CODEX ALIMENTARIUS
INTERNATIONAL FOOD STANDARDS

Food and Agriculture Organization of the United Nations
World Health Organization

E-mail: codex@fao.org - www.codexalimentarius.org

CODE OF HYGIENIC PRACTICE FOR LOW-MOISTURE FOODS

CAC/RCP 75-2015

Adopted in 2015.

1. INTRODUCTION

There are many different types of products that fall under the grouping of low-moisture foods. Since 2001, there have been a number of outbreaks associated with the consumption of low-moisture foods, which has raised concerns regarding the safety of these products. The primary pathogens of concern that are associated with low-moisture foods to date, include *Salmonella* spp. and *Bacillus cereus.* However, most outbreak-related illnesses associated with low-moisture foods have been caused by *Salmonella* spp. and, for this reason, the Code of Hygienic Practice focuses on controls for *Salmonella* spp.

The water activity (a_w) of low-moisture foods is often well below 0.85 and foodborne pathogens such as *Salmonella* cannot multiply under these conditions. Even though pathogen growth is prevented in these products, the cells can remain viable for extended periods of time. For *Salmonella* spp., the infectious dose is thought to be very low, as demonstrated by the small numbers of cells per serving recovered from low-moisture foods implicated in outbreaks. Furthermore, there is evidence that the composition of a food (especially, high fat content) may protect *Salmonella* against the acidic conditions of the stomach, potentially increasing the likelihood of illness from consuming low numbers of the organism. Pathogens such as *Salmonella* can be difficult to control in a low-moisture food operation environment, because they can persist for prolonged periods of time in the dry state and in low-moisture products. Microorganisms are more heat tolerant in food matrices at reduced water activity.

Investigations from *Salmonella* outbreaks indicate that the safety of low-moisture foods depends fundamentally on the control of *Salmonella* in the food operation environment. Maintaining good hygienic practices, hygienic design of equipment, proactive maintenance programmes, control of incoming materials, and effective ingredient control in the low-moisture food establishment, will help prevent the contamination of low-moisture foods with pathogens. Special attention should be paid to those products that are exposed to the processing environment following a pathogen reduction step, products that are not subjected to a pathogen reduction step, and products for which ingredients are added after a pathogen reduction step.

SECTION I - OBJECTIVES

This Code addresses Good Manufacturing Practices (GMPs) and Good Hygienic Practices (GHPs) that will help control microbial hazards associated with all stages of the manufacturing of low-moisture foods. Particular attention is given to minimize *Salmonella* spp., which is currently considered the primary pathogen of concern in these products. These GMPs and GHPs, if adhered to, should also be effective in preventing the risk from other pathogens that may be of concern.

SECTION II - SCOPE, USE AND DEFINITIONS

2.1 Scope

This Code covers GMPs/GHPs for the manufacturing of low-moisture foods for human consumption. This Code applies to, dried fruits and vegetables (e.g. desiccated coconut), cereal-based products (e.g. breakfast cereals), peanut and other nut butters, dry protein products[1] (e.g. dried dairy products and soy protein), confections (e.g. chocolate and cocoa), snacks (e.g. spice-seasoned chips/crisps), tree nuts, seeds for consumption (e.g. sesame seeds and sesame seed paste), spices and dried aromatic herbs, and specialized lipid based nutritional products[2] for the treatment of moderate and severely acute malnutrition[3]. Milled grain products such as flour may be within the scope when used in foods that would not be subject to a microbial inactivation step.

