Development of Hazard Analysis Critical Control Point (HACCP) Plan for Comminuted meat products in Gills Food Products (Pvt) Ltd.

By

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DECLARATION

The work described in this thesis was carried out by me at the Department of Food Science & Technology, Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka, under the supervision of Mr. M.C.N. Jayasooriya, Lecturer, Department of Food Science & Technology, Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka & Mr. L.T. Bernard Gills food products (Pvt) Ltd- Wattala A report on this has not been submitted to any other university for another degree.

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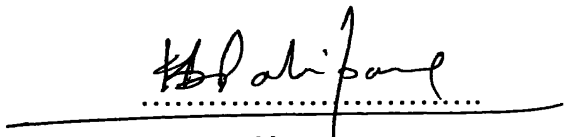

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BUTTALA

Affectionately
Dedicated

To

My Parents

&

Teachers

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ABSTRACT

The Study was aimed at development of HACCP manual for comminuted meat products of Gills Food Products (Pvt) Ltd, one of developing meat-processing company in Sri Lanka. The HACCP plan was developed for four major products categorized as Stuffing, Forming products, Cold meat and Slices and Uncooked products.

Good Manufacturing Practices (GMP) manual, Standard Sanitary Operating Procedures (SSOP) and Standard Operating Procedures (SOP) were developed and documented as pre-requisite programs for HACCP plan development.

All potential hazards associated with each processing step, beginning from raw material reception to transportation of end products were identified. Then Critical Control Points (CCP's) were determined based on Codex alimentarious guidelines. According to this study, similar CCP's were identified in stuffing, forming and cold meat and slices as raw meat reception, sensitive ingredients weighing, chamber operation, vacuum packaging and metal detection. CCP's of uncooked products were identified as raw meat reception, raw meat cold storage, thawing of meat, vacuum packaging and metal detection.

Then Critical Limits of identified CCP's were established with effective monitoring activities, corrective actions and verification procedures. During meat reception, hazard of toxin and pathogen presence in raw beef and frozen chicken was successfully controlled through the microbiological analysis of *Staphylococcus aureus* not more than 1000 per gram, *Escherichia coil* not more than 100 per gram and *Salmonella* spp. absent in 25 gram of meat. Raw meat storage is needed to maintain at (-18^0C)-(-22^0C) temperature and 0^0C-4^0C temperatures for raw meat thawing chiller in order to maintain biological hazards related to uncooked products.

Chemical hazard associated with Nitrites were needed to overcome using 100ppm of Nitrite during product formulation and supervision during weighing. Critical limits estimated for chamber operation were maintained at core temperature 72^0C for Stuffing and forming products and 68^0C for 30 seconds for Cold meat and Slices.

Visual inspection by trained personnel is monitored for no single vacuum leaked product during vacuum packaging of meat products. The critical limit for metal detection was purposed as the detector capable of detecting 1/32 inch metal fragment. Safety assurance can be obtained with higher consumer satisfaction through the effective implementation of developed HACCP plan into production process.

CONTENT

CHAPTER 3

3. Methodology

CHAPTER 4

4. Result and discussion

CHAPTER 5

LIST OF TABLES

LIST OF ABBREVIATIONS

CCP's	Critical Control Points
CIP	Cleaning in Place
CL's	Critical Limits
CP's	Control Points
Codex	Codex Alimentarius Commission, an FAO/WHO Organization
FAO	Food and Agriculture Organization
FDA	Food and Drug Administration
FSIS	Food Safety and Inspection Service
GAP's	Good Agricultural Practices
GDP's	Good Distribution Practices
GLP's	Good Laboratory Practices
GMP's	Good Manufacturing Practices
HACCP	Hazard Analysis Critical Control Points
ISO	International Organization for Standardization
NACMCF	National Advisory Committee for Microbiological Criteria for Foods
NASA	National Aeronautics and Space Administration (USA)
PRP's	Pre-requisite Programs
QAE	Quality Assurance Executive
TPC	Total Plate Count
SLS	Sri Lankan Standards
SQA	Supplier Quality Assurance
US	United States
USDA	United State Department of Agriculture
WHO	World Health Organization

CHAPTER 1
Introduction

1.1 Introduction

Food-borne disease remains a real and formidable problem in both developed and developing countries causing great human suffering and significant economic losses. Food-borne diseases may affect up to one third of the population of developed countries each year and the problem is likely to be even more widespread in developing countries such as Sri Lanka where food and water-borne diarrhea diseases kill an estimated 1.8 million people each year, most of them children. Chemical hazards in foods occasionally cause acute illnesses and some food additives, residues of pesticides and veterinary drugs and environmental contaminants may pose risks of long-term adverse effects on public health. (WHO-Food safety)

Industrialization together with mass production leads to increased risks of food contamination and to considerably larger numbers of people affected in food borne diseases outbreaks as a result of changing lifestyles demand from a vast number of people to eat outside the home every day in food service or catering establishments at street food stalls or in fast-food restaurants. Urbanization leads to a longer and more complex food chain and accordingly to greater possibilities for food contamination. (FAO-Food safety through HACCP)

Therefore today, HACCP based food safety assurance systems, rather than voluntary codes have been made the legal and mandatory requirement in most of countries such as the member states of European Union. Thus recognizing its importance, food and public health authorities worldwide have promoted HACCP.

The Hazard analysis critical control point (HACCP) system is a scientific, rational and systematic approach to identification, assessment and control of hazards during production, processing, manufacturing, preparation and use of food to ensure that food is safe when consumed and does not present an unacceptable risk to health of consumer (Mortimore and Wallace, 1998). With the HACCP system, food safety control is integrated into the design of the process rather than the present ineffective system of end product testing. Therefore the HACCP system provides a preventive

and thus a cost-effective approach to food safety. (UNIDO-An Introduction to HACCP). HACCP system is comparable in-line with some other quality management standards such as ISO9000: 2001, Total Quality Management (TQM), ISO14000 etc. Further HACCP can be identifying as the core fundamental background of ISO22000, which is the latest ISO food safety management system.

Among the fast-foods in Sri Lanka, Comminuted meat products get a priority in the consumer demanding list due to its different flavor, availability and diversification. Comminuted meat products are a term collectively used for the Luncheon meat, Meatballs, Chicken Roll, Burger, Sausage and other meat products. (SLS 1218:2001)

Gills Food Products (Pvt) Ltd is one of a developing meat processing company with the aim of providing wholesome, quality products with ensuring the consumer safety related to their wide range of meat products preparing from Chicken, Beef and Fish as the raw materials. The company products are basically categorized under four major types. Those are Uncooked products, Cold meat and Slices, Stuffing products and Forming products.

Through the effective implementation of the HACCP system for the production processes of the above product categories, they are willing to ensure the product safety which is free from biological, physical and chemical hazards. During my project I attempt to develop HACCP manual for the four categories of comminuted meat products in Gills Food Products (Pvt) Ltd, which can be implement to the company in line with its existing processes.

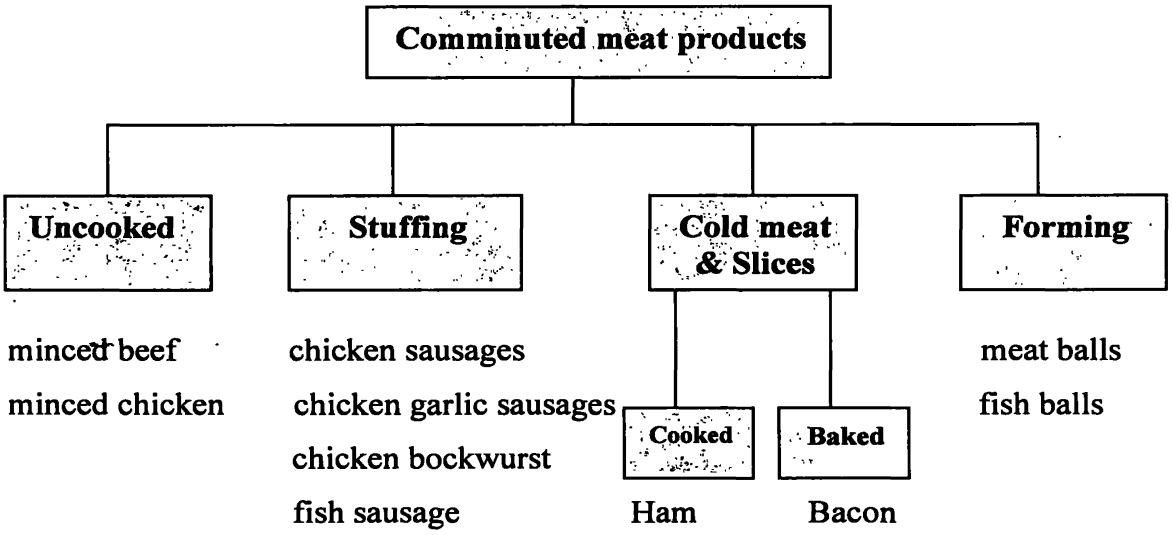


Figure 1.1 Product Categories of Gills Food Products (Pvt) Ltd.

1.2 Overall objective:

Development of HACCP manual for Comminuted meat products categorized under four basic product categories as Uncooked products, Stuffing products, Forming products and Cold meat and Slices.

1.3 Specific objectives:

1.3.1- Identification of all possible hazards associated with the Comminuted meat product processes.

1.3.2- Development of Good Manufacturing Practices (GMP) manual and other pre-requisite programs for the meat processing plant.

1.3.3- Determination of Critical Control Points (CCP) for identified hazards within the Comminuted meat production processes.

1.3.4- Application of microbiological testing to measure the effectiveness of the existing cleaning programs.

1.3.5- Carry out the microbiological analysis for selected comminuted meat products.

CHAPTER 2

Literature Review

2.1 General Overview

2.1.1 Introduction to HACCP

The acronym HACCP, which stands for Hazard Analysis and Critical Control Point, is one, which evokes 'food safety'. Originally developed to ensure microbiological safety of foodstuffs, HACCP has been broadened to include chemical and physical hazards in foods. The recent growing worldwide concern about food safety by public health authorities, consumers and other concerned parties, and the continuous reports of food borne outbreaks have been a major impetus in the application of the HACCP system. (Corlett and Donald-1992)

2. 1.2 The need for an effective food safety assurance method

Food safety has been of concern to humankind since the dawn of history, and many of the problems encountered in our food supply go back to the earliest recorded years. Many rules and recommendations advocated in religious or historical texts are evidence of the concern to protect people against food borne diseases and food adulteration. However, in recent decades this concern has grown. There are many reasons for this;

- Food borne diseases remain one of the most widespread public health problems in the contemporary world, and an important cause of reduced economic productivity, despite progress in food science and technologies. The World *Declaration on Nutrition,* adopted by the FAO/WHO International Conference on Nutrition (Rome, December 1992), emphasizes that hundreds of millions of people suffer from communicable and non-communicable diseases caused by contaminated food and water.
- The increasing incidence of many food borne diseases, e.g. salmonellosis and
- Campylobacteriosis in many regions of the world.
- Increased knowledge and awareness of the serious and chronic health effects of foodborne pathogens.
- The possibility of detecting minute amounts of contaminants in food, due to advances in scientific and analytical methods.

- Emerging food borne pathogens, e.g. *Listeria monocytogenes,* verocytotoxin producing *E. coli, Campylobacter spp,* foodborne nematodes, etc.
- An increase in the number of vulnerable people, such as the elderly, immuno-compromised individuals, the undernourished, and individuals with other underlying health problems.
- Increased awareness of the economic consequences of foodborne diseases.
- Industrialization and increased mass production, leading to: i) increased risks of food contamination; and ii) the considerably larger numbers of people affected in foodborne disease outbreaks as a result.
- Urbanization, leading to a more complex food chain, and thus greater possibilities for food contamination.
- New food technologies and processing methods, causing concern either about the safety of the products themselves or the eventual consequences due to inappropriate handling during preparation in households or food service/catering establishments.
- Changing lifestyles, depicted by an increasing number of people eating outside the home, in food service or catering establishments, at street food stalls, or in fast-food restaurants. Responsibility for food preparation shared between family members who are not always aware of food safety rules.
- Increased worldwide tourism and international trade in foodstuffs, leading to a greater exposure to foodborne hazards from other areas.
- Increased contamination of the environment.
- Increased consumer awareness of food safety.
- Lack of or decreasing resources for food safety.
- It is this climate of increasing concern about food safety, the lack of sufficient resources, and the recognition of the limitations of traditional approaches to food safety assurance, which have accentuated the need for a cost-effective food safety assurance method. The HACCP system has proven to be such a system. (National Food Processors Association's-1993)

2.1.3 The HACCP system and its benefits

The HACCP system is a scientific, rational and systematic approach to identification, assessment and control of hazards during production, processing, manufacturing, preparation and use of food to ensure that food is safe when consumed (i.e. it does not present an unacceptable risk to health). With the HACCP system, food safety control

is integrated into the design of the process rather than the present ineffective system of end product testing. Therefore, the HACCP system provides a preventive and thus a cost-effective approach to food safety.

The HACCP system can be applied throughout the food chain, from the primary producer to final consumer. Its implementation should be guided by scientific evidence of risks to human health. The successful application of HACCP requires the full commitment and involvement of management and the workforce. It also requires a multidisciplinary approach. This multidisciplinary approach should include, when appropriate, expertise in agronomy, veterinary science/medicine, production, microbiology, public health, food technology, environmental health, chemistry, and engineering, according to the particular study.

The HACCP principles can be applied in a variety of ways;

- The HACCP system is a system used as a method of food safety assurance in food production, processing, manufacturing and preparation.
- The HACCP system is amenable to effective food control. It allows for more efficient inspection of food operations, as the role of food inspectors is centered on the assessment of the HACCP plan and confirmation that it is properly designed and operating effectively.
- The HACCP concept can also be used to study food preparation practices and to identify and assess hazardous behavior, which should be the focus of health education interventions.
- The HACCP concept can also be used in the management of overall food safety programmes to identify those problems all along the food chain, which are of greatest risk to public health, and in order to prioritize interventions.

The additional benefits of the HACCP system can be summarized as follows;

- The HACCP system overcomes many of the limitations of the traditional approaches to food safety control (generally based on `snap-shot' inspection and end-product testing), including;

  (a.) Reducing the potential for product recall

  (b.) Identification of problems without understanding the causes

  (c.) The difficulty of collecting and examining sufficient samples to obtain meaningful, representative information, in a timely manner and without the high cost of end-product analysis

(d.) Limitations of 'snap-shot' inspection techniques in predicting potential food safety problems

- The HACCP system allows for the identification of conceivable reasonably expected hazards, even where failures have not previously been experienced. It is therefore particularly useful for new operations.
- The HACCP system is sufficiently flexible to accommodate changes introduced, such as progress in equipment design, improvements in processing procedures and technological developments related to the product.
- The HACCP system will help target/direct resources to the most critical part of the food operation.
- With the HACCP system one can expect an improvement in the relationship between a) food processors and food inspectors, and b) food processors and consumers. The HACCP system provides a scientifically sound basis for demonstrating that all reasonable precautions have been taken to prevent a hazard from reaching the consumer. In this way, it encourages confidence in the safety of food products and thus promotes both confidence in the food industry and stability of food businesses.
- Data collected facilitates the work of food inspectors for auditing purposes.
- The HACCP system is applicable to the whole food chain, from the raw material to the end product, i.e. growing, harvesting, processing or manufacturing, transport and distribution, preparation and consumption.
- The application of HACCP systems can promote international trade by increasing confidence in food safety.
- The HACCP system can be readily integrated into quality management systems, e.g. Total Quality Management, ISO 9000, etc.

2.2 HACCP Plan Development

2.2.1 Preliminary steps for HACCP plan development

However, prior the application of HACCP to any sector of the food chain, that sector should be operating according to the *Codex Alimentarius* General Principles of Food Hygiene, the appropriate Codex Codes of Practice, and appropriate food safety legislation. In the development of a HACCP plan, five preliminary steps need to be

accomplished before applying the HACCP principles to a specific product and process. These tasks are as follows:

- Assemble the HACCP team,
- Describe the food
- Describe the intended use and consumers of the food
- Develop a flow diagram which describes the progress
- Verify the flow diagram

(Codex Alimentarius Commission -2002)

2.2.1.1 Phase 1-Assemble the HACCP team

2.2.1.1.1 HACCP Team

In order to work out with a HACCP system we should assemble a HACCP team. The team should be familiar with overall food operation and the specific production process to be included in the plan. Therefore the team's goal and each member's responsibilities in reaching that goal must be clearly defined. The first duty of the team is to gather the information essential to the HACCP plan construction. This information starts with the products' description and the identification of its intended use. Then the team should develop a flow diagram and a plant layout and confirm it on site.

2.1.1.1.2 Team's activities

The activities of the team should focus on Hazard identification in every possible point of the production, the determination and monitoring of the CCP's and the validation of the actions implemented at CCP level. Therefore the HACCP team, after studying the whole operation, should describe the product as (identifying potential food safety problems), identify the products intended use, construct a flow diagram specific for each processing step, list all potential hazards and conduct a hazard analysis. Also team involving in considering control measures, lay down the means for the provision of resources, equipment, etc., describe what to do for the training of the personnel, and finally, be responsible for the proper implementation, verification and improvement, in other words be responsible for the follow-up of the whole plan.

It is considered very important at this point that the team should succeed in the commitment of the management and shall issue documents (fill-out forms) specific for each step of the food processing chain. These forms or records should be easy for

the personnel to understand and to complete in a given time (daily or weekly depending on the case), because this is the only way to follow-up the success of the HACCP system implementation in the plan.

2.2.1.2 Phase 2-Product Description (Productive Plans)

One of the first activities of the study team is to describe the product (which raw materials and ingredients are used, and who are the suppliers), Which parameters can be influenced to safety (pH, aw, modified atmosphere packaging, storage temperature and time), What is the processing conditions, suitable temperature treatment etc., How is the packaging performed, and what are the characteristics of the packaging materials, What are the real conditions during distribution, warehousing and sales. All these information is described in a specific "form" called "product Description Form". Next, the intended use of the product has to be defined.

2.2.1.3 Phase 3- Intended Use

As intended use of food (or product in general) is defined the normal expected use of it (i.e. whether it is ready-to-eat, to drink or ready-to-cook, or should be mixed etc). On the other hand the same terminology is used to determine the consumer, or otherwise, whether or not the food is intended for infants, immuno-compromised individuals, the elderly, pregnant women, etc.

The identification of the product's intended use is following the description of the product, because this may influence the level of safety to be assured, or the risks which can be taken. If the product is to be sold to hospitals or groups of the population with high susceptibility to certain microbes, more safety has to be built in and critical limits need to be stricter. The use and preparation practices may also influence safety of product. HACCP is successful only if applied from farm to fork.

2.2.1.4 Phase 4- Development of process flow and Plant lay out

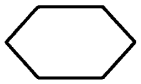
The purpose of a flow diagram is to provide a clear, simple outline of the steps involved in the process. The scope of the flow diagram must include all steps in the process, which are directly under the control of the establishment. In addition, the flow diagram can include steps in the food chain, which take place before and after the processing that occurs in the establishment.

2.2.1.4.1 Flow diagram

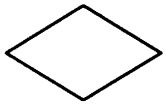
A Flow diagram is a schematic representation of the sequence of steps or operations used in the production or manufacture of a particular food, from raw materials receipt to end product sale or service. A Plant layout is a graphic representation of the plant. To understand how a product is manufactured, and to have a disciplined approach in the study, it is important to construct a flow diagram covering all steps where product safety could be affected. In order to do this all information, which should be looked at, should be gathered. For instance, all Good Manufacturing Practices require a clear separation between raw materials and prepared foods. For the same reason, it is important to indicate on the diagram or factory layout sheet, the personnel movements.

2.2.1.4.2 Flow diagrams (symbols)

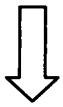
It describes the activities in each process phase



It indicates a raw material, an ingredient, a by-product of the process

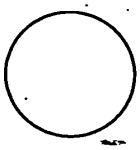


It indicates a decision point in the productive process



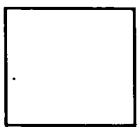
It indicates flow direction.

2.2.1.4.3 Flow process chart symbols



OPERATION:

This symbol represents any kind of operation or group of operations, which results in an intentional change in the form of arrangement of the material, which brings it nearer to completion.



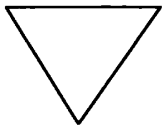
INSPECTION:

This symbol represents an inspection or decision. Material is examined for identification or is verified.

DELAY:

D

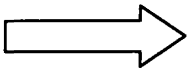
This symbol represents a delay to material when conditions do not permit the immediate performance of the next planned step. This does not include any planned change to its physical or chemical characteristics.



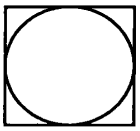
STORAGE:

Storage where material is kept in an unchanged form and protected against unauthorized removal.

TRANSPORT:



Transportation occurs when a material is moved from one place to another, except when such movements are part of an operation, or are caused by an operator at a workstation during an operation or inspection.



COMBINED ACTIVITY:

When it is desired to show activities performed either concurrently or by the same operator at the same workstation, the symbols for these activities are combined as shown for a combined operation and inspection by the circle within the square.

2.2.1.5 Phase 5-On site Confirmation of Flow diagram and Plant layout

The efficiency of the HACCP plan depends on the expertise used during its development, and the correctness of the data used. Assessment therefore starts with an evaluation of these two points. As has been mentioned before, not only should HACCP be assessed, but also the prerequisites. The accuracy of several data, such as the correctness of the flow diagram, can only be checked during on-site inspection. Up to this point, the study is a paper exercise. Clearly, what has been put on paper should be confirmed by an on-site inspection. This should check the correctness of the information and ensure that nothing crucial was overlooked. It is important to inspect the site and the practices applied during all hours (night shifts, weekends etc.) of operation, as well as the idle hours.

Inspection of the cleaning procedures and validation of their efficacy are very important. Operators often are better informed than Chief Engineers or Production Managers about practices and the problems encountered during the operation, and may have information about problems that were not considered in the study. The used method is the direct observation through the inspection in order to find out possible discrepancies between documents and reality and to adjust the wrong documents.

2.2.2 HACCP System Principles

It is unanimously accepted that responsibility for producing safe food is in the hands of producers or providers. It is thus the responsibility of industry to ensure proper application of the seven HACCP principles and implementation of the HACCP plan. The Codex Alimentarius text distinguishes principles from guidelines for their application. Application may differ according to the product, the size and sophistication of the industry, the country etc., but it is the responsibility of the industry to ensure that the essentials of HACCP are put into practice and, when requested, to provide evidence that this was done. HACCP consists of 7 principles, which are the minimum requirements in the mandatory application of the HACCP system. These principles are the following:

Principle 1: Conduct a hazard analysis
Principle 2: Determine the Critical Control Point (CCP)
Principle 3: Establish critical limits
Principle 4: Establish a system to monitor control of the CCP
Principle 5: Establish the corrective actions to be taken when monitoring indicates that a particular CCP in not under control
Principle 6: Establish procedures for verification to confirm that the HACCP system is working effectively
Principle7: Establish documentation concerning all procedures and records appropriate to these principles and their application

2.2.2.1 PRINCIPLE 1: Conduct a Hazard Analysis

The team should examine the problems caused by the foodborne diseases in the specific region or country where the product is produced or raw materials are coming from and identify the hazards to occur at any step of the process. These can be of microbiological, chemical or physical nature. Within a HACCP system, there is a distinction between biological, chemical and physical hazards. In case of physical hazards (splinters of metal, glass or other foreign material), is required logical thinking and the knowledge of the technological production procedures. Here, the expertise lies with the technical staff of the food company. In contrast, the assessment of chemical and biological hazards requires special expertise for the pathogenesis of human diseases, which are caused by such hazards. Therefore the development of effective preventive measures requires comprehensive knowledge of the epidemiological factors, which threaten the health of the consumer. A hazard analysis carried out for a product or process should be reviewed if any changes are made in the product or the process (new raw material, changes in the method of preparation, processing or packaging etc) Hazards of low probability of occurrence and of a low severity should not be addressed under the HACCP system but may be addressed through Good Manufacturing Practice (GMP).

2.2.2.1.1 Hazard

The first part of the hazard analysis is an evaluation of the specific food process and manufacturing establishment, and considers the effect of a wide range of factors on the safety of the food. The potential risk and severity of each hazard is assessed by the HACCP team, and preventative measures are identified. Hazards addressed by the HACCP team include biological, chemical, or physical properties that may cause a food to be unsafe for consumption. These hazards can affect both the product ingredients and the production process. (International Commission on Microbiological Specification for foods-1992)

- **Biological hazards** mainly consist of contamination of the product with pathogenic bacteria such as *Salmonella*, and parasites, such as *Trichinella sprialis*. Raw ingredients must be properly treated, stored, and handled. As noted earlier, heating, refrigeration and curing are used to control or prevent these types of biological hazards from contaminating the product.

- **Chemical hazards** consist of contamination of the product unapproved chemicals or ingredients. Chemical contaminants could include pesticides, fertilizers, cleaners, lubricants, and paints, food chemicals such as preservatives and processing aids, and naturally occurring chemicals, such as aflatoxins, lead, arsenic, and PCBs. An excess of approved chemicals in the product also presents a hazard. For example, including an excessive amount of acidifiers or antioxidants in the product formulation creates a chemical hazard. In addition, the packaging materials should be certified by the producer for the intended use to ensure that chemicals present in the packaging are not harmful.

- **Physical hazards** consist of contamination of the product by foreign objects, such as rocks, wood, metal glass, screws, plastics, or jewelry that may inadvertently enter the product mixture.

2.2.2.1.2 Biological Hazards of Concern to Meat products

During a 6 month period beginning August 1998, the Center for Disease Control (CDC) reported at least 50 illnesses caused by *Listeria monocytogenes* bacterium. Six adults died, and two pregnant women had spontaneous abortions.

During 1998, at least 9787 laboratory-confirmed cases of illness related to food borne contamination were confirmed, however, only a fraction of the persons who experience food borne illnesses are believed to seek medical care, and even a smaller number to submit laboratory specimens. Government health agencies actively monitor foods for the presence of pathogens such as *Campylobacter, Escherichia coli 0157, Listeria, Salmonella, Shigella, Vibrio, Yersinia, Cryptosporidium* and *Cyclospora.* Sausage makers must ensure that their products are not contaminated by pathogens such as *Listeria, E. coli 0157, Salmonella, Trichinae,* and *Staphylococcus* enter toxin. (National Advisory Committee on Microbiological criteria-1992)

2.2.2.1.2.1. *Escherichia coli* O157:H7

Escherichia coli O157:H7 is a bacterial contaminant of sausage and other meat products that can cause serious diarrheal illness, sometimes resulting in complications that can lead to death. The presence of *E. coli* in cooked meat products can be

controlled by proper cooking temperatures and times. *E. coli* contamination of dry sausages can be reduced by closely controlling the fermentation heating process, the acid content, and via post-fermentation heating to 145^0F or above. And with all sausage products, proper hygiene, handling, and storage procedures are essential to control contamination.

2.2.2.1.2.2 *Salmonella*

Nontyphoidal salmonellosis is a leading cause of food borne illness in the world. As with *E. coli*, *salmonella* organisms can be eliminated from cooked meat products by proper cooking processes. In dry sausages, the producer must follow a combination of processes to control the pathogen, including use of a fermentation starter culture, increased product temperatures during fermentation, and careful control of the product pH, cure, and salt content. In addition, product handling procedures must be designed and monitored to ensure that cross contamination of the finished product with contaminants present in raw materials does not occur.

2.2.2.1.2.3 *Listeria monocytogenes*

Listeria monocytogenes is a bacterium found in soil and water that can contaminate meats, and can cause a serious infection in humans, called listeriosis. The organism can be found in many food processing environments, and has been isolated from floor drains and refrigeration drip pans. From these niches the organism gets moved throughout the facility, and can end up on food contact surfaces. Cross contamination between raw and cooked product can also result in the presence of the bacteria on ready to eat product. Detection of post processing product contamination by *Listeria monocytogenes* can include sampling the processing lines and environment. Processors should consider the following elements in elimination of *Listeria monocytogenes*:

- Examine how raw materials are handled before they are cooked and determine how handling procedures might affect *L. monocytogenes* levels in the product.
- Determine the impact of rework practices on *L. monocytogenes* levels in the raw product.
- Examine product flows, processing patterns and employee practices and determines where opportunities for cross contamination occur.

Healthy persons rarely develop serious illnesses from exposure to *Listeria*. However, listeriosis is especially dangerous for pregnant women, newborns, and persons with weakened immune systems. Even with prompt treatment using antibiotics, listeriosis can cause death. In world, about 4216 persons become seriously ill with *Listeria* each year, resulting in about 425 deaths. Treatment of meat products to eliminate *Listeria monocytogenes* is similar to the steps to eliminate Salmonella, including thorough cooking and proper storage of the product.

2.2.2.1.2.4 *Staphylococcus aureus*

Staphylococcus aureus is a Gram-positive coccus. It is a non-motile, non-sporing and facultative anaerobic organism. Some strains of *S. aureus* are capable of producing heat-stable toxins (enter toxins) in food. It is the toxin, which causes the typical symptoms associated with *S. aureus* food poisoning. No viable organisms of *S. aureus* need to be ingested, although, the organism needs to grow to levels of about 105 - 106/g food before the food becomes toxic. Typical symptoms are nausea and vomiting with occasional abdominal cramping and diarrhoea. Deaths have occurred amongst children and the elderly.

Foods involved in *S. aureus* food poisoning are typically those that have been handled and then temperature abused prior to consumption. Foods implicated in *S. aureus* food poisoning have been cooked meats (notably salted meat such as ham), poultry products, custard or cream-filled pastries, egg foods, cheese, prawns and salads containing potato.

Staphylococcus aureus can grow within the temperature range 7°C - 48°C, with an optimum of 35°C - 37°C. The limits for toxin production are, however, narrower than for growth, the optimum being between 40°C and 45°C (very little toxin is produced at the upper and lower extremes). In most circumstances, *S. aureus* is not heat resistant and will be destroyed by pasteurization.

Table 2.1 Characteristics of growth for bacterial pathogens associated with meat and poultry products, along with of preventative measures

Pathogens	Temperature range for growth	pH	Preventative/control measures
Bacillus cereus	$10-48^0$ C	4.9 – 9.3	Proper holding/cooling temperatures
Campylobacter jejuni	$30-47^0$ C	46.5 - 7.5	Proper pasteurization/ cooking, freezing, avoiding cross contamination
Clostridium botulinum Group I (Toxin Types A,B,F), Group II (Toxin types B,E, F)	$10-48^0$ C $3.3-45^0$ C	> 4.6	Addition of nitrites and salt, refrigeration, acidification to below pH 4.6, reduction of moisture below 0.93
Clostridium perfringens	$15-50^0$ C	5.5 – 8.0	Proper holding/cooling temperatures. Proper cooking time/temperatures
Escherichia coli O157:H7	$10-42^0$ C	4.5 – 9.0	Proper holding/cooling temperatures. Proper cooking time/temperatures
Listeria monocytogenes	$2.5-44^0$ C	5.2 – 9.6	Proper heat treatment, strict sanitation program, separation of raw and ready-to-eat production.
Salmonella	$5-46^0$ C	4 – 9	Proper heat treatment, separation of raw and cooked products, fermentation controls, decreased water activity.
Staphylococcus aureus	$6.5-46^0$ C	5.2 – 9	Proper fermentation and pH control, proper heat treatment and post process product handling, reduced water activity.
Yersinia enterocolitica	$2-45^0$ C	4.6 – 9.6	Proper refrigeration, heat treatments, control of salt and acidity, prevention of cross contamination.

(Collins and Lyne- 2002)

2.2.2.1.3 Sources of Microbial contamination

Major points of meat contamination are;

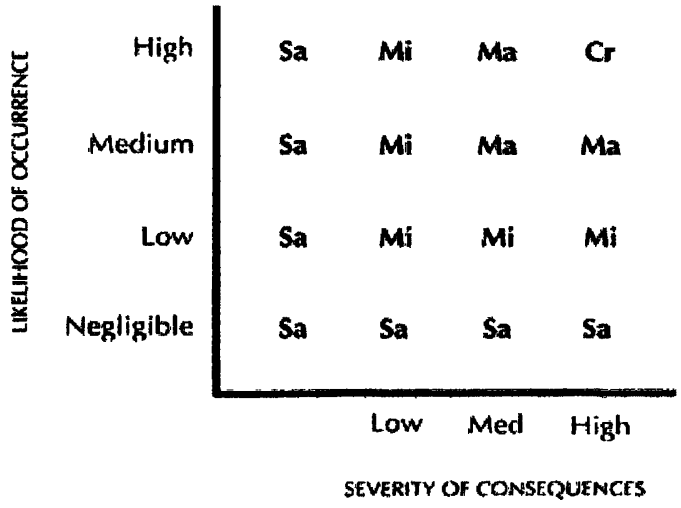
- Non-sterile knives used for exsanguinations.
- Head, leg, hide and offal removal during slaughter
- Water sources for cleaning
- Surface contact during storage, fabrication and during handling and processing.

