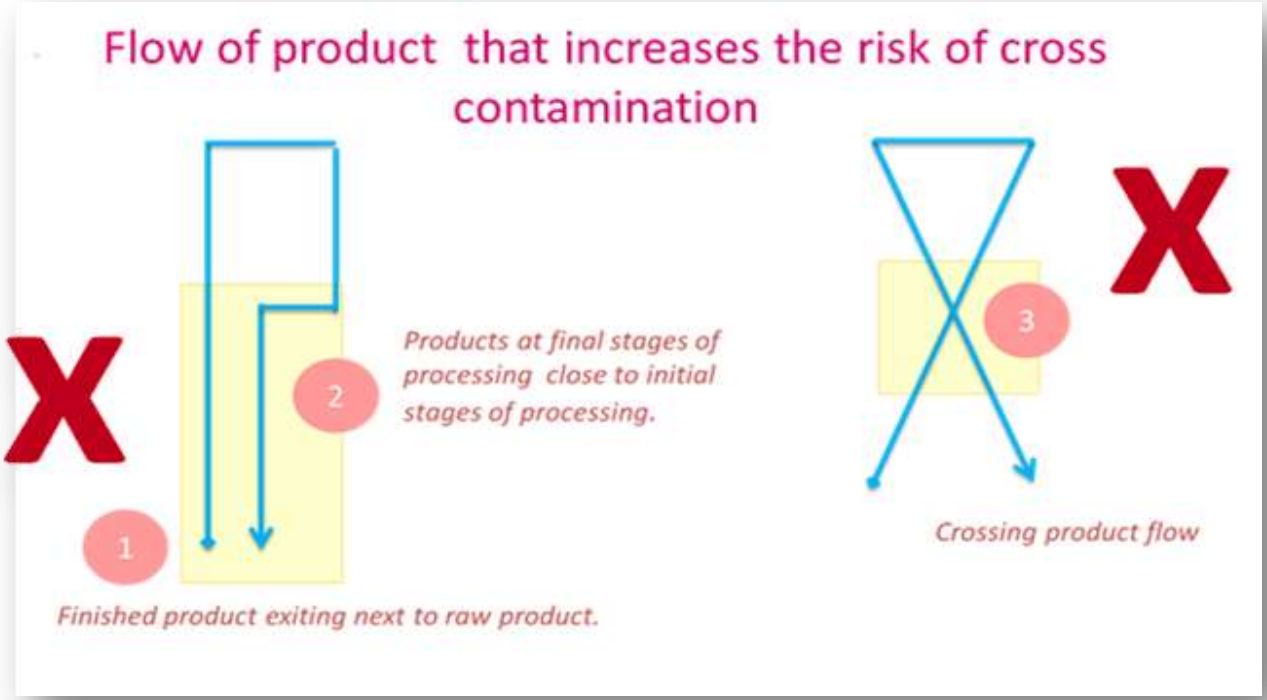
Flow of product that increases the risk of cross contamination
X
2
Products at final stages of processing close to initial stages of processing.
1
Finished product exiting next to raw product.
3
X
Crossing product flow

Figure 25: Examples of product flow that hinder food hygiene

Windows

Windows should be

- easy to clean,
- constructed to minimize the build-up of dirt
- and where necessary,
- be fitted with removable and cleanable insect-proof screens

Figure 26: Insect proof screens on windows can prevent entry of pests into the production establishment

Equipment

Clean and nontoxic materials

Equipment and containers that come into contact with food should

- allow for adequate cleaning, disinfection and maintenance to avoid contamination of food.
- Have no toxic effect in intended use

Movable and detachable

Equipment and containers that come into contact with food should

- be movable and
- allow disassembly

for maintenance, cleaning, disinfection, and monitoring.

Figure 27: Equipment should not have toxic effect

Figure 29: Probes of measuring, monitoring devices are detachable

Figure 28: Equipment can be disassembled for cleaning and repair

Figure 31: Conveyer belt design not suitable for cleaning since cannot be disassembled

Figure 30: Removable grill allows for cleaning below and in-between surfaces.

Monitoring food characteristics

Equipment used to cook, heat treat, cool, store or freeze food should

- be designed to achieve the required food temperatures as rapidly as necessary
- allow temperatures to be monitored and controlled

and where necessary,

- have effective means of controlling and monitoring humidity, air-flow and any other characteristic likely to have a detrimental effect on the safety or suitability of food.

Facilities for food operations

Depending on the nature of the food operations, adequate facilities should be available for

- heating, cooling, cooking,
- refrigerating and freezing food,
- storing refrigerated or frozen foods,
- monitoring food temperatures, and
- when necessary,
- controlling ambient temperatures to ensure the safety and suitability of food.

Waste

Containers for waste, by-products and inedible or dangerous substances, should be

- specifically identifiable,
- suitably constructed and,
- where appropriate,
- made of impervious material.

Dangerous substances

Containers used to hold dangerous substances should

- be identified and,
- where appropriate, be lockable
- to prevent malicious or accidental contamination of food.
- to prevent malicious or accidental contamination of food.

Facilities

Water

- Water supply should
  - be adequate
  - of potable (drinking) quality

  with appropriate facilities for its storage, and distribution.
- Control temperature whenever necessary to ensure the safety and suitability of food.
- Non-potable water (for use in, for example, fire control, steam production, refrigeration and other similar purposes where it would not contaminate food), shall have a separate system.
- Non-potable water systems shall be identified and shall not connect with, or allow reflux into, potable water systems.
- Adequate drainage and waste disposal should be provided and designed, avoiding risk of contamination to food and potable water supply.

Cleaning facilities

Figure 32: Rusted water containers and metal drums are not suited to washing materials that come in contact with food.

Figure 33: Adequate facilities, suitably designated, should be provided for cleaning food, utensils and equipment.

Personnel changing and washing facilities

- Personnel hygiene facilities should be available to ensure that an appropriate degree of personal hygiene can be maintained and to avoid contaminating food.
- Where appropriate, facilities should include:
  - adequate means of hygienically washing and drying hands
  - wash basins
  - supply of hot and cold (or suitably temperature controlled) water;
  - lavatories of appropriate hygienic design; and
  - adequate changing facilities for personnel.

Figure 34: Adequate washing facilities must be provided

Lighting and ventilation

- Adequate means of natural or mechanical ventilation should be provided, in particular to:
  - minimize air-borne contamination of food, for example, from aerosols and condensation droplets;
  - control ambient temperatures;
  - control odours which might affect the suitability of food; and
  - control humidity, where necessary, to ensure the safety and suitability of food.
- Where necessary, lighting should not be such that the resulting colour is misleading. The intensity should be adequate to the nature of the operation.
- Ventilation systems should be designed and constructed so that air does not flow from contaminated areas to clean areas and, where necessary, they can be adequately maintained and cleaned.

Figure 35: Adequate light and ventilation are important for food safety

Storage

- Provide adequate and separate facilities for the storage of food, ingredients and non-food chemicals (e.g. cleaning materials, lubricants, fuels)
- Food storage facilities should be designed and constructed to:
  - permit adequate maintenance and cleaning;
  - avoid pest access and harbourage;

– enable food to be effectively protected from contamination and deterioration during storage (e.g. by temperature and humidity control). (See Annex 8: Good Storage Practices)

Figure 36: Protected lighting fixtures can prevent contamination from breakages.

Figure 37: Storing chemicals with finished products is not a good idea.

4. Control of operations

Controling process inputs and operations in terms of

- correct temperature,
- pressure,
- humidity
- water activity (a_w)
- pH levels
- contamination (extraneous material, aflatoxin, pesticide residues)

reduces 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. Assurance activities in a food safety management system have the objective to provide evidence that products and processes are within set specifications. Examples of assurance activities are sampling, validation, verification, documentation.

Management of microbiological food safety is largely based on good design of processes, products and procedures. Finished product testing may be considered as a control measure at the end of the production process. However, testing gives only very limited information on the safety status of a food. If a hazardous organism is found it means something, but absence in a limited number of samples is no guarantee of safety of a whole production batch. Finished product testing is often too little and too late.

Therefore most attention should be focussed on management and control of the hazards in a more proactiveway by implementing an effective food safety management system. (Table 2) For verification activities in afood safety management system, finished product testing may however be useful.

Table 2: Examples of measurements and records that can be used for building the history of safe product in food safety management

Where and what .		Activities and record
Suppliers	Efficacy of their food safety management system	Compliance to an agreed standard of food safety management certification and efficiency of control measures, records
Factory/Process steps	Raw materials (including packaging material)	Monitoring or verification results on contamination of pathogens, spoilage or indicator organisms based on a priori risk rating applied to supplier and raw materials
	Storage	Temperature, atmosphere, storage time
	CCP monitoring results (e.g. heat process)	Holding time and temperature
	Process parameters	Time to acidification, pH drop, cooling time, etc.
	Semi-finished product	Occasionally microbial testing as verification: sampling plan and results
Prerequisite programs	Factory environment	Test results on hygiene or pathogens from swab samples, product residues or air quality
	Cleaning	Results from verification of efficiency (visual inspections, microbiological tests, ATP-test, etc.)
Verification of finished products	Microbial tests	Sampling plan and microbiology resuts
	Intrinsic properties	Verification results on pH, $a_{w,}$ preservative concentration etc.

	Extrinsic properties	Verification results on modified atmosphere, storage temperature etc.
After factory release, during product shelf-life	Extrinsic properties of finished products	Verification results on modified atmosphere, storage temperature, in-market supply-chain testing and product durability and stability testing
Source : Relevance of microbial finished product testing in food safety management, Marcel H. Zwietering et al, Food Control.		

Sampling of raw material is important to identify relevant hazards and to show how effective the inactivation during processing is.

Monitoring results at CCPs are vital as these are related to information on the variability and consistency of process parameters (critical and/or operational limits). Relevant records for thermal processes are for example pressure, temperature and holding time. For other processes times for acidification or cooling are central. Sampling of the production environment is relevant to show the potential for recontamination, especially in case of line start-up and packaging change-overs. As the environment is large and multiple sources of contamination routes are present (e.g. food contact surfaces, hands of personnel, air, water), the sampling plan should be well designed, targeting the most likely sources of recontamination, preferably close to the line where the product is not protected. Finished product testing is useful if there is reason to believe that the process is not well under control (e.g. CCP out of control or recontamination can occur), and as explained above, for verification of the whole food safety management system.

