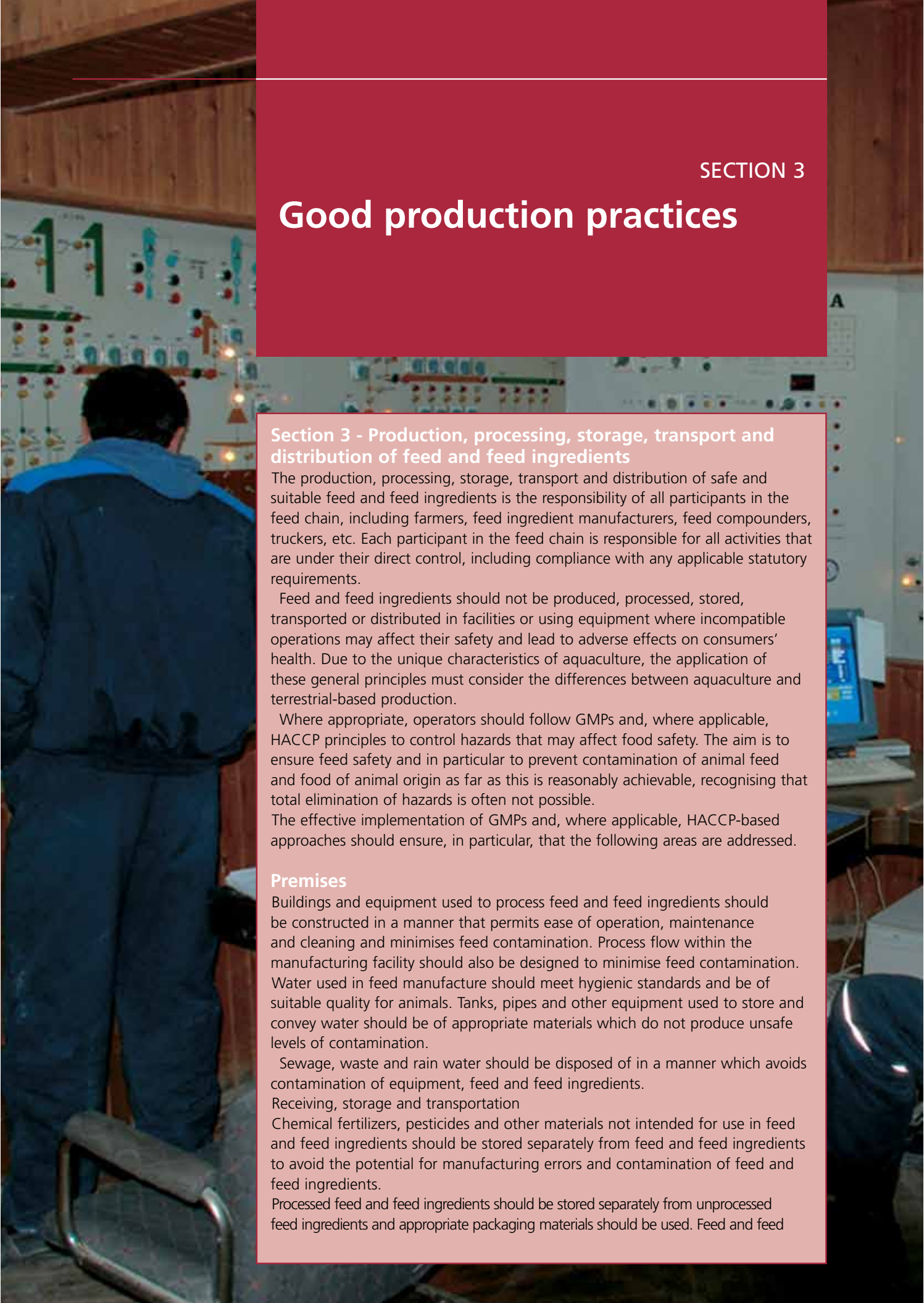


SECTION 3

Good production practices

Section 3 - Production, processing, storage, transport and distribution of feed and feed ingredients

The production, processing, storage, transport and distribution of safe and suitable feed and feed ingredients is the responsibility of all participants in the feed chain, including farmers, feed ingredient manufacturers, feed compounders, truckers, etc. Each participant in the feed chain is responsible for all activities that are under their direct control, including compliance with any applicable statutory requirements.

Feed and feed ingredients should not be produced, processed, stored, transported or distributed in facilities or using equipment where incompatible operations may affect their safety and lead to adverse effects on consumers' health. Due to the unique characteristics of aquaculture, the application of these general principles must consider the differences between aquaculture and terrestrial-based production.

Where appropriate, operators should follow GMPs and, where applicable, HACCP principles to control hazards that may affect food safety. The aim is to ensure feed safety and in particular to prevent contamination of animal feed and food of animal origin as far as this is reasonably achievable, recognising that total elimination of hazards is often not possible.

The effective implementation of GMPs and, where applicable, HACCP-based approaches should ensure, in particular, that the following areas are addressed.

Premises

Buildings and equipment used to process feed and feed ingredients should be constructed in a manner that permits ease of operation, maintenance and cleaning and minimises feed contamination. Process flow within the manufacturing facility should also be designed to minimise feed contamination.