Major sources of contamination are hide, feet, manure and viscera, Equipment, Clothing and hands of personnel, Air, Water, Walls and doors.
The initial microbial load is the major factor determining the shelf life of the raw meat

2.2.1.4 Determination of Significance of Hazards.

Points that should be considered while performing a hazard analysis include:

- The likely occurrence of hazards and the severity of their adverse effects.
- The qualitative and quantitative evaluation of hazards.
- The survival or multiplication of microorganisms in concern.
- The production or persistence in foods with toxins, chemicals or physical agents.
- The quality of raw material.



Significance of the hazard
Sa – Satisfactory (negligible)
Mi – Minor
Ma – Major
Cr – Critical

Figure 2.1 Determination criteria for Significance of hazards

2.2.2.2. PRINCIPLE 2. Determine the Critical Control Point (CCP's)

A CCP is a step in the food chain where activities are carried out, or conditions prevail which can have an influence on the safety of the product, and where control can be exercised over one or more factors to prevent or eliminate a food safety hazard or reduce it to an acceptable level. The Codex Alimentarius guidelines define a

critical control point (CCP) as a step at which control can be applied and is essential to preventing or eliminating a food safety hazard or reducing it to an acceptable level. Critical Control Points are crucial to ensuring product safety.

A CCP can be related to raw materials, processes and practices applied along the food chain. CCP's govern all factors, which are basic to the prevention of food borne diseases. If a hazard has been identified at a step where is necessary for safety and if no control measure exists at that point or at any other, then the product or process should be modified at that step, or at any earlier or later stage, to include a control measure for this hazard.

Determination of critical control points (CCP's) must follow a logical consideration of all steps where hazards can be controlled. There may be one or more CCP's at which control can be applied to address the same hazard. The determination of a CCP in the HACCP system can be facilitated by the application of a flexible, decision tree according to the type of operation, which indicates a logical reasoning approach. (E.g. production, slaughter, processing, storage, distribution or other). A decision tree included in the Codex Alimentarius, Hazard Analysis and Critical Control Point (HACCP) System and Guidelines for its Application.

2.2.2.3 PRINCIPLE 3. Establish Critical and Operating limits

2.2.2.3.1 Critical Limits

Critical limits are defined as criteria that separate acceptability from unacceptability. A critical limit represents the boundaries that are used to judge whether an operation is producing safe products. The critical limits must be specified for each critical control point, be realistic and especially sufficient to provide the necessary food safety assurances. Measurable and observable criteria used to set critical limits may include measurements of temperature, pH, time, available chlorine etc. The critical limits should meet requirements set out by government regulations and company standards and most of all should be supported by scientific data.

2.2.2.3.2 Operating limits

If monitoring shows a trend towards lack of control at a CCP, operators can take action to prevent loss of control of the CCP before the critical limit is exceeded. The point at which operators take such action is called "the operating limit". Operating limits should not be confused with critical limits because they may be almost similar and yet they are quite different to each other. The explanation is because the operating limit is more restrictive and it will be reached before the critical limit is violated.

2.2.2.4 PRINCIPLE 4: Establish a System to Monitor Control of the CCP

The Codex Alimentarius Hazard Analysis and Critical Control Point (HACCP) System and Guidelines for its Application, defines "monitoring" as the observations or measurements of control parameters in order to assess whether a CCP is under control. Therefore "Monitoring" is checking by testing, measuring or observing, whether a Critical Control Point is under control. It is the tool that will confirm if the HACCP plan is being followed. It is essential in making sure that critical steps are under control. It will identify where a loss of control has occurred or if there is a trend towards a loss of control. It will also identify the corrective actions to the processes to restore or maintain control.

The monitoring procedures must be able to detect loss of control at the CCP. The monitoring system will be effective only if the owner of the establishment, the manager and employees are given the knowledge, skills and the responsibility for preparing safe food. There are many ways to monitor the critical limits of a CCP. Most commonly monitoring can be done on a continuous basis (100%) or on an every batch analysis basis. Among the above, continuous monitoring is preferred, where feasible, because it is more reliable. The higher the frequency of monitoring (i.e. the less time between each instance of monitoring), the less product will be affected when there is a loss of control at the CCP.

Monitoring procedures need to be rapid, as they relate to on line processes, which in general do not leave time for lengthy analytical testing. For this reason, physical and chemical measurements (temperature, time, pH, moisture level and water activity) or visual observations, which may be done rapidly, are often preferred to microbial testing. The purposes of monitoring include the following:

- To measure the performance level of the operation at the CCP (trend analysis)
- To determine when the performance level of the system results in a loss of control at the CCP (e.g. when there is deviation from a critical limit); and
- To establish records reflecting the performance level of the system's operation.

2.2.2.5 PRINCIPLE 5. Establish the Corrective actions

Specific corrective actions must be developed for each CCP. Corrective actions must specify what should be done to bring the CCP under control and ensure that potentially unsafe products are not marketed. Corrective actions include steps to correct the problem and steps to deal with the affected product. The Codex Alimentarius Hazard Analysis and Critical Control Point (HACCP) System and Guidelines for its Application define as "Corrective action", any action to be taken when the results of monitoring at the CCP indicate a loss of control. In this concept, loss of control is considered a deviation from the critical limit of a CCP and deviation is a failure to meet a critical limit. Corrective action programme should include:

- Investigation to determine the cause of the deviation,
- Effective measures to prevent recurrence of the deviation and
- Verification of the effectiveness of the corrective action taken.

2.2.2.6 PRINCIPLE 6. Establish verification Procedures

The Codex Alimentarius guidelines define "Verification" as the application of methods, procedures, tests and other evaluations, in addition to monitoring, to determine compliance with the HACCP plan. In other words "Verification" refers to all these activities undertaken to check compliance with the plan and its implementation. These activities should be planned ahead, because they should be approved by the responsible person in the establishment, at the same time as all other activities of the HACCP study. Originally, the producer did verification in order to check out the effectiveness of the HACCP system. For this reason he was using a qualified individual or individuals who were capable of detecting deficiencies in the plan or its implementation. The verification may be done:

- After each HACCP plan elaboration,
- As part of a continuous revision, established by the program in order to demonstrate that the HACCP plan is efficient,

- When there is any change that affects hazard analysis or changes HACCP in any way.

2.2.2.6.1 Verification activities

Verification is an ongoing activity. A new hazard analysis is necessary after changes in raw materials, processing conditions, line layout, distribution conditions, preparation and use etc. The outcome of such an analysis may need to be validated and verified. As a consequence of trends detected in monitoring results, or results of raw material and end product testing, changes may be made which need to be verified. External auditors or government inspectors should keep records of all these verification activities for examination.

The verification activities are mentioned more detailed below:

- Analyze the HACCP plan documents and its registers,
- Scientifically evaluate all hazards,
- Analyze deviations of critical limits,
- Analyze corrective actions taken for each deviation in the past,
- Guarantee that all CCP are under control,
- Guarantee -through calibration- that all measuring equipment are working properly
- Perform laboratory analysis to guarantee that the critical limits are well established, and
- Evaluate suppliers for quality assurance.

2.2.2.6.2 Review

Review means a retrospective view or survey of past events, experiences etc. A review should show whether unacceptable deviations were followed up and/or whether CCP's were kept under control. The review of consumer complaints can demonstrate that deviations were not detected, and thus that things have to be changed: the system did not deliver what was expected. If the review shows that CCP's were not always monitored as foreseen, or that instruments used for monitoring were not accurate, the system or its implementation has to be improved. End product testing may provide some evidence that the plan was effective, and that

objectives were achieved, but especially as regards to the control of pathogens it is a poor verification tool.

2.2.2.7 PRINCIPLE 7. Establish Documentation system

Records are written evidence through which an action is documented. A record shows the process history, the monitoring, the deviations and the corrective actions that occurred in the past. Accurate documentation and record keeping is essential to the application of a HACCP system. They should be appropriate to the nature and size of the operation. They should also be sufficient to enable the business to be confident that controls are in place and being maintained. Records document that the critical limits at each CCP were met or that appropriate corrective actions were taken when the limits were not met. They can also record that the actions performed were verified. Therefore it is imperative that the producer maintains complete, current, properly filed and accurate records.

Four types of records should be used in the HACCP plan:

- Basic Support Documentation (bibliographical or other data used for the establishment of control measures, shelf life, critical limits)
- Records generated by the HACCP system. These records describe all activities and documentation required to prove adherence of a HACCP system to the originally designed HACCP plan.
- Documentation of methods and procedures used. They clearly relate to the safety of the product and therefore they should be maintained for possible auditing by the regulatory authorities.
- Records of employee training programs (employees are trained to understand the appropriate procedures/methods and actions in order to intervene when critical control limits are threatened).

Verification is one of the seven principles of HACCP, that's why it's associated activities are established during the HACCP study. Validation on the other hand is mentioned in the Codex Alimentarius guidelines on the application of the seven HACCP principles, but the Codex does not describe how to do it.

2.2.3 Pre-requisite Programs for HACCP

The GMP and SOP (Standard Operating Practices)/SSOP (Standard Sanitary Operating Practices) are known as the cornerstones of food safety and quality and are two of the prerequisite programs required for a successful implementation of a HACCP plan.

The other programs that are needed to have an effective HACCP plan are Supplier Quality Assurance (SQA), Product Identification, Tracking, and Recall, Preventive Maintenance, and Education and Training. It is of the highest importance that all employees, including management, have an understanding of these prerequisite programs if their HACCP plan is to be effective and their entire organization is to be successful. (Codex Alimentarius Commission- 2002)

2.2.3.1 Good Manufacturing Practices

GMP is important to the manufacture of safe, clean, and wholesome foods. GMP is one of the most important factors to be considered in any food-based establishment. If a company follows good manufacturing practices correctly, most of the CCP's can be controlled. So only few CCP's need to be monitored. A key issue for product safety is the risk of cross-contamination occurring during the process from the internal factory environment. Cross-contamination could arise from a wide range of sources and the inherent risks in a particular processing area must be understood. Most of these issues are managed through adherence to Good Manufacturing Practice (GMP). Some of the main factors that are considered in GMP manual can be identify as follows.

- **Factory Layout**

Factory building and layout need maintain to minimize the cross-contamination risks. This should include adequate segregation of raw materials and finished products. Full separation between raw and cooked product may be required and raw materials and finished products will need to be kept separate from the main processing area. Plant need to be availability of potable water, and adequate cleaning facilities, equipment and environment, with the connection of all other facilities. e.g. steam heating and cooling facilities. If there is any holding stage involved, adequate space for holding the required and cross-contamination should

be minimized. Appropriate temperature-control facilities, humidity controls facilities, lighting facilities need to be are available (Donald and Corlett, 1998).
The patterns of movement of staff and equipment should also be considered.
Staff needs to be facilitating with adequate hygiene facilities, such as changing and rest rooms and hand wash stations, along with canteen and recreational facilities.

- **People and personal hygiene**

Factory workers and other personnel who are enter in to food processing area could cause cross-contaminate the product with microbiological, chemical or physical hazards. The process layout and movement patterns should be considered in order to minimize this risk, along with the appropriate training programmes.
Employees need to be provided with all types of protective clothing that is required, along with frequencies of changing and laundering procedures. Facilities that you have given such rest rooms, hand wash stations, canteen, recreational facilities need to be crosscheck whether are properly installed and working. All personnel in a food plant should be trained in Good Hygiene Practice. Company executives or specific person need to be monitor whether, employees are following the good practice.

- **Buildings**

Design of building itself could pose a hazard or safety risk to the product, through harborage of pests and other contamination, or through physical contamination duo to poor design and maintenance. Surfaces should be non-porous and easy to keep clean, with all cracks filled and sealed, and overhead services should be kept to a minimum. All buildings should be well maintained to prevent physical hazards falling into the product, and drains should be designed and serviced so that the flow is always away from production areas, with no chance of back flow or seepage.

- **Equipment**

Equipment should be designed to minimize any cross-contamination risk. This could arise through parts of the equipment breaking off and gaining entry to the product as physical hazards. Alternatively, if equipment has any dead-leg areas, is difficult to clean or is poorly cleaned, microbiological build-up could contaminate the product. Chemical contamination could arise through

Lubricants or cleaning residues remaining on the equipment food-contact surfaces. Remember also to ensure that you can clean around and under equipment. If it is too close to the floor to clean underneath, the equipment should be sealed around the base.

- **Cleaning**

There must be sufficient facilities for the cleaning of equipment; people, plant and buildings, and these should be situated to enable their convenient use. Cleaning areas should not cause a cross-contamination risk to the process. Cleaning schedules should be prepared for all areas and staff must be adequately trained to carry out cleaning activities effectively.

- **Chemicals**

Storage facilities must be provided for any chemicals that are required for use in the manufacturing area. These must prevent the risk of product contamination. All chemicals must be properly labeled and must not be decanted into food containers. All personnel handling chemicals must be trained in their safe use.

- **Raw materials**

Raw materials can act as cross-contaminants if they gain access to the wrong product, or if they are added in excess quantities. Handling areas for raw materials must be carefully planned, and areas used for more than one type of ingredient may require thorough cleaning between uses. (Walstra *et al*, 1999).

- **Storage**

Storage areas must be properly planned to minimize damage and cross-contamination issues. Consider whether you have adequate segregation, temperature and humidity control, and ensure that all storage areas are properly pest proofed. All materials should be stored off the floor and in sealed bags or containers. Part-used containers must be resealed after each use, and strict stock rotation should be employed.

- **Products**

Residues of other products can also cause a serious hazard if allergenic material is present or if they affect the intrinsic nature of the product that is contaminated. Production lines should be spatially separated to prevent cross-contamination, and handling and cleaning procedures should be planned appropriately.

- **Packaging**

Packaging areas and handling practices should be managed and controlled to prevent any cross-contamination risk. The packaging itself could be a major hazard, e.g. glass fragments, or could introduce microorganisms to the product. Make- sure that your packaging is suitable for the job and won't be damaged during product storage and distribution, and consider whether you have the correct coding and usage instructions printed legibly.

2.2.3.2 Standard Operating Procedures (SOP's)

Standard Operating Procedures (SOP) can be defined as established or prescribed methods to be followed routinely for the performance of designated operations or in designated situations. They are very concise and specific step-by-step instructions. Establishments are encouraged to have SOPs for every task or activity in the facility. GMP's can help guide the development of SOPs. SOPs are also very useful in training employees and in establishing a consistent method for conducting daily operations. (Mortimore and Wallace-1998)

2.2.3.3 Standard Sanitary Operating Practices (SSOP's)

SSOP's are procedures used by food processing firms to help accomplish the overall goal of maintaining GMP in the production of food. Typically SSOP's describe a particular set of objectives associated with sanitary handling of food and the cleanliness of the plant environment and the activities conducted to meet them. When SSOP's are well designed and effectively implemented, they are valuable in controlling hazards. Identification of Critical Control Points may be influenced by the effectiveness of a GMP program, including industry SSOP's. (Mortimore and Wallace-1998)

2.2.3.4 Supplier quality Assurance (SQA)

Raw material quality is another fundamental tool in HACCP. Company need to understand the possible hazards that is associated with the raw material that received. Different elements of an effective SQA may include some factors such as, agreed product specification; have an audit to suppler, etc. One thing that the company need to understand is that company can not produced hazard free product alone it self, if

any raw material contain a hazard. So good channel partnerships and mutual understanding of each other's objective is beneficial both parties in this kind of situation. (Mortimore and Wallace-1998)

2.2.3.5 Statistical Quality Control (SQC)

SQC plays an important role for the maintenance of proper product quality and interpretations of reports, which is a crucial function in the successful operations of the quality assurance program. The SQC employed statistical principles and methods, which have been developed, to assess the magnitude of chance cause variation and to detect assignable cause variations. Such as variations in the products should not go without corrective actions, which depends on the laws of probability. Thus SQC is really sampling of the product, determine the quality variations of the sample and relating the finding to the entire lot under consideration. (Mortimore and Wallace-1998)

2.3 Meat and Meat Products

2.3.1 Comminuted meat products

Comminuted meat products are a term collectively used for the Luncheon meat, Meatballs, Chicken Roll, Burger, Sausage and other meat products. (SLS 1218:2001)

2.3.1.1 History of Comminuted meat products

The process of preserving meats by stuffing salted, chopped meats flavored with spices into animal casings dates back thousands of years, to the ancient Greeks and Romans, and earlier. Sausages and sausage products have since evolved into a wide variety of flavors, textures, and shapes resulting from variations in ingredients and manufacturing processes.

Today, the sausage and other meat products manufacturing industry must adhere to government standards for ingredients and processes. In addition, accurate labeling requirements ensure that the consumer is informed of the ingredients of a sausage product. The objective of these standards is to help ensure that sausage products maintain a consistent quality and are safe to consume. (Tompkin- 1990)

2.3.1.2 Type of Comminuted meat products

2.3.1.2.1 Sausages

A Comminuted meat product seasoned with salt and Spices and enclosed in a natural or synthetic casings or formed by other means into a cylindrical or similar shape. (SLS 167:1988)

Mainly there are 4 types of sausages.

- Fresh sausages

  Sausages prepared from fresh/cured meat
- Cooked sausages

  Sausages prepared from fresh/cured meat, which has been subjected to boiling or heating with steam, and are ready-to-serve.
- Smoked and Cooked Sausages

  Sausages prepared from fresh/cured meat, which has been seasoned, smoked and cooked. Smoked and Cooked sausages are ready-to-serve.
- Dry and Semi-dry sausages

  Sausages prepared from fresh/cured meat and dried with out boiling or dried after boiling. These sausages may be fermented with lactic acid bacteria to produce a characteristic flavor.

2.3.1.2.2 Meat balls

A meatball or fish balls is a generally spherical mass of ground meat or fish and other ingredients, such as bread or breadcrumbs, minced onion, various spices, and possibly eggs, cooked by frying, baking, steaming, or braising in sauce. (Wikipedia-Meat balls)

There are many kinds of meatball and fish balls different kinds of meats and spices. While some meatballs are mostly made of meat and ingredients to cement the ball, others may include other ingredients. How one makes one's meatballs depends as much on one's cultural background as on one's individual taste. There are even "meatless" meatballs to satisfy vegetarian palates.

2.3.1.2.3 Luncheon meat or Cold cuts

A Cooked Comminuted meat products seasoned with salt and spices and produced into a form intended for slicing. (SLS 167:1988). Cold cuts are cheeses or precooked meat or meat loaves that are sliced and usually served cold on sandwiches or on party

trays. They can be bought pre-sliced in vacuum packs at a supermarket or grocery store, or they can be purchased at a delicatessen or deli counter, where they might be sliced to order. Most cold cuts are high in fat and sodium. Cold cuts are also known as luncheon meats, sandwich meats, cooked meats, sliced meats and cold meats. Brest products are normally categorized under this category.

2.3.1.2.4 Bacon

Bacon is defined as any of certain cuts of meat taken from the pigs, cows or chicks that may be cured and/or smoked. It is used primarily in cubes as a cooking ingredient valued both as a source of fat and for its flavor. Besides being used in cooking, bacon is also served uncooked and thinly sliced. Many people prefer to have their bacon smoked by using various types of woods. This process can take up to 10 hours depending on the intensity of the flavor desired. Bacon may be eaten fried, baked, or grilled. (Meat Science-2007)

2.3.1.2.5 Ham

Ham is the thigh and rump of any animal (usually smoked) that is slaughtered for meat. Ham is one of the earliest of preserved meats; it is now a leading product of the meatpacking industry. The flavor and quality of ham depend on the age, condition, and feeding of the animal and on the smoke used in curing.

Cooked ham is a ham prepared from cured meat, which has been subjected to boiling or heating with steam and ready-to-serve. (SLS 1146:2001)

2.3.1.2.6 Minced meat

Minced meat, ground meat or hamburger meat is a ground meat product, made of beef or chicken finely chopped by a meat grinder or mincer. Ground meat is an uncooked product and popular as a relatively cheap and quick-cooking form of meat. One of its most well known uses is in hamburgers. It is an important ingredient in meatloaf and cuisine. (Meat Science-2007)

2.3.2 Ingredients used for comminuted meat products

2.3.2.1 Meat ingredients

The flesh and fat, skin, rind, gristle and sinew in amounts naturally associated with the flesh of animal or bird, which is normally used for human consumption and includes edible parts. (SLS 167:1988)

2.3.2.1.1 Lean meat

Meat free from trimmable fat & connective tissue, containing no fatter and connective tissue than is naturally associated with particular out of trimmed meat used, provided that neither fat nor connective tissue exceeds 10% by mass.(SLS 167:1988).

2.3.2.1.2 Edible parts

Parts of animal or birds used for human consumption. (SLS 167:1988)

2.3.2.1.3 Chemical Composition of meat

Table 2.2 Typical Meat Nutritional Content from 110 grams (Henry-2002)

Component	Meat Species		
	Fish	**Chicken**	**Beef**
Energy (Calories in 110g)	110-140	160	275
Water %	80.0	75.0	72.0
Protein (grams in 110g of meat) - Myofibrilar-salt soluble Myosin, Actin, Tropomysin, Troponin, M proteins, Actinins - Sarcoplasmic-water soluble Glyceraldehyde, Aldolase, Myoglobine,Hemoglobin - Connective tissue-insoluble Collagen, Elastin, Reticulin, Mitochondrial	20-25	28	30
Lipids (Fats)	1-5	7	18
Carbohydrates - Glycogen, Glucose, Lactic acid	0.5	0.3	0.2
Miscellaneous - Vitamins, Inorganic (Minerals), Nitrogenous	1.7	2.3	2.9

Table 2.3 Composition of different meat types of chicken (Meat Science-2007)

	Lean Meat %	**Fat %**	**Skin %**	**Inedible %**	**Dissection loss %**
Chicken Breast					
Raw	64	5	9	20	2
Baked	66	2	7	23	2
Chicken Drumstick					
Raw	57	1	8	31	2
Baked	52	1	8	36	3
Chicken Thigh					
Raw	47	10	11	29	3
Baked	52	3	9	33	3
Whole Chicken					
Raw	54	5	11	27	2
Baked	57	2	8	30	3

2.3.2.2 Sword Fish (Sappara/ *Xiphias gladius*)

Swordfish (*Xiphias gladius*) are large, highly migratory, predatory fish characterized by a long, flat bill. They are a popular sport fish, though elusive. Swordfish are elongated, round-bodied, and lose all teeth and scales by adulthood. They reach a maximum size of 14.75 ft (4.3 m) and 3,190 lb (1,446kg). Swordfish is a particularly popular fish for cooking. Since swordfish are large animals, meat is usually sold as steaks, which are often grilled. The color of the flesh varies from white to pinkish color. According to Environmental Chemical contaminant and Pesticide tolerances, action levels and guidence levels in Srilanka, Sawrd fish is not categorized as a threat oranism for Natural toxins, Histamins and Heavy metals. (US Food and Drug Administration-1998)

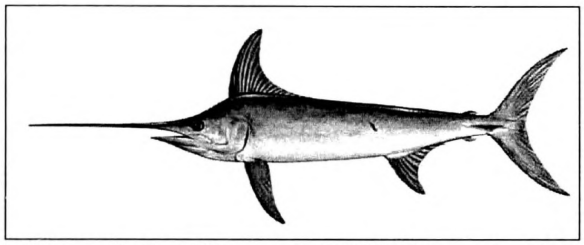


Figure 2.2- Diagram of *Xiphias gladius*

2.3.2.3 Non-meat ingredients

2.3.2.3.1 Nitrites

Nitrite in meat greatly delays development of botulinum toxin (botulism), develops cured meat flavor and color, retards development of rancidity and off-odors and off-flavors during storage, inhibits development of warmed-over flavor, and preserves flavors of spices, smoke, etc.

Adding nitrite to meat is only part of the curing process. Ordinary table salt (sodium chloride) is added because of its effect on flavor. Sugar is added to reduce the harshness of salt. Spices and other flavorings often are added to achieve a characteristic "brand" flavor. Most, but not all, cured meat products are smoked after the curing process to impart a smoked meat flavor.

Sodium nitrite, rather than sodium nitrate, is most commonly used for curing (although in some products, such as country ham, sodium nitrate is used because of the long aging period). In a series of normal reactions, nitrite is converted to nitric

oxide. Nitric oxide combines with myoglobin, the pigment responsible for the natural red color of uncured meat. They form nitric oxide myoglobin, which is a deep red color (as in uncooked dry sausage) that changes to the characteristic bright pink normally associated with cured and smoked meat (such as wieners and ham) when heated during the smoking process.

Nitrites can be toxic to humans due to formation of carcinogenic compound Nitrosamine if residual Nitrites are present in the processed products. Use of these ingredients in product formulations is carefully controlled. They are sometimes referred to as "restricted ingredients." Supplies of sodium nitrite and potassium nitrite and mixtures containing them must be kept securely under the care of a responsible employee of the establishment. (United States Department of Agriculture-1999)

2.3.2.3.2 Phosphates

Phosphates are added to the cure or brine to increase the water-binding capacity and thereby the yield of the finished product. Polyphosphates help solubilizes muscle proteins and raise the pH of meat by increasing the number of positive charges on the proteins. This increases the space around the proteins. Therefore the proteins hold more water. With increased water binding capacity, product yields increases, product surfaces are drier and firmer, and emulsions are more stable at higher temperatures. Only alkaline phosphates are effective for improving water binding since acid phosphates may lower the pH and cause greater shrinkage.

As cured products containing phosphates lose moisture after processing, the phosphates may precipitate out on the surface forming "whiskers" of phosphate crystals. Also, excessive levels have been accused of causing a "soapy" taste, especially at levels above 0.5%. Regulations on phosphates vary greatly from country to country. (United States Department of Agriculture-1999)

2.3.2.3.3 Ascorbate

The two primary reactions that occur after the curing ingredients are introduced into the meat are a reduction of metmyoglobin to myoglobin and a reduction of nitrite to nitric oxide. The nitric oxide is then available to combine with myoglobin to form nitrosyl myoglobin. To speed these reactions and shorten curing times, a strong

reducing agent is commonly added to the brine. The most frequently used compounds are sodium ascorbate or sodium erythorbate.

Ascorbate or erythorbate accelerate the conversion of metmyoglobin to myoglobin and nitrite to nitric oxide; respectively and also suppress the reverse reaction. This results in a more complete conversion of the muscle pigment to the cured pigment form. Residual amounts of ascorbate or erythorbate will also add stability to the cured meat pigment by reducing the deterioration of the nitrosohemochrome and thus giving the product a longer shelf life. The use of reducing agents results in lower levels of residual nitrites in the product. Use of reducing agents is required in some countries to ensure the complete reaction of nitrite to nitric oxide and less residual nitrites to form nitrosamines in the cooked product. (United States Department of Agriculture-1999)

2.3.2.3.4 Flavoring materials

Adding various flavorings and spices to cured meat products is becoming increasingly popular. Originally a few spices such as pepper, allspice, etc. were rubbed on the surface of dry cured hams. These probably did not penetrate too far into the ham itself and their flavor effect was primarily confined to the surface. With the advent of brine curing, however, flavorings could be introduced directly into the meat. For the most part, spices extracts are used in the flavoring of cured eat products. The most common flavorings are pepper cloves and cinnamon. Garlic and onion flavors as well as fruit juices may also be added. Additions of flavorings are an easy way for product differentiation in a finite market. The Use of flavoring is a matter of taste. Care should be used so as not to overpower the natural cured meat flavor.

Flavor enhancers, such as hydrolyzed vegetable protein, autolysed yeast protein and monosodium glutamate are sometimes added to various processed meats. These products are used to increase the intensity of flavor of the product. These flavor enhancers can be injected into meat products before addition of marinades to increase the impact of the meat flavor. (Meat science-2007)

2.3.2.5 Salt

Salt is basic to most curing mixtures. It is the only ingredient necessary for curing. Salt acts by dehydration and altering of the osmotic pressure so that it inhibits bacterial growth and subsequent spoilage. Originally salt served as a preservative and

for that matter, still does in the "country-style" cured meat products. Salt when used alone gives a harsh, dry, salty product that is not very palatable. In addition, salt when used alone results in a dark undesirable colored lean that is unattractive and objectionable to consumers.

Salt is used in most instances as a flavor enhancer but it is also important to water binding ability of meat and extraction of meat proteins necessary for the manufacture of boneless or chopped and formed hams. When salt is added to meat it causes swelling of the myofibrils. With the addition of salt the isoelectric point (lowest water holding capacity) is shifted to a more acidic pH, increasing the water binding ability of meat at its normal ultimate pH of 5.5-5.6 (Meat Science-2007).

Salt improves water binding but also is necessary to extract proteins in the manufacture of boneless hams. Salt solubilizes actin and myosin to form the glue between muscle pieces so boneless products appear as one piece and aids in the sliceability of the finished product. Increasing levels of salt will extract more muscle proteins but the amount that can be used is limited by the taste of the product.

Only food-grade salt should be used in curing and marination, since impure salt can cause flavor and color problems. Although dry salt curing utilizes salt in excess the amount used in dry curing methods and brines is variable depending upon the end product desired

2.3.2.3.6 Sugar and Sweeteners

The sugar is added to cures primarily for flavor. Sugar softens the products by counteracting the harsh hardening effects of salt especially at high levels. Sugar also interacts with the amino groups of the proteins and, when cooked, forms browning products that enhance the flavor of cured meats. In some instances, the browning reaction may become too pronounced and burned flavors result. This can especially be a problem for marinated products intended for grilling. (Bauman-1996)

Sugar substitutes have been used in bacon cures to prevent excessive browning during cooking. Non-reducing sugars are necessary to prevent browning. Corn syrup, molasses and other natural sugar substitutes are sometimes used in place of sugar.

Sugar, also, is an effective preservative at high levels. However, the level used in meat curing is so low it is doubtful that sugar has any major influence on the bacteria.

In long cures, particularly dry cures, the sugar provides food for reducing bacteria, yeasts and molds. Sugar (in this case usually dextrose) also provides food for some of the lactic acid fermenting bacteria that provide the characteristic flavor of some dry cured and fermented sausage products. (Bauman-1996)

2.3.2.3.7 Spices, Condiments and Seasonings

2.3.2.3.7.1 Anti-microbial properties of Spices

Spices and herbs have been used for thousands of centuries by many cultures to enhance the flavor and aroma of foods. Studies in the past decade confirm that garlic, onion, cinnamon, cloves, thyme, sage, and other spices can inhibit the growth of both gram-positive and gram-negative food borne bacteria, yeast and mould. Effects of the presence of these spices / herbs can be seen in food products such as pickles, bread, rice and meat products. The fat, protein, water and salt content of food influence microbial resistance. (Pearson and Gillett-1997)

Table 2.4 Anti-microbial Effectiveness of Spices and Herbs

Spices and Herbs	Inhibitory Effect
Cinnamon, cloves, mustard	Strong
Allspice, bay leaf, caraway, coriander, cumin, oregano, rosemary, sage, thyme	Medium
Black pepper, red pepper, ginger	Weak

(Pearson and Gillett-1997)

2.3.2.3.7.2 Microbial Contamination of Spices

Spices and herbs may be contaminated because of conditions in which they were grown and harvested. Spores of both *Clostridium perfringens* and *Bacillus cereus* have been found to be present in spices and contaminated spices have been reported to be causes of food borne illness and spoilage. Fewer microorganisms are present in spices with higher antimicrobial activity such as sage, cloves, and oregano. However, all spices and herbs should be cleaned and decontaminated with ethylene oxide, irradiation or other acceptable methods. (Pearson and Gillett-1997)

Table 2.5 Inhibitory Effects of Spices and Herbs

(Pearson and Gillett-1997)

Spice/ Herbs	Microorganisms
Garlic	*Salmonella typhymurium, Escherichia coli, Staphylococcus aureus, Bacillus cereus, Bacillus subtilis,* mycotoxigenic *Aspergillus, Candida albicans*
Onion	*Aspergillus flavis, Aspergillus parasiticus*
Cinnamon	Mycotoxigenic *Aspergillus, Aspergillus parasiticus*
Cloves	Mycotoxigenic *Aspergillus*
Mustard	Mycotoxigenic *Aspergillus*
Allspice	Mycotoxigenic *Aspergillus*
Oregano	Mycotoxigenic *Aspergillus, Salmonella* spp., *Vibrio parahaemolyticus*
Rosemary	*Bacillus cereus, Staphylococcus aureus, Vibrio parahaemolyticus*
Bay leaf	*Clostridium botulinum*
Sage	*Bacillus cereus, Staphylococcus aureus, Vibrio parahaemolyticus*
Thyme	*Vibrio parahaemolyticus*

2.3.2.3.8 Non-meat proteins

Soy proteins and deheated mustard flour are used as protein sources to allow for further extension and as binders for added water. Proteins binders cannot be used in products called ham but are allowed in highly extended ham loaves or poultry rolls. The typical usage level is between 0.5% and 5.0%. Levels used depend on the protein used and whether or not it is an isolate or flour.