Testing of finished product samples can indicate whether microorganisms occur in the food chain and whether control strategies are effective, i.e. the efficiency of inactivation and recontamination control. However, if the prevalence and concentrations are expected to be low, the number of samples taken should be high in order to be able to gain useful information from the sampling. At the time the process and environmental pressure to recontamination is under control, it is more efficient to monitor the production process than to test finished products only.

Also it is important to have reliable suppliers consistently providing the required quality of raw materials. This can be achieved through audits which in particular are focused on the controls the supplier has in place to reduce the hazard in incoming raw materials. Records from supplier audits may be useful to document and assure consistent quality of raw materials supplied to the factory.

Analyses on incidents, recalls or consumer complaints should becarried out regularly and can lead to actions aimed at avoiding repetition of such events (See Annex 5: Food recall and withdrawal management). When corrective actions are needed because critical limits have been violated the reason why the process went out of control must be established and measures to prevent recurrence should be implemented and documented.

Incoming materials

Quality control

- Use only sound, suitable raw materials or ingredients.
- Do not accept raw material or ingredient if it is known to contain parasites, undesirable micro-organisms, pesticides, toxic or decomposed substances that cannot be reduced to an acceptable level by normal sorting and/or processing.
- Specifications for raw materials should be identified and applied.
- Raw materials or ingredients should be inspected and sorted before processing. Where necessary, laboratory test to establish fitness for use.
- Stocks of raw materials and ingredients should be subject to effective stock rotation.(First in first out).(See Annex 2: Stock rotation).

Figure 38: Control the quality parameters of incoming materials

HACCP

Use systems of Hazard Analysis and Critical Control Points (HACCP) throughout from receipt of raw material to processing and delivery of product.

- Identify steps in operations which are critical to the safety of food;
- Implement effective control procedures at those steps;
- Monitor control procedures to ensure their continuing effectiveness; and
- Review control procedures periodically, and whenever the operations change.

Food process parameters

Inadequately heated food is one of the most common causes of food borne diseases

Hygiene control in food processing operations includes effectively controlling :

- temperature – heating, chilling
- moisture (drying)
- chemical preservation, vacuum or modified atmospheric packaging.
- microbiological and physical contamination

based on sound scientific principles.

Figure 39: Food thermometers help to confirm if interior of food has reached adequate cooking temperature.

Chilling and storage

Refrigeration (cooling) is the total process of reducing the temperature of a food and maintaining that temperature during storage, transport, and retailing.

Chilling: If the temperature of the food does not fall below one where ice is formed in the food, the food is considered chilled and the temperature reduction process is called chilling.

Freezing: If ice is formed then the food is considered frozen, and the temperature reduction process is called freezing.

Chill holding: Holding food chilled is very often critical to food safety. Find out which foods need to be held under temperature control and be aware of the relationship between temperature and the shelf life of food.

Temperature monitoring and logging are part of food safety management procedures.

Food that is likely to support the growth of pathogenic micro-organisms or the formation of toxins must be kept at a temperature of 8°C or below, and applies to all such foods, including raw materials and ingredients, at all stages of preparation, processing, transport, storage and display for sale within the manufacture, retail and catering sectors.

Cooling: Heated product should be cooled as quickly as possible through the temperature range 63ºC to 5ºC or less to minimise risk of spore germination and outgrowth. The time taken for cooling will vary from product to product, but as a guideline, should be no more than 4 hours.

Thawing: Thawing procedures, time and temperature should be selected and controlled strictly to avoid conditions favourable for multiplication of microorganisms.

After thawing, the raw materials should be processed immediately, or be held at the specified refrigerated temperature until use.

When using microwave oven, manufacturer's instructions should be followed to prevent overheated areas and uneven thawing.

Plant/facility design and equipment: The plant should be designed and equipped in such a way that the interior temperature is compatible with keeping products at a temperature that controls proliferation of microorganisms during the various operations, regardless of the outside temperature.

Where needed only filtered air should be allowed into the facility to remove dust.

Refrigeration facilities: All refrigerated rooms and cooling facilities should have devices to monitor and record the temperature and a reliable system, such as an audible or visual alarm, to signal loss of control.

These monitoring devices should be clearly visible and placed so that the maximum temperature in the refrigerated area is recorded as accurately as possible.

Establishments should also have rooms or equipment which permit rapid cooling methods to be used, as well as refrigerated storage for a quantity of prepared food equal at least to the maximum daily production of the establishment.

Choice of equipment: Choice of cooling equipment depends on the products being processed. Their characteristics, (cooling capacity, etc.) should be selected based on the quantities of products produced in order to allow for:

- refrigeration without delay after the heat treatment, as soon as the internal temperature reaches 60°C and
- an even temperature distribution in the batch when it is cooled.

In all steps of processing, critical temperatures for multiplication of microorganisms (10°C to 60°C) should be avoided or in any case passed through rapidly.

If there are delays in manufacture, perishable raw materials and in-process products must be maintained at a temperature which minimizes bacterial growth. This can be achieved by placing the product quickly into refrigerated storage areas and kept at the specified temperature or else kept at ≥60°C until normal production is resumed.

Regular and effective monitoring of temperatures of storage areas, transport vehicles and store display cases should be carried out:

- where the product is stored, and
- within the product load, which could be done by using temperature indicating and recording systems.

This monitoring should take place, in particular, when the transport vehicle is loaded or unloaded.

Source FAO, and Food Safety Authority Ireland

Prevent cross contamination

Separate cooked food from raw ingredients.

Figure 40: Mixing ready to eat / cooked foods with raw foods causes contamination

Only allow authorized staff and visitors. Prevent entry of dust, fumes, smoke and insects into the processing area by doors or other appropriate physical barriers.

Figure 41: Restrict access to the food processing site.

Figure 42: Require all visitors to food processing area to also use overalls, gloves, hairnets, as needed

5. Personal hygiene

People who do not maintain an appropriate degree of personal cleanliness, who have certain illnesses or conditions or whose conduct / behaviour is not appropriate to food safety, can contaminate food and transmit illness to consumers.

Hygiene and protective clothing

Food handlers should maintain a high degree of personal cleanliness

Where appropriate, food handlers must wear suitable protective clothing, head covering, and footwear.

Sick persons

Figure 43: Sick persons suffering from illness transmitted through food, should not be allowed to enter any food handling area.

Staff health

Monitor the health of staff. Conditions to be reported for medical examination and/or possible exclusion from food handling are :

- jaundice;
- diarrhoea;
- vomiting;
- fever;
- sore throat with fever;
- visibly infected skin lesions (boils, cuts, etc.);
- discharges from the ear, eye or nose.

Handwashing

Personnel should always wash their hands when personal cleanliness may affect food safety, for example:

- at the start of food handling activities;
- immediately after using the toilet;
- after handling raw food or any contaminated material; and
- after smoking.

Gloves

Figure 44: Change gloves if they are contaminated

- If using gloves, make sure they are fresh and clean.
- Contaminated gloves can be a hazard to food.
- Change gloves as often as you wash hands.

Personnel conduct

People engaged in food handling activities should refrain from conducting themselves in a manner which could result in contamination of food, for example:

- smoking;
- spitting;
- chewing (gum / tobacco) or eating;
- sneezing or coughing over unprotected food and in the premises where food is being processed

Figure 45: People handling food should conduct themselves in a manner suitable to maintain hygiene.

Personal affects

Personal effects such as jewellery, watches, pins or other items should not be worn or brought into food handling areas if they pose a threat to the safety and suitability of food.

Figure 46: Personal effects may harbour germs. or may fall into food.

6. Cleaning and maintenance

Establishments and equipment should be kept in an appropriate state of repair and condition.

Repair and maintenance

- Dirty or unmaintained equipment and facilities promote food hazards, pests, and other agents likely to contaminate food.
- Carry out repairs early.

Figure 47: Rusted equipment with old sediments poses a food contamination hazard.

Figure 48: Grease and oil from machinery can drip into food

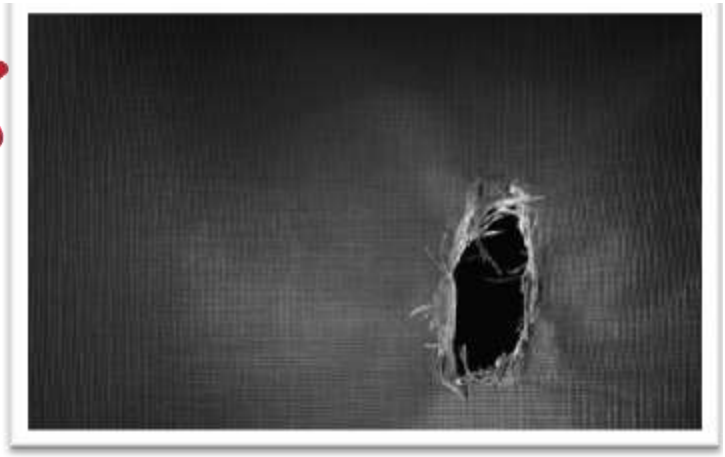

Figure 49: Carry out repairs early

Cleaning method

- Cleaning should remove food residues and dirt which may be a source of contamination.
- Disinfection may be necessary after cleaning.

Choice of detergent

Food residue	*Solubility in water*	*Ease of removal*	*Detergent*
protein	insoluble	difficult	Chlorinated alkaline
fats/oils	insoluble	difficult	Alkaline
carbohydrates	soluble	easy	Alkaline
minerals / salts	variable insolubility	variable	acid

Figure 50: Cleaning methods should be adapted to the nature of the food business.

Cleaning chemicals

Cleaning chemicals should be:

- handled and used carefully
- in accordance with manufacturers' instructions
- stored separated from food,
- clearly identified to avoid the risk of contaminating food.

Figure 51: Chemicals used for cleaning must be used according to the manufacturer's instructions

Cleaning programme

Cleaning and disinfection programmes should

- ensure that all parts of the establishment are appropriately clean
- use food compatible cleaning products
- include the cleaning of cleaning equipment.
- continually and effectively monitored for their suitability and effectiveness
- where necessary, documented to specify
  - areas, items of equipment and utensils to be cleaned;
  - responsibility for particular tasks;
  - method and frequency of cleaning; and
  - monitoring arrangements.
- where appropriate, drawn up in consultation with relevant specialist.