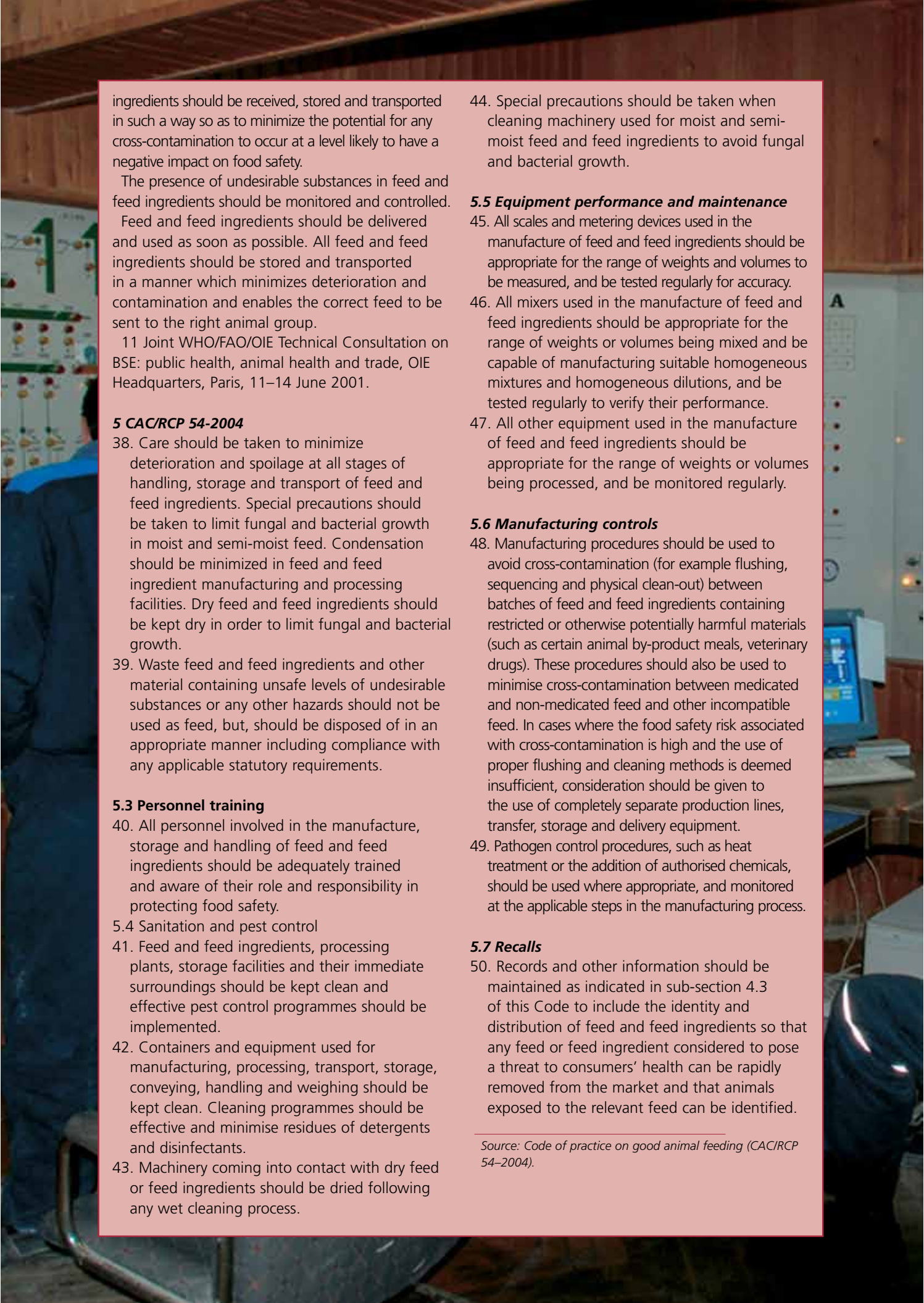
Water used in feed manufacture should meet hygienic standards and be of suitable quality for animals. Tanks, pipes and other equipment used to store and convey water should be of appropriate materials which do not produce unsafe levels of contamination.

Sewage, waste and rain water should be disposed of in a manner which avoids contamination of equipment, feed and feed ingredients.

Receiving, storage and transportation

Chemical fertilizers, pesticides and other materials not intended for use in feed and feed ingredients should be stored separately from feed and feed ingredients to avoid the potential for manufacturing errors and contamination of feed and feed ingredients.

Processed feed and feed ingredients should be stored separately from unprocessed feed ingredients and appropriate packaging materials should be used. Feed and feed



ingredients should be received, stored and transported in such a way so as to minimize the potential for any cross-contamination to occur at a level likely to have a negative impact on food safety.

The presence of undesirable substances in feed and feed ingredients should be monitored and controlled.

Feed and feed ingredients should be delivered and used as soon as possible. All feed and feed ingredients should be stored and transported in a manner which minimizes deterioration and contamination and enables the correct feed to be sent to the right animal group.

11 Joint WHO/FAO/OIE Technical Consultation on BSE: public health, animal health and trade, OIE Headquarters, Paris, 11–14 June 2001.

5 CAC/RCP 54-2004

38. Care should be taken to minimize deterioration and spoilage at all stages of handling, storage and transport of feed and feed ingredients. Special precautions should be taken to limit fungal and bacterial growth in moist and semi-moist feed. Condensation should be minimized in feed and feed ingredient manufacturing and processing facilities. Dry feed and feed ingredients should be kept dry in order to limit fungal and bacterial growth.
39. Waste feed and feed ingredients and other material containing unsafe levels of undesirable substances or any other hazards should not be used as feed, but, should be disposed of in an appropriate manner including compliance with any applicable statutory requirements.

5.3 Personnel training

40. All personnel involved in the manufacture, storage and handling of feed and feed ingredients should be adequately trained and aware of their role and responsibility in protecting food safety.

5.4 Sanitation and pest control

41. Feed and feed ingredients, processing plants, storage facilities and their immediate surroundings should be kept clean and effective pest control programmes should be implemented.
42. Containers and equipment used for manufacturing, processing, transport, storage, conveying, handling and weighing should be kept clean. Cleaning programmes should be effective and minimise residues of detergents and disinfectants.
43. Machinery coming into contact with dry feed or feed ingredients should be dried following any wet cleaning process.
44. Special precautions should be taken when cleaning machinery used for moist and semi-moist feed and feed ingredients to avoid fungal and bacterial growth.

5.5 Equipment performance and maintenance

45. All scales and metering devices used in the manufacture of feed and feed ingredients should be appropriate for the range of weights and volumes to be measured, and be tested regularly for accuracy.
46. All mixers used in the manufacture of feed and feed ingredients should be appropriate for the range of weights or volumes being mixed and be capable of manufacturing suitable homogeneous mixtures and homogeneous dilutions, and be tested regularly to verify their performance.
47. All other equipment used in the manufacture of feed and feed ingredients should be appropriate for the range of weights or volumes being processed, and be monitored regularly.

5.6 Manufacturing controls

48. Manufacturing procedures should be used to avoid cross-contamination (for example flushing, sequencing and physical clean-out) between batches of feed and feed ingredients containing restricted or otherwise potentially harmful materials (such as certain animal by-product meals, veterinary drugs). These procedures should also be used to minimise cross-contamination between medicated and non-medicated feed and other incompatible feed. In cases where the food safety risk associated with cross-contamination is high and the use of proper flushing and cleaning methods is deemed insufficient, consideration should be given to the use of completely separate production lines, transfer, storage and delivery equipment.
49. Pathogen control procedures, such as heat treatment or the addition of authorised chemicals, should be used where appropriate, and monitored at the applicable steps in the manufacturing process.

5.7 Recalls

50. Records and other information should be maintained as indicated in sub-section 4.3 of this Code to include the identity and distribution of feed and feed ingredients so that any feed or feed ingredient considered to pose a threat to consumers' health can be rapidly removed from the market and that animals exposed to the relevant feed can be identified.

Source: Code of practice on good animal feeding (CAC/RCP 54–2004).

INTRODUCTION

Because of the implications for human health, there is an increasing demand for greater attention to risk management by all those involved in the production and utilisation of feed. Given the direct linkage between feed safety and the safety of food products derived from farmed animals, it is essential that feed manufacture and feed production in general be dealt with as important parts of the food production chain. The Code defines feed safety as "all conditions and measures necessary to ensure the safety and suitability of feed at all stages of the feed production chain".

In some countries feed is already considered very much part of the food chain and safety programmes have been developed by various national feed associations based on this premise. All reflect the importance of keeping feed products safe and free of contaminants. Feed and food safety hazards can occur at any stage of the feed processing chain; therefore, adequate control along the whole feed and food chain is of utmost importance.