2.3.2.3.8.1 Soy protein

[Excerpt from an article by Dr. Joe Corday, Meat Business Magazine, July 1990]

During the times when raw sausage materials are expensive, processors are faced with a dilemma. They must either raise the price of their products or find away to lower their production costs. Utilization of soy proteins often enables processors to lower their costs while maintaining traditional product characteristics. All too often soy protein gets a bad rap. People complain that soy protein gives products poor taste and texture. These problems can exist if soy proteins are used incorrectly or at too high a level. When soy proteins are used correctly they have limited adverse effect on the flavor or texture of a product. In fact they often improve the product. The term "soy protein" covers a wide range of products derived from the soybean. These products are classified as: soy flours, soy protein concentrates, or isolated soy proteins.

2.3.2.3.9 Casings

During Sausage manufacturing process, after the blending is complete, the blended ingredients may be bulk packaged, or they many be extruded into a casing. Manufacturers of these products utilize a wider range of casing materials. (Bauman - 1996)

2.3.2.3.9.1 Regenerated collagen casings (Natural casings)

Regenerated collagen casings are made from collagen extracted from cattle hides and hog skins in a process called regeneration. The extracted collagen is dissolved, and then hardened, washing, swelled with acid, and finally formed into the tubular casing shape in an extrusion process. This final shape is then fixed in an alkali bath. These types of lower strength casings are typically used for smaller diameter products.

2.3.2.3.9.2 Synthetic or artificial casings

Synthetic or artificial casings are made from special papers impregnated with cellulose, saran casings made from synthetic plastics, and hydro-cellulose casings made from regenerated cellulose. Cellulose casings are created from dissolved fibers extracted from cotton seeds or paper pulp. Each of these types of casings are available in a wide range of sizes and characteristics and are easy to handle, however, these types of casings are not edible and must be removed from the sausage prior to consumption. Artificial casings provide high strength and are available with excellent permeability to moisture and smoke, or as impermeable casings for use in producing water-cooked products.

2.3.2 Important Processing Steps of comminuted meat production

2.3.2.1 Curing

Meat Curing was used originally almost entirely as a mean of preserving meat during times of plenty to carry over to times of scarcity. Although a variety of compounds can be used in curing meat, the basic curing ingredients are salt, sugar or some other sweetener, nitrites and phosphates. A number of other compounds are sometimes used in curing mixtures, such as various spices, baking soda, sodium erythorbate, hydrolyzed vegetable proteins and monosodium glutamate. Although there are a number of methods of curing primal or sub primal cuts of meat. They are all modifications or combinations of two fundamental procedures. That is dry curing and Pickle curing. (Pearson and Gillett-1997)

2.3.2.1.1 Dry curing

The dry curing uses salt alone or salt in combination with nitrite. The advantages of dry curing are safe, easy and need little special care. But it has disadvantages also that the end product is too salty and color is lost.

2.3.2.1.2 Pickle curing

The pickle curing procedures uses the same ingredients as dry curing, except the cure is dissolved in water to form brine or pickle. Either cuts are submerged in the pickle until the cure has completely penetrated the meat or inject the brine in to the cuts

using single or multiple needle brine injectors. The strength of the brine is expressed in terms of degrees brine. A salometer or salinimeter is used to determine the strength of the brine. The water used should have a high degree of purity. Normally cold water is added to prepare the brine solution used in the pickle curing.

Pickle injection is fast in operation compare to brine immersion, has also increased yields. There are several models of machineries for injecting the cure in to meat cuts. Most injection equipment contains a series of offset needles. Pickle is pumped until the desired weight is obtained. Since the pickle enters through a large number of needles spaced relatively close together, the distribution of pickle is excellent. The spacing of the needles, their size and dwell time are important to good distribution and retention of the pickle. This results in rapid curing.

2.3.2.2 Mincing (Grinding)

Meat Chunks of variable size and shape with variable fat contents are ground to form uniform cylinders of fat and lean. The worm or screw of feed in the Barrel of the mincer conveys the meat and presses into holes of the grinder plate. The rotating blade cuts the compressed meat and aids in filling the grinder plate holes. The size of the holes in the grinder plate determines the diameter; the thickness of the plate and the number of blades determines the length of cylindrical particles. During mincing, part of Shortening/ fat is adding in to the meat. These is the basic process step in the production of Minced meat products. (Pearson and Gillett-1997)

2.3.2.3 Bowl Chopping

Chopper is composed of a revolving metal bowl that contains the meat, while knife blade rotating on an axle cut through the revolving meat mass. A chopper is often used as a means of batching the sausage mix. A Chopper is basically a series of curved knives on an axle. The Speed of the knife, rpm of the bowl, and sharpness of the blades are all factors in its performance. The Bowl chopping is also called as Silent cutting or a flying. The temperature of the meat mass during cutting will rise 10^0-20^0 in 10-15 min of chopping. Vacuumized choppers de-aerate the batter making a denser product and accelerating the extraction of the salt soluble proteins.

2.3.2.4 Stuffing

This process step is applied for the Sausage products and other products such as Burger, Roll etc. The Sausage emulsion, also known in the trade as mix, sausage dough, or batter is transferred to stuffer for extruding into casings. At this point, the size and shape of the product is determined. Air pressure of 125psi is used with many stuffers.

2.3.2.5 Linking and Tying

After the emulsion is stuffed into casings, the encased mass is tied with thread or fastened with metal clips. Large sausage items are tied or clipped at one end with a hanging tie and suspended from a smoke stick or hook so the entire surface is free from contact with the equipment.

2.3.2.6 Tumbling

Tumbling accelerate the extraction of the meat proteins on to the surface of the pieces of meat or the muscle or muscle strips. Salts and Phosphates are generally added before tumbling. The action of tumbling is nit only aids in better extraction of the meat proteins but also improves the speed of curing by increasing salt absorption. It is probable that cure absorption is improved by the loosening of the muscle structure. Tumbling is done in the equipment called as tumbler. Modern tumblers are generally stainless steel drums which revolving vertically into defined agitation speeds with temperature maintaining around 0^0C-4^0C.

2.3.2.7 Chamber Operation

This operation is the main step of heat-treated comminuted meat products to control the pathogenic microbes during the production. During Chamber operation there are three main processes are carried out. That is Drying, Smoking and Cooking. Depending on the required flavor characteristics and product characteristics, these three processes are varied. For examples for sausages, these three products are applied while for meat balls only cooking process are applied. (Pearson and Gillett-1997)

2.3.2.7.1 Drying

Reduction of moisture at the surface of the meat serves several purposes. Lowering of surface moisture reduces the water activity on the surface and thus also reduces microbial growth. The reduced surface moisture content plays a key role in preventing not only the growth of surviving bacteria, but also the growth of any other bacteria that may recontaminate the product.

Surface drying during cooking is also responsible for skin formation in production of skinless sausages like frankfurters and similar products. Coagulation of Surface proteins results in the formation of outer layer that serves as a skin when the cellulosic casings used during sausage manufacture are removed. Drying of the surface is also aids in giving the skin a dense texture and imparts the characteristic appearance of skinless products. Although the ingredients have some influence on peelability, poor cooking without excess shrinkage and wrinkling are important in imparting good peelability.

2.3.2.7.2 Smoking

Like curing, smoking has a preservative effect on meat. The primary purpose of smoking meat is development of aroma, flavor and color, for preservation and for creation of new products. It also leads to formation of a protective skin on emulsion-type sausages, and protect from oxidation. The browning or Millard reaction is responsible for development of the characteristic brown color on the surface of smoked products. One of the most important properties of the smoke is its effect on the bacterial population. The chemical components that are responsible for the preservative action and flavor, color development are phenols, organic acids, alcohols, carbonyls, hydrocarbons, and some gaseous components such as carbon dioxide, carbon monoxide, oxygen, nitrogen and nitrous oxide. Basically smoke houses are used for the smoking purposes and smoke generates either from liquid smoking or wood smoking can be used.

2.3.2.7.3 Cooking

Cooking is not only improved palatability but also reduced the incidence of spoilage by partial destruction of bacterial flora. Thus, cooking meat improved the keeping

qualities and extended its storage life. Cooking has the following effects on meat and meat products. It coagulates and denatures the meat proteins, at the same time altering their solubility and effecting changes in color. Cooking improves meat palatability by intensifying the flavor and altering the texture. It also destroys the considerable number of microorganisms and improves the storage life of meat products.

Cooking inactivate the indigenous proteolytic enzymes and prevents development of off-flavors. It decreases the water content of raw meat, especially on the surface, which in turn lowers the water activity and improves the peelability of sausages and extends their shelf life. Cooking also stabilizes the red color in cured meat and modifies the texture or tenderness of meat and met products.

2.3.2.8 Chilling

After smoking and cooking the product is showered with cold water and then chilled by refrigeration. Normally chilling is done until the internal temperature reached to 35^0F-45^0F.

2.3.2.9 Packaging

Different types of packaging are used for marketing of Comminuted meat products. Shrink packages and Vacuum packages are the most popular and widely used methods. Vacuum packaging refers to packaging in containers (rigid or flexible), from which substantially all air has been removed prior to final sealing of the container. This method of packaging is actually a form of "Modified Atmosphere" since normal room air is removed from the package. Advantages of the vacuum packaging are Extends shelf life and aids in controlling oxidative rancidity. It also prevents the growth of normal spoilage bacteria. Aerobic organisms such as Pseudomonas are suspended and lactic-acid bacteria are favored. The latter can grow to high numbers without causing spoilage.

Vacuum packaging can reduces moisture loss and freezer burn and prevents movement of water out of the product into the surrounding headspace. It requires minimal storage space and package is drawn tight around product taking up minimal space. Also Leaks are easily detected. A small puncture or pinhole in a vacuum pack is easy to detect by looking for loose packages. (Meat science section- 2007)

2.3.2.10 Freezing and Storage

Proper freezing and storage of meat are essential for maintaining the integrity of the product. Storage temperature is important for extending shelf life and controlling pathogen growth. Understanding proper techniques for freezing will help protect the integrity of the product.

When freezing, it is important to freeze fast. Fast freezing causes the formation of small ice crystals. Slow freezing causes the formation of large ice crystals, which can damage proteins, resulting in a loss of elasticity, resorption and water-holding capacity. It reduces the eating quality of the meat products with resulting coarse texture. Freezing at -22°C to -30°C causes 99.9% of the water contained in meat to be frozen. Microbial and enzymatic activity virtually ceases at these temperatures. The most common methods used to achieve a fast freezing are;

- **Blast freezing:** Involves rapid air movement that removes heat from a product. The most common temperature for blast freezing is -40°C with high velocity air movement.

- **Plate freezing:** Plate freezing is used for boxed goods. Products are stored on a series of shelves and frozen to a temperature of -20°C. (Meat science section-2007)

CHAPTER 03

Methodology

3.1 Study about the Company lay out, production process, raw material, ingredients and all the relevant information

All relevant information associated with the HACCP concept was studied and monitored using Sanitation Check List to identify the current status of the company and production flow. Those observations were gathered and the company management was aware about the modifications and improvements.

3.2 Measure the effectiveness of the existence Manufacturing practices by monitoring and inspection, using past records and with the use of microbiological testing

Swab testing were carried out for food contact surfaces (machineries and tables) and Workers hands to measure the effectiveness of Cleaning and Disinfection procedures. Depending on the microbiological testing results altered the Strength and Dilution of the Cleaning chemicals.

3.2.1 Swab testing

Sterile swab was removed from Aluminum foil

⇩

Swab was moisten with sterile diluent (100ml) poured into sterile container

⇩

25 cm^2 area was swabbed with the sterile rectangular block

⇩

Swab was break into the sterile diluent

⇩

Four Swab samples were taken from each location

⇩

Container was shaken well to transfer organism to diluent

⇩

1ml from 100ml of diluent was taken and carried out Total Plate Count (TPC) in Plate Count Agar (Incubated at 35^0C for 48 hours)

⇩

Colonies were counted and Calculated the organisms present in 1 cm^2

3.3 Development of Pre-requisite Programs necessary for HACCP system

3.3.1 Development of Good manufacturing Practices (GMP) Manual

GMP manual was developed to fulfillment of pre-requisite program. GMP manual was developed by considering Codex Alimentarius requirements. As Supporting documents, Calibration Schedule, Maintenance Schedule, Pest treatment Schedule, Cleaning Schedule and Training Schedule were developed.

3.3.2 Development of Sanitary Standard Operating Procedure (SSOP) and Standard Operating Procedures (SOP)

SSOP and SOP manuals were developed to fulfillment of pre-requisite program. Supplier Acknowledgement and Supplier evaluation Criteria were developed under SOP manual.

3.4 Identification of the scope of HACCP study and Company Quality and safety policies

Scope of the HACCP study was developed as a entering to the HACCP study. Company Quality policy and Safety policy ware recorded as to establish to identify the commitment of the company for its products.

3.5 Identification of HACCP team

By considering the key skills and responsibilities that each person was involved in the company, HACCP team was set up in a suitable manner. Team has been appointed a team leader who had good knowledge of the factory activities and experienced in development of HACCP plans. Selected team only contained appropriate number of persons else it's difficult to control and manage.

3.6 Product description and intended use of Comminuted meat products

Product features and attributes ware understood as much as possible. Full description of the product such as composition, structure, processing, packaging, storage and

distribution conditions, and expected shelf life were identified. Type of raw materials used, ingredients used, quantities of ingredients were recorded. Product's intended usages were identified as considering it's characteristics and observing catered target market.

3.7 Construction of Factory flow diagram and Process flow diagrams

Process flow diagrams of the four product categories has been identified and constructed. Further factory flow layout was identified with included the potential delay stages. Simultaneously all possible cross-contamination risks that would happen were identified. Then the process flow diagrams were confirmed with the discussion of the group.

3.8 Identification of Hazards and Hazard Analysis (Principle 1)

All potential hazards such as biological hazards, chemical hazard and physical hazard were identified with regard to raw material and process steps of four product Categories of Comminuted meat products. Raw material hazards and process flow hazards were separately identified, documented and discussed with other team members to identify any other hazard is to be considered. Possible sources or courses for each hazard also identified. Control measures are also documented to each identified hazard.

3.9 Determination of Critical Control Points (Principle 2)

CCP decision tree approach was used to identify each CCP. Raw material control decision tree (Codex, 1997) was used to identify the CCP's in the raw material, which was used. Separate CCP decision tree (adapted from Codex, 1997) was used to identify CCP's in the process/process flow.

3.9.1 Critical Control Point identification for raw materials

Q1. Is there a hazard associated with this raw material?

Q2. Are you or the customer going to process this hazard out of the product?

Q3. Is there a cross-contamination risk to the facility or to other products, which will not be controlled?

Sensitive raw material High level of control required.

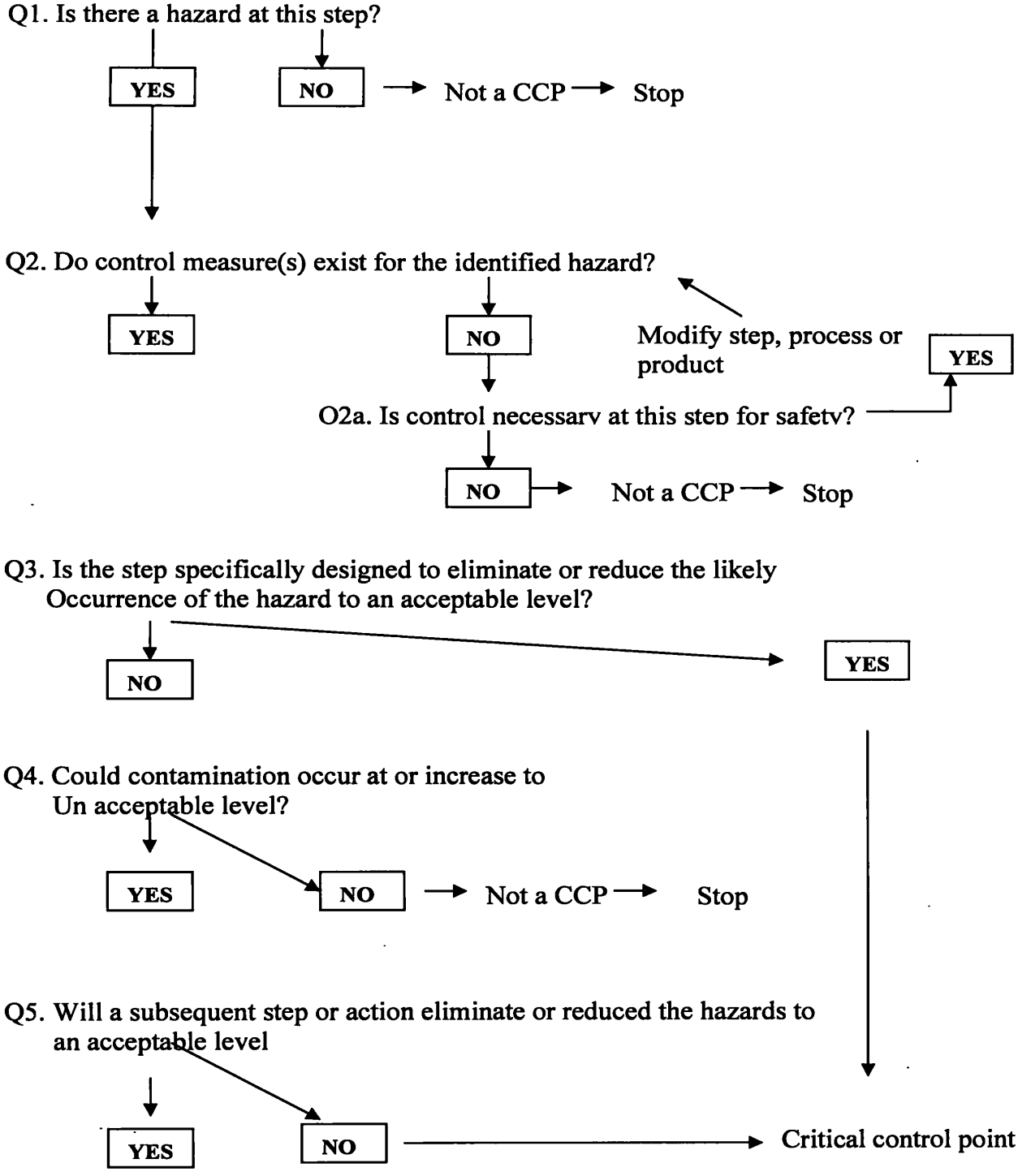
Key

* Proceed to your next raw material.

(Codex, 1997)

Fig.3.1 HACCP decision tree-Raw material

3.9.2 Critical Control Point identification for Process flow



Key

* Proceed to your next process step
(Codex, 1997)

Fig.3.2 A CCP decision tree- Process step

3.10 Establishment of Critical limits for identified CCP's (Principle 3)

Critical limits established using public sources as scientific publications, regulatory requirements and guidelines given by SLSI and Food Safety and Inspection Service (FSIS)- US.

3.11 Establishment of Monitoring procedures (Principle 4)

Monitoring procedures for identified CCP's were established. Monitoring of relevant limits, responsible persons, how the monitoring done and monitoring frequency were established.

3.12 Establishment of Corrective action procedures (Principle 5)

Relevant corrective action were developed for each identified CCP's for any deviation that would indicate from the given critical limits. Established whom to be reported on such a deviation occasions and the relevant actions necessary to be take on such incident.

3.13 Establishment of verification procedure (Principle 6)

Verification procedure and the responsible person of relevant verifications were established for each critical limits/critical points.

3.14 Established record keeping and documentation procedure (Principle 7)

All hazards identification notes, process flow charts, factory flows, critical limits established records, log sheets, maintenance records, Calibration records, CCP determination charts, GMP manual, SSOP manual, SOP manual and SQA questioners were recorded.

3.15 Microbiological testing for Comminuted meat products

Microbiological testing were carried out according to the SLSI requirements mentioned in the Specification for Comminuted meat products, 1218:2001.

3.15.1 Sterilization of Equipments and Media

- All glassware was washed with teepol and rinsed with water to remove the excess teepol, dried and sterilized in a hot air oven at 180^0C for 2 hour.
- Cork borers, scalpels and forceps were dipped in 70% ethanol and placed in a hot air flame. The needles were flamed until they glow red.
- Culture media and water were autoclaved under pressure of 15lbs and temperature of 121^0C for 15 minutes.

3.15.2 *Staphylococcus aureus* testing

(SLS 516: Part 5: 1992)

1ml from the 10^{-2} and 10^{-3} Sample dilutions were taken and Spread in to Baird parker Agar (BP Agar) medium

⇩

Plates were incubated at 37^0C for 24 hours

⇩

Counted the Typical colonies with black, shining and convex features

⇩

Coagulase test was carried out for confirmation

⇩

1 colony from BP Agar media was transferred into a tube of Brain heart infusion broth

⇩

Tubes were incubated at 37^0C for 20-24 hours

⇩

0.1ml of above broth was mixed aseptically with 0.3ml of Rabbit plasma in a sterile tube

⇩

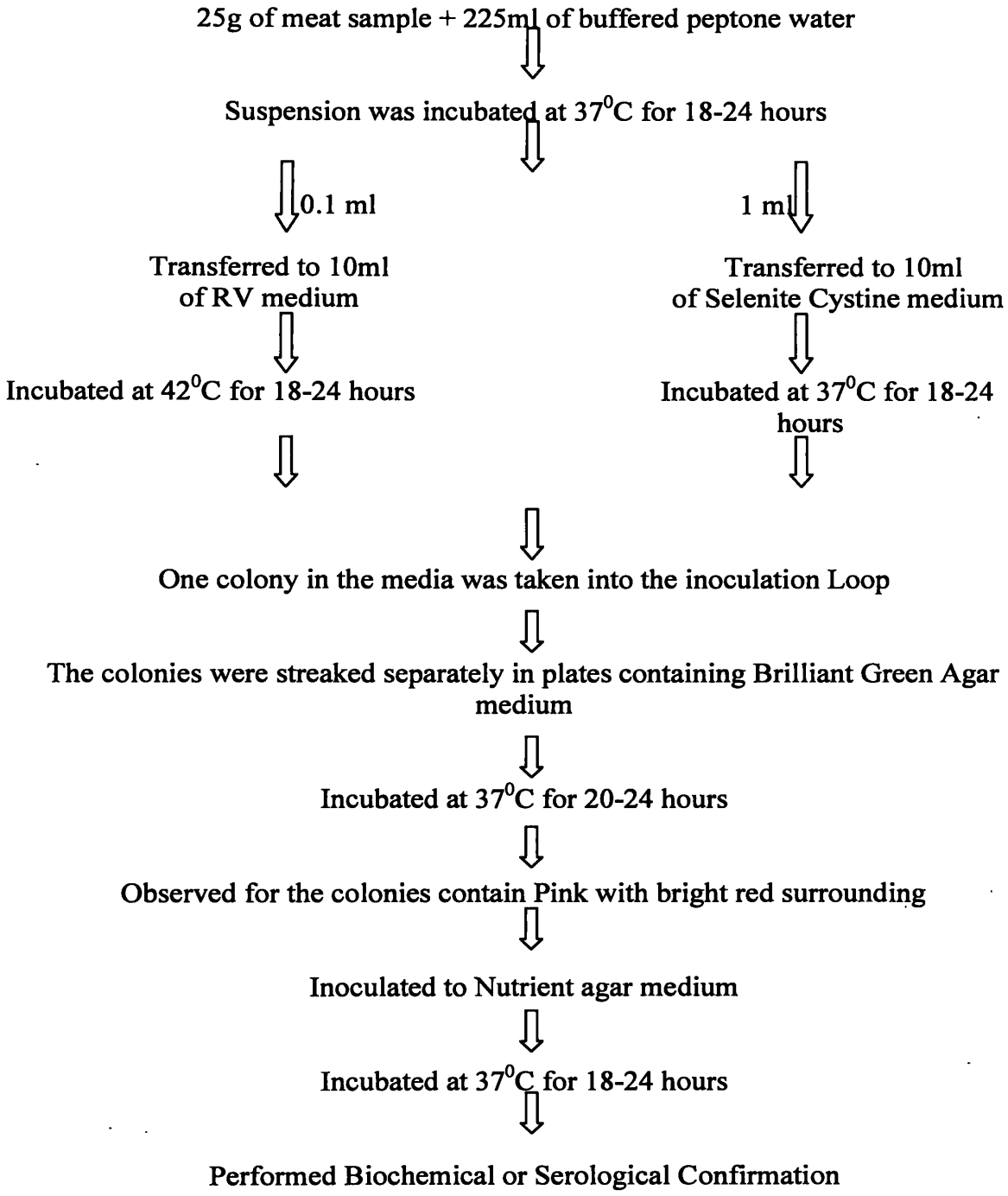
Tubes were incubated at 37^0C

⇩

Examined for Clotting of plasma after 4-6 hours

3.15.3 *Salmonella* Spp. testing

(SLS 516: Part 6: 1992)



3.15.4 *Escherichia coli* testing

(SLS 516: Part 3: 1992)

1ml from the 10^{-2} and 10^{-3} Sample dilutions were taken and Spread in to MacConkey Agar medium

⇩

Plates were incubated at 36^0C for 24 hours

⇩

Counted the Typical colonies

⇩

One colony was taken from each plate into separate tubes of Peptone water

⇩

Tubes were incubated at 44^0C for 24-48 hours

⇩

Add 0.2 ml of Kovacs reagent (Indole reagent)

⇩

The tubes were shaken and let them stand for 10 min.

⇩

Observed for formation of dark red color in amyl alcohol surface layer

⇩

Culture showing Indole production (dark red color layer) were considered as positive for *Escherichia coli*

Chapter 4
Results and Discussion

4.1 Results

4.1.1 Study about the Company lay out, production process, raw material, ingredients and all the relevant information

Those observations were attached in the Appendix 01.

4.1.2 Measure the effectiveness of the existence Manufacturing practices by monitoring and inspection, using past records and with the use of microbiological testing

The TPC Count of Swab Samples which taken from the machineries and Tables after cleaning was as followed.

Table 4.1 Swab testing Records (1:25 dilution)

Location	Chemical used	Dilution/Strength	Microbial Count (cfu/cm^2)	Satisfactory Conditions	Conclusion	Suggestions/ Action taken
Mincer	M-100	1:25	52	* 0-6= Satisfactory * 6-30= Fairly Satisfactory * >30= Unsatisfactory (Roday, S.- 1992)	Unsatisfactory	Increase strength of chemical
Bowl Chopper	M-100	1:25	36		Unsatisfactory	Increase strength of chemical
Peeling machine	M-100	1:25	39		Unsatisfactory	Increase strength of chemical
Packing tables	M-100 IPA	1:25 100%	12		Fairly Satisfactory	Increase strength of chemical

After increase the Strength of the Cleaning chemical (1:10), Swab testing were carried out and results were as followed.

Table 4.2 Swab testing Records (1:10 dilution)

Location	Chemical used	Dilution/Strength	Microbial Count (cfu/cm^2)	Satisfactory Conditions	Conclusion	Suggestions/ Action taken
Mincer	M-100	1:10	12	* 0-6= Satisfactory	Fairly Satisfactory	Proceed with this dilution
Bowl Chopper	M-100	1:10	09	* 6-30= Fairly Satisfactory	Fairly Satisfactory	Proceed with this dilution
Peeling machine	M-100	1:10	08	* >30= Unsatisfactory	Fairly Satisfactory	Proceed with this dilution
Packing tables	M-100 IPA	1:10 100%	03	(Roday, S.- 1992)	Satisfactory	Proceed with this dilution

4.1.3 Development of Pre-requisite Programs necessary for HACCP system

4.1.3.1 Development of Good manufacturing Practices (GMP) Manual

GMP manual was developed to fulfillment of pre-requisite program. GMP manual was developed by considering several legal and industrial practices. The prepared GMP manual was as followed.

4.1.3.1.1 GMP Manual

(According to Codex Alimentarius- General Principles of food hygiene and SLS-1065: 1982 requirements)

GILLS® **Food products (Pvt) Ltd.**	**Document Ref:** ID/GMP **Page No:** **Revision:** **Date:** **Approved:**
GMP Manual	

1.Establishment: Design and facilities

1.1 Location

- Establishments shall be located in areas not subject to regular and frequent flooding and shall be free from objectionable odors, smoke, dust and other contaminants.

1.2 Building and facilities

- Establishment shall provide adequate working space for the satisfactory performance of all operation.
- The constructions shall be sound and ensure adequate ventilation, good natural and artificial lighting and easy cleaning. All construction materials shall be such that they do not transmit any undesirable substances to the meat or meat products.
- The establishment shall be laid out and equipped so as to facilitate proper supervision of meat hygiene including performance of inspection and control.
- The establishment shall be of such construction as to protect against. The entrance and harboring of insects, birds, rodents or other vermin, as well as the entry of environmental contaminants such as smoke, dust etc.
- Building and facilities shall be designed to provide separate by partition, location or other effective means, between those operations, which may cause cross-contamination.
- Establishments shall be laid out and equipped so as to ensure that meat and meat products do not come in to contact with floors, walls or other fixed structure, except

- Those, which are specifically designed for contact with meat.
- In rooms where work on meat & meat products is undertaken;
    - Floors shall be waterproof, non-absorbent, washable and non-slip materials, with out crevices and should be easy to clean and disinfect. Where appropriate, floors shall be slope sufficiently for liquids to drain to trapped outlets.
    - Walls shall be waterproof, non-absorbent and washable materials and should be light colored. Up to a height appropriate for the operation they shall be smooth and without crevices, and shall be easy to clean and disinfect. Where appropriate, angles between walls and floors shall be sealed to facilitate cleaning.
    - Ceiling shall be so designed, constructed and finished as to prevent the accumulation of dirt and those which open shall be fitted with insect-proof screen. Screens shall be easily movable for cleaning and kept in good repair. Internal window sills shall be sloped to prevent use as Shelves.
    - Doors shall have smooth, non-absorbent surfaces and, where appropriate, be self-closing and close fitting.
    - Windows shall be easy to clean and glass shall be laminated in order to minimize the hazards when breakages occur.
    - Tube lights shall be covered in order to minimize the introduction of glass materials to the foods.
    - Stairs, lift cages and auxiliary structures such as plat for ladders and chutes, shall be so situated and constructed as not to cause contamination meat. They shall be capable of being effectively cleaned. Chutes shall be contracted with inspect and cleaning hatches.

1.3 Equipment

- Equipment and re-usable containers coming into contact with food shall be designed and constructed to ensure the safety of the food, adequate cleaned, disinfected and maintained to avoid the contamination of food.
- The equipment and container shall be made from stain less steel to ensure the safety of the food processing.

- Equipments shall be designed to allow temperature to be monitored and controlled.
- Food grade lubricants shall be used for the equipments and machineries to ensure the safety.
- Necessary Equipments/machines shall be calibrated according to the documented calibration schedules.
- Thermometer, pH meter and Scales shall be calibrated frequently.
- Calibration records shall be maintained using calibration checklists.
- Proper preventative maintenance program shall be maintained for the machineries.
- Maintenance checklists for each step of production machineries shall be maintained.

Document name	Document reference number	Appendix number
Calibration Schedule	GF/GMP/CS	03
Calibration checklists	GF/GMP/CC	03
Maintenance Schedule	GF/GMP/MS	04
Maintenance checklists	GF/GMP/MC	04

2. Sanitary facilities

2.1 Effluent and waste disposal

- Establishment shall have an efficient effluent and waste disposal system. All effluent lines (including sewer systems) shall be large enough to curry peak loads and shall be constructed in such a manner as to avoid contamination of potable water supplies.

2.2 Facilities for storage of waste and inedible material

- Facilities shall be provided for the storage of waste and inedible material prior to removal from the establishment. These facilities shall be designed to prevent access to avoid contamination as food, potable water, equipment or building in the premises.
- Containers for waste, by-products, and inedible substances shall be identifiable, suitably constructed and properly covered with a lid.

2.3 Changing facilities and Toilets

- Adequate, suitable and conveniently located changing facilities and toilets shall be provided in all establishments. Toilets shall be so designed as to ensure hygienic removal of waste matter.