Table 3: Cleaning schedule record form

Equipment to be cleaned		**Location of equipment**	
Cleaning agents to be used		Cleaning frequency	
Cleaning method			
DATE	TIME	SIGNATURE	REMARKS

Figure 52: Do not feed birds inside the processing site

Pests

- Avoid creating an environment conducive to pests
- Good sanitation and monitoring of incoming materials reduce likelihood of pest infestation.
- Reduced pest infestation reduces need for pesticide application.
- Keep buildings in good repair to prevent pest access and to eliminate potential breeding sites. Holes, cracks, spaces in walls, corners and floors can provide shelter to pests.

Figure 53: Keep drains closed

- Install cleanable wire mesh screens, for example on open windows, doors and ventilators, to prevent pest entry.
- Animals should, wherever possible, be excluded from the grounds of factories and food processing plants.

- Avoid shrubs and bushes in the immediate vicinity of the facility and specially at the entrance / exit to the facility. These may harbour insects and other pests providing easy access to the facilities.
- No plants should be grown inside the premises.
- Treatment with chemical, physical or biological agents should be carried out without posing a threat to the safety or suitability of food.
- Use only permitted pesticides, following instructions of the manufacturer.
- Use pesticide suited to the particular pest.

Storage

- Stack stored produce in pest proof packs and containers above the ground.
- Storage should provide 50 cm between product and the wall to allow cleaning and pest control
- Store refuse in covered, pest-proof containers.
- Do not allow waste, food particles or water to accumulate. These would attract and harbour pests.

Figure 54: Stock products above the ground

- Establishments and surrounding areas should be regularly examined for evidence of infestation.

  (See Annex 8: Good Storage Practices)

7. Transportation

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.

Figure 55: Food must be adequately protected during transport and not be exposed. Vehicles must not be overloaded.

Assess and use the type of transport vehicle or containers used depending on the nature of the food and the conditions under which it has to be transported.

The transport vehicle and bulk containers should:

- not contaminate foods or packaging;
- be effectively cleaned and, where necessary, disinfected and kept in good repair;
- permit effective separation of different foods or foods from non-food items where necessary during transport provide effective protection from contamination, including dust and fumes;
- allow to to effectively maintain the temperature, humidity, atmosphere and other conditions necessary to protect food from harmful or undesirable microbial growth and deterioration likely to render it unsuitable for consumption
- where needed, allow any necessary temperature, humidity and other conditions to be checked.

- Clean and disinfect the vehicle between loads of different foods and between food and non-foods.

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Figure 57: Keep the transport vehicle in a clean condition

- If possible transport, containers and conveyances should be designated and marked for food use only and be used only for that purpose.

Figure 56: Do not transport non food items with food unless separated effectively. Spilled liquid (e.g. polluted water, chemical / oil from a previous delivery) in the transport vehicle can contaminate the packaging and food

8. Product information

- Insufficient product information, and/or inadequate knowledge of general food hygiene, can lead to products being mishandled at later stages in the food chain. Such mishandling can result in illness, or products becoming unsuitable for consumption, even where adequate hygiene control measures have been taken earlier in the food chain.
- Lot identification is essential in product recall and also helps effective stock rotation.(See Annex 2: Stock rotation). Each container of food should be permanently marked to identify the producer and the lot.
- All food products should be accompanied by or bear adequate information to enable the next person in the food chain to handle, display, store and prepare and use the product safely and correctly.

Product should bear sufficient information for consumers to

- make informed choices on ingredients and contents including allergens and additives.
- “Best before” and “Use by” date should be indicated
- prevent contamination and growth or survival of foodborne pathogens through instructions on storing, preparing and using the food product correctly.

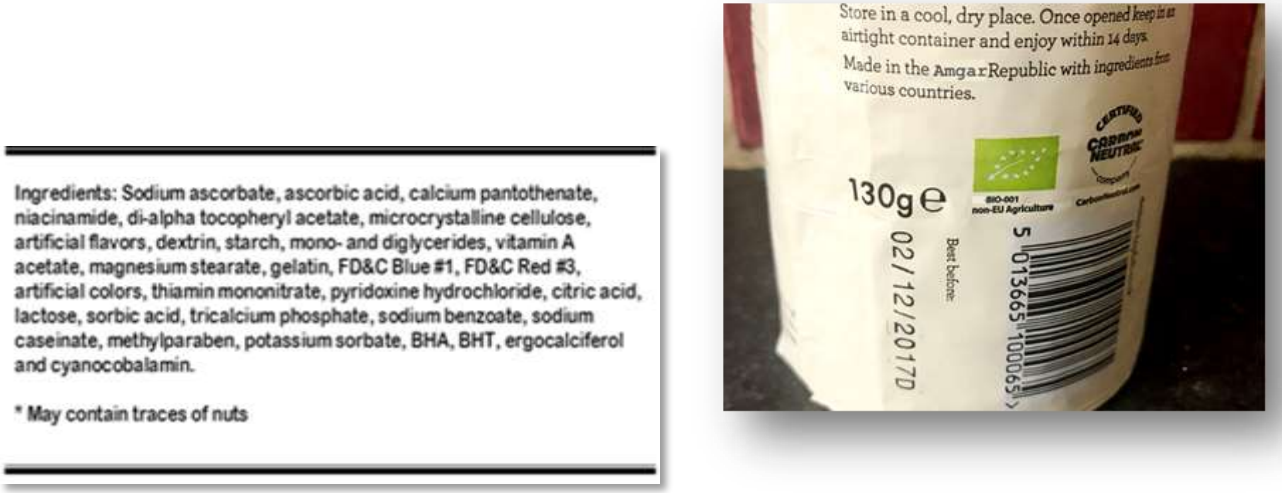


Figure 58: Information on ingredients allows consumers to make informed purchase decisions. Instructions for storage and "Best before" dates allow to store food safely and consume before the food expires.

9. Training

Inadequate hygiene training, and/or instruction and supervision of all people involved in food related activities pose a potential threat to the safety of food and its suitability for consumption. 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.

(See Annex 1: Example of a staff training record form)

All personnel should be aware of their role and responsibility in protecting food from contamination or deterioration. Food handlers should have the necessary knowledge and skills to enable them to handle food hygienically. Those who handle strong cleaning chemicals or other potentially hazardous chemicals should be instructed in safe handling techniques.

Factors to take into account in assessing the level of training required include:

- the nature of the food, in particular its ability to sustain growth of pathogenic or spoilage micro-organisms;
- the manner in which the food is handled and packed, including the probability of contamination;
- the extent and nature of processing or further preparation before final consumption;
- the conditions under which the food will be stored; and
- the expected length of time before consumption.

Reference:

1. *Food and Agriculture Organization of the United Nations, General Principles of Food Hygiene, CAC/RCP 1-1969*
2. *Chilling and Freezing of Foods, Stephen J. James and Christian James, Food Processing: Principles and Applications 2014, John Wiley and Sons.*

Resources:

FAO, Regional Guidelines for the design of control measures for street-vended foods (Africa)

CHAPTER IV: FOOD SAFETY SYSTEMS

1. Introduction

As seen in Chapter 1 , a sound food safety and quality system allows food businesses to provide confidence regarding food safety, prevents and minimizes errors and risks, through a proactive approach.

Without a well-designed and documented programme that is properly implemented and maintained, the chances that a company will have a recall or have its products cause illness are significantly higher.

The previous sections explained the requirements for the pre-requisites programme, GAP and GHP. This module will describe HACCP, ISO 22000 and BRC/IFS requirements in further detail.

2. Hazard Analysis and Critical Control Points (HACCP)

HACCP was first developed in 1960 by a company called Pilsbury, and the United States Army, for NASA (National Aeronautics and Space Administration). NASA wanted to guarantee that astronauts would not become seriously ill during a space mission. Therefore, it enacted very strict specifications upon foods it used. As a result of this requirement, the Pilsbury Company and the United States Army developed a process that would ensure production of safe food; the process was named HACCP.

This approach was found useful for wider application to production of food for consumers due to its proactive procedures. In 1993, the Codex Alimentarius Commission (CAC) published guidelines for the application of the HACCP system. Later, in 1997, CAC incorporated HACCP into an appendix of the 'Recommended International Code of Practice General Principles of Food Hygiene (latest version: Rev.4-2003).