Most of the regulations, standards and guides published worldwide by different governments, trade institutions and private sector bodies emphasize the responsibility of all participants to ensure feed safety throughout the food chain. Key tools in achieving this are the application of HACCP principles and the maintenance of traceability; the main goal being to ensure the risk of contaminating feed for food producing animals is kept as low as possible.

GAPs and GMPs are important prerequisite programmes for the implementation of HACCP principles. Effective hazard control is ensured by the combination of prerequisite programmes and the HACCP plan.

In this Section we will consider the detailed application of GMP and HACCP to feed production

Good Agricultural Practices in the primary production and on-farm handling of feed ingredients will be covered in Section 5 of the this manual, which addresses "On-farm production and use of feed and feed ingredients"

GOOD MANUFACTURING PRACTICES

GMPs are the practices and procedures that ensure the safety and suitability of feed and food; they should be applied throughout the feed chain.

Buildings and facilities

The design and construction of all buildings and facilities should ensure that feed products are protected from contamination at all times. There should be adequate space for all operations and the safe storage of equipment and materials. Easy access should be possible for maintenance and cleaning operations. Location, design and construction of premises should deter pests and restrict access by pests to a minimum.

Location of feed establishment

Potential sources of contamination should be considered when deciding where to locate feed establishments, as well as the effectiveness of any reasonable measures that might be taken to protect feed. Establishments should be located in areas that are not exposed to undesirable levels of smoke, dust and other contaminants.

Establishments should normally be located away from:

- Environmentally polluted areas and industrial activities which pose a serious threat of contaminating feed;
- Areas subject to flooding (unless sufficient safeguards are provided);
- Areas prone to infestations of pests or the presence of domestic and wild animals;
- Areas where wastes, either solid or liquid, cannot be removed effectively.

Design and layout

The internal design and layout of establishments should permit good hygiene practices, including protection against cross-contamination. Activities should be adequately separated by physical or other effective means where cross-contamination may result.

Buildings and facilities should be designed to allow easy access for cleaning, including access to the inside of relevant equipment. There should be enough space to satisfactorily conduct all process operations and product inspections.

The building exterior should be designed, constructed and maintained to prevent entry of contaminants and pests. There should be no unprotected openings, air intakes should be appropriately located, and the roof, walls and foundation should be maintained to prevent leakage.

Gardens and other vegetation should be limited to the external areas. Parking areas, external areas and all access routes to the manufacturing plant should be designed to avoid contamination

of the production area, for example by the tracking of mud or snow by vehicles.

Where necessary, designated and appropriately designed storage areas for toxic, explosive or inflammable materials should be provided and located away from manufacturing, storage and packing areas.

Intake and loading facilities should be designed and constructed to maintain the safety of incoming raw materials and outgoing finished feeds. Controls should be in place to avoid contamination by water or pests.

Internal structure and fittings

Structures within the establishment should be built of durable materials. They should be easy to maintain and clean and, where appropriate, to disinfect. In particular the following specific conditions should be satisfied where necessary to ensure the safety and suitability of feed:

- The surfaces of walls, partitions and floors should be made of impervious materials with no toxic effect in intended use;
- Walls and partitions should have a smooth surface that enables and facilitates cleaning;
- Floors should be constructed to allow adequate drainage and cleaning, when necessary due to the nature of operation;
- Ceilings and overhead fixtures should be constructed and finished to minimize the build up of dirt and condensation, and the shedding of particles;
- Windows should be easy to clean, constructed to minimize the build up of dirt, be fitted with removable and cleanable insect-proof screens;
- Doors should have smooth, non absorbent surfaces and be easy to clean.
- Working surfaces, such as weighing tables that may come in direct contact with feed ingredients should be in sound condition, durable and easy to clean and maintain.

Water supply

Any water coming into contact with feed products should be of potable quality. There should be an adequate supply of potable water with appropriate facilities for its storage, distribution and temperature control. Potable water should be as specified in the latest edition of WHO guidelines for drinking water quality (WHO, 2006).

Non-potable water, for use in fire control, steam production, refrigeration and similar purposes should have a separate system. Non-potable water systems should be identified and should not connect or allow reflux into, potable water systems. All hoses, taps and other similar possible sources of contamination should be designed to prevent back-flow or siphoning.

Water treatment chemicals, where used, should be food compatible. Chemical treatment should be monitored and controlled to ensure the correct dosage is delivered.

Recirculated water should be treated, monitored and maintained as appropriate for its intended purpose. Recirculated water should have a separate distribution system which is clearly identified.

Cleaning facilities

Adequate facilities, suitably designated, should be provided for cleaning feed utensils, equipment and vehicles used to transport feed products. Such facilities should have an adequate supply of hot and cold water, where appropriate.

Facilities should ideally be constructed of corrosion-resistant materials that can easily be cleaned and should be provided with potable water at temperatures appropriate for the cleaning chemicals used. All cleaning chemicals should be food compatible.

Equipment cleaning facilities should be adequately separated from feed storage, processing and packaging areas to prevent contamination.

Personnel hygiene facilities

Personnel hygiene facilities should be available to ensure that an appropriate degree of personal hygiene can be maintained. When appropriate, facilities should include:

- Adequate means of hygienically washing and drying hands, including wash basins and a supply of hot and cold, or a suitably controlled temperature water;
- A constant supply of potable water;
- An adequate number of toilets of an appropriate hygienic design with hand wash basins in close proximity provided with soap, paper towels or other suitable means for drying hands;
- Adequate changing facilities for personnel.

Facilities should be suitably located and designed. Whenever the nature of operations require, there should be facilities to wash and/or disinfect hands in product handling areas.

Air quality, temperature and ventilation

Adequate means of natural or mechanical ventilation should be provided to:

- Minimize airborne contamination of feed from aerosols and condensation droplets, specially in open production systems;

TABLE 2. **Premises layout and design recommended practices**

Premises design and facilities	Recommended practices	Objective
Location	Away from polluted areas, areas subject to flooding, pest infestations and presence of wastes	Avoid feed contamination
Design and lay out	Physical separation of activities that can cause contamination Covering and protection of intake and loading facilities Sufficient space to conduct operations Prevention against the entry of pests and contaminants No cross-connection between sewage and drainage systems	Enable good cleaning operations Prevent external and cross-contamination Prevent contamination through weather, pests and others
Internal structures and fittings	Walls, doors and partitions with smooth surface Windows fitted with removable and cleanable screens Floors with adequate drainage	Allow cleaning Avoid build up of dirt
Equipment	Made of non toxic materials Control operation conditions efficiently Easy to disassemble, clean and maintain Identify waste and dangerous substances containers	Avoid feed contamination and carry-over Monitor CCPs efficiently Avoid accidental and malicious contamination
Water supply	Potable water, where needed, according to WHO guidelines Monitored and controlled chemical treatment	Avoid feed and equipment contamination
Drainage and waste disposal	Constructed not to cross-connect with potable water	Avoid feed and equipment contamination
Cleaning facilities	Corrosion resistant and easily cleanable Separated from production and storage areas	Prevent contamination Maintain utensils and small equipment in cleaned conditions
Hygiene facilities	Provided with means for washing and drying hands Hand wash basins near toilets Availability of soap and paper towels Constant supply of potable water Availability of protective clothing	Maintain adequate personal hygiene to avoid feed contamination Avoid people to pass through areas without washing hands
Air quality, temperature and ventilation	Control of temperature, humidity and ventilation, where necessary. Air flow from clean to contaminated areas	Minimize air-borne contamination of feed
Lighting	Adequate artificial or natural lighting sources Protected lighting fixtures	Ensure hygienic and inspection conditions. Protect food so that it is not contaminated by breakages
Storage	Permit adequate maintenance, cleaning and inspection activities Cleaned as soon as possible after product damage or spillage Separate areas for rejected products, waste material and chemicals	Avoid deterioration and spoilage of stored materials Prevent contamination of other areas