2.4 Hand washing facilities in processing areas

- Adequate and conveniently located facilities for hand washing ad during shall be provided wherever the prices demands. Where appropriate, facilities for hand disinfection shall also be provided with the taps of a non-hand operable type.

2.5 Cleaning and disinfection facilities

- All rooms used for preparing, packaging or other handling of meat & meat products shall be equipped with adequate facilities for cleaning and disinfecting implements, conveniently located for the use of personnel during operations.
- These facilities are for use exclusively in the cleaning and disinfection of knives, steels, cleavers, saws and other implements.
- All facilities for cleaning & disinfecting implements shall be of such nature and size to permit proper cleaning and disinfections. These facilities shall be constructed of corrosion resistant materials and shall be capable of easily cleaned.

2.6 Lighting

- Adequate natural or artificial lighting shall be provided throughout the establishment. Where appropriate the lighting shall not alter colors and the intensity should not be less than;
    - 540 lux at all inspection room
    - 220 lux in work rooms
    - 110 lux in other drew

- Light bulbs and fixtures suspended over meat in any stage of production area shall be of a safety type and protected to prevent contamination of meat & meat products in case of breakage.

2.7 Storage and disposal of waste

- Waste material shall be handled in such a manner as to exclude contamination of food or potable water. Precautions shall be taking to prevent access to waste by pests.
- Waste shall be removed from the meat ant meat products handling & other working areas at intervals and at least daily. Immediately after disposal of the waste, receptacles used for storage and any equipment, which has come in to contact with the waste, shall be cleaned and disinfected. At least daily the waste storage area shall also be cleaned and disinfected.

2.8 Discharge of Wastewater

- Wastewater treatment plant shall be maintained and functioned properly in order to ensure the quality of the discharge water from the company to surrounding.
- Wastewater shall be discharged according to the Central Environmental Authority (CEA) Standards.
- Daily inspection for pH of the discharge water shall be monitored using calibrated pH meter.
- Once a week Chemical analysis of the discharge water shall be tested (for COD, BOD, Suspended solids and Oil & Grease) and suitable corrective actions shall be taken when deviations are occurred.

3. Incoming materials

3.1 meat and non-meat ingredients

- The raw materials and ingredients used for comminuted meat production shall be purchased from the certified suppliers, which offer effective Supplier Quality Assurance (SQA) for their raw materials and ingredients.
- Suppliers who supply meat ingredients, which not offer SQA, shall be evaluated through the supplier evaluation criteria.
- Meat ingredients shall be accepted based on the documented Acceptance/Rejection criteria for meat receiving to the company.
- Raw materials and ingredients shall be inspected before storing and processing.

- Laboratory tests shall be carried out for the necessary raw materials to establish fitness for use.
- Raw materials shall be stored separately either freeze storage or dry storage depending on the nature and requirement.
- Effective storage practices shall be maintained during storage.

3.2 Water

- Water used for the production shall be chlorinated before use for the production and shall compliance to SLS 971:1982.
- Only potable water shall be used in handling and processing taken from the main water line. Well water shall be used for the cleaning purpose only.
- It shall be maintained effective communication with the Authorized water bodies.

3.3 Packaging and casings

- Packaging design and materials shall be provided adequate protection for products to minimize contamination, prevent damage and accommodate proper labeling.
- Packaging materials and casings shall be non-toxic and not pose a threat to the food safety and suitability of food under the specified conditions, storage and use.
- Food grade packaging material shall be used to pack the final products.

4. Pest control

4.1 Preventing access

- Building shall 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 shall be kept sealed. Where sealing is not possible measures like wire mesh screens shall be in place to reduce the problem of pest entry.

4.2 Monitoring and infestation

- There shall be an effective continuous program for the control of insects, birds, rodents or other vermin.
- Establishment and surrounding area shall be regularly examined for evidence of infestation and records shall be kept.

4.3 Eradication

- Pests gain entrance to the establishment or surrounding areas, eradication measures shall be instituted.
- Control measures involving treatment with chemical, physical or biological, agents shall only be under taken by or under direct supervision of personnel who have a through understanding of the potential hazards to health resulting from the use of these agents, including those which may arise from residues retained in the product.
- Such measures shall only be carried out in accordance with the recommendations of the official agency having jurisdiction and with the full knowledge of the inspector. All the necessary information's shall be documented.

Document name	Document reference number	Appendix number
Pest control Schedule	GF/GMP/PCS	05
Pest monitoring checklists	GF/GMP/PMC	05

5. Personal hygiene & Health requirements

5.1 Hygiene training

- Managers of establishments shall be arranged for adequate and continuing training of every handler of meat as products in hygienic handling of meat & meat products and in personal hygiene so that they understand the necessary precautions to prevent contamination.

5.2 Medical examination

- Persons who come in to contact with meat & meat products in the course of their work shall have a medical examine prior to their employment if the official agency having jurisdiction, acting on medical advice, considers that this is necessary, whether because of epidemiological considerations & medical examinant of a meat or a meat products handler should be carried out at other times when clinically or epidemiological indicated.

5.3 Injuries

- Any person who has a cut or a wound shall be discontinued working with meat & meat products and until he is suitably bandaged should not engage in the preparation, handling packaging or transportation of meat & meat products.
- No person working in any establishment should wear exposed bandage unless the bandage is completely protected by a water proof covering which is conspicuous in color and is of such a nature that if cannot become accidentally detached. Adequate first-aid facilities should provide for this purpose.
- When personnel with a minor injury are permitted to continue working, cuts and wounds shall be covered by suitable waterproof dressings.

5.4 Washing hands

- Hands shall always be washed before commencing work, immediate after using the toilet, after handling diseased or suspect materials hands should be washed & disinfect immediately.
- Employees shall be washed their hand with permitted sanitizer as recommended procedure. Notices requiring hand washing should be displayed.
- Employees shall be disinfected their hands with isopropanyl alcohol before enter to the processing line.
- Aprons and similar items should not be washed on the floor. Such items shall not be left on equipment in the working area.

5.5 Personal cleanliness

- Employees shall maintain a high degree of personal cleanliness and shall wear uniform. Apron, head covering, foot wears and mask during the processing.
- Wearing of gloves does not exempt the operator from having thoroughly washed hands. Gloves shall be made of an impermeable material except where their usage would be inappropriate or incompatible with the work involved.
- Monitoring shall be carried out continuously.

5.6 Personal behavior

- Employees shall be refrained from behavior, which could result in contamination of food, such as smoking, spitting, chewing or eating, sneezing or coughing over unprotected food.

- Personnel effect such as jewellery, watches, pins or other items shall not be worn or brought into food handling areas.
- Employees in raw meat handling shall be not entered into the processing line. If not, person shall change the apron, well washed his hands and shall pass through the footbath.
- Employees shall not be directly touched the food items after handling of tools, floors and non-food items.

5.7 Visitors

- All visitors shall be wear safety kit and shall wash their hands before enter into the processing or handling areas.

Document name	Document reference number	Appendix number
Personnel hygiene assessment checklists	GF/GMP/PHAC	-

6. Cleaning and Disinfection

6.1 Cleaning chemicals

- Cleaning chemicals shall be handled and used carefully and in accordance with manufactures instructions.
- Food grade cleaning chemicals shall be used for the cleaning purpose to avoid the risk of residual leavening in the food items.
- Cleaning chemicals shall be stored separately from foods, in clearly identified containers to avoid the risk of contamination of food.

6.2 Cleaning programs

- The cleaning and disinfection method shall be specified and documented.
- Documented cleaning programs shall specify the areas, items of equipment and utensils to be cleaned, responsibility of particular task, method and frequency of cleaning and monitoring arrangements as well as the cleaning chemicals which use for the cleaning and disinfect ion.

- The cleaning programs shall be daily assessed by a responsible person and suitable corrective actions shall be taken immediately.
- Cleaning and disinfection programs shall be continually and effectively monitored for their suitability and effectiveness using microbiological testing (Swab testing) and shall be documented.

Document name	Document reference number	Appendix number
Cleaning Schedule	GF/GMP/CS	06
Cleaning assessment checklists	GF/GMP/CAC	06

7. Hygiene processing requirement

7.1 Prevention of cross contamination

- Effective measures shall be taken to prevent cross contamination of meat & meat products by direct or indirect contact with material at an earlier stage of process.
- Entry of the other workers to the department shall be restricted or limited and the people who enter in to another department shall be passed through the footbath.
- Footbath shall be contained water with 200ppm liquid Chlorine.
- The responsible worker shall be changed water of the footbath in frequent intervals.
- Every department in which meat products are prepared, processed or stored shall be used at that time only for that purpose or for the preparation and storage of other edible products subject to the same conditions of hygiene.
- If the departments are used for the processing of non-meat products, the managements shall be such that it can be ensured that there is no resultant contamination of the meat products.
- Any person handling raw materials or semi-processed meat products capable of contaminating the end product shall not come in to contact with any finished products unless and until they have cleaned and disinfected all utensils used by them and have changed and disinfected all utensils used by them and have changed all protective clothing worn by them during the handling or raw material

and semi-processed products which have came into contact with or have been soiled by the raw material or semi-processed products.

- Hands & arms shall always be washed thoroughly and disinfected after handling raw material and semi-processed products prior to handling finished products.
- Equipment such as trays, vats, table, etc., shall not be used interchangeably for raw products & processed products unless it is completely cleaned and disinfected before moving to area designated for processed meat products. Exposed ready-to-eat or cooked products shall not be stored in the same room with raw meat.
- Any cooking or smoking of meat products shall be done in separate area equipped for this purpose.

8. Process control

- Technically competent personnel shall be supervised the processing operations.
- All steps in the products process including packaging shall be performed without unnecessary delay and under conditions which will prevent the possibility of contamination, deterioration, or the development of pathogenic and spoilage microorganisms.
- Control systems for temperature and time during cooking, cooling and storage shall be in place necessary for the production and handling of safe food. Control systems shall include critical limits, registration and testing of accuracy of measuring equipment.
- Suitable and effective detection or screening devices are used in the process in order to ensure the safety of the products. Non-conformances and incidents of process control shall be documented.

9. Safety and Incident management

- Adequate fire extinguishers shall be located at each department and display the purpose of each unit.
- Every worker in the company shall be aware the preventative action and controlling methods of fire and other physical hazards.
- Adequate emergency exits shall be provided to prevent the hazards of the people.
- First-aid boxes shall be installed at each department with adequate medicines and tools.

- Code display system shall be maintained in the production area in order to reduce the occurrence of physical hazards.

10. Training and awareness

- Training programs shall be included the hygienic practices, safe handling, food safety, GMP, equipment maintenance &calibration and other necessary training requirements.
- Management shall be identified the training needs and requirements of the workers and training programs shall be arranged according to that requirements.
- Training shall be done according to the Scheduled program including all the level of the organizational hierarchy.
- Every employee shall be acknowledged each task and duties of the process and instruction set of the each task.
- After the training, effectiveness shall be monitored by the immediate supervisor or manger.
- All training requirements and measurement of training effectiveness shall be documented.

Document name	Document reference number	Appendix number
Training Schedule	GF/GMP/TS	07
Training assessment records	GF/GMP/TAR	07

11. Product information and recall procedure

11.1 Product information and labeling instruction

- Packaged meat products shall bear a permanent marking in code or in clear to identify the producing factory and the lot.
- All meat products shall be accompanied by or bear adequate information to enable the next person in the food chain to handle, display, store, prepare and use the product safely and correctly.
- Pre-packed foods shall be labeled with clear instructions to enable the next person in the food chain.

11.2 Recall procedure

- Managers shall ensure that effective procedures are in place to deal with any food safety hazard and to enable the complete, rapid recall of any implicated batch of finished meat products from the market.
- Receiving and dispatch report for the finished goods shall be maintained during the dispatch of finished goods to the market to record the issued batch numbers of the products.
- Recalled products shall be held under supervision until they are destroyed, used for purposes other than human consumption, determined to be safe for human consumption, or reprocessed in a manner to ensure their safety.

Document name	Document reference number	Appendix number
Product Recall log	GF/GMP/TS	-
Customer Complaints records	GF/GMP/TAR	-

12. Transport of the end product

- Means of transport of containers shall comply with the following conditions;
    - All internal finishes shall be made of corrosion-resistant material, be-smooth, impervious and easy to clean and disinfect.
    - Joints and doors shall be sealed so as to prevent the entry of paste & other sources of contamination.
    - Temperature recorders shall be installed. Temperatures shall be read at regular intervals and the reading recorded in a logbook.
    - Vehicles intended for the transport of meat products shall be equipped in such a manner that the meal products do not come into contact with the floor.
    - Vehicles shall be made to prevent changes in temperature of frozen meat products at any time during storage and transport but where accidental thawing takes place, the meat products shall be examined and evaluated by the inspector before any further step in taken.

4.1.3.2 Development of Sanitary Standard Operating Procedure (SSOP) and Standard Operating Procedures (SOP)

SSOP and SOP manuals were developed to fulfillment of pre-requisite program. Supplier Acknowledgement and Supplier evaluation Criteria were developed under SOP manual. SSOP and SOP manuals are as followed.

4.1.3.2.1 SSOP Manual

GILLS® **Food products (Pvt) Ltd.**	**Document Ref:** ID/SSOP **Page No:** **Revision:** **Date:** **Approved:**
SSOP Manual	

1). Safety of water

Propose/ Scope

a). Water that comes into direct contact with food or food-contact surfaces or is used in the manufacturing of ice is derived from a safe and sanitary source or is treated to make it safe.

Procedure

- Gills Food products (Pvt) Ltd will use City water throughout processing, including the manufacture of Ice. Well water will use only for the Cleaning Purposes. The company's Quality Control Supervisor will daily monitor the visual parameters and pH of incoming water before use for production.
- Gills Food products (Pvt) Ltd will perform microbiological analysis for both city and well water according to SLSI standards in every 6-month basis.

Propose/ Scope

b). There are no cross-connections between the potable water system and any non-potable system

Procedure

- The Quality Control Supervisor will perform monthly inspection to determine that no cross connections exist between potable and waste systems. The results of the inspection will be recorded on the monthly Sanitation Audit form.

2). Condition/ Cleanliness of Food contact Surfaces

Propose/ Scope

a). All food contact surfaces of plant equipment and utensils, including equipment used for ice production and storage are designed of such material and workmanship to easily cleaned and maintained in a sanitary condition. Such surfaces will be constructed of non-toxic materials and designed to withstand the environment of its intended use and the action of food-cleaning compounds and Sanitizing agent.

Procedure

- Presently food contact surfaces of all equipment and Utensils are made from Stainless steel. Prior to replacing any major piece of equipment, the Quality assurance, Production and maintenance departments will meet to evaluate the equipment.
- The evaluation will determine whether replacing the equipment will impact adjacent processing steps. Specifications of all equipment will be reviewed to ensure it is capable of withstanding the intended use and can be easily cleaned. The same evaluation will be conducted on materials used in the modification of the physical plant. The results of these evaluations will be kept on file.
- The QC Supervisor will evaluate the condition of plant equipment and utensils monthly. The results of these evaluations will be recorded on the monthly Sanitation Audit form.

Propose/ Scope

b). Gloves and outer garments that contact food or food-contact surfaces are made of an impermeable material and are kept clean and sanitary.

Procedure

- The company will issue line workers apron and work gloves. The line supervisor will ensure that his or her employees are issued this gear. Employees are not allowed to use personnel gear in place of these items unless authorized by the line supervisor and foreman. Employees are require maintaining this gear in a sanitary and Operable condition and if necessary, must replace it through the line supervisor. QC supervisor will check this gear at the beginning of each day's operation. Observations will be recorded in a daily Sanitation Audit form.

3). Prevention of Cross-contamination

Propose/ Scope

a). Employee's hands, gloves and outer garments, utensils and food contact surfaces of equipment that come into contact with raw products will not contact cooked products or ice used on cooked products without first being adequately cleaned and sanitized.

Procedure

- Employees working on the raw meat handling area will not be assigned to work on the cooked side of the production line. If such an assignment becomes necessary, supervisors must ensure that those employees clean and sanitize their hands, gloves and outer garments before working in the ready-to-eat process line.
- These practices will be observed every 4 hours by the QC Supervisor and recorded in a daily Sanitation Audit form.

4). Hand Washing and sanitizing

Propose/ Scope

a). Hand washing and hand sanitizing facilities are located in all processing areas where good sanitary practices require employees to wash and sanitize their hands. These facilities must be equipped with hand-cleaning and effective sanitizing preparations and disposable towels.

Procedure

- Hand-washing stations and hand dips will be located at all entrances to the process flow, including entrance from the administrative offices. These will be used upon entry to the process floor. In addition, line employees will use foot dips for their boots, which will also be located at each entrance to the production floor.
- Hand-washing stations and hand dips will also be located at the beginning and each process line. These will be used each time on employees contaminates hands or gloves and upon return to the process line.
- Rest room will be equipped with foot-activated hand washing facilities, soap dispensers stocked with anti-bacterial soap and disposable towels.
- The hand washing facilities/ stations will be checked by the QC supervisor for adequate supplies before production begins and every 4 hours during operation.

The concentration of hand dip chemical will be checked before operation and every 4 hours during operation by the QC supervisor. The results of these will be recorded on a daily Sanitation Audit form.

5). Protection from food adulteration

Purpose/ Scope

a). Food, food-contact surfaces and food packaging material shall be protected from adulteration with lubricants, fuel, cleaning chemicals, sanitizing agents, metal fragments or other chemical or physical contaminants.

Procedure

- All cleaning compounds and sanitizing agents used by gills Food Products (Pvt) Ltd will be clearly identified and stored away from the process area and any other lubricants or chemicals. The cleaning chemical supply company will provide Quality Assurance certificate with a material-safety data sheet for all compounds and agents stored at the plant.
- All food grade lubricants will be stored separately from non-food grade lubricants and will be properly labeled.
- The maintenance department store and properly label all non-food lubricants within the maintenance area. No fuels will be stored within the facility. If it becomes necessary to use such fuels during production, maintenance personal will raise barriers to ensure that the process is not contaminated. When finished, the area will be thoroughly cleaned, sanitized and inspected before production starts again.
- The QC Supervisor will inspect the processing area daily during operation for possible contamination sources and to make sure, toxic compounds are labeled and stored properly. The results will be documented on the daily Sanitation Audit form.

Purpose/ Scope

b). Any toxic compounds allowed in the plant shall be identified, held, used and stored in a manner that protects against contamination of food, food-contact surfaces or packaging materials.

Procedure

- The QC Supervisor will inspect the processing area daily during operations for possible contamination sources and to make sure toxic compounds are labeled and stored properly. The results will be documented in the daily Sanitation Audit form.

Purpose/ Scope

c). Food, food-contact surfaces and food packaging materials will be protected from contaminants that may sprayed, dripped, drained or drawn into food.

Procedure

- The maintenance department is responsible for establishing a regular maintenance program for the facility's ventilation system. This ensures adequate Ventilation, air flows and air pressure that prevents or inhibits the formation of condensates in the processing and storage areas. Condensates can lead to contamination of product, product-contact surfaces or packaging materials.
- Supervisors must also ensure that no floor Splash occur in processing areas during cleaning or sanitizing during production hours. They must also make sure that the area is cleaned, sanitized and inspected before restarting production.
- The food processing area will be inspected for possible sources of contamination, including condensate by the QC Supervisor each day during operations and the results recorded on a daily Sanitation Audit form.

6). Proper Labeling and Storage

Purpose/ Scope

a). Ready-to-eat food products will be physically separated from raw food products during frozen storage.

Procedure

- Under normal conditions, cooked ready-to-eat products are not stored in the cold storage unpacked. If this becomes necessary. It must be physically separated from any raw product by a minimal distance of 3 feet. No exceptions allowed. In addition ready-to-eat product, a raw or cooked, packed or unpacked will be clearly identified by lot number, Species and intended final product form.

Cold storage will be inspected daily for product separation during operations by the QC Supervisor. Observations will be recorded on the daily Sanitation Audit form.

7). Control of Employee health conditions

Purpose/ Scope

a). Any one who has or may have, by medical examination or supervisory observation, an illness, infected wounds, an open lesions such as a boil or sore, or any other problem that might contaminate food, food-contact surfaces or packaging material shall be excluded from any operations until the condition is healed or corrected.

Procedure

- As a part of new employee's orientation, staff will be briefed on the need to notify immediate supervisors of any illness or injury that may lead to contamination of any part of the process. Employees must notify immediate supervisors if they have been exposed to a confirmed disease out break of Salmonella, Hepatitis A or Shigella, especially when employees are asymptotic. In addition, employees will be informed that, if at all possible, they will be assigned duties that will not compromise the process. The results of the training will be documented and kept on file.
- It is the responsibility of all supervisory personnel to observe the apparent well being of their personnel. Employees will be reviewed for signs of medical problems daily before operations begin by the QC Supervisor. At any indication of injury or illness that may compromise the process due to contamination, the supervisor will remove that person from the line and report to the Operational/ Personnel manager. If that employee cannot be assigned other duties, he or she will be sent home until the situation is alleviated or medical authority states that he or she may return to work. Observations will be recorded on the daily Sanitation Audit form.

Purpose/ Scope

b). Adequate, readily accessible toilet facilities that provide for proper sewage disposal shall be available and maintained in a sanitary condition and in good repair.

Procedure

- Separate toilet facilities are provided for male and female employees in the break area and adjacent to the processing area. The number of toilets provided is based on the number of employees, with consideration to gender given separately.
- Gills Food Products (Pvt) Ltd has 35 males and 5 female employees. There are 3 toilets for males and 1 toilet for females. Extra toilets will be installed if an increase in employees occurs.
- During production hours, line supervisors check, on a rotational basis, that toilet facilities are sanitary and well stocked. Following production, cleaning labourers are responsible for cleaning and sanitizing toilet facilities and for restocking them.
- The maintenance department keeps toilet facilities operable and in good repair. The condition of the rest rooms will be inspected daily by the QC Supervisor. The results will be recorded in the daily Sanitation Audit form.

8). Exclusion of pest

Purpose/ Scope

a). No pests are in any area of a food plant.

Procedure

- The presence of rodents, insects, birds or other pests in the plant is unacceptable. The Finlay-Rentokill Company has been contracted and is responsible for all facets of pest control within the plant as well as the grounds. Material data sheets for all pesticides used by the company are on file.
- A representative of the company will meet monthly with the QC supervisor and will inspect the facility for the presence of pests daily, before operation. Observations will be recorded on the daily Sanitation Audit form.

Purpose/ Scope

b). The plant is designed to minimize the risk of contamination of the food, food-contact surfaces and food packaging material.

Procedure

- The QC Supervisor and representative from the maintenance department will schedule a monthly review of the plant lay out and structure to ensure that contamination of any aspects of the process does not occur from internal or external sources. Observations will be recorded in monthly Sanitation Audit form.

4.1.3.2.2. SSOP Checklists

4.1.3.2.2.1 Daily Sanitation Audit form

Food Products (Pvt) Ltd.	**Document Ref:** ID/SSOP **Serial No:** ID 02-001 **Page No:** 1 of 2 **Revision:** **Date:** **Approved:**
Daily Sanitation Audit Form	

Location	Time			Comments
	8.00 am	12.00 pm	4.00 pm	
1.Equipment cleaning and Sanitizing				
(a). Equipment Cleaned and Sanitized before start-up.				
(b). Product residue removes from equipment during breaks.				
(c). Ready-to-eat product equipment cleaned and sanitized during breaks.				
(d). Concentration of chemical used for sanitizing equipment (ppm).				
2. Employee attire				
(a). Gloves and Aprons clean and in good repair				
3. Cross-contamination				
(a). Employee's hand, gloves, equipment and utensils that contact unsanitary objects are washed and sanitized before contacting product.				
(b). Employees on raw side, wash and sanitize hands, gloves and aprons before moving to cooked side.				
4. Hand washing and Sanitizing facilities				
(a). Adequate Supplies.				
(b). Concentration of sanitizers in hand dips.				
(c). Concentration of liquid Chlorine in footbath (ppm).				

Daily Sanitation Audit form Continue..

Food Products (Pvt) Ltd.	**Document Ref:** ID/SSOP **Serial No:** ID 02-001 **Page No:** 2 of 2 **Revision:** **Date:** **Approved:**
Daily Sanitation Audit Form	

Location	Time			Comments
	8.00 am	12.00 pm	4.00 pm	
5. Protection from Adulterants				
(a). Cleaning compounds labeled and stored properly.				
(b). Lubricants labeled and stored properly.				
(c). Pesticides labeled and stored properly.				
(d). Product protected from condensation.				
(e). Product protected from floor splash.				
6. Cold storage				
(a). Unpackaged, cooked product separated from raw products.				
7. Employee health				
(a). Employee do not show signs of medical problems that could compromise product.				
8. Toilet facilities				
(a). Toilets are clean and properly functioning.				
9. Pest				
(a). No pest in the processing area.				

Date:..... **Supervisor:**.....

4.1.3.2.2.2 Monthly Sanitation Audit form

Food Products (Pvt) Ltd.	**Document Ref:** ID/SSOP **Serial No:** ID 02-002 **Page No:** 1 of 1 **Revision:** **Date:** **Approved:**
Monthly Sanitation Audit Form	

Location	Condition	Comments
1. No cross connections exist between potable and waste systems.		
2. Condition of plant equipment and utensils.		
3. Plant lay out and structure does not occur any aspects of cross contamination of the process from internal or external sources.		
4. No pest in factory ground and outer area.		

Date:..... **Supervisor:.....**

4.1.3.2.3 SOP Manual

GILLS® Food Products (Pvt) Ltd.	**Document Ref:** ID/SOP **Page No:** **Revision:** **Date:** **Approved:**
SOP Manual	

1. Raw material reception

1.1 Meat ingredients

- Meat receiving area shall be cleaned and kept in well condition.
- Meat shall not be received onto the floors and trolleys/crates shall be used for stacking and transporting meat ingredients.
- Designated employee (Supervisor) shall be verified that the raw material is from a company-approved supplier.
- Supervisor shall be evaluated and documented on a raw material receiving log the condition of truck, container and carriers of frozen meat ingredients arrival.
- If truck condition is acceptable, then supervisor shall be verified that incoming material meets the company purchase specifications.
- The following items shall be included in purchase specifications;
    - Species identity
    - Domestic or foreign supply source
    - Product identity
    - Boning date/slaughtering date
    - Manufacturing and Expire date
- If the product meets the purchase specifications, then the supervisor shall be evaluated the actual condition of raw materials.
- The Organoleptic properties of the frozen and raw meat shall be evaluated by supervisor and recorded in raw material receiving log.
- Supervisor shall be inspected the Supplier Quality Assurance (SQA) reports including microbiological analysis for each batch of meat.
- The well-experienced and trained personnel in the company shall be performed the visual inspection.

- Temperature of the frozen and fresh meat ingredients shall be taken from the calibrated thermometer with trained employee of the company.
- Frozen meat shall be well packed during receiving and condition of packages shall be monitored.
- The supervisor based on acceptance/rejection criteria of the company shall be accepted the meat ingredients.
- Acceptance/rejection criteria for the meat ingredients as follows;

Table 4.3 Acceptance/rejection criteria for frozen chicken

Specification	Verification Responsibility	Decision
*Acceptable red-brown flesh color * Acceptable smell * Free from sands, stones and bone particles. * Supplier Quality Assurance (SQA) for each batch. * Internal Temperature of the frozen chicken is < 0^0C. * Not exceed the Expire date.	*Production Manager *Production Executive *Production Supervisor	<u>Accept the lot If;</u> - Compliance the specifications. - Internal Temperature is 0-4^0C, but other Specification is satisfactory. - Presence of bones & scale. But inform supplier to remove the bones & scales when supply the fish. <u>Reject the lot If;</u> - Unacceptable color & smell. - Presence of sands, stones and bone particles. - No SQA. - Exceed Expire date. - Temperature > 5^0C.

Table 4.4 Acceptance/rejection criteria for fresh beef

Specification	Verification Responsibility	Decision
* Acceptable Reddish brown flesh color and Acceptable smell. * Free from sands, stones, bone particles and fecal matter. * PHI certification for each batch. * Washing of fresh beef before transportation. * Internal Temperature of the beef when receiving to the company is < 21^0C.	* Production Manager * Production Executive * Production Supervisor	Accept the lot If; - Compliance the specifications. - Internal Temperature is 22-30^0C, but other Specifications are satisfactory. - If bone particles are present, accept the lot. But inform supplier to remove the bones when supply the beef. Reject the lot If; - Unacceptable color & smell. - No washing treatment and PHI certification and Presence of fecal matter. - Internal Temperature > 30^0C.

Table 4.5 Acceptance/rejection criteria for fresh Sappara fish

Specification	Verification Responsibility	Decision
*Acceptable Pinkish-white flesh color and Smell and Free from parasites * Free from sands, stones, bone particles and scale * Dip in sodium-metabi-Sulfite solution between cutting and receiving to the company. * Place in Crushed Ice during transportation. * Temperature of the fish dipping solution when receiving to the company is < 8^0C.	*Production Manager *Production Executive *Production Supervisor	Accept the lot If; - Compliance the specifications. - Internal Temperature is 8-12^0C, but other Specification is satisfactory. - Presence of bones & scale. But inform supplier to remove the bones & scales when supply the fish. Reject the lot If; - Unacceptable color & smell. - Presence of parasites. - No Ice & SMS dipping treatments. - Temperature > 13^0C

- Microbiologist shall be taken random Samples of the each beef and fish that do not have Supplier certification and testing shall be carried out for TPC, *Escherichia coli, Salmonella sp. and Staphylococcus aureus.*
- The materials should not be used for the production until the test results are received.
- The beef lot that has the lowest bacterial count in the TPC shall be used for the production of minced beef when two or three batches exist in the freezer.
- Once a month random microbiological testing for meat ingredients which taken from the approved suppliers shall be carried out and the suppliers shall be acknowledged.
- Once a three month chemical analysis shall be carried out for veterinary drug residues in the meat ingredients and heavy metal analysis for fish from approved laboratory.
- Once a six-month chemical analysis and microbiological testing shall be carried out for the all meat ingredients from approved laboratory.
- If incoming raw materials pass receiving inspection, then the accepted meat lot shall be weighed using calibrated scales.
- Weighed meat materials shall be entered into the freezer immediately using well-cleaned trolleys.
- The suppliers who not offer SQA for their meat ingredients (for beef and fish) shall be evaluated once a month by sending company representative to the supplier premises.
- During supplier evaluation criteria, the supplier shall be acknowledged for avoid the use of unapproved veterinary drugs and hormones during live stock management and husbandry stage.
- The evaluation details are as follows;
  - Company or supplier name, address & contacts?
  - Production site for the product?
  - How long has the supplier been in operation?
  - Who are other customers of the supplier?
  - Are any other types of product manufactured at this facility?
  - Does supplier operate GMP's based on HACCP principles?
  - Does the supplier perform pre-treatments for the product?
  - Does the supplier provide the product on time according to the requirements?

Table 4.6 Supplier evaluation records for beef

Date	Supplier Name	Location	Slaughtering Method	Hygienic Condition			PHI Certification	Raw Meat Treatment	Time duration during Transportation	Transportation Condition	Overall Satisfaction	Remarks	Inspector Signature
				Slaughtering environment	Equipment	Personal							

Table 4.7 Supplier evaluation records for fish

Date	Supplier Name	Location	Hygienic Condition			Dipping in Ice	Raw fish Treatment	Time duration during Transportation	Transportation Condition	Overall Satisfaction	Remarks	Inspector Signature
			Cutting environment	Equipment	Personal							

1.2 Non-meat ingredients

- Designated employee (Supervisor) shall be verified that the raw material is from a company-approved supplier.
- Dry ingredients (Spices, Additives, Salt, Binders, TVP, Soya iso protein) receiving to the company shall be inspected by trained person.
- Ingredients that have SQA shall be inspected for the supplier certification including analysis report for each batch by supervisor.
- Trained person shall be inspected Shortening/fat received to the company for its visual characteristics, SQA including microbiological analysis.
- Non-meat ingredients shall be inspected for physical matters, particle size, packaging integrity, and batch number, manufacturing date and expire date and recoded in the raw material receiving log.
- Trained employee shall be inspected the packaging material and Casings receiving to the company for the physical mater for each batch and for SQA.
- Dry ingredients shall be entered into the dry stores immediately.
- Shortening/fat and Caseins shall be entered into the Chill storage immediately.
- Water used for the production shall be used from the main line, which chlorinated.
- pH of the drinking water shall be inspected using calibrated pH meter.
- pH shall be 6.5-9.
- Once a three month microbiological testing for drinking water shall be carried out for Aerobic microorganism, Coliform and *Escherichia coli*
- Once a three-month adulteration test and microbiological testing for the Spices shall be carried out.