HACCP Concept

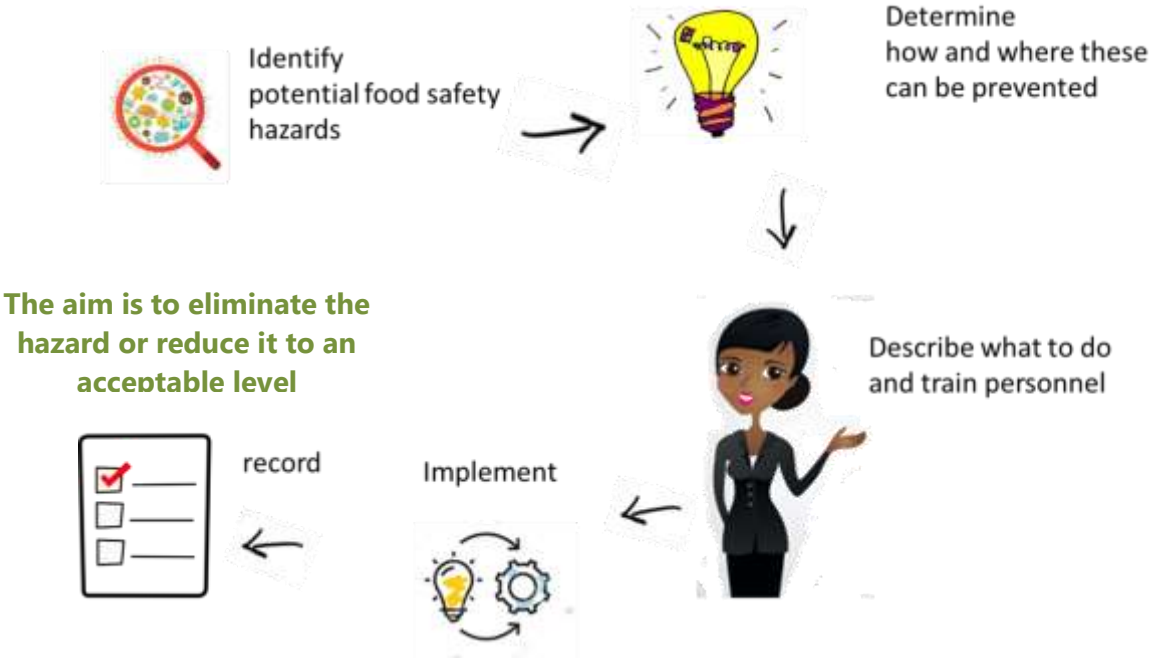


Figure 59: The HACCP concept

HACCP is a science-based system which systematically

- ✓ **identifies,**
- ✓ **evaluates, and**
- ✓ **controls**

hazards which are significant **for food safety.**

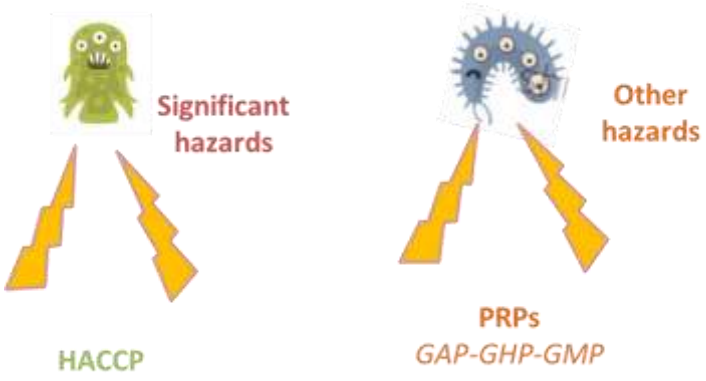


Figure 60: HACCP vs PRPs

HACCP deals with hazards that are significant for food safety. Other hazards (not significant for food safety, however are important to hygiene and removal of contamination) are covered under the Pre-Requisite Programmes, namely, GAP, GHP and GMP. **Whereas PRPs focus is on the production environment: facility, programmes and people, HACCP primarily focuses on raw materials, product and process.**

Since PRPs are general control measures applicable across all areas of food processing and aimed at maintaining a safe and hygienic environment, well-functioning GAP, GHP, GMP, before and during the implementation of HACCP is essential.

HACCP Key terms

Hazard: A biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health effect

Agent: Bacteria, Viruses, Moulds, Parasites, Toxins, Chemicals, Foreign material

Adverse health effects: Examples:

- Acute illness (choking, vomiting, abdominal cramps, diarrhoea, nausea, fever)
- Chronic illness (chronic infections, organ damage, cancer)
- Death

Control measures: Actions and activities that can be used to prevent or eliminate a food safety hazard or reduce it to an acceptable level.

Acceptable level: Not all levels of all agents are harmful to all individuals under all conditions. Agents (contaminants) are acceptable as long as their levels remain below a certain maximum. This level is called the Acceptable Level.

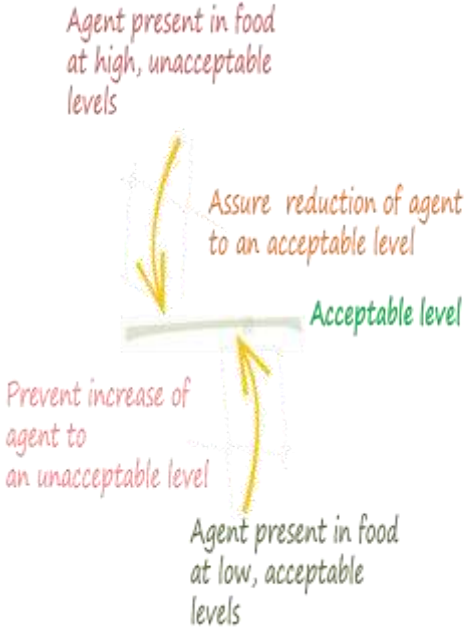


Figure 61: Agents should not exceed the Acceptable Level

- If an agent is present in a food in high, unacceptable, level, its reduction to an acceptable level should be assured.
- If an agent is present in a food at a low, acceptable, level, its increase to an unacceptable level should be prevented.

Hazard control: Control of hazards involves:

- Preventing contamination
- Preventing increase in level (from acceptable level)
- Assuring adequate reduction (to acceptable level)
- Preventing recontamination
- Preventing dissemination (spread).

Hazard Analysis: The process of collecting and evaluating information on hazards and conditions leading to their presence to decide which are significant for food safety and should be addressed in the HACCP plan.

HACCP Plan: A document prepared in accordance with the principles of HACCP to ensure control over hazards which are significant for food safety in a segment of the food chain.

Critical Control Point: A step in the food chain where activities are carried out, or conditions prevail which can have an influence on the safety of the product, and where control can be exercised over one or more factors to prevent or eliminate a food safety hazard or reduce it to an acceptable level. CCPs may be identified with the help of decision trees.

Critical limit: A criterion which separates acceptability from unacceptability. Critical limits can be :

- Values of : pH (Level of acidity or basicity), aw (water activity), temperature, time, pressure
- Maximum residue limits (of pesticides or mycotoxins)
- Maximum levels (of contaminants)

- Limits in microbiological criteria
- Level of cleanliness
- Levels of additives (salts, colouring, stabilizers, flavours) etc.

Monitor: The act of conducting a planned sequence of observations or measurements of control parameters to assess whether a CCP is under control.

Corrective actions: Actions to be taken when the results of monitoring at the CCP indicate a loss of control.

Verification procedures: Procedures that are intended to check the effectiveness of the HACCP system.

The HACCP system has the potential to identify all conceivable, reasonably expected hazards, even where failures have not previously been experienced. HACCP enhances food safety, makes better use of resources, enables more timely response to problems

HACCP implementation

HACCP is implemented along 7 principles (Figure 61) and as elaborated in Table 2.

Figure 62: The 7 principles of HACCP

Table 4: Steps in implementing HACCP principles

1. Conduct a hazard analysis

- Prepare a process flow diagram covering all steps from receipt of raw material to dispatch of finished product.
- Identify likely hazards at every process step.
- Describe the measures for control of hazards at each process step.

2. Determine the critical control points (CCPs)

- Analyse each step by using the HACCP decision tree (Figure).
- Identify the steps (points) where control is critical for assuring the safety of the product.

3. Establish critical limits

- Fix critical limit for control measures relating to each identified CCP (e.g. temperature, time, speed, pH, moisture content).

4. Establish a system to monitor control of the CCP

- Decide on monitoring procedure, which should cover the nature of monitoring (observation, testing), monitoring frequency and responsibility for monitoring and recording monitoring results.

5. Establish corrective action to be taken when monitoring results indicate that a particular CCP is not under control.

- Develop procedures for dealing with the deviation from critical limits when it occurs and how to bring the CCP back into control, including disposition of the affected product produced during deviation.

6. Establish verification procedures to confirm that the HACCP system is working effectively.

- Develop procedures for verification to confirm that the HACCP plan is working (e.g. periodic audit, random

sampling and analysis, review of the HACCP system and its records).

7. **Establish documentation on all procedures and records appropriate to the HACCP principles and their application.**

- Prepare and follow procedures and work instructions for each control measure, including those needed for maintaining hygiene conditions; keep records.

Hazard analysis: The process of collecting and evaluating information on hazards and conditions leading to their presence to decide which are significant for food safety and should be addressed in the HACCP plan.

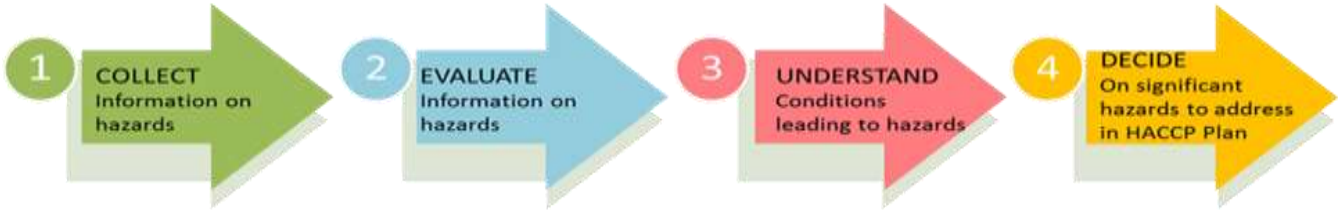


Figure 63: Steps of hazard analysis

The HACCP Plan

The HACCP plan is the documentation produced that shows how significant hazards will be controlled. It indicates what needs to be done, when and where, and by whom. The HACCP plan is a formal document, holding all details of areas critical to food safety management for a product or process. It is the result of a HACCP study, and is specific to a production site and the product. It consists of the following.

1. Core plan:

- Valid process flow diagram
- Documented CCP management details (captured in a HACCP control chart or CCP management table)

An example of a HACCP control chart is as follows.

Table 5: Example of a HACCP control chart

1 CCP	2 Hazard to control	3 Critical limits	Monitoring				8 Corrective action	9 Verification	10 Record keeping
			4 What?	5 How?	6 Frequency	7 Who?			
1.1 Incoming raw material	Aflatoxin	<10 mg/kg	Flour	Inspect Certificate on analysis	Every batch	Incoming goods clearance staff	Reject batch	Samples tested regularly and matched	

								with	
2.1 Equipment	Bacterial pathogen survival	Cook temperatur e =100°C time≥3 minutes	Cooker temperatur -e and cooking time.	Continuous temp. recorder and conveyor belt time log	Hourly check of records	Cooker operato -r	Stop processing line till temp is 100° C or cook time is >3 minutes	Thermome ter and timer of cooker calibrated regulary.	

2. Support documentation:

This comprises the preparatory documentat that has been used in deelopoing the HACCP plan as well as details of the verification requirements, including the following.

- HACCP team details
- Product/process description (including terms of reference, consumer targt group and intended use of the product)
- Hazard analysis details
- CCP identification – details of approach and justification
- HACCP verification plan
- HACCP audit and review data
- Documenting the HACCP study and HACCP plan development

Implementing the HACCP Plan

The steps involved in developing and implementing a HACCP plan are as follows:

1. Assemble HACCP team (Pre-Step 1)

Appoint a multidisciplinary team with a HACCP coordinator. The team may comprise, for example, a food technologist, microbiologist and the supervisors of the following sectors: quality assurance, engineering,

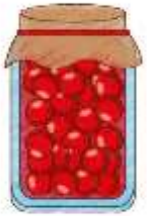
purchasing, production, maintenance. If necessary, external help can also be availed of.

