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* PU: Public; PP: Restricted to other programme participants (including the Commission Services); RE: Restricted to a group specified by the consortium (including the Commission Services); CO: Confidential, only for members of the consortium (including the Commission Services)

CSIR trained during the kick-off meeting the partners involved in sample collection the methodology of doing HACCP studies in a practical environment.

Partners have then to conduct their individual HACCP studies in their own countries as samples are being collected, according to the training protocol described during the session. The training sensitised partners to evaluate the processing methods for critical control points.

Material for the HACCP training was prepared by the South African group, Prof EM Buys from the University of Pretoria – part of the CSIR – AFTER team. In this document you will fine the training support materials on HACCP.

Proposed Questionnaire

Hazard Analysis and Critical Control Points (HACCP) audit guide for AFTER project

STRUCTURE OF THIS DOCUMENT

This document is intended to provide:

- A guidance checklist for auditing PRPs for small and less developed (cottage) food businesses
- Provide guidance checklist for auditing HACCP plan/ system
- Provide a checklist for verification of he HACCP system

INTRODUCTION

The USA position on imports is that the country of origin must have food safety management system or HACCP plan that is equal to or better than the requirements expected of a company in the USA.

Centre for Disease Control (CDC) lists 5 most common risk factors that cause foodborne illnesses:

- Practicing poor personal hygiene
- Improperly cooked food
- Holding foods at wrong temperatures
- Using equipment that has not been properly calibrated, cleaned and sanitized
- Buying food from unsafe suppliers

HACCP provides continual self inspection, consequently, regulatory bodies have access to documentation that food safety is practiced at all times. This encourages a proactive attitude to food safety instead of reacting to out-of-control procedures.

HACCP is defined as a systemic approach to the identification, evaluation and control of food safety hazards based on the following 7 principles

1. Conduct a hazard analysis
2. Determine critical control points
3. Establish critical limits
4. Establish monitoring procedures
5. Establish corrective actions
6. Evaluate verification procedures
7. Establish record keeping and documentation procedures

The Codex Alimentarius code of practice recommends a HACCP based approach wherever possible to enhance food safety. The HACCP philosophy states that biological, chemical and physical hazards at certain points in the flow of food can be prevented, removed or reduced to safe levels.

Establish a HACCP team: The team should include personnel who are knowledgeable about:

- Equipment used
- Food operation
- Food microbiology
- HACCP principles

It is the team's responsibility to determine the **scope** of the HACCP plan. The team should define the flow of food(s) to be studied, be specific with the processes and products, and identify biological, chemical and physical hazards to be included.

Based on guidelines for the application of the HACCP system to small and/or less developed businesses, recommended international code of practice for food hygiene and Basic texts: Hazard Analysis and Critical Control Points (HACCP) system and guidelines for its application

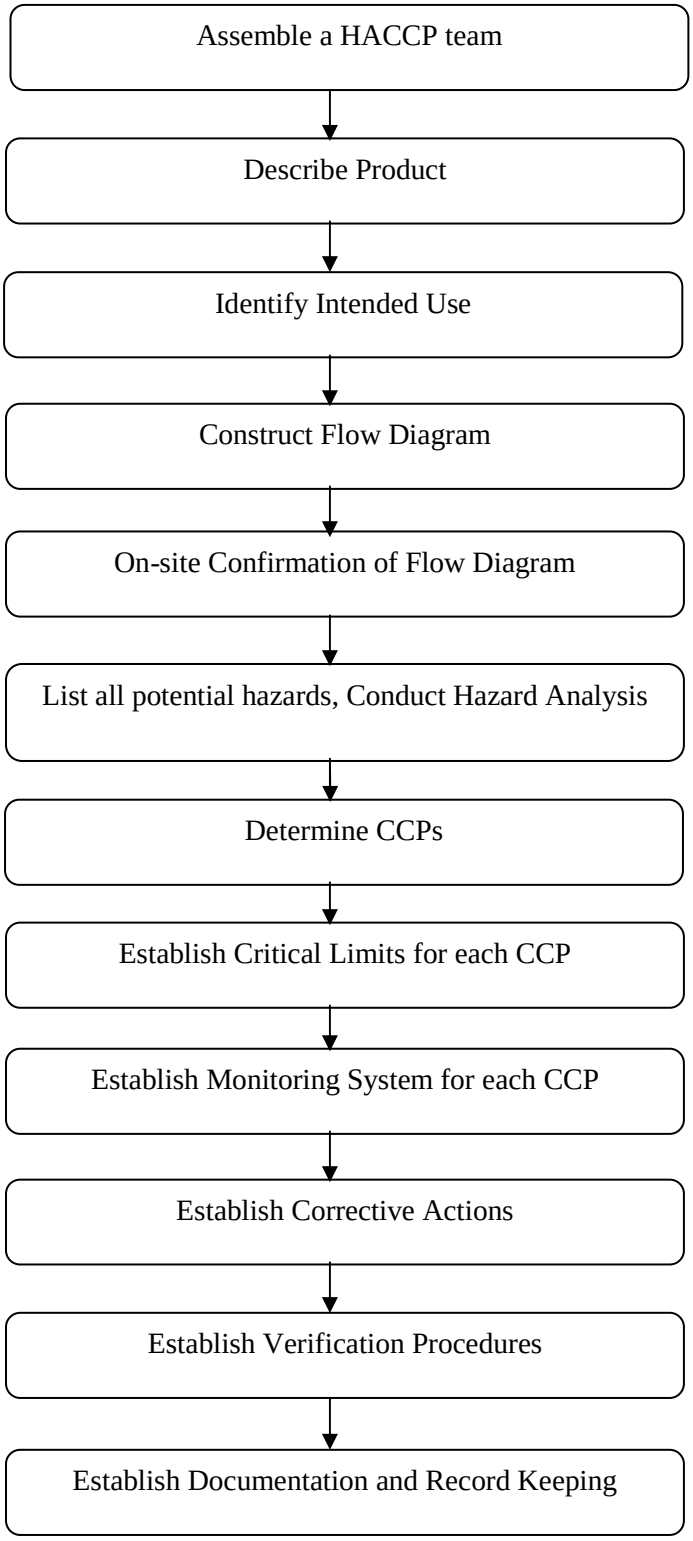
Hazard Analysis and Critical Control Points (HACCP) System – General requirement/guidelines