2 Raw material storage

2.1 meat storage

- Freezer which maintain the temperature (–18) ^{0}C – (-20) ^{0}C shall be used to store the meat ingredients.
- Entry shall be restricted to personnel necessary to carry out operation efficiently.
- Doors shall not be left open for extended periods and shall be closed immediately after use.
- Raw meat as well as containers holding meat shall not be stacked directly on the floor.

- No freeze stores shall be loaded beyond its designed capacity.
- The Freezer shall be defrosted regularly to prevent ice building up on the freezer coils to avoid the malfunctioning of coil.
- Sharp Instrument shall not be used to remove frost from the coils or frozen food to avoid the stuck of coils and damage of packaging.
- Freezer shall be insulated adequately well lit and door shall have proper gasket.
- It shall be maintained first-In-First-out [FIFO] system and effective stock rotation for the raw material.
- When raw meat receiving to the freezer, it shall be given a color-code for each batch depending on the time of receiving.
- The tag shall be included;
    - Date of receiving
    - Supplier Name
    - Expire Date

- The tag colors shall be;
    - Red – for 1st received batch
    - Orange – for 2nd received batch
    - Yellow – for 3rd received batch
    - Green – for 4th received batch

- Color tag system shall be display in the freezer to aware the workers dealing with raw meat handling.
- It shall be arrange the batches separately without stacking upon each to avoid the bruising and damages.
- It should maintained separate location for separate products with maintaining proper stock rotation.
- It shall be aware the workers to issue first-in batches for the production.
- It shall not be ordered the fourth batch until the end of first batch.
- It shall be maintained minimum retaining time of the raw material inside the freezer.
- The workers shall be filled the following chart display the available raw meat batches in the freezer.

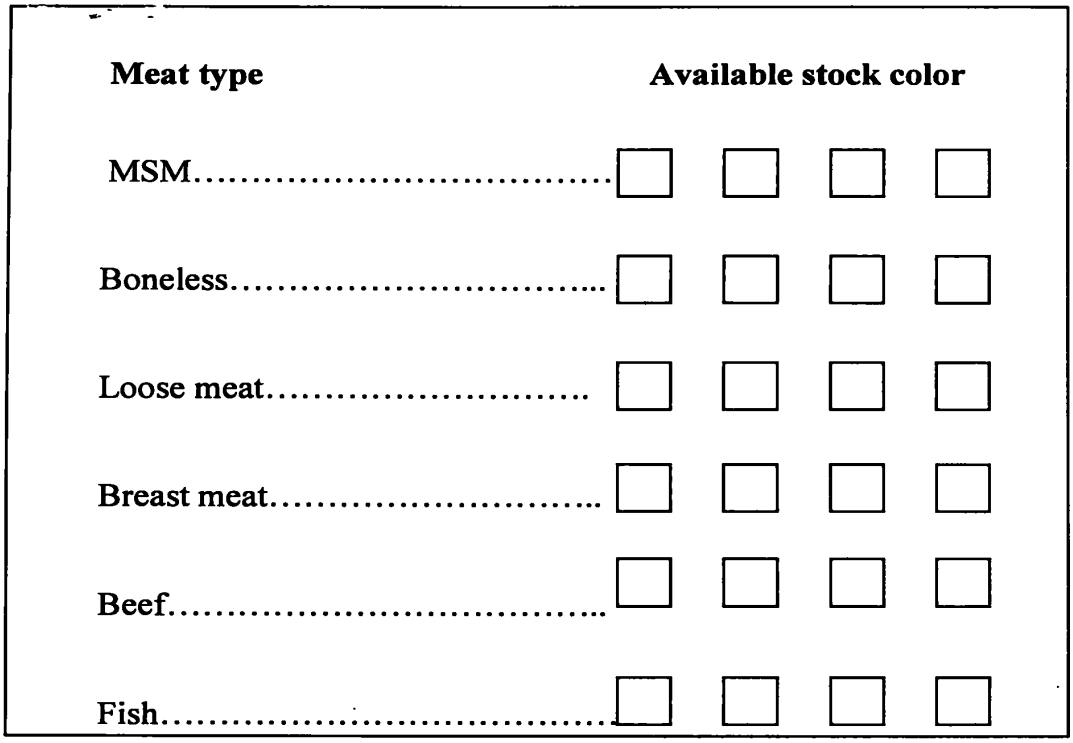


Figure 4.1 –Freeze Storage Stock Display Sheet

- All fresh products shall be utilized within 7days and frozen products within 6 month of fabrication.
- Freezer temperature shall be monitored in every 1 hour.
- The freezer in charge worker shall calibrate the temperature indictor of the freezers using calibrated thermometer.

2.1 Dry storage

- Spices, Additives, Salt, Binders, TVP, and Soya iso protein shall be stored separately.
- Cleaning chemicals shall be stored away from food ingredients in the dry stores.
- Dry stores shall be cleaned with dry cleaning frequently.
- FIFO system shall be applied for stores during issue of ingredients for production.

2.2 Chill storage

- Separate Chillers shall be used for the processing operations and semi-processed product storage.
- Separate locations of the chiller shall be used for the thawing, thumbing, brine immersion and shortening fat and casing storage.
- Chiller temperature shall be maintained 0^0C - 5^0C.

- Chiller temperature shall be monitored in every 1 hour.
- The Chiller in charge worker shall calibrate the temperature indictor of the Chillers using calibrated thermometer.
- Entry shall be restricted to personnel necessary to carry out operation efficiently.
- Employees shall be trained and aware continuously for the safe handling of products during chiller storage.
- Doors shall not be left open for extended periods and shall be closed immediately after use.
- Ingredients shall not be stacked directly on the floor and crates or trolleys shall be used for the stacking purpose.
- No chiller stores shall be loaded beyond its designed capacity.

2.3 Packaging material storage

- Packaging material shall be stored separately in the packaging room.
- The atmosphere of the packaging room shall be well controlled in order to avoid the contamination from atmosphere.
- Entry shall be restricted to personnel necessary to carry out operation efficiently.

3 Spice room Operation

3.1 Spice mixing

- The Spice room in charger shall be carried out spice room operations.
- Dry cleaning of the spice room shall be carried out frequently.
- Entry shall be restricted to personnel necessary to carry out operation efficiently.
- The Spices shall be weighed using calibrated scales.
- After weighing, Spices shall be sieved to remove the physical matter.
- The Quantity of the spice mix shall be depending on the type of the product.
- Formulation checklist shall be maintained during Spice weighing.

3.1 Additives weighing

- Additives shall be weighed using calibrated scales with well-trained person.
- Production supervisor shall be monitored the additive weighing operation.
- After weighing, additives shall be sieved to remove the physical matter.
- Sensitive additives shall be used in the recommended amounts according to the Srilankan Standard Institute Specifications.

- Nitrate shall be used in 100mg/Kg of meat for production of comminuted meat products.
- Formulation checklist shall be maintained during additives weighing.

3.2 Non-meat ingredients weighing

- Non-meat ingredients shall be weighed using calibrated scales by well-trained person.
- After weighing, additives shall be sieved to remove the physical matter.
- Formulation checklist shall be maintained during Non-meat ingredients weighing.

3.3 Paste making

- The Paste shall be prepared using well-cleaned containers.
- Oil used for the production shall be heated above 220^0C until start smoking.
- The spice mixer shall be added to the pre-heated oil and shall be cooked for 10 minutes while mixing.
- The cooked paste shall be cooled in the semi-processed product storage chiller and it shall be covered using polyethylene sheet until used for the packing operation.
- Trained person shall be allocated for the paste making operation.

3.4 Brine preparation

- The containers used for the brine preparation shall be well cleaned.
- Trained person shall be allocated for the brine preparation operation.
- Additives (Salt, phosphates, nitrate, ascorbic/ ascorbate, sugar and water) shall be weighed using calibrated scales.
- Cold water ($<10^0$C) shall be used for the preparation of brine.
- Production supervisor shall be monitored the additive weighing operation.
- After weighing, additives shall be sieved to remove the physical matter.
- Sensitive additives shall be used in the recommended amounts according to the Srilankan Standard Institute Specifications.
- Nitrate shall be used in 100ppm for the production of cured meat products.
- Formulation checklist shall be maintained during additives weighing.
- Mixing shall be done by the curing incharger using a spoon to ensure the proper solubility of brine solution.
- Salinity of the brine solution shall be maintained 18.3%.

- Salinity of the brine solution shall be monitored by the curing incharger using calibrated salinity meter and shall be recorded in the brine preparation checklist.
- If the concentration of brine solution is above 18.3%, cold water shall be added for the mixture until desirable concentration achieved.
- If the concentration of brine solution is below 18.3%, salts shall be added for the mixture until desirable concentration achieved.
- Brine containers shall be covered using polyethylene sheet and shall be immediately transferred in to the Chiller.

3.5 Packaging material Preparation

- Packaging material received to packaging room shall be printed using injector printer.
- Proper maintenance shall be carried out for the injector printer according to the documented maintenance schedule.
- Supervisor shall be checked the packaging for the batch number, manufacturing date and expire date after printing and records shall be maintained in "Bag making Reports" checklist.
- Entry shall be restricted to personnel necessary to carry out operation efficiently.
- Trained personnel shall be allocated for the packaging material preparation operation.

4. Thawing of meat ingredients

- The meat ingredients taken from the freezer shall be thawed in the chiller that is 0^0C - 5^0C and shall be allowed to reach desired level of thawed state.
- The packaging shall be retained during the thawing in order to avoid the contact of drip on the floor of chiller.
- Thawing shall be done <1day before use for the production.
- Meat shall be monitored on a schedule basis to prevent the loss of package integrity and contamination of drip.

5. Band saw/ Cutting

- Band saw/cutter shall be daily inspected by operator according to maintenance schedule.

- Band saw/cutter shall be approved by the maintenance officers before start of the production of each day.
- Band saw/cutter shall be cleaned with permitted sanitizer according to the cleaning schedule and monitored frequently.
- The well-trained production employee shall be monitored the thawed meat receiving for the cutting operation for the visual characteristics.
- Meat in good condition shall only be permitted for feeding the cutter.
- The cutter shall not be over fed.
- Cutter and other machine starter switch shall be near to the particular machine and clearly display with danger symbol.
- Trolleys/trucks used to transport the meat shall be cleaned well before use for the next purpose.
- Meat after cutting shall not be discharged in to the floors.
- Trolleys/trucks or containers shall be used to collect the cut meat.
- Trained people shall be employed in the cutting operation.

6. Mincing

- Mincer shall be daily inspected by the operator according to the maintenance schedule.
- Mincer shall be approved by the maintenance officers before start of the production of each day.
- Production employee/operator shall be evaluated the organoleptic properties for off-flavors, off-odors, discoloration and improper appearance prior to the mincing and shall be recorded in the mincer report.
- Minced meat shall be collected for well-cleaned plastic crates or containers.
- Trained employee shall be allocated for the mincing operation.
- Required quantities shall be minced when preparing the minced meat product.
- Mincing operation shall be performed as soon as possible when preparing minced meat product in order to maintain the product temperature as low as possible.
- Shortening/fat shall be added for the meat during mincing when production of comminuted meat products other than minced meat products.
- Production employee shall be evaluated the quantities of raw material to ensure that proper formulation is obtained.

7. Bowl chopping

- Bowl chopper shall be daily inspected by the operator according to the maintenance schedule.
- Bowl chopper shall be approved by the maintenance officers before start of the production of each day.
- The rotational speed of the bowl chopper shall be set properly to ensure the proper mixing and chopping during production.
- Non-meat ingredients and water shall be added during bowl chopping operation.
- For the first cutting, 40 rounds shall be maintained by the operator.
- For the second cutting, 20 rounds shall be maintained by the operator.
- For the third cutting, 15 rounds shall be maintained by the operator.
- Final product temperature after bowl chopping shall be maintained at 0^0C - 5^0C.
- Production employee shall be evaluated the quantities of raw material to ensure that proper formulation is obtained.
- Trolleys and crates used for the handling of meat and non-meat ingredients shall be cleaned with good condition.
- Bowl chopping operation shall be carried out for minutes until desired texture obtained in the meat paste.
- Trained employee shall be allocated for the bowl chopping operation.

8. Brine Immersion

- Brine immersion should be performed under chilling condition (0^0C - 5^0C).
- Brine immersion should be performed for beef bacon & smoked beef wrapped in pepper.
- Length of the brine immersion should be depended on the type of the product.
- For beef bacon, immersion time shall be 2 days and 2-3 days for smoked beef wrapped in the pepper.
- Brining completion shall be indicated after achieve the desirable pinkish red color.
- Well-trained person shall be carried out visual inspection

9. Brine Injection

- Well- cleaned Brine injectors shall be used for the brine injection.
- Condition of needles of the injector shall be monitored frequently.

- Brine and product Temperature during injection shall be maintained below 10^0C.
- Brine injection shall be performed properly until the brine solution reach to middle of the product.
- Brine injection shall be carried out for 15-30 min depending on the size of meat slice.
- Well-trained personnel shall be allocated for perform the brine injection operation.

10. Tumbling

- Tumbler shall be daily inspected by the operator according to the maintenance schedule.
- Tumbler shall be approved by the maintenance officers before start of the production of each day.
- Tumbling shall be conducted in chilling condition and Temperature shall be maintained at 0^0C - 5^0C.
- Tumbling time shall be depended on the type of cured product.
- For Smoked chicken breast and Chicken bacon, tumbling shall be performed for 45 minutes.
- For chicken ham, tumbling time shall be 8 hours and For smoked beef, tumbling shall be done for 10 hours.
- Rotational speed of the tumbler shall be se properly to ensure the proper tumbling of cured products.
- Tumbling shall be carried out for cured products only.
- Non-meat ingredients shall be added during the tumbling process.
- Production employee shall be evaluated the quantities of raw material to ensure that proper formulation is obtained.
- Trained employee shall be allocated for the tumbling operation.

11. Stuffing and Linking

- Stuffer/filler shall be daily inspected by the operator according to the maintenance schedule.
- Stuffer shall be approved by the maintenance officers before start of the production of each day.
- Synthetic and edible casings shall be used for the stuffing of chopped meat.

- Fibrous casings shall be soaked in water for 30 minutes before used for production.
- After filling of casings, linking shall be done by rolling the stuffed casing by well-trained person depending on length of the product.
- After filling of fibrous casings, linking shall be done by trained person using threads.
- The supervisor shall be recorded the number of filled product for each casing.
- Stuffed products shall be hanged in well-cleaned trolleys to perform chamber operation.

12. Chamber operation

- Chamber shall be daily inspected by the operator according to the maintenance schedule.
- Chamber shall be approved by the maintenance officers before start of the production of each day.
- The Chamber operator shall be calibrated the temperature indictor of the Chamber using calibrated digital thermometer.
- Before loading products to the chamber operator shall be programmed the chamber temperature and core temperature.
- Products shall be loaded to the chamber after it reaches the programmed temperature.
- Chamber temperature shall be maintained according to the type of product.
- For the Stuffing products, chamber temperature shall be maintained as;
    - Drying 55^0C -60^0C for 30 min
    - Smoking 60^0C-70^0C for 30 min
    - Cooking 85^0C-90^0C for 15-20 min
- For the Forming products, chamber temperature shall be maintained as;
    - Cooking 85^0C-90^0C for 2- 2 ½ hours.
- For the Cold meat and Sliced products, chamber temperature shall be maintained as;
    - For Cooked products- Cooking 85^0C-90^0C for 3 hours
    - For Baked products- Drying 55^0C -60^0C for 30 min
      Smoking 60^0C-70^0C for 1 hour
      Baking 170^0C-180^0C for 5min

- For the Cooked products internal temperature shall be maintained 72^0C and for Baked products, it shall be maintained at 68^0C for 2 min.
- Product internal temperature shall be monitored using calibrated thermocouple and time shall be monitored using stopwatch.
- The trolleys with the products shall be weighed before perform the chamber operation as well as after the chamber operation using calibrated scales.
- Trolleys shall not be over filled to ensure the effective chamber operation.
- Chamber shall be cleaned after end of each batch of production.
- Chamber temperature shall be recorded before, during and end-of each batch of production.
- Trained employee shall be allocated to perform the chamber operation.

13. Showering

- Drinking water shall only be used for the showering purpose.
- Stuffed products shall be showered after cooking process.
- Showering shall be performed for 20 min.
- Trolleys shall not be over filled to ensure the proper showering process.
- Speed of the drip of water shall be set properly and shall be controlled properly during showering by well-trained, experienced person.

14. Forming

- Forming machine shall be daily inspected by the operator according to the maintenance schedule.
- Forming machine shall be approved by the maintenance officers before start of the production of each day.
- Chopped meat shall not be over filled into the hopper of the machine.
- Formed products shall be collected in to the well-cleaned trays.
- Forming machine shall be cleaned after end of each batch of production.
- Trained employee shall be allocated to operate and perform the forming operation.

15. Molding

- Tumbled products shall be molded manually into desired shape molds.
- Molded products shall be placed in the chamber to perform heat treatment.
- Molds shall be well cleaned with permitted sanitizer before use for filling.

- After the chamber operation, mold with the product shall be chilled until the packing is performed.
- Molds shall be removed by compression using a compressor and air tubes.
- De-molded products shall be placed in the cleaned crates.
- Molds shall be cleaned after each use.
- Trained employee shall be allocated for the molding and de-molding operations.

16. Chilling

- Chiller shall be maintained at 0^0C - 5^0C.
- Chiller shall be daily monitored according to the documented maintenance schedule.
- Heat treated and Showered products shall be stored separately from the uncooked and raw ingredients.
- Products shall be chilled until the vacuum packaging is performed.
- Heat-treated products shall not be directly placed on the floor of chiller. Containers, crates or trays shall be used for the storage purpose.
- Employees shall be trained and aware continuously for the safe handling of products during chilling operation.
- Chiller temperature shall be monitored in every 1-hour basis and shall be recorded in Cold room temperature mentoring log.
- The Chiller in charge worker shall calibrate the temperature indictor of the Chillers using calibrated thermometer.
- Entry shall be restricted to personnel necessary to carry out operation efficiently.
- Doors shall not be left open for extended periods and shall be closed immediately after use.
- No chiller stores shall be loaded beyond its designed capacity.

17. Peeling

- Peeler shall be daily inspected by the operator according to the maintenance schedule.
- The operator shall be sharpened peeler blade continuously.
- Synthetic casings used for the sausage production shall be peeled-out from steam injection.
- Edible casings shall not be peeled-out as it remains with the product.

- Gas cooker, gas cylinder and pressure cooker used for the steam generation shall be used safely and switched-off when not in use.
- Trained personnel shall be allocated for the peeling operation.
- Gas tubes and pressure tubes shall be monitored frequently for the blockages and leakages.
- Peeled products shall be collected in to the well-cleaned containers.
- Product fall on to the floors during peeling shall not be used for packaging and shall be discarded into the dustbins.
- Responsible cleaning workers shall be cleaned the dustbins frequently.
- Container with peel products shall be fed into the hoist to pass into the packing section.

18. Slicing

- Slicer shall be daily inspected by the operator according to the maintenance schedule.
- The operator shall be sharpened the Slicer blade continuously.
- Slicer shall be cleaned with permitted sanitizer after each batch of production.
- Employees shall be aware to maintain the safety during cutting operation.
- Trained person shall be allocated to perform the cutting operation.

19. Vacuum packaging

- Vacuum packaging machine shall be daily inspected by the operator according to the maintenance schedule.
- Vacuum packaging machine shall be approved by the maintenance officers before start of the production of each day.
- Before production started, operator shall be checked the seal integrity of package by performing a pre-testing packaging.
- Operator shall be monitored the vacuum pressure and time frequently.
- Vacuum pressure during the packaging shall be 0.4 MPsi.
- Well-trained personnel shall be visually inspected for the vacuum packaging performance frequently.
- Package shall be printed with brand name, batch number, amount, date of manufacture, date of expire, ingredients and directions for use.

- Supervisor shall be checked the packaging for the batch number, manufacturing date and expire date and details shall be recorded and documented.
- Packing employees shall be inspected the packing bags before filling the product.
- Packaging weight shall be frequently monitored and recorded by Supervisor.
- Number of packages produced from each batch shall be recorded.
- Samples shall be taken from each batch and shall be vacuum packed separately for the further analysis purposes.
- Every 20 minutes, employees shall be cleaned the packaging tables with Iso Propanyl Alcohol.
- Once a month tabletops, packaging surfaces, workers gloves, aprons, etc., that make contact with end products shall be swabbed to monitor the environmental contamination by *Listeria* spp.
- Vacuum packaging machine shall be cleaned according to the documented cleaning schedule.
- Vacuum packed packages shall be transferred in to the blast freezers immediately.
- Employees shall be trained and aware about safe handling of the packed product.

20. Metal detection

- Metal detector shall be daily inspected by the operator according to the maintenance schedule.
- Metal detector shall be approved by the maintenance officers before start of the production of each day.
- Operator shall be monitored the sensitivity of the metal detector at one hour basis using testing metal sphere.
- Packs, which are detected in presence of metal fragments, shall be re-opened and checked manually.
- Pack shall be repacked after removing metal containing products.
- Those metal presence products shall be discarded to the dustbin.
- Well-trained person shall be allocated for the metal detection operation.
- It shall be separated the end product depending on the month of production using a colored wrapping for each bundle.
    - January - Dark yellow
    - February - White
    - March - Dark green

- April - Red
- May - |Blue
- June - Light yellow
- July - Black
- August - White
- September - Orange
- October - Pink
- November - Yellow
- December - Dark purple

21. Blast Freezing

- Blast Freezer which maintain the temperature (–30) ^{0}C – (-40) ^{0}C shall be used to store the end products.
- Products shall be hold for that temperature for 3-4 hours.
- Blast freezer shall be daily monitored according to the documented maintenance schedule.
- Operator shall be maintained the records of loading time and unloading time of end products received to the blast freezer.
- Frozen food shall be well packed to prevent freezer burn, Cross-contamination and absorption of odor and flavor.
- In case of power failure or breakdown of the blast freezer, the freezer shall not be opened and the food shall be left inside.
- Entry shall be restricted to personnel necessary to carry out operation efficiently.
- Doors shall not be left open for extended periods and shall be closed immediately after use.
- End products shall not be stacked directly on the floor.
- It should maintained separate location for separate products with maintaining proper stock rotation.
- No freeze stores shall be loaded beyond its designed capacity.
- The Blast Freezer shall be defrosted regularly to prevent ice building up on the freezer coils to avoid the malfunctioning of coil.
- Sharp Instrument shall not be used to remove frost from the coils or frozen food to avoid the stuck of coils and damage of packaging.
- Freezer shall be insulated adequately well lit and door shall have proper gasket.

- It shall be maintained first-In-First-out [FIFO] system and effective stock rotation for the end product to ensure proper blast freezing time.
- It shall be aware the workers to issue first-in batches for the dispatch freezers.
- The freezer in charge shall be monitored the Blast freezer temperature in every 1-hour basis and shall be recorded in Cold room temperature monitoring log.
- The Blast freezer in charge worker shall calibrate the temperature indictor of the freezer using calibrated thermometer.
- Before issuing the products in to dispatch freezers, the trained employee shall be inspected the vacuum packaging condition and non-vacuum packages shall be removed from freezer.
- During unloading, the products shall be fed into the hoist using well-cleaned trucks/trolleys.
- Workers shall be aware and trained regarding safe handling of product during loading and unloading.
- Well-trained worker shall be allocated for the blast freezer operation.

22. Dispatch storage

- Dispatch freezer shall be maintained at temperature $(-18)\,^{0}C - (-20)\,^{0}C$.
- End products shall be stored in the dispatch freezer until the product load in to the distribution vehicles.
- Freezer shall be daily monitored according to the documented maintenance schedule.
- In case of power failure or breakdown of freezer, the freezer shall not be opened and the food shall be left inside.
- Entry shall be restricted to personnel necessary to carry out operation efficiently.
- Doors shall not be left open for extended periods and shall be closed immediately after use.
- End products shall not be stacked directly on the floor.
- It should maintained separate location for separate products with maintaining proper stock rotation.
- No freeze stores shall be loaded beyond its designed capacity.
- The dispatch Freezer shall be defrosted regularly to prevent ice building up on the freezer coils to avoid the malfunctioning of coil.

- Sharp Instrument shall not be used to remove frost from the coils or frozen food to avoid the stuck of coils and damage of packaging.
- Freezer shall be insulated adequately well lit and door shall have proper gasket.
- It shall be maintained first-In-First-out [FIFO] system and effective stock rotation for the end product.
- It shall be aware the workers to issue first-in batches when load in to the distribution vehicles.
- Freezer temperature shall be monitored in every 1-hour basis and shall be recorded in Cold room temperature monitoring log.
- The freezer in charge worker shall calibrate the temperature indictor of the freezer using calibrated thermometer.
- Once a month Random end products Samples taken from Storage shall be Sent to the external laboratory to perform microbiological analysis for *Salmonella spp, Escherichia coli and Staphylococcus aureus.*
- During loading, the products shall be transported using well-cleaned trucks/trolleys.
- Well-trained worker shall be allocated for the freezer operation.

23. Loading/ Distribution

- Production supervisor shall be evaluated and documented the condition of truck, container and carriers of finished product prior to loading product.
- Workers shall be aware and trained regarding safe handling of product during loading.
- Products shall be dispatched from the freezers based on the batch number.
- Supervisor and Storekeeper shall be monitored and recorded the batch number with issued customer details.
- The following items shall be evaluated.
  - Cleanliness of truck/ vehicle- no foreign material, dirt, free of debris and free of off-odors.
  - Temperature of truck/ vehicle- it shall be acceptable to maintain product temperature.
  - Condition of door seals.
  - General truck condition- void of cracks, insulation in good condition etc.
- All vehicles shall be pre-chilled prior to loading products.

- Package integrity shall be maintained during loading/ distribution.
- Product identification shall be maintained through loading and distribution to ensure that the product can be traced if needed for recall and/or market withdrawal purpose.
- Vehicle driver shall be recorded the temperature of the vehicle in each 1 hour basis during distribution.
- Trained drivers shall be used for the distribution operation.

24. Calibration

- Calibration of Equipments shall be done according to the documented Calibration Schedule.
- It shall be make sure that the thermometer is fully equilibrated with the ambient room temperature. This could take 1 - 2 hours if the thermometer is from a cool room or freezer to a normal room temperature.
- Crushed ice shall be filled to a small-insulated container with that has been made from potable water (town drinking water is OK). Little water shall be added to the container, no more than one third the quantity of ice, to start the ice melting then pour off the excess water.
- Thermometer probe shall be placed in the center of the container so that the point of the probe is in contact with the ice.
- It should allowed the temperature reading of the thermometer to reach a steady reading (allow about 10 minutes), if the thermometer is accurate it should read 0°C. If the temperature is more or less than 0°C (e.g. +1 or -1, etc), note the difference in the temperature reading and allow for any such difference when reading a temperature for monitoring purposes. It is recommended that thermometers with a deviation of more than 1°C should be discarded or returned to the manufacturer.
- Cool room temperature gauges shall be checked by placing the thermometer probe in the cool room for about 10 minutes attached to or in contact with the probe, which connects with the gauge, and then checking against the temperature gauge for that cool room. Thermometer calibration shall be recorded in "Thermometer calibration Checklist".
- pH meters shall be calibrated according to the instructions provided with the instrument.

4.1.4 Identification of the scope of HACCP study and Company Quality and safety policies

4.1.4.1 Scope of the HACCP Plan

The HACCP manual for Comminuted meat products is developing for implement that to ensure product safety throw out the meat reception to distribution by analyzing and controlling all possible hazards.

In this plan, it addresses the all possible hazards including physical, chemical and biological from Raw material reception to Distribution of finish meat product.

4.1.4.2 Company Quality Policy

Gills Food products (Pvt) Ltd is dedicated to manufacturing and supplying our customers with a competitive quality line of standard, wholesome meat products with maximum consumer satisfaction.
The goal of the organization is not only to achieve superior customer satisfaction also delighting them with the product diversification what they need. Always seeking the opportunities to identify our customer needs and fit our gills foods for their use.
Each and every employee's commitment to quality improvement and management's further commitment to implementation of supporting managerial and operating systems which are essential to realizing this goals.

4.1.4.3 Company Safety policy

Gills food products (Pvt) Ltd. is dedicated to manufacture quality, safe meat products using the good manufacturing practices. We are placing every effort to provide safe products to our customers with maintaining the highest standards of operational process, occupational health, hygiene and ensuring that all the employees will remain free from injury and preventing danger to property.

Company is implementing this policy on safety by;

- Only producing and installing tested and proven start-of-the machinery and technology.
- Controlling every aspect on factory operation.

- Maintaining good communication between all relevant internal and external parties.
- Continuously training our employees on safe manufacturing practices and vigorously implementing best practices in all areas.
- Continuously communicating with employees on the standards of safe work practices.
- Company practices all national legislation of heath and safety.

4.1.5 Identification of HACCP team

- Production manager -Team Leader.
- Operational manager
- Personal manager
- Quality assurance executive
- Production executive
- Maintenance executive
- Stores executive
- Section Leaders
    - From raw material stores
    - Spice room
    - Meat preparation section
    - Cooking section
    - Packing section
    - Packaging material preparation section
    - End-product storage

4.1.6 Product description and intended use of Comminuted meat products

Descriptions of Comminuted meat products categorized under four product categories were as followed.