- Control ambient temperatures where these may adversely affect feed safety. If necessary, heating, cooling or air-conditioning systems should be designed and installed so that air-intake or exhaust vents do not cause contamination of products, equipment or utensils;
- Provide ventilation of sufficient capacity to prevent grease and condensation from collecting on walls and ceilings;
- Control humidity and ensure the safety and suitability of feed.

Ventilation systems should be designed and constructed to ensure intakes draw only clean air. Ideally design should ensure that air flows from clean areas to contaminated areas. Mechanical ventilation systems should be adequately maintained and cleaned.

Lighting

Lighting sources should be sufficient to ensure that hygienic conditions are maintained throughout the production and storage areas, as well as where equipment and utensils are cleaned, in hand-washing areas and toilets. Where artificial lighting is required, it should be designed to ensure that it reflects true colours.

Adequate lighting conditions are particularly important in areas where feed is visually inspected or instruments are monitored (Box 12).

BOX 12

Lighting conditions

Recommended lighting:

- 540 lux in inspection areas
- 220 lux in work areas
- 110 lux in other areas

Equipment

Equipment and containers should be made of non toxic materials, capable of being disassembled to allow proper maintenance, cleaning and inspections.

Equipment should be placed away from the walls to facilitate cleaning and maintenance and to prevent pest infestation.

Equipment designed to achieve and control specific process conditions such as temperature, humidity and air flow should be provided with appropriate metering devices and their accuracy checked regularly. These requirements are intended to ensure that:

- Harmful or undesirable micro-organisms or their toxins are eliminated or reduced to safe levels or their survival and growth effectively controlled;
- Where appropriate, critical limits established in HACCP based-plans can be monitored;
- Temperatures and other conditions necessary to feed safety and suitability are achieved and maintained.

Containers for waste, by-products and inedible or dangerous substances should be specifically identifiable and suitably constructed. Containers that hold dangerous substances should be identified and lockable to prevent contamination of products and environment. No containers used for holding waste or harmful materials should be used for holding feed products.

Utensils such as spoons and knives used to open bags and weigh additives and drugs should be tethered or otherwise kept safe and not placed on the floor or over raw material bags and pallets.

Mixers must be appropriate for the range of weights and volumes required to obtain homogeneous mixtures.

Weighing equipment such as scales and other metering devices should be appropriate for the weights and volumes to be used. Accuracy of the weighing and dosage equipment should be compatible with the items to be weighed.

Where bulk bins are in use, controls should be in place to ensure only the correct raw materials are loaded into any bin.

Sieves, screens, filters and separators should be regularly checked for possible damage and to ensure their effective operation.

Equipment, containers and other utensils that come into contact with feed, should be designed and constructed to ensure that, where necessary, they can be adequately cleaned and maintained to avoid contamination of feed. Equipment, containers and utensils should be made of materials with no toxic effect in intended use.

Equipment should be designed to allow maintenance, cleaning, monitoring and facilitate inspections for pests.

Coatings, paints, chemicals, lubricants and other materials used for surfaces or equipment that may have contact with feed should be such that they will not contribute to unacceptable contamination of feed.

Equipment used to mix, cook, store and transport feed should be designed to achieve and maintain the required operating conditions. Such

equipment should be designed to allow essential temperatures, humidity, pressure and mixing conditions to be monitored and controlled. Any controls implemented should ensure that:

- Where appropriate, critical limits established in HACCP based plans can be monitored;
- Temperature, humidity and other process conditions necessary for feed safety and suitability can be efficiently achieved and maintained.

Calibration methods and frequencies should comply with manufacturers' recommendations for all equipment monitoring and or controlling devices that may have an impact on feed safety. Calibration of equipment should be performed by appropriately trained personnel.

Personal hygiene

People known or suspected to be suffering from or to be a carrier of a disease or illness likely to be transmitted through feed, should not be allowed to enter any process area if there is a likelihood of their contaminating feed products. Any person so affected should immediately report any illness or symptoms of illness to management and be assigned suitable duties or sent home.

Symptoms which should be reported to management, include:

- Jaundice
- Diarrhea
- Vomiting
- Fever
- Sore throat with fever
- Visibly infected skin lesions (boils, cuts, etc)
- Discharges from the ear, eye or nose

Feed handlers should maintain personal cleanliness and, where appropriate, wear suitable protective clothing, head covering and safety footwear that have to be kept in a hygienic condition. Clothing should be designed to not only protect the personnel where necessary but also to avoid contamination of feed products by personnel.

Where gloves are worn, controls should be in place to ensure these do not get into the feed products.

There should be clear rules on smoking and eating/drinking on site. Designated facilities should be provided away from areas where feed products are handled, stored or processed.

Personal effects, such as items that might fall out of pockets and which may pose a threat to the safety and suitability of feed, should not be carried into areas where feed is stored, processed or handled.

Contractors and any other person, including staff members, visiting the processing and handling areas should wear protective clothing and adhere to the other personal hygiene provisions.

Cleaning

Cleaning should remove residues and dirt that may be a source of contamination. The cleaning methods and materials must be compatible with feed products. Sufficient standards of cleanliness should be employed to ensure that exposure to pests and pathogens is minimised at all stages of processing, storage and handling.

Cleaning programmes should be documented and ensure that processing, storage and handling facilities are cleaned in a manner that is sufficient to maintain feed safety at all times.

Cleaning and disinfection programmes should be monitored for their suitability and effectiveness. An authorised person should carry out inspections of cleaning and a record of all inspections should be kept.

Only food compatible cleaning and disinfectant / sanitising agents should be allowed to come into contact with feed products and should be used in accordance with manufacturers recommendations and safety data sheet requirements. Where cleaning agents and disinfectants / sanitizers come into contact with feed products, one must ensure that control systems provide the correct and effective dilution levels at all times.

Cleaning and disinfection / sanitising chemicals must be stored, where necessary, separately in clearly identified containers to avoid the risk of (malicious or accidental) contamination.