2.2 Use

This Code follows the format of the *General Principles of Food Hygiene* (CAC/RCP 1-1969) and should be used in conjunction with it, as well as with other applicable codes such as the *Code of Hygienic Practice for Dried Fruits* (CAC/RCP 3-1969), *Code of Hygienic Practice for Desiccated Coconut* (CAC/RCP 4-1971), *Code of Hygienic Practice for Dehydrated Fruits and Vegetables including Edible Fungi* (CAC/RCP 5-1971), *Code of Hygienic Practice for Tree Nuts* (CAC/RCP 6-1972), *Code of Hygienic Practice for Groundnuts (Peanuts)* (CAC/RCP 22-1979), and the *Code of Hygienic Practice for Spices and Dried Aromatic Plants* (CAC/RCP 42-1995). When designing and implementing food safety control systems for products according to the provisions of commodity specific Codes of Hygienic Practices (e.g. *Code of Hygienic Practice for Milk and Milk Products* (CAC/RCP 57-2004)) the recommended practices and measures of this Code should be taken into consideration.

---

[1] Report of an FAO/WHO Consultation Process: Ranking of Low Moisture Foods in Support of Microbiological Risk Management (to be published).

[2] Specialized lipid based nutritional products can be categorized as ready-to-use supplementary foods (RUSF) for the treatment of moderate acute malnutrition and ready-to-use therapeutic foods (RUTF) for the treatment of severely acute malnutrition.

[3] Although the provisions of this Code could be applied in the production of powdered infant formula, this product is excluded from the scope, given the specific vulnerable group of consumers. These products are currently appropriately addressed in the *Code of Hygienic Practice for Powdered Formulae for Infants and Young Children* (CAC/RCP 66-2008).

The provisions in this document should be applied as appropriate, with consideration of the diversity of ingredients, processes, and control measures of the products and various degrees of risk involved in producing low-moisture foods.

2.3 Definitions

Refer to definitions in the *General Principles of Food Hygiene* and other applicable codes (see section 2.2 of this code for the list of additional applicable codes). In addition, the following terms have the meaning stated:

Controlled wet cleaning – the removal of soil, including food residues, dirt, grease or other objectionable matter using a limited amount of water and detergents and controlling the spread of the water used.

Dry cleaning – the removal of soil, including food residues, dirt, grease or other objectionable matter by actions such as wiping, sweeping, brushing, scraping, or vacuuming the residues without the use of water and detergents.

Harbourage site – a site in the environment or on equipment (e.g. cracks, holes, junctions) that enables the accumulation of residues (e.g. food debris, dust, and water) potentially permitting the growth and/or survival of microorganisms such as *Salmonella*.

Low-moisture foods – foods that have a water activity (a_w) of 0.85 or below.

Wet cleaning – the removal of soil, including food residues, dirt, grease or other objectionable matter using water and detergents.

SECTION III - PRIMARY PRODUCTION

Raw materials and ingredients used to manufacture low-moisture foods vary substantially. They are produced under different conditions and using various production methods and technologies. Therefore, microbial hazards vary significantly from one type of product to another and detailed discussions of the primary production methods of each raw material and ingredient is beyond the scope of this document. In each primary production area, it is necessary to consider practices that promote the production of safe food. Refer to the *General Principles of Food Hygiene* and other applicable codes.

SECTION IV - ESTABLISHMENT: DESIGN AND FACILITIES

4.1 Location

Refer to the *General* Principles *of Food Hygiene.*

4.2 Premises and rooms

Refer to the *General Principles of Food Hygiene.*

4.2.1 *Design and layout*

Proper hygienic design, zoning and layout of premises and rooms are essential to ensure that entry of pathogens into the establishment is controlled (e.g. minimizing the potential for entry and, in the case of entry, preventing the pathogen from becoming established in the environment). For example, if a pathogen such as *Salmonella* is introduced into the establishment, proper design and layout can prevent the transfer to areas where processed products are exposed to the environment prior to packaging. In establishments processing and packing low-moisture foods, dry processing areas should be designed to exclude moisture from the environment to the extent possible, in order to prevent growth and minimize the likelihood of a pathogen becoming established in the environment.