4.1.6.1 Product Description- Stuffing Products

Table 4.8 Stuffing Product Description

Product Description **Process/Product Type Name: Stuffing Products**	
1. Product Name(s)	Chicken Bockwurst, Beef Sausages, Fish Sausages, Chicken Garlic Sausages, Chicken Breakfast Sausages, Chicken Sausages, Premium Chicken Sausages, Chicken Frankfurter, Chicken Lingus, Gills Catering, Chicken Hot dogs.
2. Important Product Characteristics (a_w, pH, Salt, Preservatives,...)	Sodium Nitrite: 100 ppm Lean meat: not less than 60 %
3. Meat Ingredients	Mechanical Separated Meat (MSM) Chicken, Boneless Chicken, Loose meat- Chicken, Beef and Sappara fish
4. Non-meat Ingredients	Binders, Soya iso protein/ TVP Powder, Salt, Mixed Spices, Fat and Water
5. Additives	Nitrites (E-250), Polyphosphates (E-450, 451, 452), Ascorbic acid/ Ascorbate (E-301), Colorings (E-161 and E-110) and Flavor Enhancers (E-621)
6. How it is to be used	Ready-to-eat
7. Packaging	Nylon15 Micron/ LLDPE-60 and 70 gauge
8. Shelf Life	Vacuum-packed – 6 months under refrigerated condition
9. Intended use	General Public
10. Usage	Thaw well and Fry in oil at moderate heat for 3-4 minutes with frequent turning
11. Where it will be sold	Retail, Hotel and Restaurant
12. Labeling Instructions	Manufacture date, Expire date, Batch number, Ingredients and Instructions of usage and storage
13. Special Distribution Control	Keep refrigerated at/or below 4°C

4.1.6.2 Product Description- Forming Products

Table 4.9 Forming Product Description

Product Description **Process/Product Type Name: Forming Products**	
1. Product Name(s)	Chicken Meat balls, Beef meat balls and Fish balls
2. Important Product Characteristics (a_w, pH, Salt, Preservatives,...)	Sodium Nitrite: 100 ppm Lean meat: not less than 60 %
3. Meat Ingredients	Mechanical Separated Meat (MSM) Chicken, Boneless Chicken, Loose meat- Chicken, Beef and Sappara fish
4. Non-meat Ingredients	Binders, Soya iso protein/ TVP Powder, Salt, Mixed Spices, Fat and Water
5. Additives	Nitrites (E-250), Polyphosphates (E-450, 451, 452), Ascorbic acid/ Ascorbate (E-301) and Flavor Enhancers (E-621)
6. How it is to be used	Ready-to-eat
7. Packaging	Nylon15 Micron/ LLDPE-60 and 70 gauge
8. Shelf Life	Vacuum-packed – 6 months under refrigerated condition
9. Intended use	General Public
10. Usage	Thaw well and Fry in oil at moderate heat for 3-4 minutes with frequent turning
11. Where it will be sold	Retail, Hotel and Restaurant
12. Labeling Instructions	Manufacture date, Expire date, Batch number, Ingredients and Instructions of usage and storage
13. Special Distribution Control	Keep refrigerated at/or below 4°C

4.1.6.3 Product Description- Cold meat and Slices

4.1.6.3.1 Product Description- Cold meat and Slices- Cooked products

Table 4.10 Cold meat and Slices- Cooked product Description

Product Description **Process/Product Type Name: Cold meat and Slices (Cooked Products)**	
1. Product Name(s)	Chicken Ham and Beef Ham
2. Important Product Characteristics (a_w, pH, Salt, Preservatives,...)	Sodium Nitrite: 100 ppm Lean meat: not less than 60 %
3. Meat Ingredients	Mechanical Separated Meat (MSM) Chicken, Boneless Chicken, Loose meat- Chicken and Beef
4. Non-meat Ingredients	Binders, Soya iso protein/ TVP Powder, Salt, Mixed Spices, Fat and Water
5. Additives	Nitrites (E-250), Polyphosphates (E-450, 451, 452), Ascorbic acid/ Ascorbate (E-301), Colorings (E-161 and E-110) and Flavor Enhancers (E-621)
6. How it is to be used	Ready-to-eat
7. Packaging	Nylon15 Micron/ LLDPE-60 and 70 gauge
8. Shelf Life	Vacuum-packed – 6 months under refrigerated condition
9. Intended use	General Public
10. Usage	Thaw well and Fry in oil at moderate heat for 3-4 minutes with frequent turning
11. Where it will be sold	Retail, Hotel and Restaurant
12. Labeling Instructions	Manufacture date, Expire date, Batch number, Ingredients and Instructions of usage and storage
13. Special Distribution Control	Keep refrigerated at/or below 4°C

4.1.6.3.2 Product Description- Cold meat and Slices- Baked products

Table 4.11 Cold meat and Slices- Baked product Description

Product Description **Process/Product Type Name: Cold meat and Slices (Baked Products)**	
1. Product Name(s)	Chicken Bacon, Beef bacon, Tandoori chicken breasts, Herbs chicken breasts, Roast Chicken Breasts and Smoked Chicken Breasts
2. Important Product Characteristics (a_w, pH, Salt, Preservatives,...)	Sodium Nitrite: 100 ppm Lean meat: not less than 60 %
3. Meat Ingredients	Breast meat- Chicken and Beef
4. Non-meat Ingredients	Mixed Spices, Salt and Water
5. Additives	Nitrites (E-250), Polyphosphates (E-450, 451, 452), Ascorbic acid/ Ascorbate (E-301), Colorings (E-161 and E-110) and Flavor Enhancers (E-621)
6. How it is to be used	Ready-to-eat
7. Packaging	Nylon15 Micron/ LLDPE-60 and 70 gauge
8. Shelf Life	Vacuum-packed – 6 months under refrigerated condition
9. Intended use	General Public
10. Usage	Thaw well and Fry in oil at moderate heat for 3-4 minutes with frequent turning
11. Where it will be sold	Retail, Hotel and Restaurant
12. Labeling Instructions	Manufacture date, Expire date, Batch number, Ingredients and Instructions of usage and storage
13. Special Distribution Control	Keep refrigerated at/or below 4°C

4.1.6.4 Product Description- Uncooked products

Table 4.12 Uncooked product Description

Product Description **Process/Product Type Name: Uncooked Products**	
1. Product Name(s)	Minced Chicken and Minced Beef
2. Important Product Characteristics (a_w, pH, Salt, Preservatives,...)	Total meat: not less than 100 %
3. Meat Ingredients	Mechanical Separated Meat (MSM) Chicken and Beef
4. Non-meat Ingredients	-
5. Additives	-
6. How it is to be used	Ready-to-cook
7. Packaging	Nylon15 Micron/ LLDPE-60 and 70 gauge
8. Shelf Life	Vacuum-packed – 6 months under refrigerated condition
9. Intended use	General Public
10. Usage	Thaw well and cook well(above 75^0C)
11. Where it will be sold	Retail, Hotel and Restaurant
12. Labeling Instructions	Manufacture date, Expire date, Batch number, Ingredients and Instructions of usage and storage
13. Special Distribution Control	Keep refrigerated at/or below 4°C

4.1.7.1 Factory Flow diagram

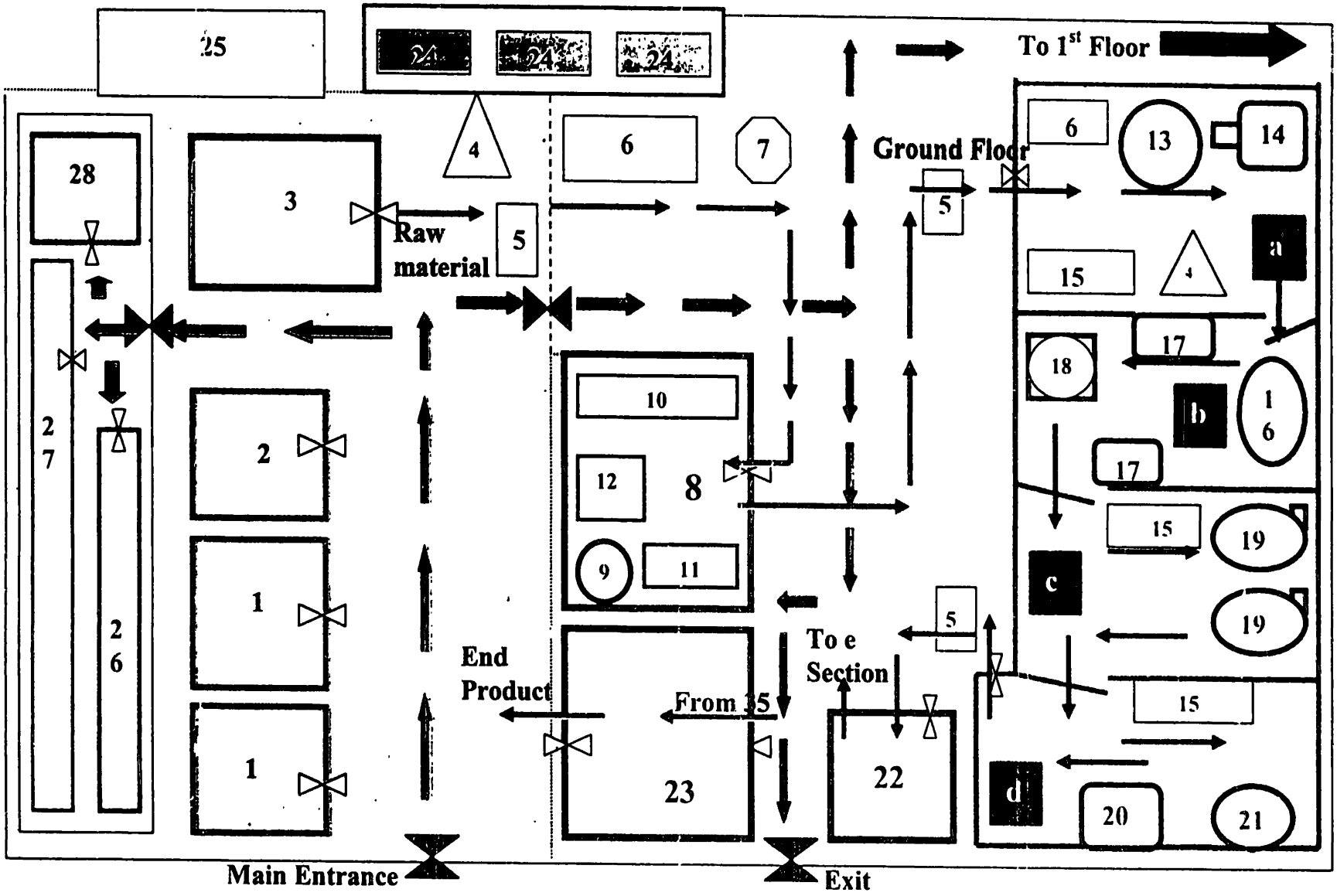


Figure 4.2 Plant Lay out- Ground Floor

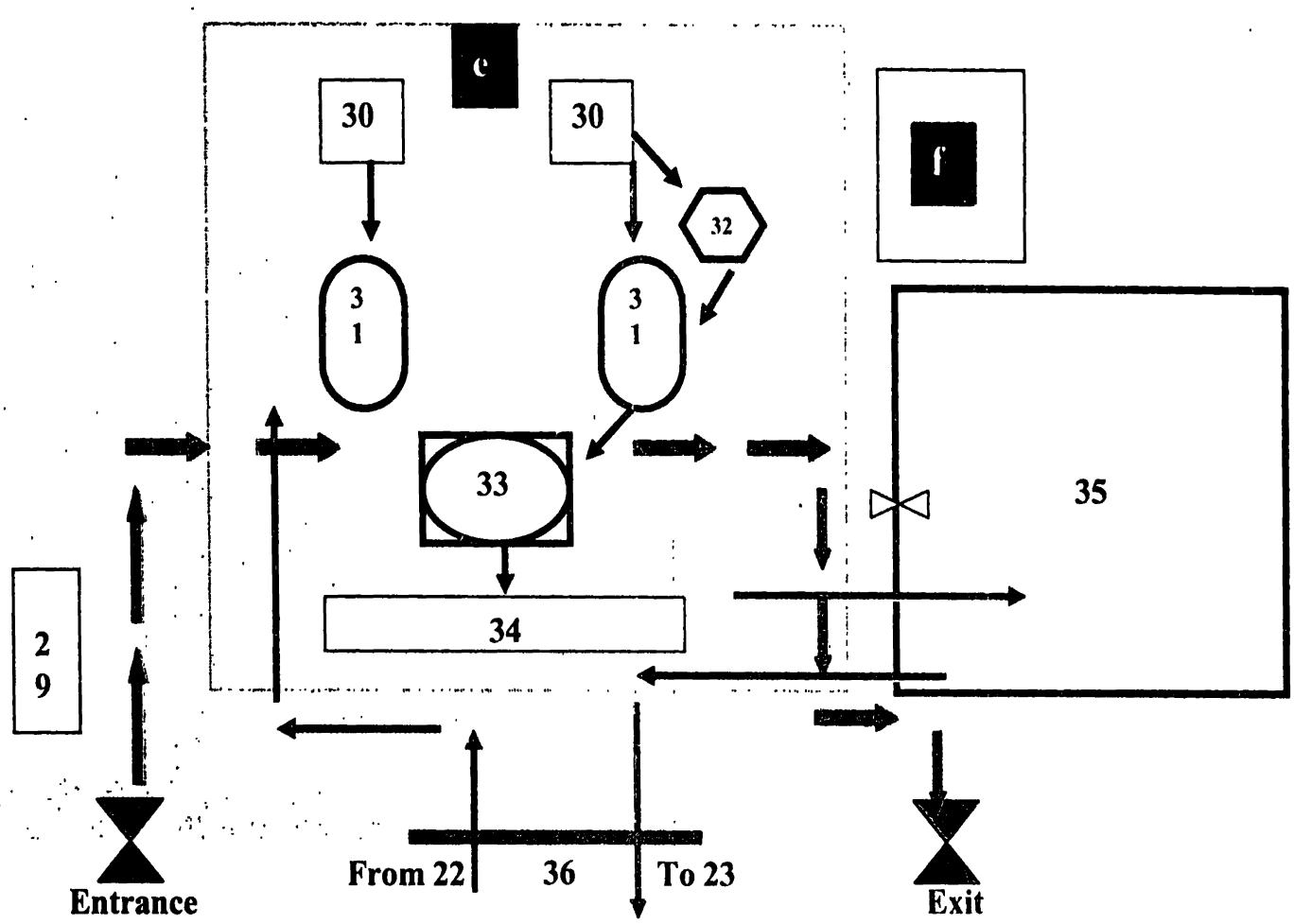


Figure 4.3 Plant Lay out- First Floor

Product Flow

Employees Path way

Locations indicated by numbers;

1- Dry stores

2- Spice Room

3- Raw material Freezer

4- Weighing Scale

5- Foot Bath

6- Raw meat Receiving Table

7- Hand Washing area

8- Chiller 1

9- Tumbler

10-Thawing area

11- Fat storage area

12- Brine immersion area

13- Band saw/Cutter

14- Mincer

15- Crates/trolleys Stacking area

16- Bowl Chopper

17- Stuffer

18- Forming machine

19- Chamber

20- Showering area

21- Peeler

22- Chiller 2

23- Dispatch area

24- Water Collection tanks

25- Aeration tank

26- Dinning room

27- Packaging material Preparation area

28- Changing room

29- Washing area

30- Packing tables

31- Vacuum Packaging machine

32- Slicer

33- Metal Detector

34- Finishing Table

35- Blast Freezer

36- Hoist

a- Mincing area

b- Bowl Chopping area

c- Cooking area

d- Showering area

e- Packing area

f- Exhaust area

4.1.7.2 Process Flow Diagrams

4.1.7.2.1 Stuffing products-Process flow diagrams

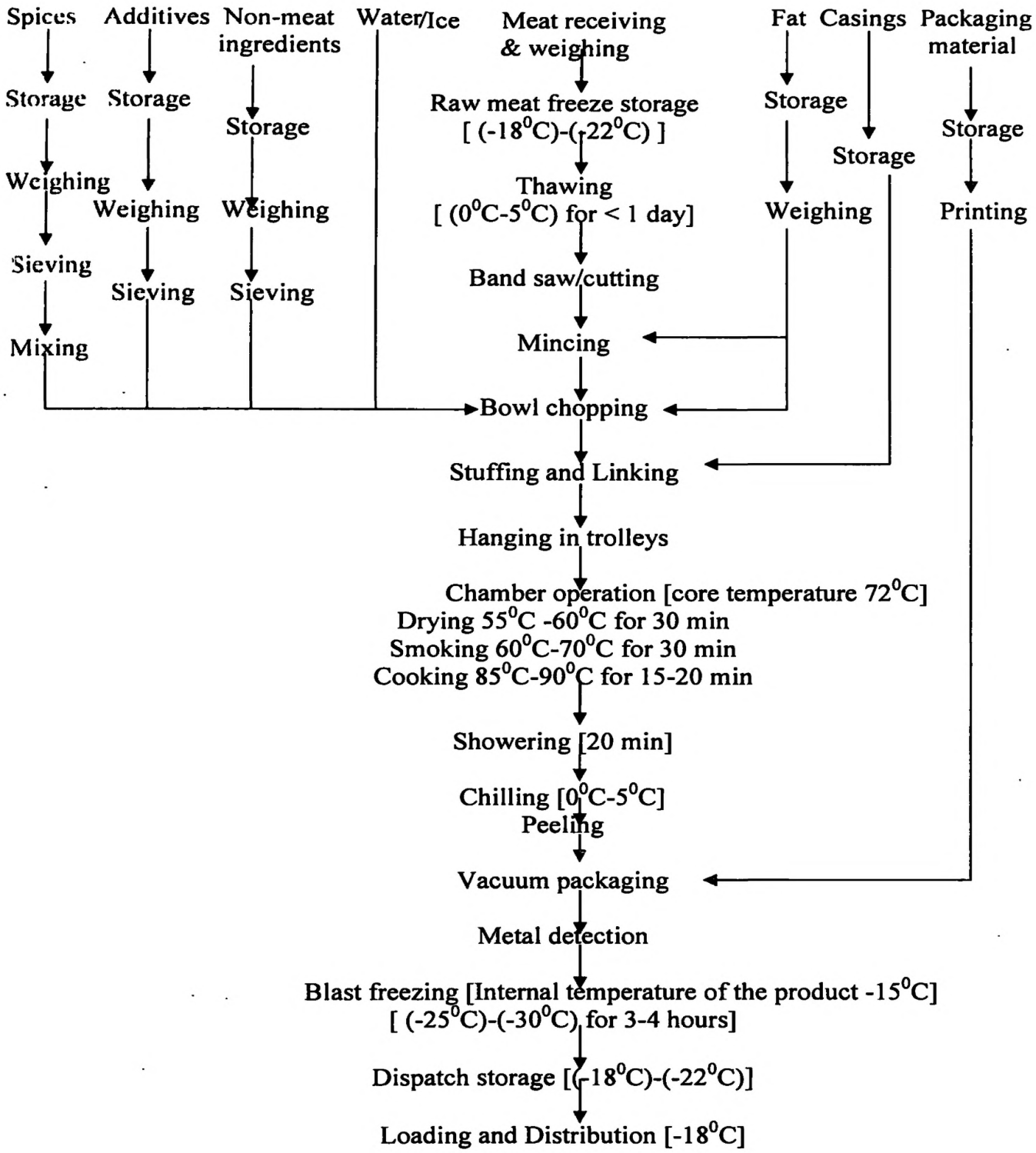


Figure 4.4 Flow Chart of Stuffing Product Production

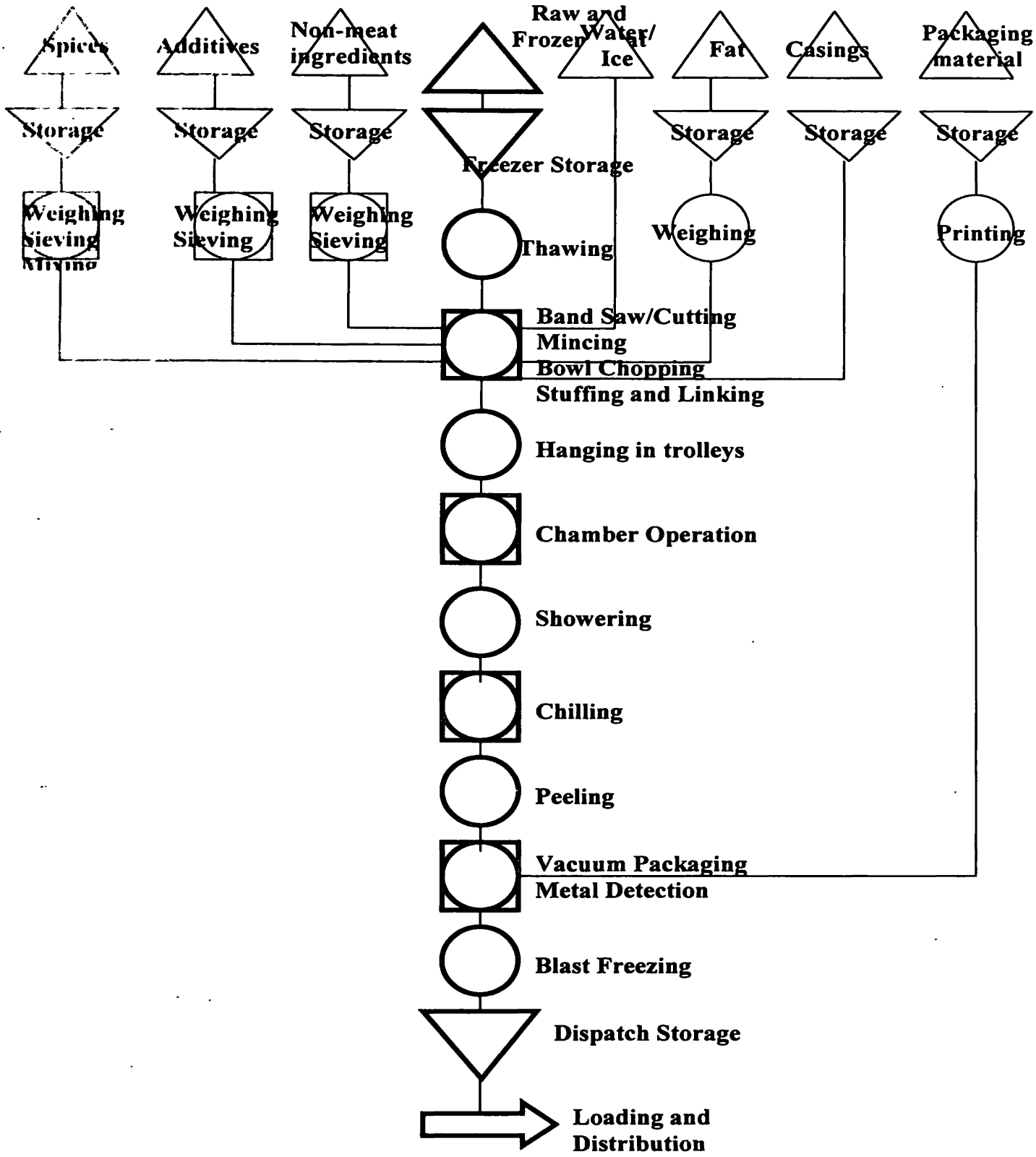


Figure 4.5 Flow Chart of Stuffing Product Production (Using Symbols)

4.1.7.2.2 Forming products-Process flow diagrams

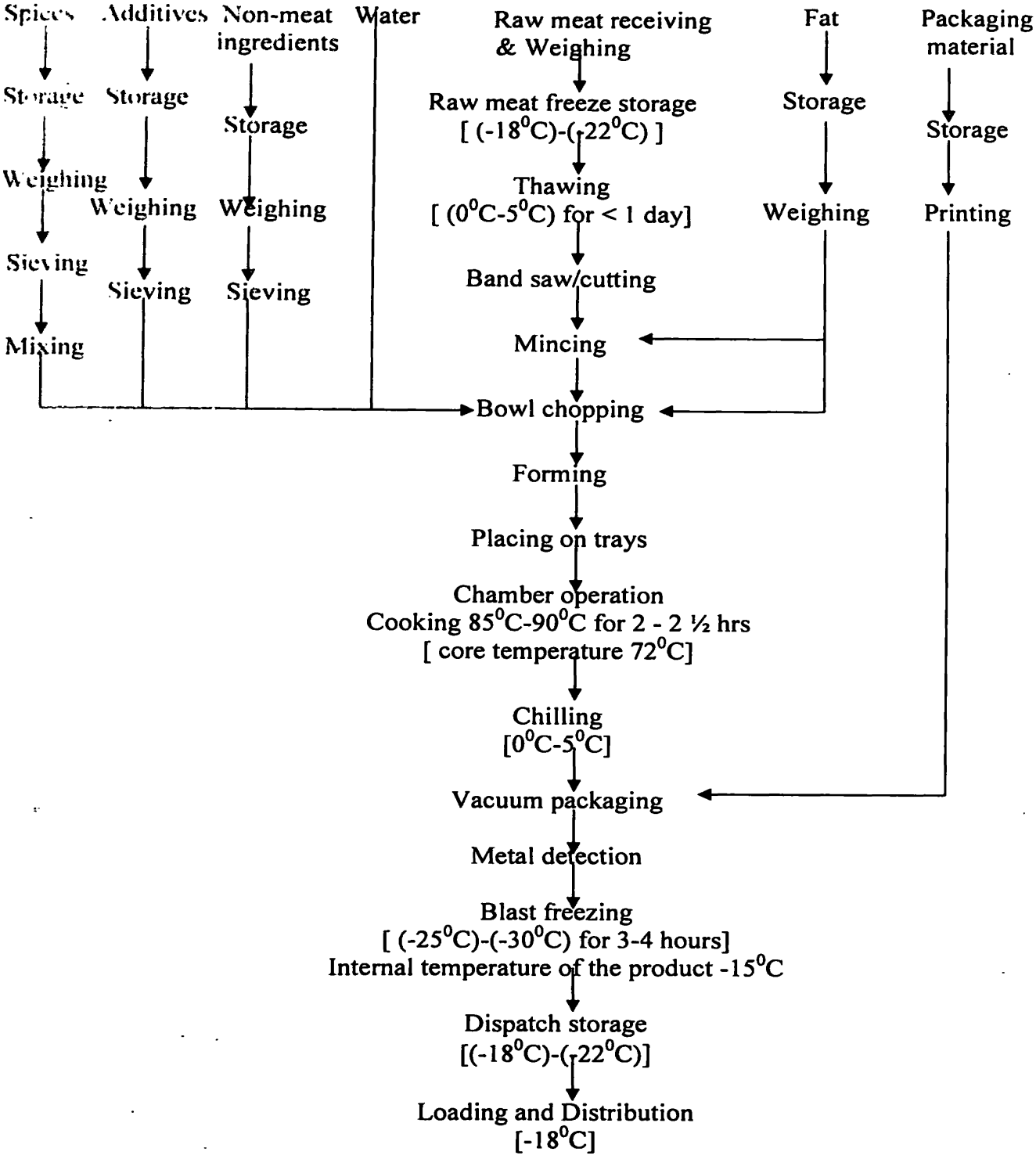


Figure 4.6 Flow Chart of Forming Product Production

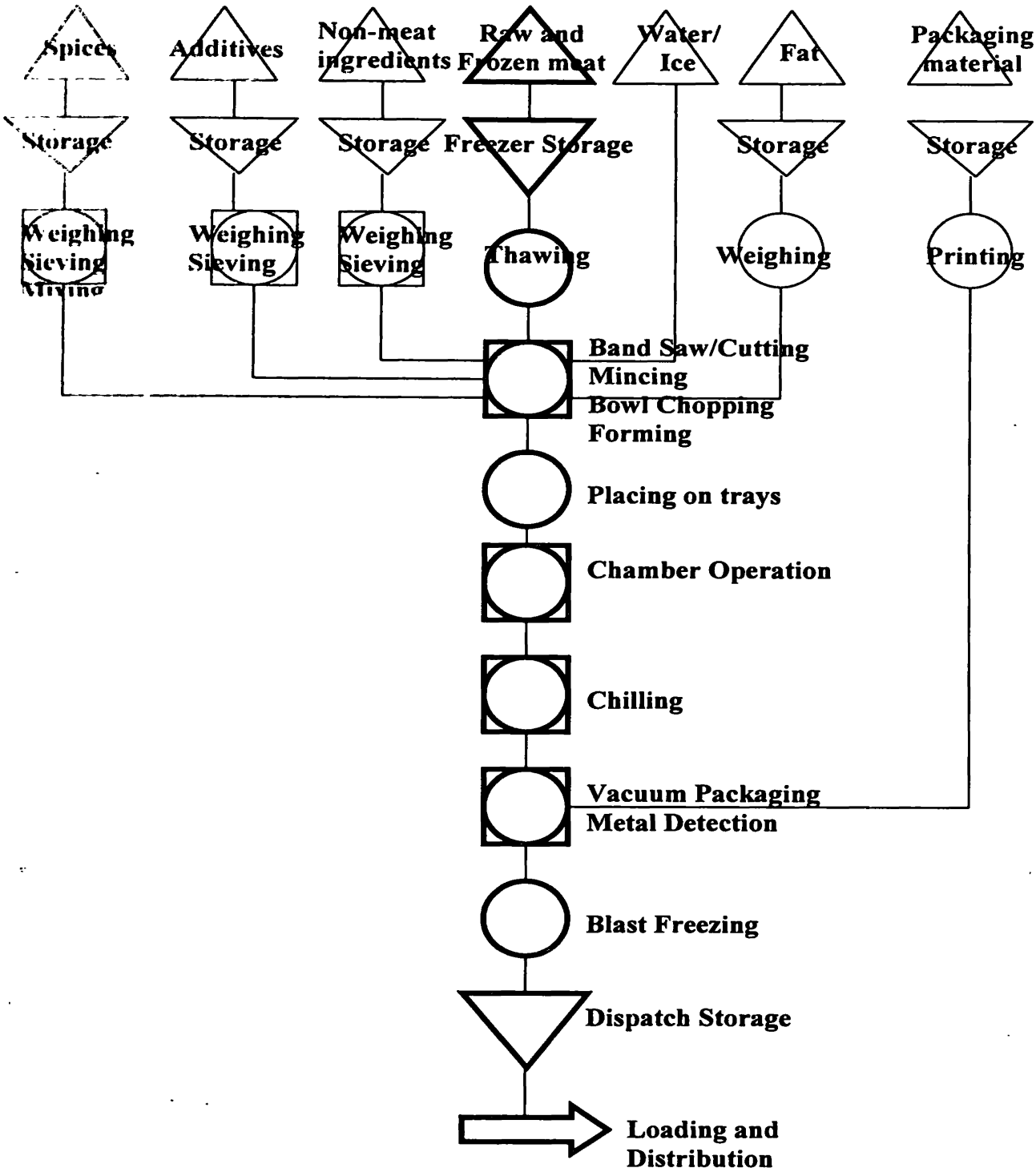


Figure 4.7 Flow Chart of Forming Product Production (Using Symbols)

4.1.7.2.3 Cold meat and slices (Cooked and Baked)- Process flow diagrams

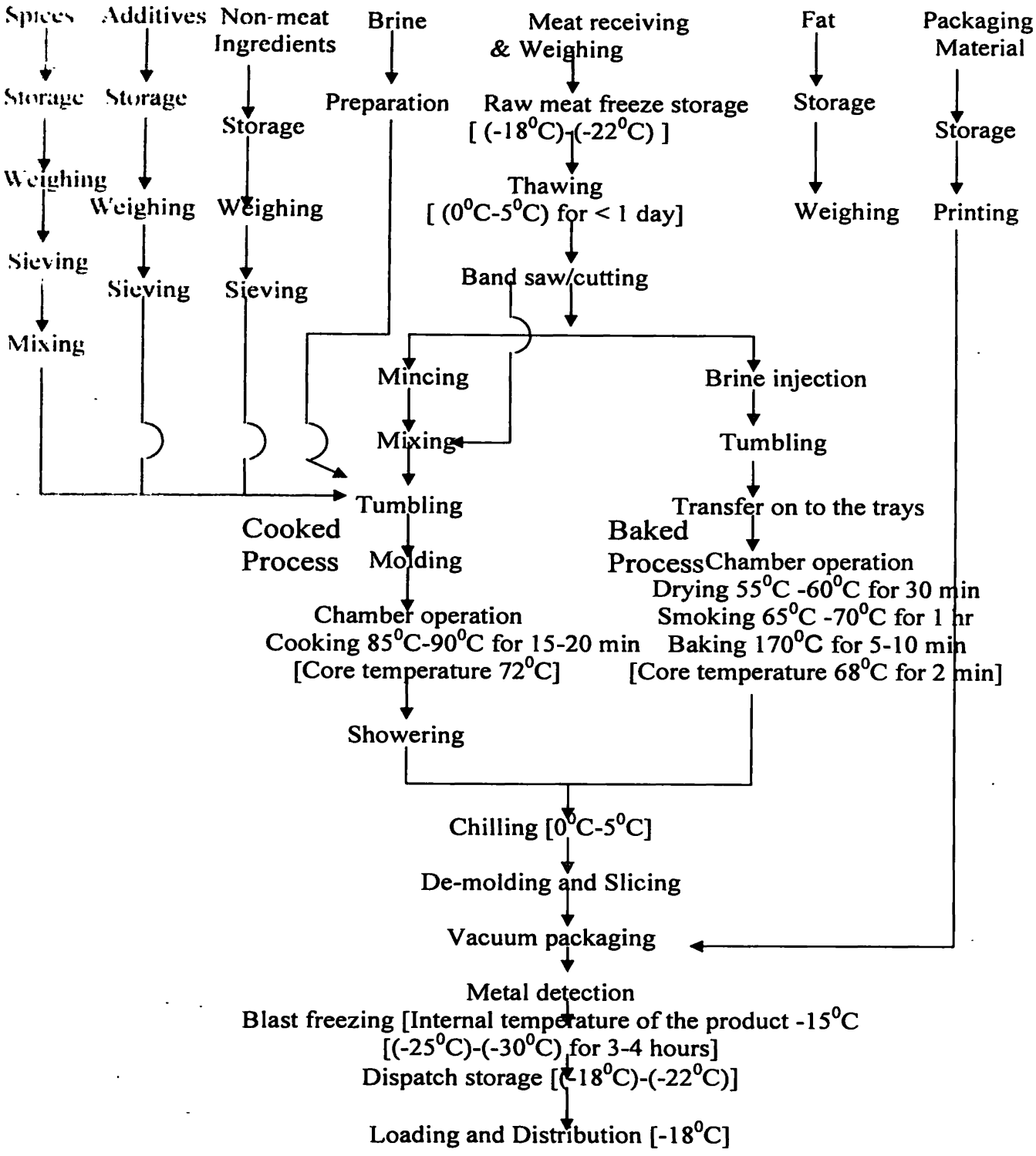


Figure 4.8 Flow Chart of Cold meat and Slices Production

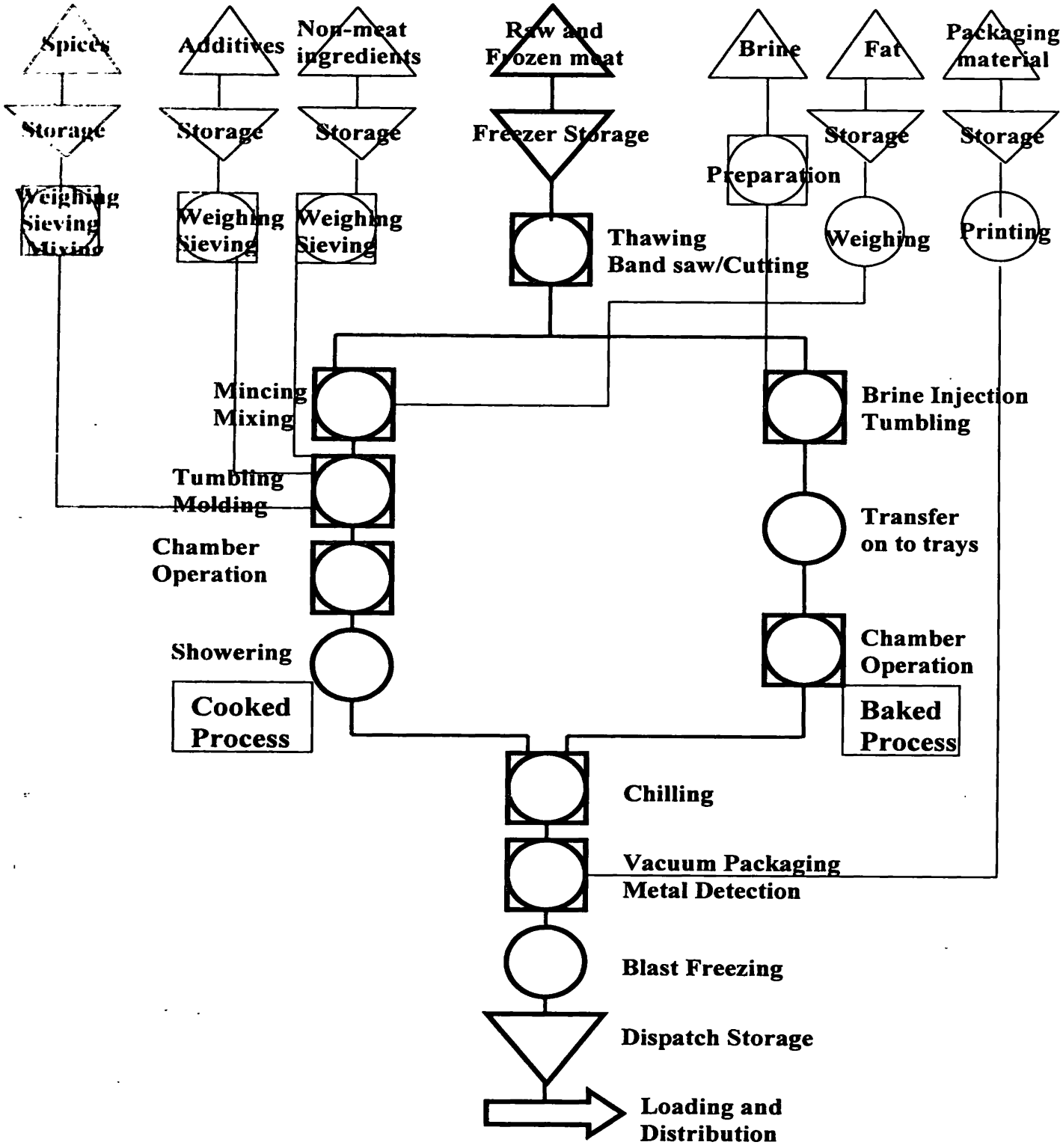


Figure 4.9 Flow Chart of Cold meat and Slices Production (Using Symbols)