Maintenance

Equipment should be subject to a programme of planned maintenance that ensures it is kept in safe and effective working condition.

Records should be kept of any maintenance carried out on equipment critical to the production of safe feed, for example: essential measuring equipment, cookers, magnets, etc.

Engineers and contractors working on site should be controlled in such a way that maintenance and building works do not adversely affect feed safety. There should be a procedure in place to ensure that appropriate cleaning and tidying has been completed prior to recommencing activities in areas where maintenance or building works have been undertaken.

Pest control

Active measures should be taken to control and limit pest activity throughout all process, storage and handling areas. Risk assessment methods should be used to identify potential problems with all classes of animals (e.g. birds, insects, reptiles and mammals) whether they are wild, feral or domestic. Records should be maintained to show that risks from pests are adequately managed and consistently under control.

Animals should, wherever possible, be excluded from the grounds of feed manufacturing establishments, and the area surrounding stores and processing plants. Where the presence of pests is unavoidable, procedures should be implemented to protect feed products from potential contamination. Wherever there is a significant risk from pests, access points should be proofed against their entry. Doors should be kept closed whenever possible and be close-fitting and proofed against pests when closed.

Buildings should be kept in good repair and condition to prevent pest access and to eliminate potential breeding sites. Holes, drains and other places where pests are likely to gain access should be kept sealed wherever possible. Where sealing is not possible, measures such as wire mesh screens should be in place to reduce the possibility of pest entry.

Pest infestations should be dealt with promptly and any actions taken should be compatible with feed products.

Only appropriately qualified / trained personnel should carry out any control treatment required.

In cases where shooting is undertaken as part of the pest control programme, lead, or other toxic ammunition, should not be used.

All bait containers should be fixed in their intended position unless there is a specific reason why this is not appropriate. Open bait containers and loose baits should not be positioned in areas where their use may result in a hazard to feed products.

Pest control procedures should be documented and ensure that no materials designed to kill or deter pests can contaminate feed products. Pest control records should include:

(i) Details of any poisons used, including safety data sheets;
(ii) Qualifications of personnel involved in pest control activities;
(iii) Map(s) indicating the location of any bait stations and the baits with which they are baited;
(iv) Records of any pests found;
(v) Details of corrective actions implemented.

Waste

Waste and material that is not appropriate for feed must be identified as such, kept separate and removed. Waste should not be allowed to accumulate in feed processing, handling and other working areas.

Waste should be collected and stored in clearly identified bins or containers and segregated to eliminate the likelihood of accidental or inadvertent use. Waste should be disposed of legally and according to any applicable environmental regulations.

Containers used to hold waste should not be used for feed products. Containers used to store waste that is attractive to pests should be covered. Such waste containers should also be stored away from processing and storage areas and removed from site as frequently as practical.

Waste stores must be kept appropriately clean and should be included in the cleaning and disinfection programmes.

Drains

All drains must be designed and maintained in a manner that ensures they do not present a hazard to any feed products.

No waste water or material recovered from waste water systems should be incorporated into feed ingredients.

Storage

Storage areas for raw materials and finished products should be separated to prevent cross-contamination. These facilities should be free of chemicals, fertilizers, pesticides and other potential contaminants.

Feed products should be stored in such a way that they can be identified easily and that confusion with other products is prevented.

Medications and medicated pre-mixtures should be stored in a secure place and with restricted access to authorized personnel only.

Any rejected products should be clearly identified and held in segregated areas to prevent their accidental use.

Finished feeds, which are approved and according to specifications, should be stored in suitable packaging materials or containers. Medicated feed should be stored in a separate and secure area.

Storage facilities should be designed and

constructed to prevent the entry of pests. Storage areas should be cleared completely and cleaned on a routine basis.

Raw materials and finished products should be kept cool and dry to prevent mould growth. Temperature and humidity should be controlled where necessary.

Stock control measures should be adequate to ensure that neither raw materials nor finished feeds deteriorate prior to use / despatch, or during storage. Wherever practical, raw materials must be used and feed materials must be supplied on a first in, first out basis.

Transport

Both raw materials and finished feeds should be adequately protected during transport. All means of transport, whether owned or contracted, bulk or packed and by water, rail or land should be appropriately cleaned to control and minimize the risk of contamination.

The most appropriate method of cleaning will depend on the nature of the loads being carried. As a general rule load compartments should be kept dry and sweeping or vacuuming used wherever this is effective. Where wet or sticky materials are being carried it will be necessary to use a pressure washer or steam cleaner.

Vehicles used for the transport of medicated feed and other materials that present a high risk (including those subsequently identified to be infested with insects or pathogens) should be cleaned completely, sanitized and dried before they are used again for the transport of feed products.

Attention should be paid to contracted transport and maintenance of clean transport should be a condition of hire. Compliance with this requirement should be checked regularly.

No materials from previous loading should remain in the tank trucks, boxes or other containers before being loaded with the feed products. Containers should be clean and dry prior to loading.

Checks should be made that the previous loads carried in any transport are compatible with the subsequent load being feed. The three previous loads carried should be confirmed and guarantees sought that no transport used to carry feed has been used to transport material likely to result in long-term contamination.

All vehicles used for transport of feed products should be subject to regular cleaning and sanitizing programmes to ensure clean transport conditions and no accumulation of residual material.

Products should be protected from contamination and kept dry. When transport in closed vehicles is not possible, loads should be covered. The cover should also be maintained in a clean, sanitized and dry condition.

Training

Good training is essential to ensure feed and food remain safe. Those engaged in feed manufacturing and handling operations should be trained in feed hygiene as well as production protocols and handling of feed products.

All personnel should be aware of their roles and responsibilities in maintaining feed safety. All training activities should be documented.

Periodic assessments of the effectiveness of training and instruction programmes should be made, as well as routine supervision and checks to ensure that procedures are being carried out effectively.

Managers and supervisors should have the necessary knowledge of feed and food hygiene principles and practices to be able to judge potential risks and take the necessary actions.

Training programmes should be regularly reviewed and updated.

HAZARD ANALYSIS AND CRITICAL CONTROL POINTS (HACCP)

A formal hazard analysis should be carried out with the aim of identifying and controlling hazards that might adversely affect the safety of any feed products to human health. Internationally recognized HACCP preliminary steps (items 1-5) and principles (items 6-12) are defined in Codex Alimentarius Commission in 'Recommended International Code of Practice General Principles of Food Hygiene – CAC/RCP 1- 1969, Rev. 4 – 2003'. (Box 13)

HACCP is plant-specific and firms that manufacture similar feeds can implement HACCP plans that differ in their identified hazards and control measures.

Prerequisites

Before undertaking the development of a HACCP plan, the HACCP team should have in place basic operating procedures validated as effective by internal auditing systems. These procedures are referred to as 'prerequisites' (i.e. 'required as a prior condition') for the HACCP.