Raw material handling, pre-processing and other areas (e.g. maintenance areas, waste areas, and toilet facilities) should be separated from post-processing handling areas. Additionally, physical separation within the low-moisture food establishment based on specific hygiene requirements will help minimize pathogen transfer from one area to another. Where an establishment uses a pathogen reduction step, the area following that step should be physically separated from other parts of the operation in order to implement different hygiene measures based on the type of production and the risk for pathogen introduction. In some establishments the design may include a transitional area in order to enhance hygiene measures prior to the area with the most stringent hygiene measures. This last approach should be considered for food intended specifically for consumers more susceptible to illness from foodborne pathogens, to facilitate the implementation of enhanced controls.

Separation of one hygiene area from another and the control of dust can be achieved using physical barriers, such as walls, doors, split conveyers, etc. Alternatively, separation of areas and control of dust can also be achieved by the appropriate design of ventilation systems and airflow.

Limiting the introduction and use of water is one of the primary means to control pathogens in low-moisture food establishments. In the low-moisture food establishment, there may be areas that only require dry cleaning and other areas where water is appropriately used. It is important that the layout and the hygienic design of the establishment ensure that areas intended for dry cleaning remain in a dry state and receive only dry cleaning and disinfection. If these sites are intended to be wet cleaned even occasionally, then the hygienic design should accommodate water while preventing the establishment of microbial harbourage sites. To limit the introduction of water in the processing areas requiring stringent hygiene controls, hand washing and footbath (if used) stations should be located outside, at the entrance of this area, and, to the extent possible, water distribution systems (e.g. piping) should be located outside the high hygiene area. Additionally, the infrastructure (e.g. ventilation, physical structure) should be designed to prevent entry of unwanted water from the surrounding processing area, as a result of processing activities or from cleaning and disinfecting activities or from outside the establishment.

4.2.2 *Internal structures and fittings*

Overhead structures should be designed to minimize the accumulation of dust and dry materials, especially when they are directly above exposed products.

Internal structures and fittings should be designed to eliminate cavities that could serve as microbial harbourage sites.

In operations where condensate may form or where humidity is high, adequate control measures, such as drip pans or a ventilation system to remove environment humidity, should be in place to prevent condensate from contaminating products or creating conditions that allow the proliferation of pathogens such as *Salmonella* within the production environment.

Entry and exit doors from basic (general) hygiene areas to areas of more stringent hygiene control should be tightly fitted and, if necessary, equipped with self-closing devices.

4.3 Equipment

Refer to the *General Principles of Food Hygiene.*

4.3.1 *General*

Proper hygienic equipment design is essential to prevent contamination of the product with a pathogen from the processing environment and to ensure that if a pathogen such as *Salmonella* is introduced, it remains transient and does not become established in areas of the equipment that could serve as a source of product contamination. Equipment should be designed to facilitate cleaning with little or no water and, when controlled wet cleaning is required, to allow thorough drying before reusing the equipment for low-moisture foods. Alternatively, equipment should be designed for easy disassembly such that parts can be removed from the stringent hygiene area for wet cleaning in a separate location outside the area. The equipment design should be as simple as possible with a minimum number of parts, and to the extent possible, all parts should be accessible for inspection and cleaning. If water is required for washing, the equipment should be designed to accommodate water and should ensure rapid and complete drying to prevent microbial growth and the establishment of microbial harbourage sites. Furthermore, the equipment design should minimize the build-up of food residues and the creation of microbial harbourage sites. Particular attention should be given to the design of equipment located in areas that require the most stringent hygiene controls.

A written document should be developed for equipment acceptance, as well as for cleaning, disinfecting and drying of equipment prior to allowing entry into the processing area. This is particularly important for used equipment, which may have been contaminated during its prior use.

In order to minimize the potential for harbourage sites, hollow areas of equipment should be eliminated whenever possible or permanently sealed.

Push buttons, valve handles, switches and touch screens should be designed to ensure product and other residues (including liquid) do not penetrate or accumulate and become a harbourage site.