At this stage, the scope (terms of reference) of the HACCP plan should be defined, i.e. the product or process lines for which the HACCP plan should be prepared. Then, the nature of the hazards (biological, chemical or physical or their combination) to be studied by the team should be determined.

2. Describe the product (Pre-Step 2)

Describe the product e.g. its

- composition (ingredients),
- structure (liquid, powder or solid),
- processing condition (heat treatment, freezing, brining),
- packaging (bottled, packed or in bags),
- storage (ambient temperature, refrigeration, freezing),
- distribution (transport condition, e.g. ambient temperature, refrigeration),
- shelf life.



3. Identify intended use (Pre-Step 3)

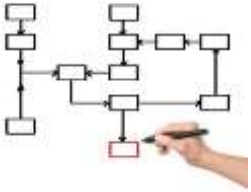
Describe the expected use of the product and by whom:

- by the end user (restaurant, food processor, retailer, consumer) or
- consumer (adult , child, elderly, patients in hospitals, pregnant women)
- whether the product should be consumed as is, drained, cooked (fried, baked, steamed).

Table 6: Example of Form- Description and identified use of product

Name of product	
Full description of product including structure/variety, processing parameters, additive concentrations, storage instructions, pH/Aw/moisture levels, *and any mycotoxin target levels (regulatory or to customer specification).*	
Customer specification	
Conditions of storage and distribution	
Shelf Life	
Packaging	
Instructions on the label	
Target Consumer	
Recommendation for further processing required before consumption	
Intended use, e.g. will the end product be cooked before consumption?	
Source: FAO	

4. Construct flow diagram (Pre-Step 4)



Prepare a detailed process flow diagram or diagrams showing each step in the operation from receipt of raw materials up to defined end use (receipt, storage, processing, storage, transport, end use). The flow charts should also indicate time and temperature requirements, product recycle or rework loops, equipment layout, personnel routes, water and water flow, waste flow.

5. On-site conformation of flow diagram (Pre-Step 5)

Observe actual operations during the normal working day, nightshift, weekend and confirm or amend the flow diagram to reflect the actual steps.

6. List all potential hazards associated with each step, conduct a hazard analysis, and consider any measure to control hazards (Codex HACCP: Principle 1)

- List all potential hazards (identified in the scope) at each step of the process.
- Conduct a risk analysis of each hazard (probability of occurrence and its potential severity) to identify which hazards are of such a nature that their elimination or reduction to acceptable level is essential to the production of safe food.
- Describe the preventive measures (control measures) for each identified hazard (e.g. supplier control procedure, chilling, heating, screening, metal detection, personnel hygiene such as hand washing, headgear use, cleaning, maintenance).

7. Determine critical control points (CCP) (Principle 2)

Apply the decision tree (as prescribed in the Codex General Principles of Food Hygiene) at each step (for each hazard) and identify the steps where control is critical for assuring the safety of food. These steps are called CCP.

8. Establish critical limits for each CCP (Principle 3)

Specify the critical limit (control parameter that should be achieved to ensure that the product is safe, e.g. measurements of temperature, time, moisture level, pH, water activity (A_w), available chlorine and observation of sensory parameters such as visual appearance and texture, for each CCP. Critical limits are decided on the basis of a legal requirement, national or international standards or scientific data

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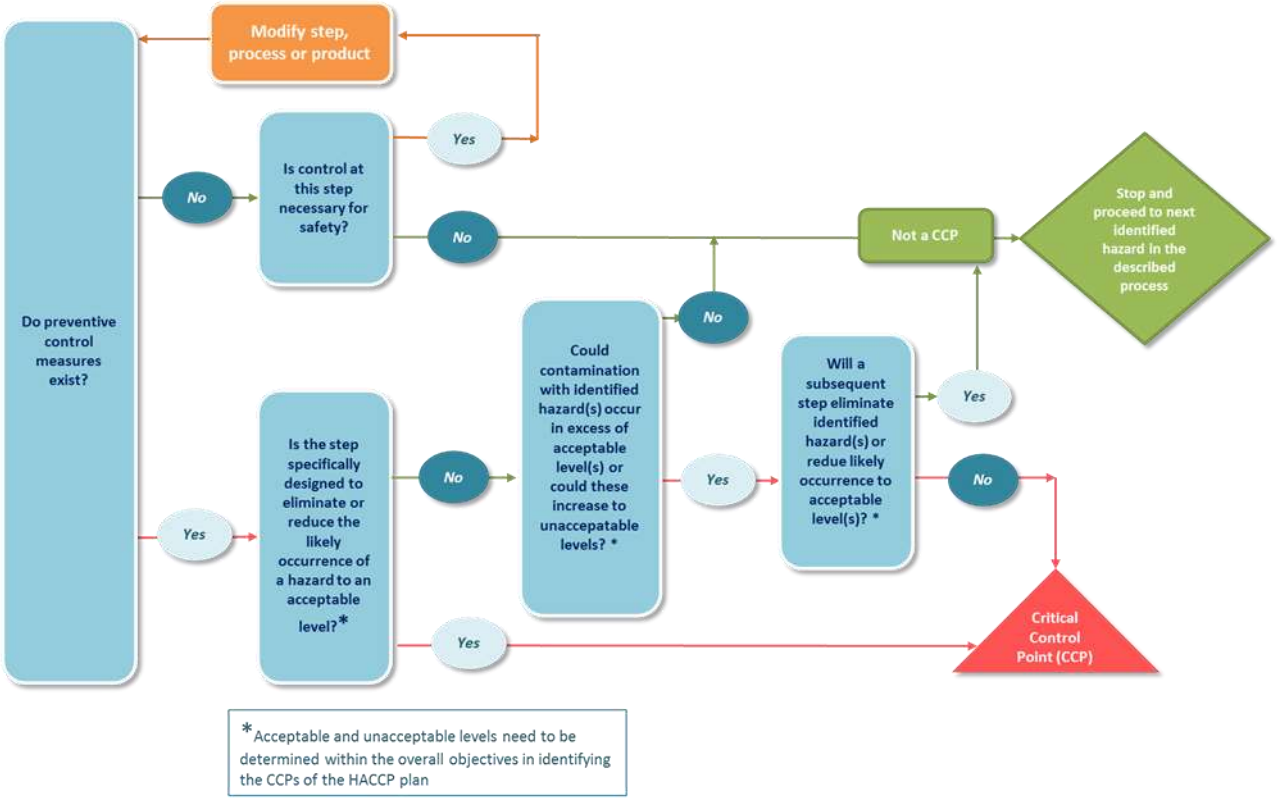

Figure 64: HACCP decision tree to decide CCP

9. *Establish a monitoring system for each CCP (Principle 4)*

- Select an appropriate method for monitoring (e.g. observation, inspection, testing, measurement).
- Decide the frequency of monitoring, assign responsibility for monitoring activities and keep a record of monitoring results.

10. *Establish corrective actions (Principle 5)*

- Specify the action(s) to be taken to bring the process back to a state of being under control when the results monitored indicate a trend towards loss of control.
- Specify the disposition action to be taken on the product that has been produced when the CCP was out of control.
- Define the responsibility for corrective action and disposition action.
- Maintain a record of the action(s) taken.

11. *Establish verification procedures (Principle 6)*

With a view to checking if the HACCP system is working satisfactorily, draw up the procedure for verification activity and designate responsibilities for it. Verification activities include review of the HACCP system and its records, internal and external auditing, random sampling, product testing, analysis of swabs.

12. Establish documentation and record keeping (Principle 7)

Document and keep records efficiently, as required by the HACCP system. For example, hazard analysis, identified CCPs and their limits (including revisions, if any) should be documented. Examples of records are CCP monitoring records, records of deviation found and corrective action taken on them, verification records.

3. ISO 22000: Food Safety Management System

ISO 22000 is an International Standard which defines the steps an organization must take to demonstrate its ability to control food safety hazards and ensure that food is safe for human consumption.

ISO 22000 specifies the characteristics of a management system designed to

- carry out the hazard analysis,
- design the HACCP plan,
- identify the prerequisite programmes (PRP), and
- select the operational prerequisite programmes

Relationship between ISO 22000 and HACCP

ISO 22000 has made it easier for organizations worldwide to implement the Codex HACCP system for food safety in a harmonized way, i.e. it does not vary with the country or food product or service concerned. ISO 22000 can be used for certification, and this may be acceptable as an alternative to certification against different national standards.

Implementing HACCP is part of the fundamental requirement of the ISO 22000 standards, and hence HACCP and ISO 22000 are complementary and mutually reinforcing.

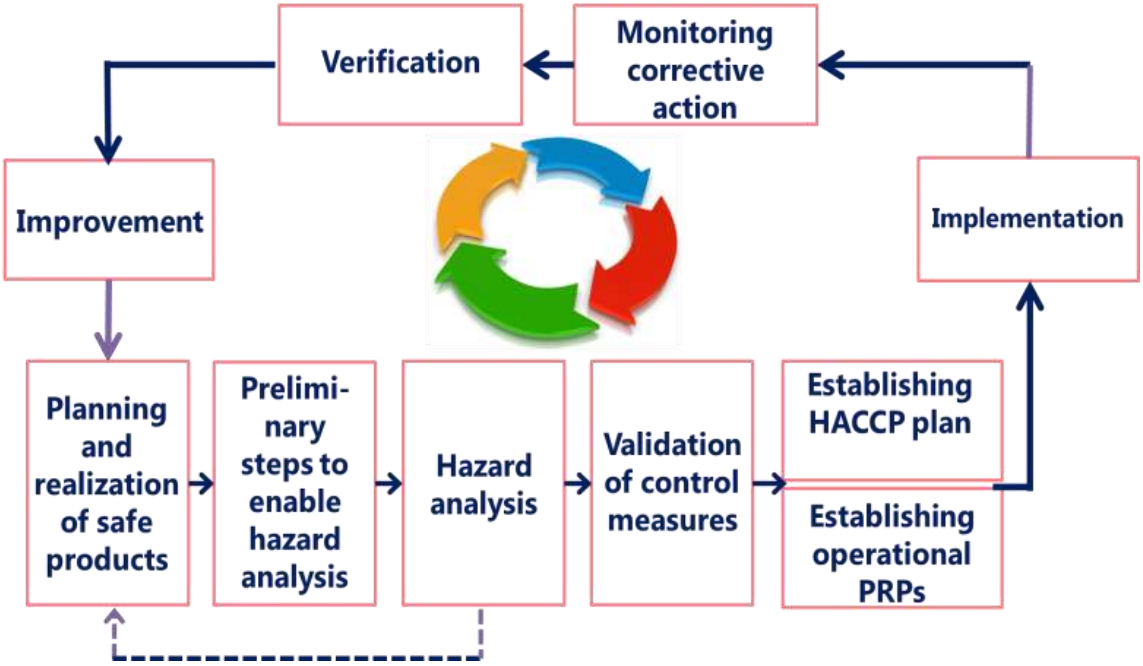

Figure 65: Steps in implementing ISO 22000

Steps in implementing ISO 22000

The steps for implementing ISO 22000 are described below.