- *Prior to the application of HACCP, the food sector should have prerequisite programmes in place such as GMP, or GHP according the CODE general principles of food hygiene, the appropriate code of practices and appropriate food safety requirements (legislation). The Prerequisite programs should be well established, fully operations and verified to facilitate successful application and implementation of HACCP*
- *The intent of the HACCP system is to focus control at CCPs. Redesign of the operation should be considered if a hazard which must be controlled is identified but no CCPs are found*
- *HACCP should be applied to each specific operation separately.*

- *The HACCP plan should be reviewed and necessary changes made when a modification is made to a product, process or any step.*
- *Management awareness and commitment is necessary for effective HACCP implementation*
- *It has been recognized that when applying HACCP (especially for small and less developed businesses), flexibility appropriate to the business should be exercised but in either case all seven principles must be applied to the HACCP system*

When preparing HACCP, reference should be made to the Codex code of practice of food hygiene, relevant legislation and codes of practice or guidelines relevant to the specific product (i.e. all general food safety legislation applicable in your country)

- **Logical sequence for application of HACCP**



▪ Audit checklist of HACCP plan

S: Satisfactory U: Unsatisfactory (no evidence of documentation/records) N/A: Not applicable

Assessment criteria	Compliance S U N/A	Objective evidence/ comments
1. Conduct a hazard analysis **1.1 Assemble a HACCP team** i. Is there evidence of a multidisciplinary team with a team leader? • E.g. Those responsible for quality/ technical, production operations, engineering, finance, marketing etc. Evidence could be in the form of their qualifications, appointment letters etc. • In the case of a one-man HACCP 'team' is there evidence of expert advice from consultants, trade bodies, local authorities, academics etc? ii. Is the HACCP team leader able to demonstrate competence in the understanding of the application, implementation and review of the HACCP principles? E.g. the HACCP team leader should have formal training on HACCP • In the event that the company does not have the expertise in-house for a HACCP team leader, is external expertise sought and used to develop, implement and review the HACCP system? • In the event of the above, does the day-to-day management of the HACCP system remain the responsibility of the company? iii. Is the team knowledgeable about HACCP? • Is there evidence of training on HACCP? • If training is conducted in-house, is there evidence of completion of training? iv. Is there evidence of involvement in conduction of hazard analysis e.g. minutes of initial and review meetings? v. Is there evidence of senior management commitment to HACCP In small businesses, senior management (or owners) could be part of the HACCP team. Look out for financial commitment to HACCP system, attendance to meetings etc. NB: seek evidence of proper expertise in-house or adequately sought from outside the operation.		

1.2 Describe the Product i. Are all products and processes included in the scope described? • This includes all product variations, packaging, all food safety aspects related to the products e.g. pH, a_w, temperature control, storage conditions, etc. ii. Are references made to scientific literature, Codex code of practice, legislation and guidelines specific to the company's products? iii. Is there evidence of these documents? iv. Are the documents updated as necessary?		
1.3 Identify Intended Use Some considerations: Consider the nature of the likely consumer and vulnerable groups. • Is there any possibility of mishandling of the food prior to consumption that will result in a food safety hazard? What are the circumstances in which the product will be used? • Does the product have to be cooked by the consumer? • If so, are there cooking instructions? • Have the instructions been verified? • If the product is already cooked and does not require any further preparation by the consumer, are there storage instructions. (NB: consider hazards that might occur when the product leaves the production premises)		
1.4 Construct a Flow Diagram i. Is the flow diagram simple to follow? ii. Does it include all necessary steps? iii. Have steps before and after manufacturing of the product been included in the flow diagram? • Have as many flow diagrams as necessary for the food operation		
1.5 On-site Confirmation of Flow Diagram • This is the verification of the flow diagram against the actual process flow • Confirm the flow diagram during all stages and hours of production i.e. consider all shifts and note any variations in the process flow i. Is there evidence of an internal audit? ii. Has the flow diagram been reviewed and modified where necessary?		

PRINCIPLE 1: Conduct a hazard analysis

According to the FDA food code (2005) a hazard is a biological, chemical or physical property that may cause a food to be unsafe for human consumption.

Confirm all products and processes within the scope of the HACCP plan. List all potential hazards that are not controlled by pre-requisite programs at each processing step for all products. Considerations should be made to steps preceding and following processing. Also potential microbiological, chemical and physical (see Annex) hazards as well as allergens in raw materials, actual processing and hazards that may survive processing shall be considered. The list should be comprehensive but it should also be specific and relevant to the product.

> E.g. A small company making bread rolls and other bakery products produced sesame seed buns. However they neglected to include the risk of cross-contamination if sesame seeds into products which do not contain sesame as a potential hazard. Therefore they had not considered the risk of this potential allergen appearing in their sesame-free products and it was missing completely from their hazard analysis and their HACCP system. A non conformity resulted.

Assessment criteria	**Compliance** **S U N/A**	**Objective evidence/ comments**
1.6 List all potential hazards associated with each step, conduct a hazard analysis, and consider any measures to control identified hazards **A. List all potential hazards associated with each step** i. Are potential hazards documented ii. Is the list comprehensive? iii. Have allergens been considered in the list as well as possibility of cross-contamination prior to processing, during processing and after processing? **B. Conduct a hazard analysis** i. Are there records of initial and latest hazard analysis of all relevant hazards that can be prevented, eliminated and reduced to acceptable levels? • Have the occurrence and severity of the hazard been considered and rated? E.g. what is the likelihood that a hazard will occur and what is the risk if that hazard does occur? ii. Has there been qualitative and quantitative evaluation of the presence of hazards? iii. Is there indication, where necessary, the possibility of microbial survival and proliferation and conditions		

that might affect their survival, e.g. pH, temperature? iv. Are there toxins, chemicals or physical agents that are produced or persist in the production process? • E.g. pesticide residues or mycotoxins that may be present in raw materials or developed through poor storage. Also considerations should be made to foreign bodies e.g. from packaging, non-organic products in organic products, presence of genetic modified ingredients etc. **C. Consider any measures to control identified hazards** i. Which hazards will be prevented, eliminated or reduced to acceptable levels at what steps in the process flow? ii. Have all possibilities of controlling a hazard been given? iii. In an event where a hazard cannot be eliminated but reduced to acceptable levels in the finished product, have the limits been given and justified?		