4.4 Facilities

Refer to the *General Principles of Food Hygiene.*

The integrity of the facilities should be inspected on a regular basis for problems such as the presence of bird nests or roosting sites, roof leaks, etc. Problems should be corrected as soon as they are detected to ensure a sound structure of the facility.

4.4.2 *Drainage and waste disposal*

Since limiting water is one of the primary means to control pathogens such as *Salmonella* in a low-moisture food establishment, the areas requiring stringent hygiene controls should ideally not have drains. However, if drains are present, the floors should be properly sloped for effective drainage and to allow for rapid drying and kept dry under normal conditions. The drains should be designed to prevent backflow, especially if drains are connected to areas with less stringent hygiene requirements. Additionally, when drains are present, these should be sealed during dry processing operations. When water is used in other areas such as the basic hygiene area, water drainage must ensure rapid drying.

4.4.3 *Cleaning*

Areas where low-moisture foods are handled and manufactured should be designed and constructed in such way as to facilitate dry cleaning and the avoidance of water. Non-fixed equipment should be cleaned outside of the area needing more stringent hygiene control.

4.4.6 *Air quality and ventilation*

Exhaust vents should be inspected to ensure they are hygienically designed, so as to prevent condensate formation and accumulation around the vent exit and to prevent water dripping back into the facility. It should be ensured that exhaust ducts are of sanitary design, are cleanable, and that reverse air flow does not occur.

Where necessary, prevention of the ingress of dust, as well as the movement of dust from one area to another, should be prevented or minimized using air filters and by maintaining a positive air pressure in the areas requiring more stringent hygiene control relative to other areas in the establishment. The type of filters installed in the air handling units may vary from simple dust filters to high efficiency filters, depending on the product and the intended use and consumer. Filters should be inspected and maintained to prevent them from becoming harbourage sites for pathogens.

Attention should be given to the location of the air intake for the establishment in relation to sources of contamination e.g. if the air intake is too close to the surface of the roof, contaminants from bird faeces can be drawn into the operation. Air filters should be considered for use on air intakes.

Where air is used in the facility, in the equipment or in processing lines for specific purposes such as for cooling or transportation of products, direct contact with the product is possible and the air should be dried and filtered to exclude microorganisms and moisture, where appropriate.

SECTION V - CONTROL OF OPERATION

5.1 Control of food hazards

Refer to the *General Principles of Food Hygiene*.

Different hygiene requirements should be implemented based on the degree of hygiene control required in the different areas, or zones, such as the pre-processing raw material handling area and the post-processing and finished product handling area. More stringent hygiene controls should be applied in areas where products that have received a pathogen reduction treatment or that are in their final ready-to-eat state are exposed to the environment of the facilities**.**

Since food particles and dust are normally expected to be present in some processing areas, adequate nutrients are always available to microorganisms. However, microbial growth cannot occur if the low-moisture food establishment is maintained in a dry state. Processing and packing areas for low-moisture foods are typically at ambient temperature. This facilitates maintaining dry conditions, but if moisture is present, growth of microorganisms can occur rapidly. Control measures should be in place to minimize the use of water in the entire low-moisture food establishment. During operation, dry conditions should be maintained in processing areas requiring the most stringent hygienic controls, e.g. after the product has received a pathogen reduction treatment. Some low-moisture food establishments use processing steps that involve the addition of moisture, e.g. blanching almonds in a hot water bath to remove the skin, steam treatments for pathogen reduction. Where water is used, measures should be taken to ensure that it does not enter the dry processing areas of the establishment. Conditions leading to the formation of condensate should be eliminated or minimized to the greatest extent possible. Problems may arise not only when water is visible, but also once an area that has become wet has dried. *Salmonella* is tolerant to drying and can be found in spots where standing water has dried out.