Management Commitment

Before starting to implement the ISO 22000 food safety management system (FSMS), it is important that the top management be fully committed to the development and implementation of the system. This includes providing financial, infrastructural and competent human resources for the development of the system.

Step 1: Nomination of the food safety team (FST)

Your top management should appoint a competent food safety team with a team leader. Preferably the team should consist of a food technologist, microbiologist and the supervisors of the quality assurance, engineering, production and maintenance functions. One of the members of the team should have good knowledge of HACCP/FSMS. If the team members require additional training, this should be arranged by the team leader. The team will play a major role in the development of your food safety management system. If you wish, you could also engage a food safety consultant to support your team, but in no way should this be regarded as an exercise in shifting responsibilities from the team to the consultant.

Step 2: Setting up prerequisite programmes (PRPs)

Depending upon the segment of the food chain in which you operate, you will need to set up the prerequisite programmes for maintaining a hygienic environment in your unit. These programmes include Good Hygienic Practice (GHP), Good Manufacturing Practice (GMP), Good Agricultural Practice (GAP), Good Distribution Practice (GDP) (Annex C of ISO 22000:2005). If you find that your current PRPs are

inadequate, you may have to devote additional financial resources and time to improving them. For example, you may need to improve your factory layout, floors, walls, ventilation system, lighting, drainage system and waste collection facilities.

Step 3: Development of the HACCP plan

Before you can develop your HACCP plan, you need to carry out a detailed hazard analysis of each step of the process . This analysis will lead to the identification of critical control points (CCPs), the process step(s) on which exercising control will be essential to preventing or eliminating the hazards or reducing them to acceptable limits. A system for monitoring the CCPs and taking corrective action on the process should be set up for the products or processes. Control measures determined in the HACCP plan and operational PRPs should be validated prior to their implementation.

Step 4: Documentation

FSMS documentation includes the food safety policy and related objectives, documented procedures (for example, procedures for the control of documents, control of records, internal audit, handling of potentially unsafe products, control of nonconforming end product, corrective action and withdrawal of end product), HACCP plan(s), and certain records to demonstrate compliance with HACCP plans and the other requirements of your FSMS. The use of additional documents covering additional procedures and including process flow diagrams, specifications, methods of test, records, wherever required, should also be decided on and the documents developed by the team. A proper system of control of documents and control of records should be introduced.

Step 5: Training, awareness generation and implementation

All employees carrying out activities with an impact on food safety should be competent to do their jobs.

Training on monitoring and taking corrective action should be provided to the employees who are responsible for these activities. In addition, your employees should be aware of the relevance and importance of their food safety activities. They should also understand the need for effective internal communication on food safety issues. After awareness generation and training as needed, system implementation can start and records should be maintained as evidence of the operating FSMS.(See Annex1: Example of a staff training record form).

Step 6: Internal FSMS audit

The internal audit process determines how well your FSMS is working. Some of your employees should be trained to carry out internal auditing, including inter-functional audits. During the early period of FSMS implementation, the audits may be done more frequently; once the system stabilizes, the frequency of audit as prescribed in your internal audit procedure may be followed.

Step 7: Management review

The findings of internal audits, along with information on customer feedback and complaints, analysis of results of verification activities, lessons learned from emergency situations or accidents, if any, product withdrawals, if any, should be reviewed by your top management and decisions taken to improve the FSMS. A system for conducting such reviews on a periodic basis should be introduced.

Step 8: Certification

Certification to ISO 22000 is voluntary. If your top management considers it a necessity, then you may apply for certification to a certification body of your choice. The prerequisite for such certification is effective implementation of the system for at least three months, including one internal audit followed by a management review.

Action plan

A period of six to nine months is considered reasonable for fully developing and implementing the FSMS.

Costs and benefits of ISO 22000

Setting up an ISO 22000 FSMS and having it certified have cost implications. The costs categories are related to

- Cost of establishing and implementing the FSMS;
- Cost of maintaining the FSMS;
- Cost of initial certification and cost of maintaining the certification.

These costs can vary greatly, depending on the size of your facility, range of products, nature of your operation, existing infrastructure and facilities. The cost items and the benefits of implementing FSMS are described below.

Costs of establishing and implementing FSMS

- **Cost of obtaining copies of the national and international standards and food legislation**. You will also need the Codex guidelines on the general and specific principles of food hygiene, but these Codex documents are freely downloadable from the Codex website.

- Depending on the background of your multidisciplinary food safety team members and its leader, **cost of training** them on food safety hazards and related control measures, hazard analysis, development of the HACCP plan, method of developing FSMS documentation and their related control measures. The overall cost will include both the **direct costs of training and the indirect cost of the time spent by your FST team** in training.
- Depending on the nature of your product and the associated hazards, **cost of making necessary alterations** in the layout of your

premises, floors, walls, ceilings, ventilation system, employees' facilities, waste disposal system, pest control system, water supply.

- **Cost of introducing additional control measures** to prevent, eliminate or reduce the hazards to an acceptable level. The direct costs involved may cover selection and acquisition of new processing equipment or technology; revamping temperature controls for storage (in freezers or cold storage) of raw materials and finished products; installing facilities for metal detection, packaging, heat treatment, freezing, brining, transport, personal hygiene, as needed; and the means for validating these control measures.
- Cost of developing **FSMS documentation**, e.g. documents on food safety policy and objectives, food safety procedures, prerequisite programmes, operational prerequisite programmes, HACCP plan.
- Cost of **creating awareness** in all persons who have roles and responsibilities for FSMS activities and cost of training when required.
- Cost of **day-to-day monitoring** activities, calibration of instruments, testing of raw materials and finished products, verification activities, product withdrawals, corrective actions.
- Cost of maintaining the FSMS
- Cost of periodic reorientation, awareness generation and training of your employees to update them on new legislation and changes to your FSMS.
- Cost of training some of your managers to perform periodic internal audits.
- Cost of conducting periodic internal audits, corrective actions, continual improvement and management review of FSMS.
- Cost of initial certification and cost associated with the maintenance of certification payable to the certification body you selected
- Registration or certification fee payable to the nominated certification body for a period of three years.
- Fee for a two-stage certification audit by the auditors of the certification body.

- Fee for periodic surveillance audits (at a frequency of every 6 to 12 months) by the auditors of the certification body.
- Travel, board and lodging of the auditor(s) of the certification body.

It may be added here that certification to ISO 22000 is not a mandatory step after the implementation of FSMS. The decision to have it is always a need-based decision, which your management should take before incurring the above costs.

Benefits of ISO 22000 FSMS

The implementation of ISO 22000 FSMS will provide both internal and external benefits, for example:

- Improved competence of employees through training and awareness generation, bringing about, among other benefits, clarity about their responsibilities and the designation of authority within FSMS.
- A defined system for obtaining information on emerging food safety hazards and control measures, and on applicable statutory and regulatory requirements.
- Cost savings from reduced instances of producing unsafe products, smaller number of customer complaints, low withdrawal levels of unsafe products from the supply chain.
- ISO 22000 compliance and its certification may generate opportunities for new business, including giving you a chance to become a preferred supplier of the big retail chains.
- Customers will have greater confidence in the food safety of products made by an ISO 22000 compliant or certified company.

4. British Retail Consortium (BRC) Standard

British Retail Consortium Global Standard for Food Safety is developed by food industry experts from retailers, manufacturers and food service organisations. It provides a framework to manage

product safety, integrity, legality and quality, and the operational controls for these criteria, in the food and food ingredient manufacturing, processing and packing industry.

The BRC Global Standard focuses on:

- Importance of management commitment
- HACCP (Hazard Analysis and Critical Control Point) based food safety programmes
- Quality management systems
- Auditing good manufacturing processes – it is not just a paperwork audit
- Auditing areas which often have the highest rate of product recalls and withdrawals, such as labelling and packing
- Developing systems to reduce exposure to food fraud
- Ensuring consistency of the audit process
- Providing a BRC Global Standard that is portable enough to allow Additional Modules to be added to reduce audit burden
- Promoting greater resilience, transparency and traceability in the supply chain

The BRC Global Standard is divided into seven sections:

1. Senior Management Commitment and Continual Improvement
2. The Food Safety Plan (HACCP)
3. Food Safety and Quality Management System
4. Site Standards
5. Product Control
6. Process Control
7. Personnel

(Source: www.brcglobalstandards.com/brc-global-standards/food-safety/)

For more information on private standards see ITC Standards Map www.standardsmap.org

Reference :

1. *Food and Agricultural Organization of the United Nations*
2. *International Trade Centre, Export Quality Management: A guide for SMEs*
3. *Mortimer and Wallace, 2013, HACCP : A Practical Approach, Springer.*
4. *Wallace, Sperber, Mortimore, 2014, Food Safety for the 21st Century, Wiley Blackwell*
5. *Principles of Food, Beverage, and Labour Cost Controls, John Wiley and Sons.*
6. *Safe Catering, Food Safety Authority of Ireland.*
7. *Supplier Food Safety Assurance, Ministry of Agriculture and Forestry Centre, Alberta Canada.*

ANNEXES

ANNEX 1: Example of a staff training record form

Name:……Position……Date of employment……

Nature of training Topic	Dates	Trainer, Training Provider (Institution)	Employee signature	Trainer signature / Record (certificate)
Training on specific steps used in your business				
Purchase, Delivery/Receipt, Collection				
Storage				
Defrosting				
Training on general hygiene requirements				
Cleaning				
Pest control				
Waste				
Maintenance				
Personal hygiene				
Training / Supervision				
Correct use of equipment (e.g. thermometer….)				
Food allergies				

Further training

Nature of training, external, in-house, refresher	Course provider	Date completed	Employee signature	Certificate /Record

Adapted from “SC6-Hygiene Training Record” Safe Catering, Food Safety Authority of Ireland.