4.1.7.2.4 Uncooked products-Process flow diagrams

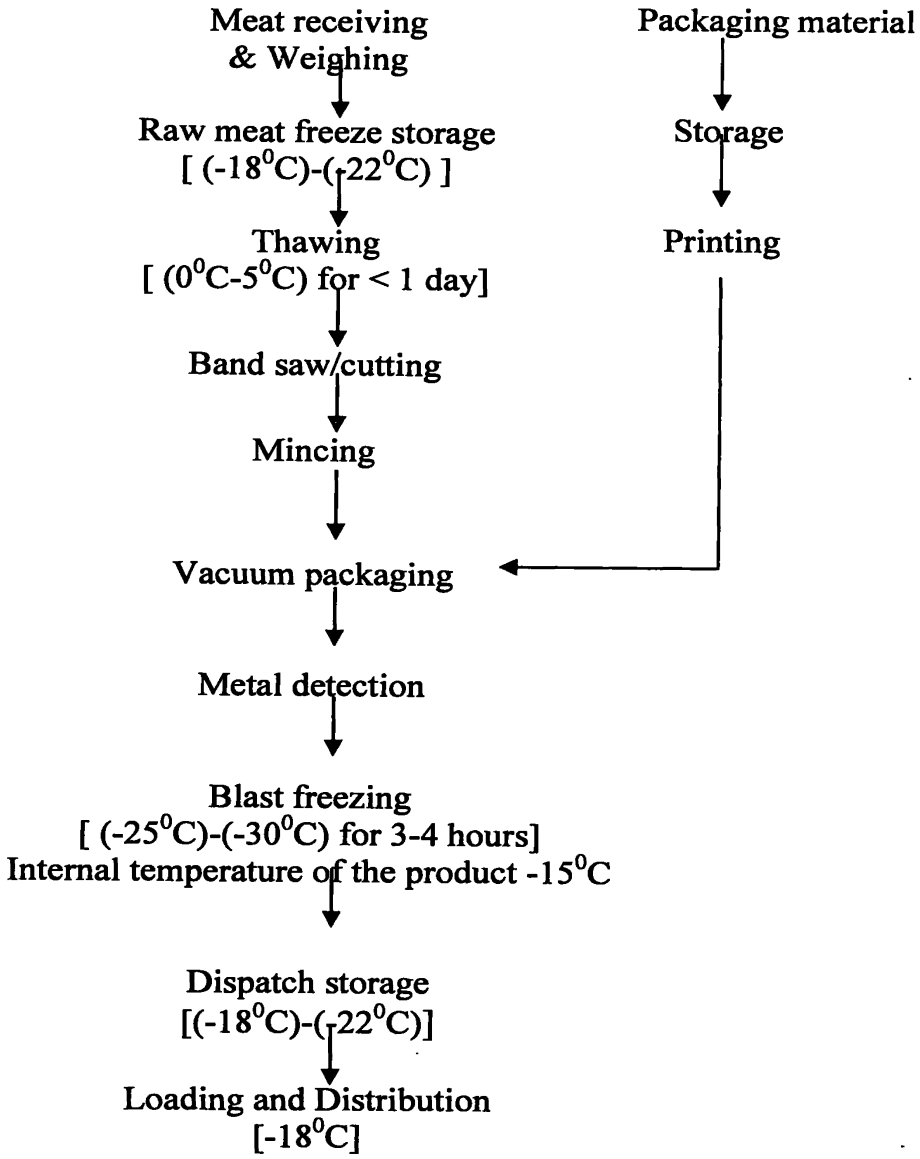


Figure 4.10 Flow Chart of Uncooked product Production

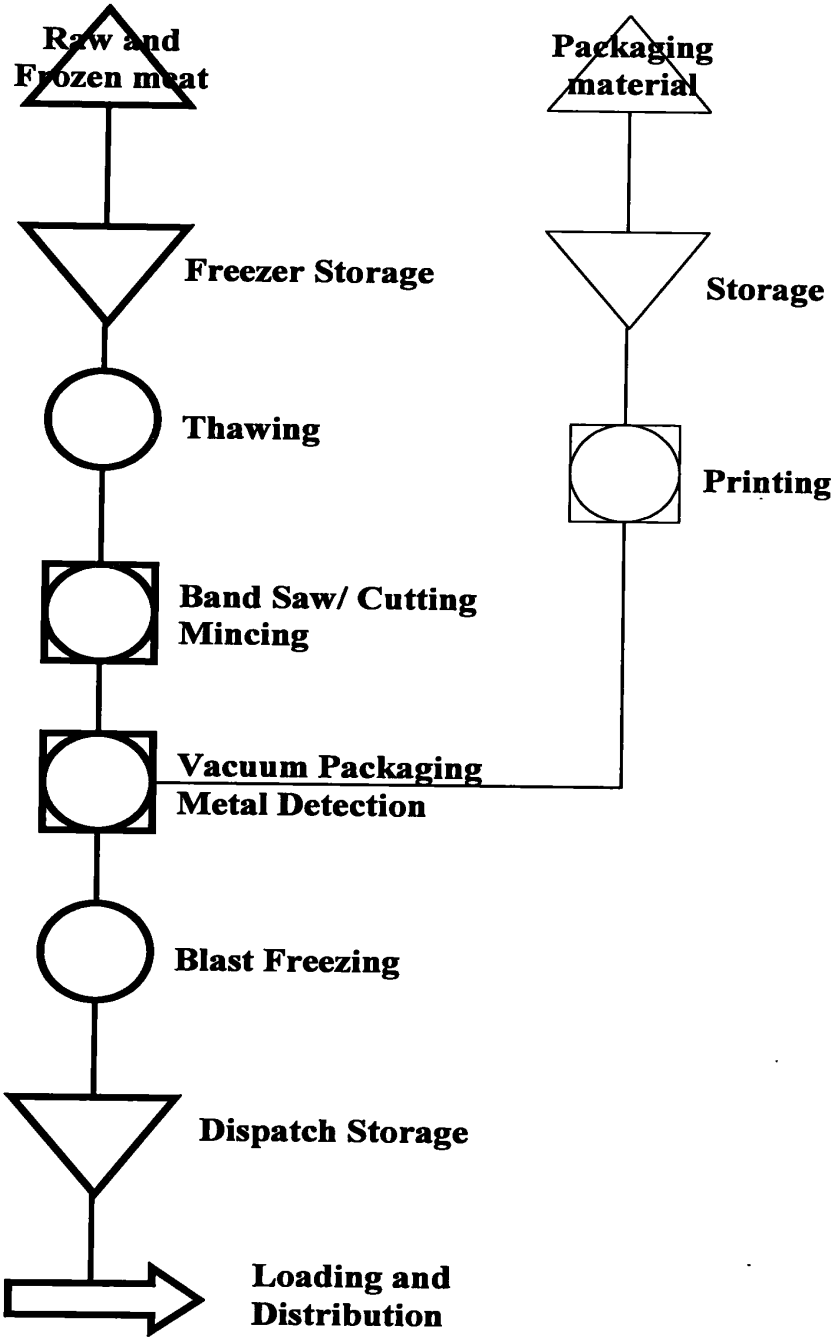


Figure 4.11 Flow Chart of Uncooked product Production (Using Symbols)

4.1.8 Identification of Hazards and Hazard Analysis (Principle 1)

4.1.8.1 Ingredients Hazard analysis

4.1.8.1.1 Ingredients Hazard analysis- Stuffing, Forming and Cold meat and Slices

Table 4.13 Ingredients Hazard analysis

M: Microbiological hazards, P: Physical Hazards, C: Chemical hazards
H-High, M-Medium, L-Low Y-Yes, N-No
Cr-Critical, Ma-Major, Mi-Minor, Sa-Satisfactory (Negligible)

Ingredient	Potential hazards & possible causes	Severity	Likely occurrence	Significance	Address in the plan	Control measures
1.Meat ingredients	M: Presence of pathogenic organisms like *Salmonella* spp., *Staphylococcus aureus, Escherichia coli* O157:H7 etc.	H	H	Cr	Y	SQA GMP 3.1, GMP 1.3, SOP 1.1 SOP 12 (effective Chamber operation)
1.a **Frozen chicken** ▪ Mechanical Separated Meat (MSM)	P: Presence of bone particles, metal particles, stones and other physical contaminants.	H	M	Ma	Y	SQA, GMP 3.1, GMP 1.3, SOP 1.1, SOP6, 7 (effective mincing and bowl chopping operation), SOP 20 (effective metal detection)
▪ Mechanical Deboned Meat (MDM)	C: Presence of Microbial toxins	H	H	Cr	Y	SOP 1.1 (microbiological testing)
	C: Presence of anti biotic residues and veterinary residues.	M	M	Ma	Y	SQA, GMP 3.1 SOP 1.1
▪ Boneless meat ▪ Loose meat ▪ Breast meat	M: Presence of pathogenic organisms like *Salmonella* spp., *Staphylococcus aureus, Escherichia coli* O157:H7 etc.	H	H	Cr	Y	GMP 3.1, GMP 1.3 SOP 1.1 SOP 12 (effective Chamber operation)
	P: Presence of bone & metal particles, stones and other physical contaminants.	H	M	Ma	Y	GMP 3.1, GMP 1.3, SOP 1.1, SOP6 (effective mincing operation), SOP 20 (metal detection)
1.b **Fresh beef**	C: Presence of Bacterial toxins	H	H	Cr	Y	SOP 1.1 (Microbiological testing)
	C: Presence of anti biotic residues and veterinary residues.	H	M	Ma	Y	GMP 3.1, 1.3 SOP 1.1

Table 4.14 Ingredients Hazard analysis Continue..

Ingredient	Potential hazards & possible causes	Severity	Likely occurrence	Significance	Address in the plan	Control measures
1.c **Sappara fish** Swordfish *Xiphias gladius*	M: Presence of pathogenic organisms like *Salmonella* spp., *Clostridium botulinum, Staphylococcus aureus, Escherichia coli* O157:H7, *Vibrio* spp. etc.	H	H	Cr	Y	GMP 3.1, GMP 1.3 SOP 1.1 SOP 12 (effective Chamber operation)
	P: Presence of bone particles, metal particles, stones and other physical contaminants.	H	M	Ma	Y	GMP 3.1, GMP 1.3 SOP 1.1 SOP6, 7 (effective bowl chopping operation) SOP 20 (effective metal detection)
	C: Presence of heavy metals, PCB	H	L	Mi	Y	SQA, GMP 3.1 and SOP 1.1
2. Non-meat ingredients	M: Presence of pathogenic organisms like *Salmonella* spp., *Clostridium botulinum, Staphylococcus aureus, Escherichia coli* O157:H7 etc.	H	L	Mi	Y	SQA GMP 3.1 SOP 1.2 SOP 12 (effective Chamber operation)
2.a **Spices**	P: Presence of metal particles, stones and other physical contaminants.	H	M	Ma	Y	SQA, GMP 3.1, GMP 1.3 SOP 1.2, SOP 3.1 SOP6, 7 (effective mincing and bowl chopping operation) SOP 20 (effective metal detection)
	C:-	-	-	-	N	-

Table 4.15 Ingredients Hazard analysis Continue..

Ingredient	Potential hazards & possible causes	Severity	Likely occurrenc	Significan ce	Address in the plan	Control measures
2. b Nitrite	M & C: - P: Presence of metal particles, stones and other physical contaminants.	- H	- M	- Ma	N Y	- SQA, GMP 3.1, GMP 1.3, SOP 1.2, SOP 3.2, SOP6, 7 (effective mincing & bowl chopping operation), SOP 20 (effective metal detection)
2.c Phosphates	M & C: - P: Presence of metal particles, stones and other physical contaminants.	- H	- M	- Ma	N Y	- SQA, GMP 3.1, GMP 1.3, SOP 1.2, SOP 3.2 SOP6, 7 (effective mincing and bowl chopping operation), SOP 20 (effective metal detection)
2. d Ascorbic acid/ Ascorbate	M & C: - P: Presence of metal particles, stones and other physical contaminants.	- H	- M	- Ma	N Y	- SQA, GMP 3.1, GMP 1.3, SOP 1.2, SOP 3.2 SOP6, 7 (effective mincing and bowl chopping operation), SOP 20 (effective metal detection)
2.e Coloring material	M & C: - P: Presence of metal particles, stones and other physical contaminants.	- H	- M	- Ma	N Y	- SQA, GMP 3.1, GMP 1.3, SOP 1.2, SOP 3.2 SOP6, 7 (effective mincing and bowl chopping operation), SOP 20 (effective metal detection)

Table 4.16 Ingredients Hazard analysis Continue..

Ingredient	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
2. f Chicken and Beef flavor	M: -	-	-	-	N	-
	P: Presence of metal particles, stones and other physical contaminants.	H	M	Ma	Y	SQA, GMP 3.1, GMP 1.3 SOP 1.2, SOP 3.2, SOP6, 7 (effective mincing & bowl chopping operation), SOP 20 (effective metal detection)
	C: -	-	-	-	N	-
2.g Salt	M & C: -	-	-	-	N	-
	P: Presence of metal particles, stones and other physical contaminants.	H	M	Ma	Y	GMP 3.1, GMP 1.3 SOP 1.2, SOP 3.2 SOP6, 7 (effective mincing and bowl chopping operation) SOP 20 (effective metal detection)
2.h Sugar	M & C: -	-	-	-	N	-
	P: Presence of metal particles, stones and other physical contaminants.	H	M	Ma	Y	SQA, GMP 3.1, GMP 1.3 SOP 1.2, SOP 3.2 SOP6, 7 (effective mincing and bowl chopping operation) SOP 20 (effective metal detection)

Table 4.17 Ingredients Hazard analysis Continue..

Ingredient	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
2.i Milk powder	M & C: -	-	-	-	N	-
	P: Presence of metal particles, stones and other physical contaminants.	H	M	Ma	Y	SQA, GMP 3.1, GMP 1.3 SOP 1.2, SOP 3.2 SOP6, 7 (effective mincing and bowl chopping operation) SOP 20 (effective metal detection)
2.j Mono Sodium Glutamate (MSG)	M & C: -	-	-	-	N	-
	P: Presence of metal particles, stones and other physical contaminants.	H	M	Ma	Y	SQA, GMP 3.1, GMP 1.3 SOP 1.2, SOP 3.2 SOP6, 7 (effective mincing and bowl chopping operation) SOP 20 (effective metal detection)
2.k Soya iso protein	M: -	-	-	-	N	-
	P: Presence of metal particles, stones and other physical contaminants.	H	M	Ma	Y	SQA, GMP 3.1, GMP 1.3 SOP 1.2, SOP 3.3 SOP6, 7 (effective mincing and bowl chopping operation) SOP 20 (effective metal detection)

Table 4.18 Ingredients Hazard analysis Continue..

Ingredient	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
2.l Rusk powder	M & C: -	-	-	-	N	-
	P: Presence of metal particles, stones and other physical contaminants.	H	M	Ma	Y	GMP 3.1, GMP 1.3 S OP 1.2, SOP 3.3 SOP6, 7 (effective mincing and bowl chopping operation) SOP 20 (effective metal detection)
2.m Binders	M & C: -	-	-	-	N	-
	P: Presence of metal particles, stones and other physical contaminants.	H	M	Ma	Y	GMP 3.1, GMP 1.3 SOP 1.2, SOP 3.3 SOP6, 7 (effective mincing and bowl chopping operation) SOP 20 (effective metal detection)
2.n TVP powder	M: -	-	-	-	N	-
	P: Presence of metal particles, stones and other physical contaminants.	H	M	Ma	Y	GMP 3.1, GMP 1.3 SOP 1.2, SOP 3.3 SOP6 (effective mincing operation) SOP 20 (effective metal detection)
	C: -	-	-	-	N	-

Table 4.19 Ingredients Hazard analysis Continue..

Ingredient	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
3. Soft fat	M: - Presence of pathogenic organisms and lypolitic organisms & growth and proliferation due to inadequate temperature control during storage.	H	H	Cr	Y	SQA GMP 3.1, SOP 1.2, SOP 2.3 SOP 12 (effective Chamber operation)
	P: Presence of metal particles, stones and other physical contaminants.	H	M	Ma	Y	SQA, GMP 3.1, GMP 1.3, SOP 3.1 SOP 1.2, SOP 2.3, SOP 6, 7 (effective mincing & bowl chopping operation), SOP 20 (effective metal detection)
	C: -	-	-	-	N	-
4. Water	M: - Presence of Coliform, E. coli and protozoa.	H	H	Cr	Y	GMP 3.3, SOP 1.2, SOP 12 (effective Chamber operation)
	P & C: -	-	-	-	N	-
5. Casings	M & C: -	-	-	-	N	-
	P: Presence of metal particles, stones and other physical contaminants.	H	M	Ma	Y	SQA, GMP 3.1, GMP 3.4, SOP 1.2, SOP 3.2, SOP 6, 7 (effective mincing and bowl chopping operation), SOP 20 (effective metal detection)
6. Packaging material	M: -	-	-	-	N	-
	P: Presence of metal particles, stones and other physical contaminants.	H	M	Ma	Y	SQA, GMP 3.1, GMP 3.4, SOP 1.2, SOP 3.2 SOP6 (effective mincing operation) SOP 20 (effective metal detection)
	C: - Introduce packaging material chemical in to the food.	M	M	Ma	Y	SQA GMP 3.3

4.1.8.1.2 Ingredients Hazard analysis- Uncooked products

Table 4.20 Ingredients Hazard analysis

Ingredient	Potential hazards & possible causes	Severity	Likely occurrence	Significance	Address in the plan	Control measures
1.Meat ingredients **1.a Frozen chicken** ▪ Mechanical Separated Meat (MSM) ▪ Mechanical Deboned Meat (MDM)	M: Presence of pathogenic organisms like *Salmonella* spp., *Clostridium botulinum, Staphylococcus aureus, Escherichia coli* O157:H7 etc.	H	H	Cr	Y	SQA GMP 3.1, GMP 1.3 SOP 1.1
	P: Presence of bone particles, metal particles, stones and other physical contaminants.	H	M	Ma	Y	SQA GMP 3.1, GMP 1.3, SOP 1.1, SOP6 (effective mincing operation), SOP 20 (effective metal detection)
	C: Presence of Microbial Toxins	H	H	Cr	Y	SOP 1.1 (Microbiological testing)
	C: Presence of anti biotic residues and veterinary residues.	M	M	Ma	Y	SQA, GMP 3.1 SOP 1.1
1.b Fresh beef	M: Presence of pathogenic organisms like *Salmonella* spp., *Staphylococcus aureus, Escherichia coli* O157:H7 etc.	H	H	Cr	Y	GMP 3.1, GMP 1.3 SOP 1.1
	P: Presence of bone particles, metal particles, stones and other physical contaminants.	H	H	Ma	Y	GMP 3.1, GMP 1.3 SOP 1.1, SOP6 (effective mincing operation), SOP 20 (effective metal detection)
	C: Presence of Microbial Toxins	H	H	Cr	Y	SOP 1.1 (Microbiological testing)
	C: Presence of anti biotic residues and veterinary residues.	H	M	Ma	Y	GMP 3.1, 1.3 SOP 1.1

4.1.8.2 Pre-production activities-Hazard analysis

4.1.8.2.1 Pre-production activities Hazard analysis- Stuffing & Forming products

Table 4.21 Pre-Production activities Hazard analysis

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
1.Non-meat ingredients weighing	M: Cross contamination with Microorganisms due to unhygienic condition during mixing.	M	M	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 2.2, 3.1 SOP 12 (effective Chamber operation)
1. 1 Spice Weighing and Mixing	P: Cross contamination with sands, metals and other contaminants.	M	L	Mi	Y	GMP 7.1, 10 (training), SOP 6, 7 (effective mincing & bowl chopping operation). SOP 20 (effective metal detection)
	C: Cross contamination with cleaning chemicals in utensils and tools used for weighing and mixing purposes.	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning
1.2. Additives weighing	M: -	-	-	-	N	-
	P: Cross contamination with sands, metals and other contaminants.	M	L	Mi	Y	GMP 7.1, 10 (training), SOP 3.2, 6, 7 (effective mincing & bowl chopping operation). SOP 20 (effective metal detection)
	C: Inaccurate weighing of Nitrite (usage of excess amount) may cause carcinogenic effect to the consumer.	H	H	Cr	Y	Use recommended levels only, GMP 3.2 GMP 10(training), GMP 3.2 (calibration)
1.3 Other dry ingredients weighing (Rusk, binders, TVP, Soy iso protein)	M: -	-	-	-	N	-
	P: Cross contamination with sands, metals and other contaminants.	M	L	Mi	Y	GMP 7.1, 10 (training), SOP 3.3, 6, 7 (effective mincing & bowl chopping operation). SOP 20 (effective metal detection)
	C: Cross contamination with cleaning chemicals	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning

Table 4.22 Pre-Production activities Hazard analysis Continue..

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
2. Packaging material preparation	M: Loss of traceability due to inaccurate date coding. Cross contamination with Microorganisms due to unhygienic condition and personnel during printing.	M	L	Mi	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 2.4, 3.6
	P: -	-	-	-	N	-
	C: -	-	-	-	N	-

4.1.8.2.2 Pre-production activities Hazard analysis- Cold meat and Slices

Table 4.23 Pre-Production activities Hazard analysis

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
1.Non-meat ingredients weighing	M: Cross contamination with Microorganisms due to unhygienic condition during mixing.	M	M	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 2.2, 3.1 SOP 12 (effective Chamber operation)
1.1 Spice Weighing and Mixing	P: Cross contamination with sands, metals and other contaminants.	M	L	Mi	Y	SOP 6 (effective mincing operation) SOP 20 (effective metal detection)
	C: Cross contamination with cleaning chemicals in utensils and tools used for weighing and mixing	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
1.2. Additives weighing	M: -	-	-	-	N	-
	P: Cross contamination with sands, metals and other contaminants.	M	L	Mi	Y	SOP6 (effective mincing operation) SOP 20 (effective metal detection)
	C: Inaccurate weighing (usage of excess amount) may cause carcinogenic effect to the consumer.	H	H	Cr	Y	Use recommended levels only, GMP 3.2 GMP 10(training), GMP 3.2 (calibration)
1.3 Other dry ingredients weighing (Rusk, binders, TVP, Soy iso protein)	M: -	-	-	-	N	-
	P: Cross contamination with sands, metals and other contaminants.	M	L	Mi	Y	GMP 7.1, 10 (training), SOP 3.3, 6, 7 (effective mincing & bowl chopping operation). SOP 20 (effective metal detection)
	C: Cross contamination with cleaning chemicals	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning

Table 4.24 Pre-Production activities Hazard analysis Continue..

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
2. Brine preparation	M: Cross contamination with Microorganisms due to unhygienic condition during preparation.	M	M	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 3.5, SOP 12 (effective Chamber operation)
	P: Cross contamination with sands, metals and other contaminants.	M	L	Mi	Y	SOP6 (effective mincing operation), SOP 3.5 SOP 20 (effective metal detection)
	C: Cross contamination with cleaning chemicals in utensils and tools used for mixing and preparation purposes.	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing of utensils with water
3. Packaging material preparation	M: Loss of traceability due to inaccurate date coding. Cross contamination with Microorganisms due to unhygienic condition and personnel during printing.	M	L	Mi	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 2.4, 3.6
	P: -	-	-	-	N	-
	C: -	-	-	-	N	-

4.1.8.2.3 Pre-production activities Hazard analysis- Uncooked products

Table 4.25 Pre-Production activities Hazard analysis

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
1. Packaging material preparation	M: Loss of traceability due to inaccurate date coding. Cross contamination with Microorganisms due to unhygienic condition and personnel during printing.	M	L	Mi	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 2.4, 3.6
	P: -	-	-	-	N	-
	C: -	-	-	-	N	-

4.1.8.3 Process step hazard analysis

4.1.8.3.1 Process step hazard analysis- Stuffing products

Table 4.26 Process step Hazard analysis

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
1. Raw meat receiving and weighing.	M: Cross contamination with Microorganisms due to unhygienic condition of people and utensils during receiving and unloading.	M	M	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 1.1, SOP 12 (effective Chamber operation)
	P: Cross contamination with sands, metals and other contaminants.	M	L	Mi	Y	SOP6, 7 (effective mincing and bowl chopping), SOP 20 (effective metal detection)
	C: Cross contamination with cleaning chemicals in utensils and tools used for unloading operation.	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
2. Raw meat Storage	M: Growth and proliferation of microorganisms due to inadequate temperature control.	H	H	Cr	Y	GMP 1.3 (proper maintenance & calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training), SOP 2.1, SOP 12 (effective Chamber operation)
	P: -	-	-	-	N	-
	C: Cross contamination with cleaning chemicals in freezer.	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
3. Thawing	M: Growth and proliferation of microorganisms due to inadequate temperature control and Cross contamination with drip of thawed meat.	H	M	Ma	Y	GMP 1.3 (proper maintenance and calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training),SOP 4,SOP 12 (Chamber operation)
	P: -	-	-	-	N	-
	C: Cross contamination with cleaning chemicals in chiller.	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.

Table 4.2 / Process step Hazard analysis Continue..

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
4. Band saw/ cutting	M: Cross contamination with Microorganisms due to unhygienic condition of band saw/ cutter & people.	M	H	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 5, SOP 12 (effective Chamber operation)
	P: Cross contamination with metals of the cutter.	H	H	Cr	Y	GMP 1.3 (proper maintenance), SOP 6, 7 (effective mincing and bowl chopping operation), SOP 20 (effective metal detection)
	C: Cross contamination with cleaning chemicals	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
5.Mincing	M: Cross contamination with Microorganisms due to unhygienic condition of mincer and people.	M	H	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 6 SOP 12 (effective Chamber operation)
	P: Cross contamination with metals of the mincer.	H	H	Cr	Y	GMP 1.3 (proper maintenance), SOP 6, 7 (effective mincing and bowl chopping operation), SOP 20 (effective metal detection)
	C: Cross contamination with cleaning chemicals	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
6. Bowl chopping	M: Cross contamination with Microorganisms due to unhygienic condition of bowl chopper and people.	M	H	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 7 SOP 12 (effective Chamber operation)
	P: Cross contamination with metals of the bowl chopper.	H	H	Cr	Y	GMP 1.3 (proper maintenance) SOP 7 (effective bowl chopping operation) SOP 20 (effective metal detection)
	C: Cross contamination with cleaning chemicals	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.

Table 4.28 Process step Hazard analysis Continue..

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
7.Stuffing and linking	M: Cross contamination with Microorganisms due to unhygienic condition of stuffer and people.	M	H	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 11 SOP 12 (effective Chamber operation)
	P: Cross contamination with metals of the stuffer.	H	M	Ma	Y	GMP 1.3 (proper maintenance) SOP 20 (effective metal detection)
	C: Cross contamination with cleaning chemicals	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
8. Hanging in trolleys.	M: Cross contamination with Microorganisms due to unhygienic condition of trolleys and people.	M	H	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 12 (effective Chamber operation)
	P: -	-	-	-	N	-
	C: Cross contamination with cleaning chemicals	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
9. Chamber operation	M: Survival of microorganisms due to inadequate heat treatment and Cross contamination with drip of earlier thawed meat	H	H	Cr	Y	GMP 1.3 (proper maintenance and calibration) 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 12 (effective Chamber operation)
	P: -	-	-	-	N	-
	C: Cross contamination with cleaning chemicals in chamber.	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.

Table 4.29 Process step Hazard analysis Continue..

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
10. Showering	M: Cross contamination with Microorganisms due to unhygienic condition of water.	M	H	Ma	Y	GMP 3.2, 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 13, 1.2
	P: -	-	-	-	N	-
	C: Cross contamination with chemical contaminants in water.	M	H	Ma	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
11.Chilling	M: Growth and proliferation of microorganisms due to inadequate temperature control and Cross contamination with microorganisms due to the unhygienic condition.	H	M	Ma	Y	GMP 1.3 (proper maintenance and calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training), SOP 16
	P: -	-	-	-	N	-
	C: Cross contamination with cleaning chemicals in chiller.	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
12.Peeling	M: Cross contamination with Microorganisms due to unhygienic condition of peeler and people.	M	H	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 17
	P: Cross contamination with metals of the peeler.	H	M	Ma	Y	GMP 1.3 (proper maintenance) SOP 20 (effective metal detection)
	C: Cross contamination with cleaning chemicals	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.

Table 4.30 Process step Hazard analysis Continue..

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
13. Vacuum packaging	M: Growth of microorganisms due to improper vacuum packaging. .	M	H	Ma	Y	GMP 1.3 (Proper maintenance), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 19
	P: -	-	-	-	N	-
	C: -	-	-	-	N	-
14.Metal detection	M: -	-	-	-	N	-
	P: Inadequate metal detection may result the pass of metal containing products	H	H	Cr	Y	GMP 1.3 (proper maintenance and calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 20
	C: -	-	-	-	N	-
15. Blast freezing	M: Growth and proliferation of microorganisms due to inadequate temperature control and Cross contamination with microorganisms due to the unhygienic condition.	H	M	Ma	Y	GMP 1.3 (proper maintenance and calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 21
	P: -	-	-	-	N	-
	C: -	-	-	-	N	-

Table 4.31 Process step Hazard analysis Continue..