The aforementioned Good Manufacturing Practices are examples of prerequisite programmes and include:

- Smoking, eating and drinking policy
- Cleaning schedules and hygiene audits
- Pest control program
- Supplier approval procedures
- Plant operating procedures and instructions
- Equipment maintenance
- Job descriptions and responsibilities
- Staff training

The validation of prerequisite programmes' effectiveness to control potential hazards allows the HACCP team to focus on those hazards not controlled by other means. Subsequent reviews must revisit prerequisites as well as the HACCP plan itself to ensure that changes in the process or previously unidentified hazards are controlled.

Prerequisite programmes to HACCP, including training, should be well established, fully operational and verified in order to facilitate the successful application and implementation of the HACCP plan.

BOX 13

HACCP Principles

Logic sequence for the application of HACCP include:

1. Assemble HACCP Team
2. Describe Product
3. Identify Intended Use
4. Construct Flow Diagram
5. On-site Confirmation of Flow Diagram
6. Principle 1:
   List all Potential Hazards
   Conduct a hazard Analysis
   Consider Control Measures
7. Principle 2:
   Determine CCPs
8. Principle 3:
   Establish Critical Limits for each CCP
9. Principle 4:
   Establish a Monitoring System for each CCP
10. Principle 5:
    Establish Corrective Actions
11. Principle 6:
    Establish Verification Procedures
12. Principle 7:
    Establish Documentation and Record Keeping

Note: The team members should be trained and work together with a common focus using the same approach and terminology

Source: Recommended International Code of Practice General Principles of Food Hygiene – CAC/RCP 1-1969, Rev 4 (2003)

HACCP team

The first preliminary step in developing a HACCP plan involves the formation of a HACCP Team.

The HACCP team should include personnel from all of the relevant operations and functions within the company and at least one member with demonstrably effective HACCP training.

The members of the HACCP team should be recorded within the HACCP Plan.

It is acceptable for individual personnel to fulfil multiple roles in the HACCP team or to utilise resources from outside of the company, provided that the role of the team remains effective.

In a classic HACCP team the following disciplines will be represented but not necessarily by different people in every case:

Team leader - This may be one of the people identified below and ideally will have been trained in HACCP principles and have experience of applying them.

Quality assurance/quality control/technical - This will require someone who understands the products under consideration and the historical hazards and critical issues associated with them.

Production - This will require someone who is closely involved with the production process and has an intimate knowledge of what happens where in the process.

Engineering - This will require someone who understands the mechanics of the processing plant, where material may accumulate inside machinery, where heat or moisture may be applied and how to gain access to machinery.

Additional, part–time expertise - This may require specialists who offer technical or specific expertise on purchasing, operational activities, distribution, microbiology, specific species requirements, etc.

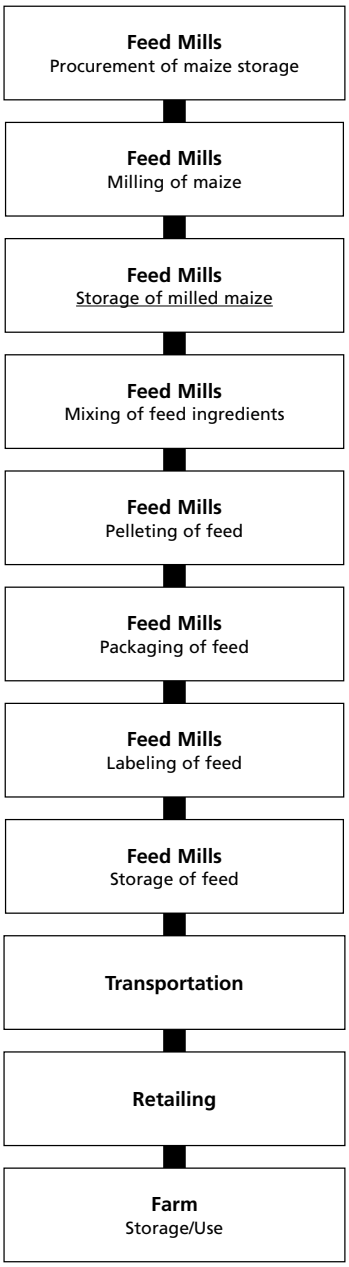
It is essential that team members are familiar with what actually happens in the business and are not too removed from day to day activities.

Product Description and Intended Use

The HACCP team first describes the feed product through written specification that describes the product including a general description of the product, its ingredients and how it is to be used.

The method of product distribution could include internal use, further processing, retail or wholesale. The HACCP team also des-

Graph 1.



Source: Manual of Application of HACCP System in Mycotoxin Prevention and Control, FAO 2001, page 70 , HACCP Flow Diagram - Maize Based Feed

cribes the normal expected use of the product. This information is used during the hazard analysis phase of HACCP plan development.

The written product specifications should be amended when any relevant changes take place. Additionally, the written specification developed for the HACCP plan should include:

i) Nutritional and analytical characteristics;
ii) Hazards or limitations for intended use, where these apply.
iii) Details of any medications included; andassociated withdrawal period.

Definition of process steps

The HACCP team should identify and record all of the steps involved in their operations: from raw material procurement and supplier approval, through to the point at which any feeds produced are transferred to a purchaser (process analysis).

The process analysis should be illustrated using a flow diagram that shows each step of the process operation. Flow diagrams should include:

(i) Clear identification of each step.
(ii) The use of any processing aids and technological additives;

Flow diagrams should include (where relevant):

- All administrative processes such as order receipt and product formulation;
- All relevant inputs to the process flow, including raw materials and any products purchased for re-sale;
- All mechanical process steps;
- Passive equipment (such as stone traps and magnets);
- Recycle and return loops where fractions are returned to the process;
- Potential areas for cross-contamination;
- All areas where product is not enclosed;
- Storage, packing and transport steps;
- Steps where fractions are removed from the process (and do not return).

(This list is not necessarily exhaustive)

The HACCP team should confirm the details of any flow diagrams produced by physically checking them against the process being studied, prior to progressing to the next stage.

Hazard analysis /identification (CODEX Principle 1)

At each step of the process, the HACCP team should list all the potential hazards that might reasonably be expected to present a threat. At this stage all hazards should be listed and any that may be removed from the study as prerequisites can be identified at a later stage.

Key considerations are:

- Hazards inherent within the product;
- Hazards that may be introduced at the process step in question;

- Hazards that may increase at the process step in question.

The HACCP team should next undertake a hazard evaluation of all the hazards identified. The aim is to identify those that have the most impact on feed or food safety by assessing the likelihood of each occurring and the severity of its effect. Some practitioners find it helpful to use a simple model for scoring hazards but, whether or not a risk scoring method is used, it is necessary to ensure that the most significant risks receive the most attention.

Determination of control measures

It is important to apply a control measure or measures wherever there is a hazard that presents a significant risk and to eliminate it or reduce it to an acceptable level. The control measure(s) can take several forms but must be practical and achievable. When determining control measures the following considerations apply:

- Can the hazard be eliminated?
- Can the hazard be removed by engineering design?
- Can the hazard be managed by automated process control systems?
- Can the hazard be managed by personnel action?