PRINCIPLE 2: Determine the Critical Control Points

The CCP is an essential step or procedure in the flow of food where hazards can be prevented, eliminated or reduced to acceptable levels. Loss of control at this point can lead to an unacceptable health risk. If loss of control occurs at a point in the process flow and there's any a minor chance of contamination, and there is not an unacceptable health risk, then that control point is not critical, and can be controlled with PRPs.

To identify CCPs, the following questions should be asked (Paster, 2007).

- Can the food being prepared become contaminated?
- Can contaminants multiply at this point?
- Does this step eliminate or reduce the likely occurrence of a hazard to an acceptable level?
- Can corrective action(s) be taken to prevent this hazard?
- Is this step the last chance to prevent, eliminate, or reduce hazards before the food item is consumed?

The Codex Alimentarius Commission recommends the use of the decision tree[2] to determine if the operational process is not a CCP.

Assessment criteria	Compliance S U N/A	Objective evidence/ comments
2. Determine CCPs i. Have CCPs been developed in a logical way? ii. Are they comprehensive; are all process steps included? iii. Are there records of the decision tree/ decision process?		

PRINCIPLE 3: Establish Critical Limits for each Critical Control Point

A critical limit is the specific scientific measurement that must clearly indicate what needs to be done and must be met for each CCP. Codex suggests that *Critical limits must be set and validated for each CCP. Critical limits should be measurable.*

Critical limits must be realistic and attainable and must be met for each CCP. If critical limits are not met, corrective actions must be performed. Relevant legislation and codes of practice should be taken into account.

Parameters that can be set and validated for CCPs include but are not limited to: salt concentration, time-temperature combinations, pH, water activity, viscosity, humidity, titratable acidity, moisture, free available chlorine, odours, visual appearance, etc.

Assessment criteria	Compliance S U N/A	Objective evidence/ comments
3. Establish critical limits for each CCP i. Is there a record of a clear description of critical limits for each CCP listed? ii. Are the critical limits being applied correctly? iii. Are there records showing validation of critical limits i.e. are critical limits being met consistently at each CCP? (records to look for include checks, audit reports, customer complaints etc) • *E.g. A bakery producing cakes, pastries and other confectionery had the sieving of flour down as a CCP for preventing contamination. However, they had not given a critical limit for this, such as mesh size for the sieve. A nonconformity was given*		

• If critical limits are based on subjective data, such as visual appearance, there should be clear guidance or standards to justify it e.g. photographic standards, colour charts or written descriptions.		

PRINCIPLE 4: Establish a Monitoring System for each Critical Control Point

Monitoring is the scheduled measurement or observation of a critical control point relative to its critical limits. Monitoring requires the use of appropriate tool to get accurate reading. Monitoring identifies loss of control at CCPs. Monitoring procedures for CCPs need to be done rapidly because they relate to online processes and there will not be time to correct loss of control if lengthy analytical testing is conducted. For that reason, physical and chemical measurements are preferred to microbiological tests because they are done more rapidly.

Assessment criteria	**Compliance** **S U N/A**	**Objective evidence/ comments**
4. Establish a Monitoring System for each CCP i. Are there SOPs for monitoring of CCPs? The SOPs should be detailed including description of monitoring procedures, frequency and those responsible for monitoring CCPs ii. Are records and monitoring documents dated, verified and signed by a person of authority?		

PRINCIPLE 5: Establish Corrective Actions

Corrective actions are predetermined steps that should be taken if critical limits are not met to bring the critical control point back into control. Also, corrective actions should be taken when results indicate a trend towards loss of control. This clause is targeted on potentially unsafe products. Such products must not be released until it can be confirmed as safe. Tasks that need to be performed when taking corrective action are:

- Establish exact cause of deficiency
- Determine who is to correct the problem
- Correct the problem decide what to do with the product
- Record the corrective actions that were taken

Assessment criteria	Compliance S U N/A	Objective evidence/ comments
5. Establish Corrective Actions i. Has personnel been designated to take corrective action when critical limits are not met? ii. Have definitive critical actions been described in the HACCP plan for each CCP? iii. How do you handle potentially unsafe products? iv. What criteria are evaluated to determine if a nonconforming product can be released, reprocessed or disposed? Do you have relevant records and procedures for the above criteria? E.g. reprocessing records v. What do you do with products that are not acceptable for release? E.g. safe disposal certificates • Is action taken on products made when CCPs are out of control? i.e. are nonconforming products isolated, what happens to the products after they've been isolated? • *E.g. At an automated bread bakery the auditor found that the corrective action for when the freezer temperature was outside of set limits just stated "call engineer". Also, there was no indication as to what to do with the affected product.*		

PRINCIPLE 6: Establish Verification Procedures

Verification procedures confirm that the steps of the HACCP plan are working efficiently through provision of objective evidence. Verification procedures include random sample analysis, internal audits, tests, review of various deviations and deposition of non-conforming products etc. Other factors to consider are customer complaints, foodborne outbreaks, recalls, incidents with local authorities, etc

Assessment criteria	Compliance S U N/A	Objective evidence/ comments
6. Establish verification procedures i. Is there a designated person to perform verification? ii. Are there recorded procedures for verifying the		

HACCP system? iii. Is there continuous review of logs, records, corrective actions, audits, etc of the HACCP plan? E.g. are there checks that CCPs are being monitored and recorded iv. Is the frequency of the checks and reviews sufficient? v. How are reviews of corrections carried out? Are nonconformance reports being reviewed? vi. How do you know corrective actions are effective? vii. Is there evidence of communication with the HACCP team?		

PRINCIPLE 7: Establish Documentation and Record Keeping

HACCP system involved keeping all documentation (plans and procedures) and records. These will assist in verification of the efficiency of the HACCP system; it also indicates conformity or nonconformity of an operators HACCP system.