Uncontrolled moisture (e.g. leaking roofs, leaking pipes, condensate, improper cleaning) is a major contributor to the presence of pathogens in low-moisture foods because it provides the moisture necessary for multiplication of the pathogen in ambient temperature rooms. This increases the likelihood of product contamination of multiple lots of product over time. In the case of an unusual event in a low-moisture production area, such as a roof leak, a faulty sprinkler, leaking water or steam valves or a drain backup that introduces water in the processing area of the establishment, efforts should be made to remove water immediately from the dry areas, in order to keep the plant environment as dry as possible. A thorough review and assessment of the situation should be made, evaluating the need for increased sampling and testing of product and the environment and appropriate corrective actions. The continuation of production should be assessed with regard to any negative impact on product safety, in which case, production should be stopped. With respect to a roof or other water leak, the leak should be fixed and the affected area cleaned, disinfected and completely dried and clean dry conditions verified through visual inspection. If any product is affected at the time of the event, it should be disposed of appropriately. This could include reconditioning. Environmental samples should be taken to verify the effectiveness of the cleaning and disinfection in the area unintentionally contaminated with water.

5.2 Key aspects of hygiene control systems

Refer to the *General Principles of Food Hygiene*.

5.2.2 *Specific process steps*

Whenever feasible, low-moisture foods or their raw materials should be treated with a validated microbial reduction treatment in order to inactivate pathogens such as *Salmonella*, noting that some pathogens have increased heat resistance characteristics at reduced water activities in food matrices. The degree of heat resistance may also vary based on specific ingredients. For additional information on validation, refer to the *Guidelines for the Validation of Food Safety Control Measures* (CAC/GL 69-2008). Additionally, refer to the *Principles and Guidelines for the Conduct of Microbiological Risk Management (MRM)* (CAC/GL 63-2007).

Commonly used microbial reduction treatments for low-moisture foods or their raw materials include both thermal (e.g. roasting, steam treatment followed by a drying step) and non-thermal (e.g. irradiation, antimicrobial fumigation) control measures. Where foods are irradiated, refer to the *Code of Practice for Radiation Processing of Food* (CAC/RCP 19-1979) and the *General Standard for Irradiated Foods* (CODEX STAN 106-1983).

The need for microbial challenge studies to support the validation should be determined. The following should be considered when choosing and validating a pathogen reduction step (control measure) for low-moisture foods and their raw materials:

- The necessary target level of pathogen reduction should be determined considering the expected level of the target pathogen in the food prior to the microbial reduction treatment.
- The control measure (thermal or non-thermal) should be validated appropriately for the type of low-moisture food and be capable of achieving the necessary target level of pathogen reduction at the operational scale of the in-plant process.
- If microbial challenge studies are needed, appropriate strains of microorganisms (pathogen or surrogate) should be identified. For laboratory studies, a pathogen such as *Salmonella* should be used, but an appropriate surrogate would be necessary for in-plant validation studies. A surrogate organism should be selected based on data specific to the low-moisture food of interest that demonstrate resistance traits equivalent to the pathogen of concern when exposed to the control measure of interest.
- The associated critical limits for the in-plant process to meet its assigned target level of pathogen reduction should be determined.

Once the necessary pathogen reduction step of the in-plant process has been appropriately validated, suitable monitoring and verification activities should be conducted by the establishment to demonstrate that the process continues to meet the critical limits during operation. When monitoring of control measures or verification results demonstrate deviations, appropriate corrective actions should be taken.

5.2.3 *Microbiological and other specifications*

Refer to the *Principles and Guidelines for the Establishment and Application of Microbiological Criteria Related to Foods* (CAC/GL 21- 1997).

In view of the limited information end-product testing provides in terms of the effectiveness of the hygiene control measures, an environmental monitoring program should be considered to verify effectiveness of the sanitation control measures in the low-moisture food establishment.