It is a good practice to

- identify the training needs of each staff member
- train staff according to their work and keep training records of every staff member
- review training needs on a regular basis and assess against the role and responsibilities, existing skills, experience and
- previous training of the staff

ANNEX 2: Stock rotation

Food stock rotation involves using products with an earlier use-by-date first. This ensures that food is used within its use-by date, preventing unnecessary and costly waste (of food that has passed its expiry date).

An effective stock control ensures that products beyond their expiry date / shelf-life are neither sold nor used.

Stock rotation applies to all food types but is particularly important for high-risk food e.g. dairy and meat products, since consumers can become extremely ill if they consume expired products.

Well managed stock rotation can also prevent physical contamination as a result of pest infestation or cross contamination of allergens.

Implementing stock rotation

Awareness and training

- Ensure that all staff are aware of the importance of stock rotation and understand how your stock rotation system works.

Receipt of deliveries

- When accepting deliveries, check dates and condition of all incoming stock before accepting it. Do not let products with seriously damaged packaging or whose use by date has already expired reach your shelves. Reject these and send back to the supplier. (See Annex 3: Receiving delivering; Annex 4: Approved and disqualified supplier lists)

- Tag each delivered item with the delivery date.

Storage

If delivery item is not intended to directly go into production, they are generally placed in one of three major storage areas:

  - dry storage
  - refrigerated storage
  - frozen storage

- Take high risk items to the appropriate storage facility (correct container, temperature, ventilation/aeration) and a as soon as possible after unloading. Never leave chilled or frozen goods sitting around at room temperature.
- In case of removing the original packaging and rewrapping high risk items, label with the use by date.
- Price and other stickers should not cover use by or best before dates.
- Store according to use
  - Always use food in the correct order of its use before / best -before date (First expiry first out- FEFO). If needed, use coloured labels on stored stock as visual aids. First in first out (FIFO) and FEFO may not always be the same dates. Usually FIFO is used for raw / unprocessed materials while FEFO is used for packed/processed ingredients.
  - Store or display food with a longer shelf life at the back / below food wih shorter shelf life.
  - Most frequently used items closest to entrance
- Fix definite locations for each item and ensure it always found in the same location
- Separate facilities for storage of different classes of foods
- Checking that food is in good condition before using it
- Monitor the display of products on a daily basis.
- Separate, and dispose of any out-of-date stock from storage or display.

  (See Annex 8: Good Storage Practices)

Managing stock rotation

- Compile a written procedure that staff should follow. This should include the tasks to be carried out at the various stages, such as delivery, storage, labelling and display. The list should include timeframes of when tasks should be carried out, for example “Check use by dates daily”. If you can provide tick box record sheets for staff this makes the process clearer and easier to follow.
- Monitored the procedure in place to ensure it is working.

- Managers and supervisors should carry out both regular inspections and spot checks, looking at the use by dates of items on the shelves and reviewing the record sheets. This will enable identification of any problem areas quickly. Record problems as non-conformities and take action to resolve them. The action taken should also be recorded. This continual review process enables to identify the areas that need improvement and help manage stock levels in the most efficient and therefore cost - effective way.

Table A2: Example of a stock rotation checklist

STEP	IMPROVE MY RATING	Done
1.	Use-By and Best Before dates of products delivered to your business are checked at the point of delivery.	
2.	You have a system in place for documenting the shelf life of your products, e.g. stock book, coloured day dots or date labels.	
3.	There are daily checks of products to ensure there are no foods past the end of their shelf life.	
4.	Foods past their shelf life or Use-By date are disposed of immediately or separated from other foods.	
5.	There is a written procedure in relation to shelf life and stock rotation, e.g. completed SFBB Safe Methods and Diary Sheets.	
6.	All staff have received training on the written procedure and put it into practice.	

Source: www.chiltern.gov.uk/foodfactsheets

ANNEX 3: Receiving deliveries

The basic requirements to properly receiving products are as follows.

- Designated receiving area that
  - can be secured and restricted to authorized employees and delivery people
  - is shielded from contamination / rain
  - has adequate space and lighting to enable examination, sampling, count, weight and HACCP temperatures
- Standard testing and inspection equipment (hygienic, calibrated and accurate)
  - scales / weighing instrument
  - temperature probes
  - knives

  and if needed, gloves.
- Transport equipment
  - carts, dollies, or hand-trucks,
  - if needed, pallet jackets forklifts
- Qualified, experienced and knowledgeable person/s
  - Assigned to receive &/test particular types of foods and non foods products
  - Able to recognize product quality consistent with purchase specifications

Table A3: Sample Record form for receiving products

Date	Time	Name of Product	Supplier	Amount of product	Condition	Temperature (°C)	Certificate of Analysis	Comments	Accepted/ Rejected

Delivery check target

Temperature:

1) Chilled food 8°C or colder.
2) Frozen food -18°C or colder. Large ice crystals absent
3) Hot food 63° or warmer
4) Dry foods – Certificate of Analysis

Date codes: Food date coded to give enough shelf life and within "use by date"

Condition:

1) Packaging: Intact
2) Appearance of food: In good condition per specification

Delivery

1) Driver personal hygiene good
2) Inside of delivery vehicle clean
3) Cargo security – Locked/covered hygienically

ANNEX 4: Approved supplier list

Once suppliers are decided on, set up an Approved Supplier List. This list will change as suppliers are added or removed and depending on the supplier's performance.

The Approved Supplier List should include:

- What product(s) the supplier is approved for;
- Whether the product is supplied from a wholesaler. If so, include the name of the manufacturer, address, and contact information;
- Details of the supplier name and individual contact information. Get an emergency contact in case of recall;
- Date of approval, and date the supplier started working with the contracting facility; and
- Date and signature of person(s) in the contracting facility responsible for this list.

Some facilities add to their list:

- The facility's name or code for the product being purchased;
- Shipping method or how the item is delivered (e.g. truck, mail, etc.);
- Whether it is bought from a local wholesale market and picked up by staff members; and
- Supplier code number and an explanation of the lot code of the incoming materials.

Enter all this information as soon as the supplier is approved. Update it each time a supplier is added or dropped. Review this list at least once a year. Make sure that all information is up-to-date.

Keep the updated list available to all staff involved in purchasing and receiving. This helps ensure that only the right materials are brought in.

Table A 4.1: Example of Approved Suppliers List

Product	Supplier details (Name Address, phone number, FSMS / certification, emergency contact)	Date approved	Remarks

Name…….. **Signature**……

Position…… **Date**……..

Table A 4.2: Example of Disqualified Suppliers Record

Product	Supplier details (Name Address, phone number, FSMS / certification, emergency contact)	Date	Cause of failure

Name…….. **Signature**……

Position…… **Date**……..

ANNEX 5: Food recall and withdrawal management

Recall

Recall is removal of unsafe food from distribution chain. Recall extends to food sold to consumers and involves communication with consumers.

A recall should be initiated when a foodstuff identified as unsafe is a potential risk to public and has been distributed to the consumer.

Withdrawal

Withdrawal is removal of an unsafe foodstuff from the distribution chain but does not extend to food sold to the consumer.

A withdrawal should be initiated when a food stuff identified as unsafe is a potential risk to public health but it can be demonstrated that the unsafe foodstuff remains wholly in the distribution chain and has not reached the consumer

Objective

The purpose of product recall is to

- protect public health by informing consumers of the presence of a potentially hazardous foodstuff on the market
- facilitate the efficient, rapid identification removal of unsafe foodstuffs from the distribution chain and
- ensure that the unsafe foodstuffs are either destroyed or rendered safe.

Lot traceability is prerequisite for effective recall. It is vitally important to be able to trace any potentially unsafe product. Both raw materials and finished products should be traceable.

Managing product recall

1. **Complaints data** is often the first indicator of a problem. It should be regularly analysed and reviewed for trends. This is extremely valuable

information and every complaint should be logged and investigated by the Quality Manager. The quality controller may initiate a red alert if:

- the control samples show any food safety issue
- customer complaints on food safety issues
- end user complaints of food safety issue
- microbiological results obtained after dispatch show the product poses threat to food safety.

2. **Put the product on hold:** The lot number is used to trace the consignee of the product. The consignee is immediately contacted and requested to keep the product on hold till further intimation.

3. **Investigate to decide to recall/withdraw or not**: The nature of complaint is investigated. This includes reviewing records of processing parameters and incoming and finished product specification testing. The control sample is also analysed and reports submitted. A report of the investigation based on all the mentioned documents is prepared based on which it is decided to recall, withdraw.

4. **Deploy the product recall team** (normally must already have been constituted under food safety /HACCP policy, with recall procedures in place). The team collects following minimum information on suspected food safety incident:

   - Product name
   - Product description
   - Batch codes involved
   - Quantity of product implicated
   - Distribution details (Suppliers, Distributors, Wholesalers, Retailers, Caterers)
   - Whether product has been sold to final consumer
   - Nature of the product fault

5. **Maintain incident log**: The recall team must keep an incident log of the actions taken during product recall as it proceeds. The incident log should consist of a list of communications including phone calls, their time, date, who made them and brief details of the communication. Notes must be maintained of any actions and decisions made by the team and any supporting information. All product recall team members are responsible for completing the incident log. The product recall

coordinator must review the log each day to verify logs are being made

6. **Notify competent authority**: The team is responsible to notify competent authorities in case of food that is potentially injurious to health and in other circumstances. Notification must be made before executing the product recall and not after it has been completed.