Assessment criteria	**Compliance** **S U N/A**	**Objective evidence/ comments**
7. Establish Documentation and Record Keeping i. Evidence of all records and documents cover the entire HACCP system, they are complete, accurate, in the correct format and properly filled out ii. Records should be easily available		

Examples of documents and records

Documents	**Records**
Information used in scope of HACCP system i.e. CODEX requirements, local and international legislation, code of practice etc	
Appointment letters defining responsibilities, job profiles, CVs	Qualifications, certificates
Flow diagram	

	Signed flow diagram
HACCP plan	
	List of hazards at each process step and their acceptable levels/ classifications
Documented procedures/ scientific literature etc for identification and assessment of hazard	HACCP plan
CCP limits and why	
	CCP logs, monitoring records
Monitoring procedures	
	Monitoring records, observation of critical limits
Procedure for nonconforming/potentially unsafe products	
	Records of corrective action
Validation procedure	
	Calibration schedule
	Certificate of calibration
Verification procedure	
	Validation and verification logs
	Records of PRP and CCP checks
	Communication methods
	Audit findings

- **PRE-REQUISITE PROGRAMS (aka GMP, GHP, site standards)**

1. Structure (Location, perimeter and grounds)

Requirements	**Conformance** **Yes, No, N/A**
1. Location i. Is the processing facility situated in an area where local activities and the environment do not adversely impact food safety? • Considerations: are there environmental pollution, industrial activities, flooding, pest infestations, dumping of waste etc in the environment that will impact food safety? ii. If measures have been taken to prevent contamination from environmental activities, is there evidence that these measures are reviewed regularly? iii. Are the boundaries of the facility clearly defined?	
2. Premises and structures **2.1 Grounds** i. Are the external areas of the facility kept tidy and maintained in good order? ii. Are the surrounding areas hard paved or debris free? iii. Are driveways, dumpsters and parking lots paved and sloped to drains iv. Is drainage adequate and maintained in good order? v. Where storage is on the outside of the production facility, have items been protected from contamination and deterioration? vi. Is solid and liquid waste kept in non-leaking, covered waste containers situated on concrete slabs away from the production area? If waste containers are not stored in a closed waste room, they must be fitted with tight fitting lids vii. If waste containers are not lined, are they washed after they are emptied? viii. Is the area around the waste containers kept clean to minimize attraction and pests and prevent cross-contamination? ix. Are areas for cleaning waste containers physically and operationally separated from food production facilities? x. Are measures being taken to prevent entry of contamination from trucks, vehicles or by foot into the production facility? xi. Are the grounds routinely monitored for pest infestations? How are pests being controlled? (Are there evidence of pest infestation e.g. rodent droppings, bird excreta, decomposed rodents, burrows, urine stains, flies etc) **2.2 Roofs and outside structures** i. Are roofs designed with down spouts to drain rainwater	

ii. Are roof penetrations for vents, oven vents and air handling systems sealed to prevent water leakage and interior air and surface contamination?
iii. Are valleys and gutters maintained to prevent contamination of food and materials used in food preparation or presentation?
iv. Are roofs, gutters and valleys kept clear or debris (including insects and dead birds) and inspected at appropriate intervals. (Weekly inspections are recommended)

2.3 Walls

i. Are walls designed, constructed, finished and maintained to prevent accumulation of dirt, reduce condensation and mold growth to facilitate cleaning?
ii. Are structural seams, cracks and crevices in walls and ceilings sealed to prevent entry of insects and rodents and inhibit debris collection and microbial contamination?
iii. Where appropriate, are walls protected from damage by moving equipment?
iv. Are areas where the wall meets the floor coved (rounded at 2.5 cm radius or sloped at a 40°-50° angle) to increase cleaning effectiveness?

2.4 Floors

i. Have floors been designed and constructed with durable, water resistant material to meet the demands of the food process and withstand cleaning materials and methods?
(e.g. Floors must withstand structural, thermal and mechanical stresses relevant to the process and must be sloped to drains)
ii. Are floors maintained in good conditions? i.e. free from cracks, holes or corrosion?
ii. Are floors in wet areas adequately sloped to drains?

- To prevent water pooling and potential microbial growth, floors shall be smooth and have a continuous slope toward trapped drains. A 1–2 per cent slope is suggested (i.e. 2–4 cm toward the drain).
- Areas that do not drain well must be mopped daily (and as spills occur) to minimize pooling and the potential for cross-contamination.
- Because floor drains can sometimes harbour pathogenic microbes (e.g., *Listeria*), drain covers shall be easily removable to facilitate regular cleaning.
- There should be an adequate number of floor drains to effectively drain liquids. A suggested guideline is one floor drain per 40 sq. m of floor area.
- The minimum recommended drain cover size is 30 cm^2.
- All drains should be trapped and vented and of adequate size to carry peak drainage loads. A minimum diameter of 10 cm is recommended.
- Trench drains shall flow from cleaner to dirtier areas.

2.5 Ceilings and overheads

i. Are ceilings and overhead designed, constructed, finished and maintained to prevent accumulation of dirt and mold growth
ii. Are ceilings smooth, impervious to water and dust and easy to clean?
iii. Are any internal point of access to outside roofs and structures controlled to preclude footborne soil from being brought into the plant?
iv. Are areas where dirt and debris accumulate cleaned regularly?
v. Where false ceilings are used, is adequate access to the void provided to facilitate cleaning, maintenance of services and inspection for pest activity?

2.6 Doors and windows

i. Are doors, windows an window frames kept clean, in good condition and free from mold growth and flaking paint?
ii. Are glass windows protected form breakage?
(When possible, windows shall be constructed of unbreakable material. Where glass windows are installed, they should be protected against breakage to minimize potential for contamination of broken glass)
iii. Are windows that can be opened fitted with fly screens?

- Windows should be tight fitting to prevent entry of pests and airborne contaminants. Window sills and ledges should be sloped at 45–60º to lessen the accumulation of dust and dirt and to discourage their use as a shelf.
- Windows that open must be fitted with screens fine enough (22 mesh or finer is suggested) to not only prevent entrance of insects but also allow easily removal for cleaning.
- Windows (both interior and exterior) that view food processing areas shall not be opened.
- Damaged windows and screens shall be repaired promptly.

iv. Where external doors to raw material handling, processing, packaging and storage areas are opened, are suitable precautions taken to prevent ingress of pests?

- If external doors cannot be kept closed, then they shall be fitted with plastic strip curtains, rubber swing doors or an appropriate alternative used.
- Doors should have smooth, non-absorbent surfaces, be easy to clean and sanitize, and be able to withstand normal use and cleaning.
- They shall be wide enough to allow product and vehicles to pass through without contacting (and potentially damaging) the door frame.
- Exterior doors, cold storage room doors and production area doors shall be self-closing.