If there is reason to suspect a product may have been contaminated (e.g. a leaking roof over an area where dry product is exposed to the environment), a thorough review and assessment of the situation should be made evaluating the need for increased sampling and testing of product and the environment and appropriate corrective actions, including, where necessary, processing of product using a validated control measure. The finished product should not be released until adequate investigation has shown that it complies with appropriate specifications.

5.2.4 *Microbiological cross-contamination*

The most stringent hygienic practices should be in place following a pathogen reduction step to prevent recontamination during subsequent manufacturing and packaging.

The traffic (e.g. movement of personnel and materials) between one hygiene area and another should be controlled to minimize the potential for pathogen contamination. The following should be considered for an area requiring a higher degree of hygienic control:

- Traffic into the area should be minimized and strictly controlled.
- Personnel should follow established hygiene procedures prior to entering the area, e.g. changing or covering shoes, washing and drying hands.
- Dedicated workers and equipment, including utensils and cleaning tools, should be assigned to this area.
- Ingredients that are mixed into a finished product without a subsequent pathogen reduction step should comply with section 5.3.
- Air should flow from the areas requiring most stringent hygiene to those with more basic hygiene, where appropriate.

5.3 Incoming material requirements

Refer to the *General Principles of Food Hygiene*.

A supplier approval and verification program should be developed for sensitive ingredients. Sensitive ingredients are ingredients that have tested positive for pathogens, such as *Salmonella,* in the past or have been implicated in past outbreaks or are used to make products that are intended for consumers more susceptible to illness from foodborne pathogens. The supplier approval and verification program should be developed to assess the adequacy of control measures implemented for pathogens such as *Salmonell*a. The supplier's food safety program should be evaluated and audited with respect to the recommendations outlined in this document before approval. Periodic raw material and/or ingredient testing should be conducted upon receipt to verify supplier control. For sensitive ingredients that will be added to the finished product without a further pathogen reduction step, the most stringent controls may be necessary.

Additionally, within the low-moisture food establishment, sensitive ingredients should be held under adequate hygiene conditions to avoid recontamination. Where feasible, sensitive ingredients should be stored in a segregated area. Where required, certain sensitive ingredients should be stored under controlled temperature and moisture conditions. Before sensitive ingredients are brought into an area that requires a high degree of hygiene control, procedures should be in place to minimize cross-contamination from packaging materials or containers used to transport the ingredients, from handling or from other sources of contamination.

5.4 Packaging

Refer to the *General Principles of Food Hygiene*.

5.5 Water

Refer to the *General Principles of Food Hygiene*.

5.5.4 *In temperature-controlled equipment*

Preventive maintenance should be in place to identify and correct microfractures in jacketed temperature-controlled equipment such as holding or mixing tanks that are double-walled and filled with water to control temperature in the processing of chocolate, peanut butter, etc. Nevertheless, potable water should be used for jacketed temperature-controlled equipment, to prevent contamination of product being held or processed in the equipment in the event of microfractures in the equipment that could allow traces of contaminated water to leak inside.

5.6 Management and supervision

Refer to the *General Principles of Food Hygiene*.

Managers and supervisors should have knowledge of the primary pathogen of concern (e.g. *Salmonella*) in their low-moisture food, as well as an understanding of the procedures necessary for control of this pathogen. Managers and supervisors should also have an understanding of the procedures to follow when environmental or finished product sampling results are non-compliant.

5.7 Documentation and records

Refer to the *General* Principles *of Food Hygiene*.

5.8 Recall procedures

Refer to the *General Principles of Food Hygiene*.

VI. ESTABLISHMENT: MAINTENANCE AND SANITATION

6.1 Maintenance and cleaning

Refer to the *General Principles of Food Hygiene*.

6.1.1 *General*

Processing of low-moisture foods will result in dust accumulation on conveyors, walls, equipment and other surfaces. Product accumulation (e.g. on walls, ceilings, conveyor belts, lids and walls of batch tanks or mixing tanks, the bottom of a bucket elevator), which may become a source of contamination, should be removed in a timely manner. This is particularly important for products that have the ability to attract and hold water, or products that are in an environment of high humidity leading to moisture absorption and localized condensation.