Any controls applied should be validated to ensure they are effective. For example, this means demonstrating by analytical or other means that a statement made about a control is true and the control works as intended. Records of this should be kept for future reference.

Determination of critical control points (CODEX Principle 2)

The process step where control measures are essential to prevent, eliminate or reduce hazards to an acceptable level (i.e. the hazard would not be detected or removed at any later stage in the operation) are Critical Control Points (CCPs) and must be identified as such within the HACCP plan.

The process step that has been identified as a CCP should be clearly identified at its location within the processing plant on the HACCP plan flow diagramme.

Establishing critical limits (CODEX Principle 3)

The HACCP Team should detail the critical limits for the control measures at each of the CCPs. The critical limit is that which divides the acceptable from the unacceptable. Some critical limits will be determined by legislative requirements, while others will be determined by experience or scientific research. The critical limits are defined as a maximum and/or minimum value to which a physical, biological, or chemical hazard must be controlled at a CCP to prevent, eliminate, or reduce to an acceptable level the occurrence of the identified safety hazard.

Monitoring (CODEX Principle 4)

The CCPs in the operation and the feed products themselves should be inspected and sampled (monitored) to ensure identified hazards remain under control.

Ideally, monitoring systems should be designed to identify as quickly as possible any controls that are becoming ineffective, prior to their failure. The frequency of any monitoring is therefore also important and should be specified in the HACCP plan.

Properly trained and authorized personnel undertake the monitoring activities specified in the HACCP plan. The HACCP plan should specify what will be monitored, how and where it will be monitored, the frequency of monitoring and who will perform the monitoring.

Preventive/corrective actions (CODEX Principle 5)

It is essential to take suitable, prompt and effective remedial action when information shows that control measure(s) are not within critical limits.

Any action taken should deal with both the cause of the problem as well as the consequences of the problem itself.

The HACCP team should specify the actions to be taken in the event of a CCP going out of control. Responsibilities for implementing corrective actions should be clearly assigned and documented.

It is important to ensure procedures also consider action to be taken with regard to any product processed since controls were last confirmed as operating within acceptable limits. This may require bonding of stock or even recall of product from customers or intermediaries. All corrective actions must be documented.

Verification (CODEX Principle 6)

Verification systems must be implemented by the HACCP team to ensure not only that all person-

nel are complying with the requirements of the HACCP Plan, but also that the Plan is effective (validation). Verification systems must review that the HACCP plan is followed and includes a review of associated records. There may be several control measures at a CCP in the HACCP Plan, each with its own appropriate monitoring. Principle 6 (verification) should include a validation that the control measure is effective and verification that the control measures are operating within the critical limits and that all monitoring activities are performed.

When establishing verification systems the following should be considered:

- Sampling and testing;
- Complaints monitoring;
- Internal auditing of the HACCP system;
- External auditing of the HACCP system.

External auditing of the HACCP System

The HACCP team should carry out regular reviews to verify the requirements of the HACCP plan are being met in practice and that the plan effectively and consistently ensures the safety of feed products. At least one complete HACCP review should be carried out each year and include any prerequisites established as part of the HACCP Plan. A record should be kept of HACCP reviews showing the HACCP team findings and any actions implemented.

Recordkeeping (CODEX Principle 7)

Records provide the written evidence that the HACCP plan is being followed and it also provides a means of tracing the history of the product as well as a mechanism to identify potential problems. Four common types of HACCP records include a summary of the hazard analysis, the HACCP plan, support documentation, and operating records.

Records provide a summary of the hazard analysis. It is good to document the deliberation of the HACCP team that supports the HACCP team's decision as to which hazards are identified as significant to humans and are included in the HACCP plan. Good documentation will include justification or discussion of the control measures that prevent, eliminate or reduce to an acceptable level that hazard.

The HACCP plan should include a record of the preliminary steps which include the HACCP team, the feed and its distribution, intended use, customers and process flow. On the process flow designate where the critical control points occur at each of the appropriate process steps and then incorporate in your overall record keeping the HACCP summary table.

The supporting documents for HACCP principles include critical control points, critical limits, monitoring, corrective action and verification. Other supporting documents include SOPs that were developed for control measures at the CCPs.

Daily operational records are an essential part of implement the HACCP plan and require monitoring, corrective action and verification records. These records provide evidence that the HACCP plan is being followed. Monitoring records provide the backbone of the HACCP system and are designed to document compliance with the plan. Continuous monitoring is likely recorded through automation, for example conditioned mash temperature is recorded through the mill automation system. Discontinuous monitoring requires accurate documentation and entails standardized forms. Corrective action documentation occurs when there is a failure to meet a critical limit, detected through monitoring. The records should include quantity and codes of product released, destroyed or reworked. Verification activities designated in the HACCP plan must be documented including calibration records, daily operation verification, any validation or reassessment of the HACCP plan and on-site audits.

PREREQUISITE PROGRAMMES

Approved Suppliers of Raw Material

To ensure raw materials are safe, it will be necessary to obtain the following information for each raw material (including additives and technological additives) utilised to produce feed:

- The name and address of the supplier of the raw material;
- Information of the production or process from which the raw material is derived;
- Ingredient definition or risk assessment that identifies potential ingredient hazard.

Where risk assessments identify the need for specific controls or limits to ensure the appropriate management of potential hazards, these should be included in the specifications agreed with suppliers of the affected raw materials.

Procedures should be implemented for ensuring that suppliers are controlled, such that:

- They are evaluated for their ability to meet contractual requirements and that the results of the evaluation are recorded;

- Written details are recorded of the technical requirements that suppliers are expected to fulfil;
- The specification of any raw material or service provided is agreed and recorded in writing;
- Records of the performance of suppliers are available and reviewed at least annually to determine their continued suitability.

Process control

Processing should be planned, scheduled and controlled by a designated and competent person, to ensure compliance with documented feed specifications and documented parameters for critical processes.

All process controls relevant to feed safety should be demonstrably effective and managed in accordance with prerequisite programs including GMPs and HACCP principles.

Procedures should include corrective actions to be taken in the event of critical process parameters being breached.

Where mixing or dispersion forms an essential part of the process, tests should be undertaken to establish initial effectiveness of equipment and, on a subsequent frequency determined by risk analysis, to ensure that no loss of efficiency occurs through the effects of wear and tear. Records should be kept of such tests.

In situations where breakdown or other unforeseen circumstances result in the production of feed that does not meet specification, the resulting products should be treated in accordance with non-conforming product procedures.

Use of additives and medicinal substances

Where additives or medicinal substances are used during manufacturing, these should be feed compatible and, where required, authorised by the competent authority.

Participants should ensure that control systems provide the correct and effective inclusion levels for feed additives and medicinal substances at all times.

Feed additives and medicinal substances should only be incorporated in a form (liquid, powder or granular) that ensures an homogenous mix can be achieved. When working with low inclusion products, ingredient suppliers should provide evidence that product particle size and concentration will provide uniform distribution.