• All doors must be tight fitting and may be equipped with brush seals to discourage pest entry. **2.7 Furnishings** i. Are furnishings designed, constructed and maintained to prevent accumulation of dirt, prevent contamination and facilitate cleaning? • Furnishings shall ideally be constructed of metal or plastic. If constructed of wood or a wood based product, the furnishings shall have a finish that is non-toxic and easy to clean. • Wood based furnishings shall not be used in high risk areas	
3. Cleaning and disinfection i. Is there an established and documented cleaning procedure for cleaning all food contact surfaces, including plant and equipments, walls, floors, windows, gullies and ancillary structures? The cleaning program shall include where appropriate, dry cleaning, wet cleaning, disinfection and sterilization, and cleaning of overhead surfaces ii. Is there a cleaning program for each room r group of rooms, production area and the exterior of the production plant and outside structures Cleaning & sanitation programme cover: • All food handling areas • All exposed food contact surfaces • Non-food contact surfaces (including production facility, equipments, conveyors, gullies, overhead structures, air vents, screens, ancillary structures) • Equipment, sampling utensils, manual agitators, mixers, canopies, • Re-useable containers & waste containers • Roofs, outside structures, overhead surfaces, valleys, gutters (shall be free from debris, bird droppings & accumulated water) • Walls (shall be free from cobwebs, dampness, condensation, mould, flaking paint) • Doors, windows & window frames (shall be free from mould, dirt, flaking paint) • Floor, floor drains & channels (shall be free from litter, accumulated water, oil) • Sieves & filters (shall be free from debris, cobwebs, mould) • Pumps shall be stripped down and cleaned • Lifts shall be free of dirt, mould, flaking paint, rust • Sewage lines / holes • Transport vehicles, tankers, bulk units, bulk containers, including their internal surfaces • Roadways & yards • Personnel facilities, change-rooms, toilets, canteens, eating rooms, visitor rooms	

iii. Is there a documented procedure to check where appropriate the efficiency of cleaning by microbiological analysis, swabbing of surfaces or appropriate means?

iv. Are plants and equipments cleaned frequently as appropriate?

Frequency of cleaning/ sanitization

- Food contact surfaces including utensils and equipments shall be cleaned whenever there is a change from handling raw products or components of raw products to ready-to-eat products
- Food contact surfaces shall be cleaned and sanitized whenever there is contamination in the course of operation
- Cleaning-in-place equipment shall be cleaned and sanitized daily
- Generally, operations (food contact surfaces) shall be cleaned and sanitized once a day but regular deep cleaning of non-food contact surfaces are necessary
  - E.g. Walls, ceiling, overhead pipes and maintenance areas shall be cleaned once a month
  - Doors and plastic curtains shall be cleaned once a week
  - Drains, grits, floors and waste bins and areas shall be cleaned daily
  - Break rooms and bathrooms shall be cleaned throughout the day
- Food contact surfaces on stationary equipments shall be removed, if possible, for cleaning and sanitization daily. If the food contact surface is fixed, it should be washed and rinsed manually and treated with sanitizer (either a chemical solution or hot water).

v. Are there sufficient tanks/sinks suitable for immersion of equipments available for cleaning purposes?

vi. Are detergents and disinfectants stored in an area segregated from food processing/storage area and clearly labeled or marked?

vii. Are cleaning chemicals approved and adequate? Are they purchased from reputable suppliers?

viii. Are eye washing and shower stations available or close to areas where hazardous chemicals are mixed or dispensed?

ix. Are cleaning objects made of appropriate materials?

- All brooms and hand brushes used to clean in the production area shall be made of material other than wood, shall have nylon bristles, which should, ideally, be coloured to enable detection of detached bristles, shall be kept clean and in good condition and, when not in use, shall be hung up with bristles facing downwards, to aid drying.
- Brushes used for floors shall not be used on equipment surfaces.
- When using cleaning cloths and scouring pads, care shall be taken to ensure that they are not a source of contamination, i.e. by being contaminated themselves or by being a source of foreign materials.
- Cleaning cloths of a woven fabric shall be used only if they are laundered and disinfected or sterilized according to a documented schedule. Alternatively, disposable or "one-day use" cloths can be used.

i. Are adequate precautions taken during cleaning or disinfecting to prevent food from contamination

ii. Are cleaning operatives trained to continually meet (at least) local and international standards?

ANNEX

a. Biological hazards

Annex 1: Selected biological hazards found at retail, associated foods and control measures

Hazard	Associated Foods	Control Measures
Bacteria		
Bacillus cereus (intoxication caused by preformed emetic toxin and infection y heat labile, diarrhoeal toxin)	Meat, poultry, starchy foods (e.g. rice and potatoes), puddings, soups, cooked vegetables	Cooking, cooling, cold holding, hot holding
Campylobacter jejuni	Poultry, raw milk	Cooking, hand washing, prevention of cross-contamination
Clostridium botulinum	Vacuum packaged foods, reduced oxygen packaged foods, under-processed canned foods, time-temperature abused baked potatoes/sauteed onions	Thermal processing (time and pressure), cooling, cold holding, hot holding, acidification, drying etc
Clostridium perfringens	Cooked meat and poultry, cooked meat and poultry products including casseroles and gravies	Cooling, cold holding, reheating, hot holding
Escherichia coli O157:H7	Raw ground beef, raw seed sprouts, raw milk, unpasteurized juice, foods contaminated by infected workers via fecal oral route	Cooking, no bare hand contact with ready to eat foods, employee health policy, hand washing, prevention of cross-contamination, pasteurization or treatment of juice
Listeria monocytogenes	Raw meat and poultry, fresh soft cheese, smoked seafood, deli meats, salads	Cooking date marking, cold holding, hand washing, prevention of cross-contamination
Salmonella spp.	Meat and poultry, seafood, eggs, raw seed sprouts, raw vegetables, raw milk, unpasteurized juice	Cooking, use of pasteurized eggs, employee health policy, no bare hand contact with ready to eat foods, hand washing, pasteurization or treatment of juice