When construction in the low-moisture food establishment is done as part of maintenance activities, control measures should be in place to prevent potential release of pathogens, such as *Salmonella*, from hidden harbourage sites. The following should be considered during construction activities:

- The construction area should be isolated from the processing area.
- Dust should be prevented, minimized, or effectively captured and controlled.
- Traffic patterns into and out of the construction area should be controlled.
- Negative air pressure should be maintained in the construction area.
- Cleaning procedures in the processing areas should be intensified to minimize the spread of dust or contaminants from the construction zone.
- Care should be taken when wet cleaning within the construction area to ensure that water does not create conditions that allow the proliferation of pathogens such as *Salmonella* within the production environment.

Similar procedures may be necessary during other maintenance activities such as dismantling or re-positioning of equipment.

6.1.2 *Cleaning procedures and methods*

There are three types of cleaning methods in a low-moisture food establishment: dry cleaning, controlled wet cleaning, and wet cleaning. The type of cleaning practices to be used in different hygiene areas should be specified. Dry cleaning should be used as the routine cleaning practice for the area that requires the most stringent hygiene control (e.g. after any pathogen reduction treatment or a product with no pathogen reduction treatment). In the area requiring the most stringent hygiene controls, there may be circumstances where controlled wet cleaning will need to be used (e.g. in response to a situation in which environmental or product contamination has been established). In those cases, documented procedures should be in place. Wet cleaning should only be used in non-critical, non-process areas of the establishment (e.g. maintenance areas, waste areas and toilet facilities).

6.1.2.1 *Dry cleaning and disinfection*

The objective of dry cleaning is to remove product residues without the use of water by using tools or cleaning aids that do not involve the application of water or other aqueous solutions. Where appropriate, dry abrasives can be an effective method of removing persistent product residues on equipment or surfaces without introducing water. Hot food grade oil is sometimes used to flush the interior of equipment used to handle pumpable low-moisture products such as peanut butter or chocolate. However, research has shown that hot oil may not be completely effective in removing *Salmonella* from contaminated processing equipment.

The following should be considered when establishing appropriate dry cleaning procedures:

- Designated trained personnel should be responsible for dry cleaning procedures.
- Dry cleaning tools should be cleanable, durable, without loose parts, designed for the purpose and dedicated for the area.
- A designated area should be provided to store cleaning tools not in use.
- Compressed air can be used for dry cleaning in special situations (e.g. to dislodge dust from inaccessible points), but when compressed air is used, it should be dried and filtered to exclude microorganisms and moisture prior to use.
- Separate tools should be provided for the dry cleaning of floors. Tools and vacuums that are used for cleaning food contact surfaces should not be used to clean non-food contact surfaces. Well-designed portable vacuum cleaners or similar tools are recommended to remove residues.
- If possible, vacuum cleaners should be dedicated to specific areas, so that vacuumed material can be tested as part of an environmental monitoring program.
- Dry cleaning tools (e.g. brooms, dry cloth) as well as vacuum cleaners should be well maintained so they do not become carriers of contamination. Vacuum cleaners should be cleaned and disinfected in a designated area, so as not to become a source of contamination.
- Where filters are part of dry cleaning tools, they should be properly maintained on a regular basis and replaced when necessary.
- Alcohol-based disinfectants provide a means to disinfect equipment with a very minimal introduction of water, but water should be avoided as much as possible.
- Cleaning and disinfection programs should be monitored for their effectiveness and verified by visual observations and, where applicable, environmental monitoring.