7. **Execute product recall.**

   a. **Communicate**: The team communicates with customers and suppliers alerting them to the incident. Remember to not alarm. Identify return location.

   b. **Arrange for collecting/storing**: The team arranges for returns. Unsafe food returned directly from consumers, returned from retail outlets, returned via the distribution chain or product already in stock must be:

   - Returned to one central site, or in the case of a widely distributed product, to major recovery sites
   - Stored in an area that is separated from any other food products
   - Labelled “not for consumption” to distinguish it from unaffected stock.

   c. Record accurately the amounts of recovered product and the codes of that product. The team attempts to reconcile recovered stock against known volumes of affected food distributed**.** Although very often consumers may destroy / dispose of the food without returning it.

   d. Close recall: Review, progress of recall. If it can be concluded that the public health risk has been reduced to the lowest possible level, the process can be brought to an end. If not, food recall/withdrawal may then have to be reiterated using different methods to reach all those affected.

A food recall or withdrawal should be formally closed so that it is clear to all parties that the incident has ended. It is recommended that this is done by the food incident coordinator in consultation with senior managers and the food incident management team.

Food business operators should remember to notify the competent authorities when a food incident is closed.

8. Recalled food

a. **Reprocessing**/relabelling: If the food safety risk can be safely removed from the recovered food through relabelling or reprocessing this must be done once it is clear that the public health will be protected and the relevant competent authority's permissions are obtained.

b. **Destruction** or denaturing: If the recovered food is unfit for human consumption it must be destroyed or denatured under the supervision of the company management and / or the relevant competent authority where legally required.

***Reference**:*

1. *HACCP training pack, ITC.*
2. *Food safety in food manufacturing volume 2, HACCP Europa.*
3. *Guidance 10, Product recall and traceability (Rev.3), 2013 Food Safety Authority of Ireland,*

Annex 6: Finished product analysis

Finished product sampling is useful as a verification tool to guarantee that the product and process meet set specifications.

Microbiological monitoring of finished product

The development and application of acceptance criteria for finished products and raw materials is discussed extensively by the International Commission for the Microbiological Specifications of Foods (ICMSF 2002).

Finished product testing may be used to verify the overall effectiveness of a food safety system. Due to statistical limitations finished product testing cannot ensure the conformance of a lot to safety requirements and is not effective as a preventive control; however, finished product testing may be useufil to evaluate the conformance of a lot to specified microbiological criteira (regulatory, customer or intrenal), and verify the overall effectivenss of contorl measures.

Such testing may be conducted within-lot or between-lot testing to demonstrate that a lot or production line is under control. Within-lot finished product testing may be conducted periodically or on each lot in response to regulatory or customer requirements. Where such testing is required as part of the contractual agreement with a customer, a Certificate of Analysis (COA) is usually provided indivating the laboratory results. In some cases regulators may require fnished product testing on a periodic frequency. Manufacturers will desing control measures and conduct their own testing more frequently to ensure that their system is able to meet regulatory criteria.

The design and use of finished product monitoring is based upon a variety of factors, including:

- Sensitivity of finished product (growth, no growth, application of a lethal process)
- Exposure of product during processing (i.e. assembled, post-lethality exposed vs. in-pack pasteurization or hot fill);
- Performance objective/criteria established for the finished product;
- Results of environmental monitoring or other verification of process environment hygien;
- Risks associated with raw materials.

In some cases it is practical to routinely examine each lot only for hygiene indicators, such as Enterobacteriaceae, coliforms or total plate count. Products that exceed a threshold on this initial examination are subject to evaluation in a detailed examination to evaluate conformance to complete

criteria (including pathogens and indicators as defined in the finished product criteria).

Thenecessity and frequency of monitoring may be adapted by the level of concern of hygiene of the product and process. An example of such adjustment is included in Table A 6.

Finished product specifications take into account relevant regulatory or customer requirements,

the hazards that may be present in raw materials and the environment, the nature of the product and process, and intended use of the material as determined in the HACCP study. Specifications include pathogens of concern as well as relevant indicator organisms, defined sampling plans and methodology. Sampling plans included in specifications should follow ICMSF format, with stringency based upon the severity of the pathogen of concern, the use of the product and the sensitivity of the consumer. Stringency may also be increased for new products or production lines, or where prior history of the product or process lead to a heightened concern.

Table A6: Example of the frequency of microbiological testing of finished products in a verification

Level of Hygiene Concern	Finished Product Testing	Notes
Routine/normal	Periodically based upon risk	Periodic evaluation to verify conformance to complete specification. Routine evaluation may be conducted for hygiene indicators, with evaluation against complete specification if threshold is exceeded
Elevated concern	Each production line/week	Evaluation to verify conformance to complete specification, including pathogens, hygiene indicator
High concern	Each lot	Evaluation to verify conformance to complete specification, including pathogens, hygiene indicator

Reference:

1. *Relevance of microbial finished product testing in food safety management, Marcel H. Zwietering et al., Food Control, Volume 60, February 2016, Pages 31-43, Elsevier*
2. *Food Safety Management: A Practical Guide for the Food Industry, 1st Edition, Editors: Yasmine Motarjemi, Huub Lelieveld.*

Annex 7: Agricultural waste

The first goal of an agricultural waste management system is to maximize the economic benefict from the waste resource and maintain acceptable environmental standards. To be practical, the system must also be affordable and suitable to theoperation. If wastes are not handled properly, they can contribute to pollution.

Spoiled fruits and vegetables, dead plants, branches, leaves and unsold fruits and vegetables, animal dungs and plastics (from wrapping and containers).

The principle that put into practice waste management are the four Rs.

- *Reduce* the amount of waste generated
- *Resue* waste on farm or inputs to other processes (e.g. gums extracted from degumming of sunflower oil is a high value emulsifier in paint industry)
- *Recycle* the waste product remaining after reducing and reusing (e.g. manures, plastics)
- *Recover* methane gas from manure waste

By-products/wastes may be used for

- Compost
- Animal feed
- Biofuels (gas/electricity)
- Value addition (e.g. preserving, drying, flours)
- Chemical extraction – e.g. citric acid, lactic acid, acetic acid, pectin.
- Building materials
- Glass and ceramics

Waste intendend for the 4Rs must be separated effectively and stored correctly, not scattered around enabling flies and other pests to feed upon and transmit diseases.

Only after considering the the four Rs should farm waste be disposed of. Environmental guidelines and regulations must be followed in treating and disposing waste.

References:

Agricultural waste management, Environment Canada.

Annex 8: Good storage practices

Good storage practices are an important part of a food safety plan. When stored incorrectly or not used in a timely manner, food can become unsafe to eat. Unsafe storage practices could allow for contaminants to get into food (e.g. workers eating and drinking in storage area, pests, chemicals or other contaminants dripping through cracks or holes in roofs or walls). Unsafe storage temperatures could allow for naturally occuring bacteria in food to grow to hazardous levels.

Following practices can help to keep food safe during storage.

- Store food only in designated and marked storage area.
- Keep store room clean, dry and well ventilated.
- Maintain storage temperature between 10-21°C and humidity between 60-70% (the ideal storage temperature may differ depending on the product).
- Check temperature and humidity daily.
- Have a regular cleaning schedule for all surface and floors.
- Store all foods 6 inches above the floor and 6 inches away from the wall.
- Store food in durable containers or jute bags that are sealed and cannot be damaged by water or pests.
- Keep food labeled, with name, delivery and use by / expiry date.
- Use the First In First Out (FIFO) method of inventory. Store new products behind the old products Rotate the stored products to ensure that the oldest food is used first.
- Protect food from contamination with regular pest control.
- Store food away from chemicals and toilets.
- Look for damaged, spoiled foods, bulging cans, infested packages, and foods and clean the area thoroughly immediately
- Discard or destroy all contaminated foods or foods that is past its expiry date. Store discarded foods separately with a clear “do not use” indication.
- Do not allow cross-contamination.

- There should be no eating, drinking, smoking, spitting, etc. inside the storage area. Checks should be carried out for any consumed products lying in the storage area.
- Personnel should not climb on racks or sit on products.
- Use preferably plastic pallets for storage. If wooden pallets are used, ensure they are cleansed and sanitized, do not have protruding parts that can damage food containers.

Annex 9: An example of a processing plant sanitation master schedule

Area	Cleaning/Sanitation Method	Tools	Cleaning Materials	Frequency
Walls	Foam, brush, rinse	Soft nylon brush and High Pressure Hose (when appropriate)	Chlorine-Quaternary ammonium ("quat")-based cleaner	Once/Month Walls adjacent to processing equipment should be cleaned daily
Ceiling	Foam, brush, rinse	Nylon brush, high pressure machine	Chlorine-quat-based cleaner	Once/Month
Floors	Wash, rinse	Hard bristle broom (not straw), floor scrubbers, low pressure hose	Chlorine-quat-or iodine based cleaner	Daily
Doors	Foam, scrub, rinse	Scouring pad, cloth	Chlorine-quat-based cleaner	Once/Week
Plastic curtains	Foam, rinse	Foam and Rinse	Chlorine-quat-based cleaner	Once/Week
Overhead pipes, electrical conduits, structural beams	Foam, brush	Brush, bucket, high water pressure machine	Chlorine-quat-based cleaner	Once/Month
Hoist, overhead light fixtures	Wipe, clean	Cleaning pad	Water, light detergent	Once/Quarter
Refrigeration coils	Rinse, sanitize	High pressure hose	Water, sanitize with quat	Once/Quarter

Chillers	Scouring	Scouring pad	Acid cleaner	As Needed/Audit
Air distribution filters	Soak	Plastic bins	Chlorine-alkaline detergent	Once/Quarter
Drains, trench	Clean, flood, rinse	Soft Nylon brush, 50 gallon container	Chlorine-alkaline detergent, quat or iodine based sanitizer	Daily
Grids	Brush, rinse	Nylon brush, high water pressure machine	Chlorine-alkaline detergent	Daily
Waste, dumpster areas	Foam, brush, rinse	Nylon brush, high water pressure machine	Heavy duty chlorine-based cleaner	Daily
Employee break rooms/bathrooms	Wash, rinse	Nylon brush, sanitary brushes	Chlorine-based soap or quat	Frequently throughout the day
Maintenance areas	Scrub, rinse	Nylon brush	Degreasing agent	Once/Month

(Source: United States, Food and Drug Administration (USFDA), Guidance for Industry: Guide to Minimize Microbial Food Safety Hazards of Fresh-cut Fruits and Vegetables)