Shigella spp.	Raw vegetables and herbs, other foods contaminated by infected workers by fecal oral route	Cooking, no bare hand contact with ready to eat foods, employee health policy, hand washing
Staphylococcus aureus (preformed heat stable toxin)	Ready to eat potentially hazardous foods touched by bare hands after cooking and further time/temperature abuse	Cooling, cold holding, hot holding, no bare hand contact with ready to eat food, hand washing
Vibrio spp	Seafood, shellfish	Cooking, approved source, prevention of cross-contamination, cold holding
Parasites		
Taenia spp	Beef and pork	Cooking
Trichinella spiralis	Pork, beer and seal meat	Cooking
Viruses		
Hepatitis A and E	Shellfish, food contaminated by infected worker	Approved source, no bare hand contact with RTE food, employee health policy, hand washing
Other viruses (rotavirus, Norovirus, Reovirus)	Any food contaminated by infected worker	Approved source, no bare hand contact with RTE food, employee health policy, hand washing

Source: 2005 FDA food code

b. Chemical hazards: Common chemical hazards in retail, their associated foods and control measures

Hazard	Associated Foods	Control Measures
Naturally occurring		
Scombrotoxin	Associated with tuna fish, mahi-mahi, blue fish, anchovies bonito, mackerel; also found in cheese	Check temperatures at receiving, store at proper holding temperatures, buying specifications: obtain verification from supplier that product has not been temperature abused prior to arrival in facility
Mycotoxins:		
Aflatoxin	Corn and corn products, peanuts and peanut products, cottonseed, milk and tree nuts, pecans, pistachio nuts and walnuts. Other grains and nuts are susceptible but less prone to contamination	Check condition at receiving; do not use moldy or decomposed food.
Patulin	Apple juice products	Buyer specification: obtain verification from supplier or avoid the use of rotten apples in juice manufacturing
Toxic mushroom species	Numerous varieties of mushroom species	Do not eat unknown varieties or mushrooms from unapproved source
Pyrrolizidine alkaloids	Plant food containing these alkaloids. Most commonly found in members of Borginaceae, Compositae, and Leguminosae families	Do not consume food or medicinal contaminated with these alkaloids
Added chemicals		
Environmental contaminants: Pesticides, fertilizers, insecticides, antibiotics, growth hormones	Any food may become contaminated	Follow label instructions for use of environmental chemicals. Soil and water analysis may be used to

		verify safety
PCBs	Fish	Comply with fish advisories
Toxic elements/compounds: Mercury	Fish exposed to organic mercury: shark, tile fish king mackerel and swordfish. Grains treated with mercury based fungicides	Pregnant women/ women of childbearing age/ nursing mothers and young children should not consume these foods Do not use mercury containing fungicides on grains and animals
Copper	High acid foods and beverages	Do not store high acid foods in copper utensils; use backflow prevention device on beverage vending machines
Lead	High acid foods and beverages	Do not use vessels containing lead
Naturally occurring		
Nitrites/nitrates Niacin	Cured meats, fish, any foods exposed to accidental contamination, spinach Meat and other foods to which niacin is added	Do not use more than the prescribed amount of curing compound according to labeling instructions. Niacin is not currently approved for use in meat or poultry with or without nitrates or nitrites
Flavour enhancers Monosodium glutamate (MSG)	Snacks and condiments	Avoid using excessive amounts
Chemicals used in production and retail establishments (e.g. lubricants, cleaners, sanitizers, paints etc)	Any food could become contaminated	Address through SOPs for proper labeling, storage, handling and use of chemicals; retain MSDS for all chemicals
Allergens	Foods containing or contacted by: Milk, egg, fish, crustacean shellfish, tree nuts, wheat, peanuts, soybeans	Use of rigorous sanitation regime to prevent cross contact between allergenic and non-allergenic ingredients

(Paster, 2007)