All manual or automated addition systems should be calibrated by a competent person and calibration records maintained.

Wherever feed additives and medicinal substances are incorporated, effective controls should be in place throughout the scheduling and manufacturing processes to ensure the correct products are incorporated into the intended feed products.

Records should be kept of all feed additives and medicinal substances incorporated.

Where medicinal substances are incorporated, tests should be undertaken at least once every six months to demonstrate that control systems are effective in including these products into the correct feeds and that non-medicated feeds are not contaminated to levels exceeding those prescribed in law in the country of manufacture or the countries in which the feed products will be distributed.

Containers / packages of feed additives and medicinal products should be held in secure storage and under the control of an authorised and competent person. Only those products in current use should be present in manufacturing areas.

INSPECTION, SAMPLING AND ANALYSIS

Inspection

Participants should have inspection regimes in place that ensure the safety of all raw materials on arrival and feed products on despatch. Inspections should include, as appropriate, assessment of:

i) Colour
ii) Physical form
iii) Odour
iv) Contamination by insect pests (droppings and other extraneous matter)
v) Mould
vi) Excessive damage
vii) Compliance with specification

Sampling

Sampling schedules should be controlled by a suitably qualified designated person. Details of the location, method and frequencies for sampling should be documented and appropriate for the raw materials and feed products concerned.

All raw materials and feed products should be subject to a sampling regime. Sampling techniques and frequencies should be adequate to ensure the true representation of the materials concerned.

The sampling regime must be appropriate to both the volume and nature of the raw materials and feed products concerned.

Samples of both raw materials and feed ingredients should be retained for a minimum period of six months, unless risk assessment studies show that shorter periods are sufficient or longer periods required.

Samples should be kept in appropriate, air-tight containers and labelled in such a way as to assist traceability.

Storage conditions for samples should be such that deterioration is minimised.

Disposal of samples should be controlled under formal procedures and, where they are incorporated back into feed products, controls should ensure this does not create any potential hazard.

PERSONNEL TAKING SAMPLES AND UNDERTAKING TESTS

Personnel involved in either taking samples or testing should be suitably qualified for these roles.

Analysis

Where analysis is carried out, it is important that adequate tests are undertaken using methodology that is appropriate to the raw materials and feed products concerned.

Testing schedules for analysis should be the responsibility of a suitably qualified designated person and include both chemical and microbiological testing, as identified by the HACCP plan.

Testing methodology should be robust enough to ensure both the safety of the raw materials used and feed products supplied. The nature and frequency of tests carried out should be based on the volume and potential risks associated with the raw materials and feed products concerned.

Undesirable substances

In addition to sampling and testing required to establish other analyses, evidence must be available to show that feed ingredients meet acceptable, and if applicable, statutory standards for levels of undesirable substances such as mycotoxins, dioxins, heavy metals , pesticide residues, bacteria and endoparasites.

Microbiological analysis

Sampling and testing schedules for microbiological analysis should be the responsibility of a suitably qualified designated person.

It should be possible to demonstrate that the level of microbiological sampling and testing carried out will ensure the safety of any feed products supplied.

Under some circumstances it is appropriate for microbiological testing to be carried out on buildings and equipment. When this is the case, appropriate records should be kept to show that correct methods are being used and, where necessary, corrective action implemented.

Testing laboratories

The methods of analysis employed in laboratories should be appropriate for the raw materials and feed ingredients being tested.

The effectiveness of testing laboratories should be regularly reviewed and approved by one or more of the following methods:

i) Accreditation by a nationally recognised accreditation authority according to ISO-17025 for the test under consideration;
ii) Validation by participating in relevant ring tests;
iii) Validation by other recognised means or comparison with results of a recognised laboratory with verified quality control procedures.

Formal validation of laboratory results is not required for testing facilities used solely for process checks, unless such checks are identified as critical in the HACCP study.

Test records

The parameters for acceptance or rejection of both raw materials and feed products should be clearly defined.

Test results for all raw materials and feed products should be recorded and include clear evidence of action in the event of results falling outside of acceptable parameters.

Test results should be reviewed by an authorised and appropriately qualified person(s) with responsibility for ensuring that both raw materials and feed products meet specified parameters.

Non-conforming products

Participants should establish a documented procedure for dealing with raw materials and feed products that do not comply with specifications. This procedure should include:

i) Identification of batches / lots affected;
ii) Documentation for managing and recording non-conforming products;
iii) Evaluation of the cause of the non-conformance;
iv) Segregation of batches / lots affected;
v) Communication with relevant parties;
vi) Preventive or corrective action to avoid repetition of the non-conformance.

Responsibility for review and disposal of non-conforming products should be clearly defined. All incidences of non-conforming raw materials or feed products should be recorded and decisions regarding actions to be taken only be made by authorised personnel.

Non-conforming feed ingredients should be dealt with in one of the following ways:

i) Sent to waste;
ii) Reworked (if it is safe to do so);
iii) Accepted by concession (if agreed in writing by the customer);
iv) Downgraded (if meeting the specification of another feed product).

Requirements for reprocessing non-conforming feed products should be documented and any affected feed products be re-evaluated on completion to ensure that the batch / lot concerned subsequently meets specified requirements.

The approval and use of reworks (e.g. from quality rejects, customer returns or spillage) should be considered within the HACCP plan. Those that are not approved should become waste and be disposed of accordingly.

Feed products that do not fully meet a customer specification should only be supplied if the customer is notified of the problem in writing and confirms in writing that he is prepared to accept them.

Recall procedure

There should be a documented recall procedure that ensures customers can be informed promptly in the event of any irregularity that may adversely affect feed product safety.

The recall procedure should detail responsibilities and include actions to be implemented in the event of a recall. Feed products should specifically be included in any recall procedures, whether or not supply of feed products is the main activity of the business.

As part of the recall procedure, all relevant contacts should be listed and kept up-to-date. Contacts listed should include the competent authorities to be notified in the following circumstances:

i) In the event of a serious feed safety risk;
ii) When legal limits are exceeded and national legislation requires notification.

Internal audits

It is important to check that all systems relating to feed safety are operating effectively. Consequently there should be a documented procedure for internal auditing.

Internal auditing procedures should require a programme of planned internal audits to check that internal systems are operating as intended and are also effective. Such internal audits should encompass:

i) Compliance with the requirements of the HACCP Plan;
ii) Compliance with formal company procedures;
iii) Compliance with legislation pertaining to feed ingredient safety and quality;
iv) Satisfaction of specified customer requirements.

The programme of internal audits should ensure that all relevant activities are audited at least once a year.

All personnel carrying out internal audits should be trained to carry out such audits and be able to demonstrate their effectiveness in the role.

The outcome of internal audits should be formally reported to those with responsibility for the area audited and record any aspects where the operations are not in compliance with operational requirements. Such areas of non-compliance should be corrected and audit report records signed off by an authorised person to indicate that problems have been corrected satisfactorily.

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