6.1.2.2 *Controlled wet cleaning*

The following should be considered when establishing appropriate controlled wet cleaning procedures:

- As much product residue as possible should be removed by dry cleaning.
- Only the minimum amount of water needed should be used.
- Procedures should be in place to collect water to prevent water spreading on the floor or to other non-wet cleaned areas.
- Water aerosols should be avoided and high pressure water application should not be used.
- When possible, parts of equipment should be removed and wet cleaning conducted in a room dedicated to cleaning.
- Equipment and areas should be disinfected following the controlled wet cleaning.
- Complete drying of all areas and components involved (e.g. equipment parts, floor) should be done after controlled wet cleaning.
- Controlled wet cleaning should be monitored and verified by visual observation that the area is dry and by environmental monitoring.
- If necessary, production should be stopped while controlled wet cleaning is taking place and only restarted once the area is dry.

6.1.2.3 *Wet cleaning*

The following should be considered when wet cleaning is used:

- The amount of water should be minimized and its use should be limited to specific areas where possible.
- Excessive use of water and high pressure hoses should be avoided.
- Care should be taken to prevent tracking water into areas intended to remain dry.
- Complete drying of all areas should be done after wet cleaning.

6.2 Cleaning programmes

Refer to the *General Principles of Food Hygiene*.

In some establishments, where there is a potential for the presence of cracks or other harbourage sites that may be difficult to eliminate even with regular maintenance, using a dry cleaning method is particularly important. By keeping the sites dry (i.e. using the dry cleaning method), even if food residues or dust enter such a site, potential problems can be minimized. Once water enters a harbourage site, microbial growth can occur and the potential risk of contamination of the environment and of the product is increased.

6.3 Pest control systems

Refer to the *General Principles of Food Hygiene*.

6.4 Waste management

Refer to the *General Principles of Food Hygiene*.

6.5 Monitoring effectiveness

Refer to the *General Principles of Food Hygiene*.

Establishments should put in place an environmental monitoring program for products with known risk for pathogens such as *Salmonella* (e.g. nuts and nut products, dry protein products). Sampling and testing of the environment, including swabs and samples of dust and product residue, is a critical activity to verify the effectiveness of pathogen control measures within the establishment. The main target organism for environmental monitoring should be *Salmonella*. However, it may be advantageous to also include Enterobacteriaceae (EB) as an indicator of process hygiene. The presence of high levels of EB is a good indication of conditions that may support the presence and potential for growth of *Salmonella*. However, testing for EB alone is not sufficient, since even low levels of EB do not guarantee the absence of *Salmonella*.

When pathogens such as *Salmonella* or process hygiene indicator microorganisms such as EB are detected in the environment of the establishment and their levels exceed “decision criteria” as established by the food business operator, appropriate measures should be taken to investigate the source of contamination and to eliminate or control the microorganisms in the environment.

SECTION VII - ESTABLISHMENT: PERSONAL HYGIENE

Refer to the *General Principles of Food Hygiene*.

SECTION VIII - TRANSPORTATION

Refer to the *General Principles of Food Hygiene*.

SECTION IX - PRODUCT INFORMATION AND CONSUMER AWARENESS

Refer to the *General Principles of* Food Hygiene.

SECTION X - TRAINING

10.1 Awareness and responsibilities

Refer to the *General Principles of Food Hygiene*.

10.2 Training programmes

Refer to the *General Principles of Food Hygiene*.

The training program should educate employees on the proper hygienic practices to follow in order to minimize the entry or the spread of pathogens, such as *Salmonella,* in the low-moisture food establishment. Adherence to traffic pattern control measures should also be included in the training. Since *Salmonella* can be difficult to control in a food operation environment because it can persist for a prolonged period of time in the dry state and in low-moisture products, the employees should understand the importance of following proper hygienic practices and the importance of avoiding the introduction of water. Such training should include personnel who enter the area on a temporary basis (e.g. maintenance workers, contractors).

10.3 Instruction and supervision

Refer to the *General Principles of Food Hygiene*.

10.4 Refresher training

Refer to the *General Principles of Food Hygiene*.