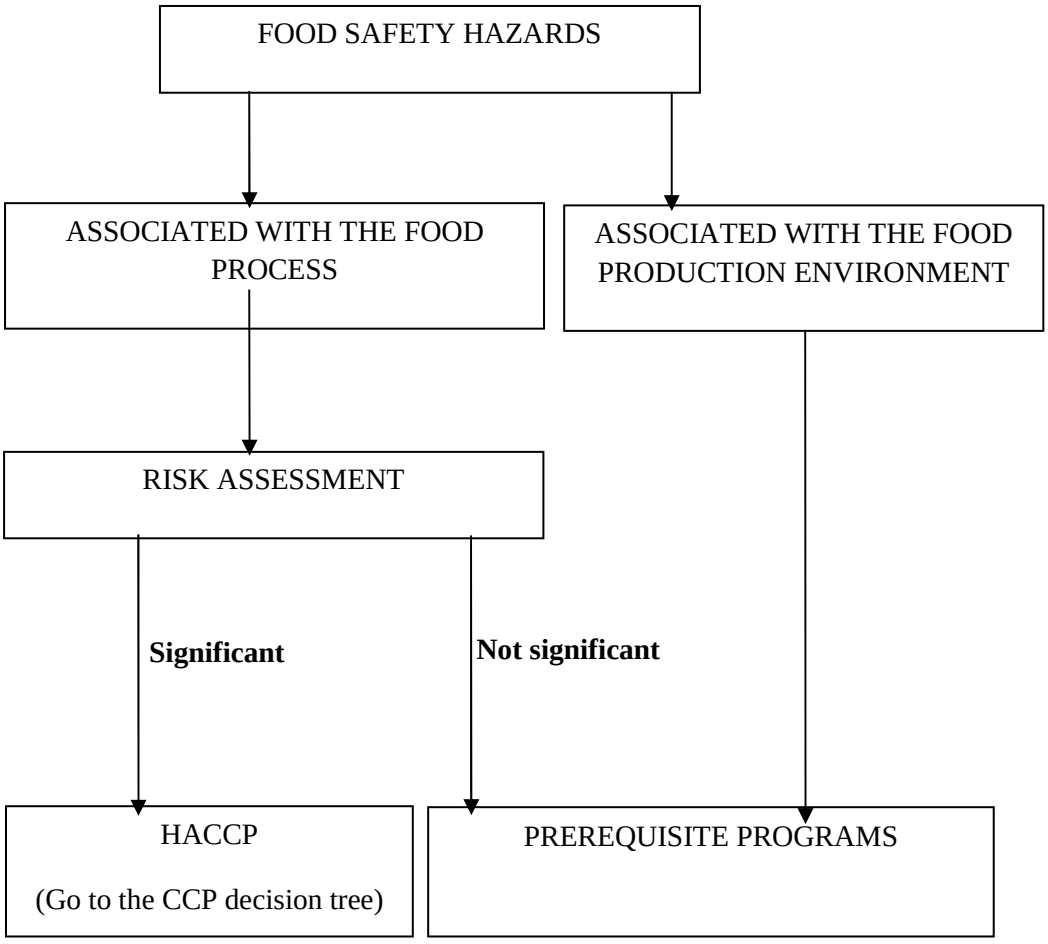
c. Physical hazards

Examples of materials of concern as physical hazards and common sources

Material	Injury potential	Sources
Glass fixtures	Cuts, bleeding; may require surgery to find or remove	Bottles, jars, light, utensils, gauge covers
Wood	Cuts, infection, choking	Fields, pallets boxes, buildings
Stones, metal fragments	Chocking, broken teeth, cuts, infection	Fields, buildings, machinery, wire, employees
Insulation	Choking; long term effects if asbestos	Building materials
Bone	Choking, trauma	Fields, improper plant processing
Plastic	Choking, cuts, infection	Fields, plant packaging materials, pallets, employees
Personal effects	Choking, cuts, broken teeth	Employees

(Paster, 2007)

Deciding prerequisites



Example of critical limits

Hazard	CCP	Critical limit
Bacterial pathogens (non-sporulating)	Pasteurization	72°C for at least 15 seconds
Metal fragments	Metal detector	Metal fragments larger than 0.5 mm
Bacterial pathogens	Drying oven	A_w<0.85 for controlling growth in dried food products
Excessive nitrite	Curing room/brining	Maximum 200 ppm sodium nitrite in finished product
Bacterial pathogens	Acidification step	Maximum pH of 4.6 to control *Clostridium botulinum* in acidified food
Food allergens	Labelling	Label that is legible and contains a listing of correct ingredients
Histamine	Receiving	Maximum of 25 ppm histamine levels in evaluation of tuna for histamine

Food quality and safety systems. A training manual on food hygiene

Process step/ incoming material	Category and identified hazard	Question 1	Question 2	Question 3	Question 4	CCP number
Mushrooms as delivered	***B*** *- pathogens*	***Yes*** *heat treatment*	*N/A*	***Yes***	***Yes*** *thermal processing*(*25*)	
	C *-pesticides*	***No*** *control is at farms/growers*				
	C *- heat-stable toxins*	***No*** *control is at farms/growers, storage*				
	P *- harmful extraneous material* (*HEM*)	***Yes*** *visual inspection and foreign object removal*	***Yes***	***No***		
Empty cans as delivered	***B*** *-post-process contamination from serious internal seam defects*	***Yes*** *can tear-down and inspection*	*N/A*	***Yes***	***Yes*** *closing and inspecting*(*23*)	
	B *- post-process contamination from serious external visible can defects*	***Yes*** *visual can inspection*	*N/A*	***Yes***	***Yes*** *inspecting/ depalletizing*(*9*)	
	C *- cleaning chemicals* (*GMPs*) ***P****-HEM*		*N/A*	***Yes***	***Yes*** *inspecting/ depalletizing*(*9*)	
Dry ingredients as delivered	***B*** *- bacterial spores*	***Yes*** *heat treatment*	*N/A*	***Yes***	***Yes*** *thermal processing*(*25*)	
	B *- rodent excrement* (*GMPs*)					
	P *- HEM* (*GMPs*)					
Water at intake	***B*** *- faecal coliform* (*GMPs*)					
	C *- heavy metals and other toxic chemicals* (*GMPs*)					
1. Mushroom receiving	***P*** *- HEM* (*GMPs*)					
2. Can/end receiving	***P*** *- HEM* (*GMPs*)					
3. Dry ingredient receiving	***P*** *- HEM* (*GMPs*)					

5. Mushrooms at receiving	***B** - growth of pathogens* (*GMPs*)					
	***P** - HEM* (*GMPs*)					
6. Can/end storing	***B** - post-process contamination because of damaged cans/ends*	***Yes** visual Inspection*	***No***	***Yes***	***Yes** inspecting/ depalletizing*(*9*)	
	***B** - rodent excrement* (*GMPs*)					
	***C** - cleaning chemicals* (*GMPs*)					
	***P** - HEM* (*GMPs*)					
7. Dry ingredient storing	***B** - rodent excrement* (*GMPs*)					
	***C** - cleaning chemicals* (*GMPs*)					
	***P** - HEM* (*GMPs*)					
9. Can inspecting/ depalletizing	***B** - post-process contamination because of incorrect cans or serious can defects*	***Yes** visual inspection*	***Yes***	***Yes***		***CCP 1* (*BP*)**
	***P**-HEM*	***Yes** visual inspection*	***Yes***	***Yes***		
11. Mushroom blanching	***B** - growth of thermophiles, textural changes affecting thermal process*(*GMPs*)					
	***B** - inadequate removal of gases* (*GMPs*)					
	***C** - cleaning chemicals* (*GMPs*)					
12. Can conveying	***B** - post-process contamination because of damage* (*GMPs*)					
	***P** - HEM* (*GMPs*)					
14. Mushroom conveying/inspecting	***C** - cleaning chemicals* (*GMPs*)					
	***P** - HEM* (*GMPs*)					
16. Mushroom slicing/dicing	***C** - cleaning chemicals, lubrificants* (*GMPs*)					
	***P** - HEM* (*GMPs*)					
18. Foreign object removal	***P** - metal fragments* (*GMPs*)					
19. Filling	***C** - cleaning chemicals, lubrificants* (*GMPs*)					
	***P** - metal-fragments* (*GMPs*)					

20. Weighing	***B** - product heavier than maximum fill weight in scheduled process*	***Yes** weighing*	***Yes***	***Yes***	***No***	***CCP 2* (*B*)**
21. Water filling	***B** - inadequate temperature resulting in low initial temperature (IT) for process*	***Yes** take IT just prior to thermal process*	***No***	***Yes***	***Yes** thermal processing(25)*	
22. Head-spacing	***B** - insufficient headspace resulting in distorted, potentially leaking seams*	*Yes*	***Yes***	***Yes***	***No***	***CCP 3* (*B*)**
23. End feeding/ closing/inspection	***B** - post-process contamination because of damaged ends*	***Yes** visual inspection*	***Yes***	***Yes***	***No***	***CCP 4* (*B*)**
	***B** - post-process contamination because of improperly formed seams*	***Yes** visual and teardown can inspection*	***Yes***	***Yes***	***No***	
	***C** - cleaning chemicals, lubrificants (GMPs)*					
25. *Thermal processing*	***B** - non-validated process or vent schedule could result in underprocessing and survival of pathogenic bacteria (GMPs)*					
	***B** - improper flow patterns for process could result in cross-contamination(GMPs)*					
	***B** - improper flow patterns for process could allow bypass of thermal process*	***Yes** use of heat-sensitive indicator*	***Yes***	***Yes***	***No***	***CCP 5* (*B*)**
	***B** - excessive delays between closing and retorting could result in excessive growth of pathogenic bacteria*	***Yes** monitor time lapse between the two operations*	***Yes***	***Yes***	***No***	
	***B** - lack of adherence to time, temperature and. other critical factors of scheduled process or vent schedule could result in inadequate heat treatment and growth of pathogens*	***Yes** control critical factors of scheduled process and vent schedule*	***Yes***	***Yes***	***No***	
26. Cooling	***B** - post-process contamination during cooling/contracting of cans because of*	***Yes** control chlorine level in cooling water*	***Yes***	***Yes***	***No***	***CCP 6* (*B*)**

	insufficiently chlorinated cooling water				
	***B** - post-process contamination because of leakage resulting from corrosion from excessive chlorine cleaning chemicals*	***Yes*** *control chlorine level in cooling water*	***Yes***	***Yes***	***No***
	***B** - insufficient chlorine contact time could lead to contamination* (*GMPs*)				
	***B** - insufficient or excessive cooling could result in thermophilic spoilage or contamination because of corrosion leakage* (*GMPs*)				
27. Conveying/drying	***B** - unclean wet equipment could lead to contamination* (*GMPs*)				
28. Labelling/storing	***B** - post-process contamination because of damaged cans* (*GMPs*)				
	***B** - growth of thermopiles* (*GMPs*)				
29. Shipping	***B** - post-process contamination because of damaged cans* (*GMPs*)				

Instructions:

• **Category and identified hazard:** Determine if hazard is fully controlled by adherence to Codex General Principles of Food Hygiene. If **Yes**, indicate "GMPs", describe and proceed to next identified hazard. If **No**, proceed to Question 1.

• **Question 1: Do control preventive measure(s) exist?** If **No**, this is not a CCP. Identify how the hazard can be controlled before or after the process and proceed to the next identified hazard. If **Yes,** describe and proceed to the next question.

• **Question 2: Is the operation specifically designed to eliminate or reduce the likely occurrence of a hazard to an acceptable level?** If **No**, proceed to Question 3. If **Yes,** this is a CCP; identify it as such in the last column.

• **Question 3: Could contamination with identified hazard(s) occur in** excess **of acceptable level(s) or could these increase to unacceptable levels?** If **No**, this is not a CCP; proceed to the next identified hazard. If **Yes**, proceed to Question 4.

• **Question 4: Will a subsequent operation eliminate identified hazard(s) or reduce likely occurrence to an acceptable level?** If **No**, this is a CCP; identify it as such in the last column. If **Yes**, this is not a CCP; identify the subsequent step and proceed to the next identified hazard.

An illustrative approach for validation and verification of HACCP principles (not comprehensive)

HACCP principle	**Validation - evidence to demonstrate that:**	**Verification – Evidence to demonstrate that:**
PRPs	• Are they suitable and appropriate to the organization, product, process etc	• Was validation carried out? • Is monitoring taking place? • Has it been updated?
Hazard analysis	• Are there correct skills in the team • Is the flow diagram correct and complete? • Are the control measures of the processing steps suitable? • Are all significant hazards identified? • How were the potential hazards identified? • Are records of the HACCP study available?	• Was validation carried out correctly? • Is consistency in team operations? • Are there records of team meetings and the decision outcomes?
Determine the CCPs	• Are all significant hazards considered during CCP identification? • Are there CCPs to control all significant hazards • Are there CCPs at appropriate stages in the process? • Is there consistency in the identification of CCPs and PRPs	• Was validation carried out correctly?
Specify the critical limits	• Will the critical limit(s) control the hazard to acceptable levels? • What method was used in identifying critical limits? • Are critical limits realistic and achievable?	• Was validation carried out correctly? • Are there records of operating within critical limits?
Establish a monitoring system	• Will the system ensure that the control measures at the CCP are effective? • Are procedures/schedules for calibration and training established • Is there suitable testing equipment available? • Is the frequency of monitoring	• Do records of monitoring exist? • Do they confirm control of hazards? • Are records correctly filled in? Are they accurate? • Are all CCPs and PRPs monitored and under control? • Is the frequency of monitoring

	adequate? • Are responsibilities stated? • Are monitoring forms designed and correct in relation to hazards and monitoring procedures	adhered to? • Are there designated persons carry out monitoring? • Are there designated persons to review records of monitoring? • Do records of calibration and training exist? Do they confirm compliance?
Establish corrective action system for deviations	• Do corrections and corrective actions prevent nonconforming products from reaching the consumer? • Is there a designated authority responsible for corrections? Are corrective actions assigned? • Are correction/ corrective action forms established/ • Are corrections/ actions realistic and achievable?	• In case of nonconformity, is control regained? • Are corrections and corrective actions recorded? • Are corrective actions taken in the specified time limit?
Establish validations, verifications and reviews	• Have procedures for verification been established? • How are verifications recorded? • How are updates and communication conducted?	• Are all verification procedures carried out? • Are validation records available? • Are system updates recorded? • Is validation of updated processes ongoing? • Are actions taken after management reviews taken within specified time limits?
Establish documents and records	• Have documentation covering the entire HACCP system been established? • Do procedures and forms match information established during the HACCP study and its outcome	• Is documentation of the entire HACCP system complete, accurate, in the correct format and properly filled out? • Are records easily available?