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
16. Dispatch storage	M: Growth and proliferation of microorganisms due to inadequate temperature control and Cross contamination with microorganisms due to the unhygienic condition.	H	M	Ma	Y	GMP 1.3 (proper maintenance and calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 22
	P: -	-	-	-	N	-
	C: -	-	-	-	N	-
17. Loading and distribution	M: Growth and proliferation of microorganisms due to inadequate temperature control during transportation and Cross contamination with microorganisms due to the unhygienic condition during transportation.	H	M	Ma	Y	GMP 1.3 (proper maintenance and calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 23
	P: -	-	-	-	N	-
	C: -	-	-	-	N	-

4.1.8.3.2 Process step hazard analysis- Forming products

Table 4.32 Process step Hazard analysis

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
1. Raw meat receiving and weighing.	M: Cross contamination with Microorganisms due to unhygienic condition of people and utensils during receiving and unloading.	M	M	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 1.1 SOP 12 (effective Chamber operation)
	P: Cross contamination with sands, metals and other contaminants.	M	L	Mi	Y	SOP6, 7 (effective mincing & bowl chopping) SOP 20 (effective metal detection)
	C: Cross contamination with cleaning chemicals in utensils and tools.	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
2. Raw meat Storage	M: Growth and proliferation of microorganisms due to inadequate temperature control.	H	H	Cr	Y	GMP 1.3 (proper maintenance and calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training), SOP 2.1 SOP 12 (effective Chamber operation)
	P: -	-	-	-	N	-
	C: Cross contamination with cleaning chemicals in freezer.	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
3. Thawing	M: Growth and proliferation of microorganisms due to inadequate temperature control and Cross contamination with drip of thawed meat.	H	M	Ma	Y	GMP 1.3 (proper maintenance & calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 4, SOP 12 (effective Chamber operation)
	P: -	-	-	-	N	-
	C: Cross contamination with cleaning chemicals in chiller.	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.

Table 4.33 Process step Hazard analysis Continue

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
4. Band saw/ cutting	M: Cross contamination with Microorganisms due to unhygienic condition of cutter and people.	M	H	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 5, SOP 12 (effective Chamber operation)
	P: Cross contamination with metals of the cutter.	H	H	Cr	Y	GMP 1.3 (proper maintenance) SOP 6, 7 (effective mincing & bowl chopping operation), SOP 20 (effective metal detection)
	C: Cross contamination with cleaning chemicals	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
5.Mincing	M: Cross contamination with Microorganisms due to unhygienic condition of mincer and people.	M	H	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 6, SOP 12 (effective Chamber operation)
	P: Cross contamination with metals of the mincer.	H	H	Cr	Y	GMP 1.3 (proper maintenance), SOP 6, 7 (effective mincing & bowl chopping), SOP 20
	C: Cross contamination with cleaning chemicals	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
6. Bowl chopping	M: Cross contamination with Microorganisms due to unhygienic condition of bowl chopper and people.	M	H	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 7, SOP 12 (effective Chamber operation)
	P: Cross contamination with metals of the bowl chopper.	H	H	Cr	Y	GMP 1.3 (proper maintenance), SOP 7 (effective bowl chopping), SOP 20 (effective metal detection)
	C: Cross contamination with cleaning chemicals	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.

Table 4.34 Process step Hazard analysis Continue..

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
7.Forming	M: Cross contamination with Microorganisms due to unhygienic condition of forming machine & people.	M	H	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 14, SOP 12 (effective Chamber operation)
	P: Cross contamination with metals of the forming machine.	H	M	Ma	Y	GMP 1.3 (proper maintenance) SOP 20 (effective metal detection)
	C: Cross contamination with cleaning chemicals	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
8. Place on trays.	M: Cross contamination with Microorganisms due to unhygienic condition of trays and people.	M	H	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 12 (effective Chamber operation)
	P: -	-	-	-	N	-
	C: Cross contamination with cleaning chemicals	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
9. Chamber operation	M: Survival of microorganisms due to inadequate heat treatment. Cross contamination with drip of earlier thawed meat	H	H	Cr	Y	GMP 1.3 (proper maintenance and calibration) 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 12 (effective Chamber operation)
	P: -	-	-	-	N	-
	C: Cross contamination with cleaning chemicals in chamber.	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.

Table 4.35 Process step Hazard analysis Continue.

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
10.Chilling	M: Growth and proliferation of microorganisms due to inadequate temperature control and Cross contamination with microorganisms due to the unhygienic condition.	H	M	Ma	Y	GMP 1.3 (proper maintenance and calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 16
	P: -	-	-	-	N	-
	C: Cross contamination with cleaning chemicals in chiller.	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
11. Vacuum packaging	M: Growth of microorganisms due to improper vacuum packaging. .	M	H	Ma	Y	GMP 1.3 (Proper maintenance), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 19
	P: -	-	-	-	N	-
	C: -	-	-	-	N	-
12.Metal detection	M: -	-	-	-	N	-
	P: Inadequate metal detection may result the pass of metal containing products	H	H	Cr	Y	GMP 1.3 (proper maintenance and calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 20
	C: -	-	-	-	N	-

Table 4.36 Process step Hazard analysis Continue..

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
13. Blast freezing	M: Growth and proliferation of microorganisms due to inadequate temperature control and Cross contamination with microorganisms due to the unhygienic condition. P & C: -	H -	M -	Ma -	Y N	GMP 1.3 (proper maintenance and calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 21 -
14. Dispatch storage	M: Growth and proliferation of microorganisms due to inadequate temperature control and Cross contamination with microorganisms due to the unhygienic condition. P & C: -	H -	M -	Ma -	Y N	GMP 1.3 (proper maintenance and calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 22 -
15. Loading and distribution	M: Growth and proliferation of microorganisms due to inadequate temperature control during transportation and Cross contamination with microorganisms due to the unhygienic condition during transportation. P & C: -	H -	M -	Ma -	Y N	GMP 1.3 (proper maintenance and calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 23 -

4.1.8.3.3 Process step hazard analysis- Cold meat and Slices (Cooked and Baked)

Table 4.37 Process step Hazard analysis

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
1. Raw meat receiving and weighing.	M: Cross contamination with Microorganisms due to unhygienic condition of people and utensils during receiving and unloading.	M	M	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 1.1, SOP 12 (effective Chamber operation)
	P: Cross contamination with sands, metals and other contaminants.	M	L	Mi	Y	SOP6, 7 (effective mincing operation) SOP 20 (effective metal detection)
	C: Cross contamination with cleaning chemicals in utensils and tools	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
2. Raw meat Storage	M: Growth and proliferation of microorganisms due to inadequate temperature control.	H	H	Cr	Y	GMP 1.3 (proper maintenance & calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 2.1,SOP 12 (effective Chamber operation)
	P: -	-	-	-	N	-
	C: Cross contamination with cleaning chemicals in freezer.	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
3. Thawing	M: Growth and proliferation of micro organisms due to inadequate temperature control and Cross contamination with drip.	H	M	Ma	Y	GMP 1.3 (proper maintenance and calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training),SOP 4,SOP 12 (Chamber operation)
	P: -	-	-	-	N	-
	C: Cross contamination with cleaning chemicals in chiller.	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.

Table 4.38 Process step Hazard analysis Continue..

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
4. Band saw/ cutting	M: Cross contamination with Microorganisms due to unhygienic condition of band saw/ cutter and people.	M	H	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 5, SOP 12 (effective Chamber operation)
	P: Cross contamination with metals of the cutter.	H	H	Cr	Y	GMP 1.3 (proper maintenance) SOP 6 (effective mincing operation), SOP 20 (effective metal detection)
	C: Cross contamination with cleaning chemicals	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
5.Mincing (for Cooked products only)	M: Cross contamination with Microorganisms due to unhygienic condition of mincer and people.	M	H	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 6 SOP 12 (effective Chamber operation)
	P: Cross contamination with metals of the mincer.	H	H	Cr	Y	GMP 1.3 (proper maintenance) SOP 6 (effective mincing operation), SOP 20 (effective metal detection)
	C: Cross contamination with cleaning chemicals	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
6. Mixing with non-minced meat (for Cooked products only)	M: Cross contamination with Microorganisms due to unhygienic condition of people and mixing utensils.	M	H	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 7 SOP 12 (effective Chamber operation)
	P & C: -	-	-	-	N	-

Table 4.39 Process step Hazard analysis Continue..

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
7. Brine Injection (for Baked products only)	M: Cross contamination with Microorganisms due to unhygienic condition of injectors and people.	M	H	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 9 SOP 12 (effective Chamber operation)
	P: Cross contamination with metals of the injector.	H	H	Cr	Y	GMP 1.3 (proper maintenance) SOP 20 (effective metal detection)
	C: Cross contamination with cleaning chemicals	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
8.Tumbling	M: Cross contamination with Microorganisms due to unhygienic condition of tumbler and people.	M	H	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 10 SOP 12 (effective Chamber operation)
	P: Cross contamination with metals of tumbler.	H	M	Ma	Y	GMP 1.3 (proper maintenance) SOP 20 (effective metal detection)
	C: Cross contamination with cleaning chemicals	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
9. Molding	M: Cross contamination with Microorganisms due to unhygienic condition of molds and people.	M	H	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 15, 12 (effective Chamber operation)
	P: -	-	-	-	N	-
	C: Cross contamination with cleaning chemicals	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.

Table 4.40 Process step Hazard analysis Continue.

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
10. Transfer on to trays (for Baked products only)	M: Cross contamination with Microorganisms due to unhygienic condition of trays and people.	M	H	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 12 (effective Chamber operation)
	P: -	-	-	-	N	-
	C: Cross contamination with cleaning chemicals	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
11. Chamber operation	M: Survival of microorganisms due to inadequate heat treatment. Cross contamination with drip of earlier thawed meat	H	H	Cr	Y	GMP 1.3 (proper maintenance and calibration) 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 12 (effective Chamber operation)
	P: -	-	-	-	N	-
	C: Cross contamination with cleaning chemicals in chamber.	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
12. Showering (for Cooked products only)	M: Cross contamination with Microorganisms due to unhygienic condition of water.	M	H	Ma	Y	GMP 3.2, 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 13, 1.2
	P: -	-	-	-	N	-
	C: Cross contamination with chemical contaminants in water	M	H	Ma	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.

Table 4.41 Process step Hazard analysis Continue..

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
13. Chilling	M: Growth and proliferation of microorganisms due to inadequate temperature control and Cross contamination with microorganisms due to the unhygienic condition.	H	M	Ma	Y	GMP 1.3 (proper maintenance and calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training), SOP 16
	P: -	-	-	-	N	-
	C: Cross contamination with cleaning chemicals in chiller.	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
14. De-molding and slicing	M: Cross contamination with Microorganisms due to unhygienic condition of Slicer and people.	M	H	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 18
	P: Cross contamination with metals of the Slicer.	H	M	Ma	Y	GMP 1.3 (proper maintenance) SOP 20 (effective metal detection)
	C: Cross contamination with cleaning chemicals	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
15. Vacuum packaging	M: Growth of microorganisms due to improper vacuum packaging. .	M	H	Ma	Y	GMP 1.3 (Proper maintenance), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 19
	P & C: -	-	-	-	N	-

Table 4.42 Process step Hazard analysis Continue.

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
16. Metal detection	M & C: -	-	-	-	N	-
	P: Inadequate metal detection may result the pass of metal containing products	H	H	Cr	Y	GMP 1.3 (proper maintenance & calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training), SOP 20
17. Blast freezing	M: Growth and proliferation of microorganisms due to inadequate temperature control and Cross contamination with microorganisms due to the unhygienic condition.	H	M	Ma	Y	GMP 1.3 (proper maintenance and calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 21
	P & C: -	-	-	-	N	-
18. Dispatch storage	M: Growth and proliferation of microorganisms due to inadequate temperature control and Cross contamination with microorganisms due to the unhygienic condition.	H	M	Ma	Y	GMP 1.3 (proper maintenance and calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 22
	P & C: -	-	-	-	N	-
19. Loading and distribution	M: Growth and proliferation of microorganisms due to inadequate temperature control during transportation and Cross contamination with microorganisms due to the unhygienic condition during transportation.	H	M	Ma	Y	GMP 1.3 (proper maintenance and calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 23
	P & C: -	-	-	-	N	-

4.1.8.3.4 Process step hazard analysis- Uncooked products

Table 4.43 Process step Hazard analysis

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
1. Raw meat receiving and weighing	M: Cross contamination with Microorganisms due to unhygienic condition of people and utensils during receiving and unloading.	M	M	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 1.1
	P: Cross contamination with sands, metals and other contaminants.	M	L	Mi	Y	SOP6 (effective mincing operation) SOP 20 (effective metal detection)
	C: Cross contamination with cleaning chemicals in utensils and tools used for unloading operation.	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
2. Raw meat Storage	M: Growth and proliferation of microorganisms due to inadequate temperature control.	H	M	Ma	Y	GMP 1.3 (proper maintenance and calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training), SOP 2.1
	P: -	-	-	-	N	-
	C: Cross contamination with cleaning chemicals in freezer.	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
3. Thawing	M: Growth and proliferation of microorganisms due to inadequate temperature control. Cross contamination with drip of earlier thawed meat	H	H	Cr	Y	GMP 1.3 (proper maintenance and calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training), SOP 4, Consumer awareness to cook properly (above 75^0C) using labeling instructions.
	P: -	-	-	-	N	-
	C: Cross contamination with cleaning chemicals in chiller.	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.

Table 4.44 Process step Hazard analysis

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
4. Band saw/ cutting	M: Cross contamination with Microorganisms due to unhygienic condition of band saw/ cutter and people.	M	H	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 5
	P: Cross contamination with metals of the cutter.	H	H	Cr	Y	GMP 1.3 (proper maintenance) SOP 6 (effective mincing operation), SOP 20 (effective metal detection)
	C: Cross contamination with cleaning chemicals	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.
5.Mincing	M: Cross contamination with Microorganisms due to unhygienic condition of mincer and people.	M	H	Ma	Y	GMP 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 6
	P: Cross contamination with metals of the mincer.	H	H	Cr	Y	GMP 1.3 (proper maintenance) SOP 6 (effective mincing operation), SOP 20 (effective metal detection)
	C: Cross contamination with cleaning chemicals	M	L	Mi	Y	GMP 6.1, 6.2 Proper rinsing with water after cleaning.

Table 4.45 Process step Hazard analysis

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
6. Vacuum packaging	M: Growth of microorganisms due to improper vacuum packaging. .	M	H	Ma	Y	GMP 1.3 (Proper maintenance), 5.4, 5.5. 5.6, 6.2, 7.1, 10 (training), SOP 19
	P: -	-	-	-	N	-
	C: -	-	-	-	N	-
7. Metal detection	M: -	-	-	-	N	-
	P: Inadequate metal detection may result the pass of metal containing products	H	H	Cr	Y	GMP 1.3 (proper maintenance and calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training) SOP 20
	C: -	-	-	-	N	-
8. Blast freezing	M: Growth and proliferation of microorganisms due to inadequate temperature control and Cross contamination with microorganisms due to the unhygienic condition.	H	M	Ma	Y	GMP 1.3 (proper maintenance and calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training), SOP 21, Consumer awareness to cook properly (above 75^0C) using labeling instructions.
	P: -	-	-	-	N	-
	C: -	-	-	-	N	-

Table 4.46 Process step Hazard analysis

Process step	Potential hazards	Severity	Likely occurrence	Significance	Address in the plan	Control measures
9. Dispatch storage	M: Growth and proliferation of microorganisms due to inadequate temperature control. Cross contamination with microorganisms due to the unhygienic condition.	H	M	Ma	Y	GMP 1.3 (proper maintenance and calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training), SOP 22, Consumer awareness to cook properly (above 75^0C) using labeling instructions.
	P: -	-	-	-	N	-
	C: -	-	-	-	N	-
10. Loading and distribution	M: Growth and proliferation of microorganisms due to inadequate temperature control during transportation. Cross contamination with microorganisms due to the unhygienic condition during transportation.	H	M	Ma	Y	GMP 1.3 (proper maintenance and calibration), 5.4, 5.5, 5.6, 6.2, 7.1, 10 (training), SOP 23, Consumer awareness to cook properly (above 75^0C) using labeling instructions.
	P: -	-	-	-	N	-
	C: -	-	-	-	N	-

4.1.9 Determination of Critical Control Points (Principle 2)

4.1.9.1 Ingredients CCP Determination

4.1.9.1.1 Ingredients CCP Determination - Stuffing, Forming and Cold meat and Slices

Table 4.47 Ingredients CCP determination

Ingredient	Hazard	Q1	Q2	Q3	CCP	Justification
1. Meat ingredients						
1.a Frozen chicken	Biological	Y	Y	N	Not a CCP	There would be a minimal risk from bacteria due to heat treatment in the later process.
	Physical	Y	Y	N	Not a CCP	This hazard control through effective SQA and later production steps such as metal detection etc.
	Chemical (Veterinary drugs)	Y	Y	N	Not a CCP	This hazard can control through the effective SQA.
	Chemical (Toxins)	Y	N	-	**CCP-C1**	During Cooking the toxins cannot be destroyed. No further step to control this hazard.
1.b fresh beef	Biological	Y	Y	N	Not a CCP	There would be a minimal risk from bacteria due to heat treatment in the later process.
	Physical	Y	Y	N	Not a CCP	This can control through effective supplier acknowledgement & later steps like metal detection.
	Chemical (Veterinary drugs)	Y	Y	N	Not a CCP	This hazard can control through the effective Supplier acknowledgement.
	Chemical (Toxins)	Y	N	-	**CCP-C2**	During Cooking the toxins cannot be destroyed. No further step to control this hazard.
1.c Sappara fish	Biological	Y	Y	N	Not a CCP	There would be a minimal risk from bacteria due to heat treatment in the later process.
	Physical	Y	Y	N	Not a CCP	Effective supplier acknowledgement and later process like bowl chopping, metal detection control this hazard.
	Chemical	-	-	-	Not a CCP	There is very low occurrence of chemical hazard associated with the swordfish.

Table 4.49 Ingredients CCP determination Continue..

Ingredient	Hazard	Q1	Q2	Q3	CCP	Justification
2.g Salt	Biological	Y	Y	N	Not a CCP	
	Physical	Y	Y	N	Not a CCP	This can control through sieving and later processing steps.
	Chemical	Y	Y	N	Not a CCP	
2.h Sugar	Biological	-	-	-	Not a CCP	-
	Physical	Y	Y	N	Not a CCP	This can control through the SQA.
	Chemical	-	-	-	Not a CCP	-
2.i Milk Powder	Biological	-	-	-	Not a CCP	-
	Physical	Y	Y	N	Not a CCP	This can control through the SQA.
	Chemical	-	-	-	Not a CCP	-
2.j MSG	Biological	-	-	-	Not a CCP	-
	Physical	Y	Y	N	Not a CCP	This can control through the SQA.
	Chemical	-	-	-	Not a CCP	-
2.k Soya iso protein	Biological	-	-	-	Not a CCP	-
	Physical	Y	Y	N	Not a CCP	This can control through sieving and later processing steps.
	Chemical	-	-	-	Not a CCP	-
2.l Rusk powder	Biological	-	-	-	Not a CCP	-
	Physical	Y	Y	N	Not a CCP	This can control through sieving and later processing steps.
	Chemical	-	-	-	Not a CCP	

Table 4.50 Ingredients CCP determination Continue..

Ingredient	Hazard	Q1	Q2	Q3	CCP	Justification
2.m Binders	Biological	Y	Y	N	Not a CCP	
	Physical	Y	Y	N	Not a CCP	This can control through the proper GMP, sieving and later processing steps.
	Chemical	Y	Y	N	Not a CCP	
2.n TVP powder	Biological	-	-	-	Not a CCP	-
	Physical	Y	Y	N	Not a CCP	This can control through the proper GMP, sieving and later processing steps.
	Chemical	-	-	-	Not a CCP	-
3. Soft fat	Biological	Y	Y	N	Not a CCP	This can control through the SQA.
	Physical	Y	Y	N	Not a CCP	This can control through the SQA.
	Chemical	-	-	-	Not a CCP	-
4. Water	Biological	Y	Y	N	Not a CCP	This can control through the effective chamber operation and GMP.
	Physical	-	-	-	Not a CCP	-
	Chemical	-	-	-	Not a CCP	-
5. Casings	Biological	-	-	-	Not a CCP	-
	Physical	Y	Y	N	Not a CCP	This can control through the SQA.
	Chemical	-	-	-	Not a CCP	-
6. Packaging material	Biological	-	-	-	Not a CCP	-
	Physical	Y	Y	N	Not a CCP	This can control through the SQA.
	Chemical	Y	Y	N	Not a CCP	This can control through the SQA.

4.1.9.1.2 Ingredients CCP Determination – Uncooked products

Table 4.51 Ingredients CCP Determination

Ingredient	Hazard	Q1	Q2	Q3	CCP	Justification
1. Meat ingredients						
1.a Frozen chicken	Biological	Y	N	-	**CCP B 1**	There is no further step to control this hazard.
	Physical	Y	Y	N	Not a CCP	There would be a minimal risk from physical matter due to mincing and metal detection in the later process.
	Chemical (Veterinary drugs) Chemical (Toxins)	Y Y	Y N	N -	Not a CCP **CCP-C1**	This hazard can control through the effective SQA. During Cooking the toxins cannot be destroyed. No further step to control this hazard.
1.b fresh beef	Biological	Y	N	-	**CCP B 2**	There is no further step to control this hazard.
	Physical	Y	Y	N	Not a CCP	This can control through effective supplier acknowledgement and later production steps such as mincing and metal detection.
	Chemical (Veterinary drugs) Chemical (Toxins)	Y Y	Y N	N -	Not a CCP **CCP-C2**	This hazard can control through the effective Supplier acknowledgement. During Cooking the toxins cannot be destroyed. No further step to control this hazard.
2. Packaging material	Biological	-	-	-	Not a CCP	-
	Physical	Y	Y	N	Not a CCP	Very rarely occurs and can control through the SQA.
	Chemical	Y	Y	N	Not a CCP	Very rarely occurs and can control through the SQA.

4.1.9.2 Pre-production activities CCP Determination

4.1.9.2.1 Pre-production activities CCP Determination – Stuffing and Forming products

Table 4.52 Pre-production activities CCP Determination

Process step	Hazard	Q1	Q2	Q2 a	Q3	Q4	Q5	CCP	Justification
1.Non-meat ingredients weighing									
1.1 Spice weighing and mixing	Biological	Y	Y	-	N	N	-	Not a CCP	Through the implementation of GMP, this hazard can be controlled.
	Physical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP, sieving and later processing steps.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
1.2 Additives Weighing	Biological	-	-	-	-	-	-	Not a CCP	-
	Physical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP, sieving and later processing steps.
	Chemical	Y	Y	-	N	Y	Y	**CCP-C 3**	No further step to control the nitrite level in the products except the additive weighing process.
1.3 Other ingredients weighing	Biological	-	-	-	-	-	-	Not a CCP	-
	Physical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP, sieving and later processing steps.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
2. Packaging material preparation	Biological	Y	Y	-	N	Y	Y	Not a CCP	This can control through effective SOP during packaging material preparation, training & GMP.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	-	-	-	-	-	-	Not a CCP	-

4.1.9.2.2 Pre-production activities CCP Determination – Cold meat and Slices

Table 4.53 Pre-production activities CCP Determination

Process step	Hazard	Q1	Q2	Q2 a	Q3	Q4	Q5	CCP	Justification
1.Non-meat ingredients weighing									
1.1 Spice weighing and mixing	Biological	Y	Y	-	N	N	-	Not a CCP	Through the implementation of GMP, this hazard can be controlled.
	Physical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP, sieving and later processing steps.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
1.2 Additives Weighing	Biological	-	-	-	-	-	-	Not a CCP	-
	Physical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP, sieving and later processing steps.
	Chemical	Y	Y	-	N	Y	Y	**CCP-C 3**	No further step to control the nitrite level in the products except the additive weighing process.
1.3 Other ingredients weighing	Biological	-	-	-	-	-	-	Not a CCP	-
	Physical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP, sieving and later processing steps.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.

Table 4.54 Pre-production activities CCP Determination Continue..

Process step	Hazard	Q1	Q2	Q2 a	Q3	Q4	Q5	CCP	Justification
2. Brine Preparation	Biological	Y	Y	-	N	N	-	Not a CCP	This can control through the effective chamber operation and GMP.
	Physical	Y	Y	-	N	N	-	Not a CCP	This can control through the effective SOP during Brine preparation, Training and GMP.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
3. Packaging material preparation	Biological	Y	Y	-	N	Y	Y	Not a CCP	This can control through the effective SOP during packaging material preparation, Training and GMP.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	-	-	-	-	-	-	Not a CCP	-

4.1.9.2.3 Pre-production activities CCP Determination – Uncooked products

Table 4.55 Pre-production activities CCP Determination

Process step	Hazard	Q1	Q2	Q2 a	Q3	Q4	Q5	CCP	Justification
1. Packaging material preparation	Biological	Y	Y	-	N	Y	Y	Not a CCP	This can control through the effective SOP during packaging material preparation, Training and GMP.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	-	-	-	-	-	-	Not a CCP	-

4.1.9.3 Process step CCP Determination

4.1.9.3.1 Process step CCP Determination – Stuffing products

Table 4.56 Process step CCP Determination

Process step	Hazard	Q1	Q2	Q2 a	Q3	Q4	Q5	CCP	Justification
1. Raw meat receiving& weighing	Biological	Y	Y	-	N	N	-	Not a CCP	Through the implementation of SOP and GMP, this hazard can be controlled.
	Physical	Y	Y	-	N	N	-	Not a CCP	Control through the proper GMP and later processing steps.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
2.Raw meat storage	Biological	Y	Y	-	N	Y	Y	Not a CCP	Effective chamber operation in later process eliminates this hazard.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
3.Thawing	Biological	Y	Y	-	N	Y	Y	Not a CCP	Effective chamber operation in later process eliminates this hazard.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
4. Band saw/ cutting	Biological	Y	Y	-	N	N	-	Not a CCP	This can control through the effective chamber operation and GMP.
	Physical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP and later processing steps.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
5.Mincing	Biological	Y	Y	-	N	N	-	Not a CCP	Control through chamber operation and GMP.
	Physical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP and later processing steps.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.

Table 4.57 Process step CCP Determination Continue..

Process step	Hazard	Q1	Q2	Q2 a	Q3	Q4	Q5	CCP	Justification
6.Bowl chopping	Biological	Y	Y	-	N	N	-	Not a CCP	This can control through the effective chamber operation and GMP.
	Physical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP and later processing steps.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
7.Stuffing and linking	Biological	Y	Y	-	N	N	-	Not a CCP	This can control through the effective chamber operation and GMP.
	Physical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP and later processing steps.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
8.Hanging in trolleys	Biological	Y	Y	-	N	N	-	Not a CCP	This can control through the effective chamber operation and GMP.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
9.Chamber operation	Biological	Y	Y	-	Y	-	-	**CCP –B 1**	This is the only step to control the microbial hazards.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
10.Showering	Biological	Y	Y	-	N	Y	Y	Not a CCP	This can control through the SOP and GMP.
	Physical	-	-	-	-	-	-	Not a CCP	-.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
11.Chilling	Biological	Y	Y	-	N	N	-	Not a CCP	This hazard can be controlled through the GMP. This is consider as a CP.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.

Table 4.58 Process step CCP Determination Continue..

Process step	Hazard	Q1	Q2	Q2 a	Q3	Q4	Q5	CCP	Justification
12.Peeling	Biological	Y	Y	-	N	N	-	Not a CCP	This is control through effective SOP & GMP.
	Physical	Y	Y	-	N	Y	Y	Not a CCP	This can control through the proper GMP and later processing steps.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
13.Vaccum packaging	Biological	Y	Y	-	Y	-	-	**CCP-B 2**	This step is specially design to reduce the microbial hazards.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	-	-	-	-	-	-	Not a CCP	-
14. Metal detection	Biological	-	-	-	-	-	-	Not a CCP	-
	Physical	Y	Y	-	Y	-	-	**CCP-P 1**	This is the only step to control the hazards from metals fragments.
	Chemical	-	-	-	-	-	-	Not a CCP	-
15.Blast freezing	Biological	Y	Y	-	N	N	-	Not a CCP	This can be control through proper GMP. This is consider as a CP.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	-	-	-	-	-	-	Not a CCP	-
16. Dispatch storage	Biological	Y	Y	-	N	N	-	Not a CCP	This can be control through proper GMP. This is consider as a CP.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	-	-	-	-	-	-	Not a CCP	-
17.Loading and Distribution	Biological	Y	Y	-	N	N	-	Not a CCP	This can be control through proper GMP. This is consider as a CP.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	-	-	-	-	-	-	Not a CCP	-

4.1.9.3.2 Process step CCP Determination – Forming products

Table 4.59 Process step CCP Determination

Process step	Hazard	Q1	Q2	Q2 a	Q3	Q4	Q5	CCP	Justification
1. Raw meat receiving& weighing	Biological	Y	Y	-	N	N	-	Not a CCP	Through the implementation of SOP and GMP, this hazard can be controlled.
	Physical	Y	Y	-	N	N	-	Not a CCP	Control through the proper GMP and later processing steps.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
2.Raw meat storage	Biological	Y	Y	-	N	Y	Y	Not a CCP	Effective chamber operation in later process eliminates this hazard.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
3.Thawing	Biological	Y	Y	-	N	Y	Y	Not a CCP	Effective chamber operation in later process eliminates this hazard.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
4. Band saw/ cutting	Biological	Y	Y	-	N	N	-	Not a CCP	This can control through the effective chamber operation and GMP.
	Physical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP and later processing steps.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
5.Mincing	Biological	Y	Y	-	N	N	-	Not a CCP	Control through chamber operation and GMP.
	Physical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP and later processing steps.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.

Table 4.60 Process step CCP Determination Continue..

Process step	Hazard	Q1	Q2	Q2 a	Q3	Q4	Q5	CCP	Justification
6.Bowl chopping	Biological	Y	Y	-	N	N	-	Not a CCP	This can control through the effective chamber operation and GMP.
	Physical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP and later processing steps.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
7.Forming	Biological	Y	Y	-	N	N	-	Not a CCP	This can control through the effective chamber operation and GMP.
	Physical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP and later processing steps.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
8.Place on trays	Biological	Y	Y	-	N	N	-	Not a CCP	This can control through the effective chamber operation and GMP.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
9.Chamber operation	Biological	Y	Y	-	Y	-	-	**CCP –B 1**	This is the only step to control the microbial hazards.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
10.Chilling	Biological	Y	Y	-	N	N	-	Not a CCP	This hazard can be controlled through the GMP. This is consider as a CP.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.

Table 4.61 Process step CCP Determination Continue..

Process step	Hazard	Q1	Q2	Q2 a	Q3	Q4	Q5	CCP	Justification
11.Vaccum packaging	Biological	Y	Y	-	Y	-	-	**CCP-B 2**	This step is specially design to reduce the microbial hazards.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	-	-	-	-	-	-	Not a CCP	-
12. Metal detection	Biological	-	-	-	-	-	-	Not a CCP	-
	Physical	Y	Y	-	Y	-	-	**CCP-P 1**	This is the only step to control the hazards from metals fragments.
	Chemical	-	-	-	-	-	-	Not a CCP	-
13.Blast freezing	Biological	Y	Y	-	N	N	-	Not a CCP	This can be control through proper GMP. This is consider as a CP.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	-	-	-	-	-	-	Not a CCP	-
14. Dispatch storage	Biological	Y	Y	-	N	N	-	Not a CCP	This can be control through proper GMP. This is consider as a CP.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	-	-	-	-	-	-	Not a CCP	-
15.Loading and Distribution	Biological	Y	Y	-	N	N	-	Not a CCP	This can be control through proper GMP. This is consider as a CP.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	-	-	-	-	-	-	Not a CCP	-

4.1.9.3.3 Process step CCP Determination – Cold meat and Slices

Table 4.62 Process step CCP Determination

Process step	Hazard	Q1	Q2	Q2 a	Q3	Q4	Q5	CCP	Justification
1. Raw meat receiving& weighing	Biological	Y	Y	-	N	N	-	Not a CCP	Through the implementation of SOP and GMP, this hazard can be controlled.
	Physical	Y	Y	-	N	N	-	Not a CCP	Control through the proper GMP and later processing steps.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
2.Raw meat storage	Biological	Y	Y	-	N	Y	Y	Not a CCP	Effective chamber operation in later process eliminates this hazard.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
3.Thawing	Biological	Y	Y	-	N	Y	Y	Not a CCP	Effective chamber operation in later process eliminates this hazard.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
4. Band saw/ cutting	Biological	Y	Y	-	N	N	-	Not a CCP	This can control through the effective chamber operation and GMP.
	Physical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP and later processing steps.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
5.Mincing	Biological	Y	Y	-	N	N	-	Not a CCP	Control through chamber operation and GMP.
	Physical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP and later processing steps.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
6.Mixing with non-mince meat	Biological	Y	Y	-	N	Y	Y	Not a CCP	This can control through the effective SOP during mixing, Training and GMP.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	-	-	-	-	-	-	Not a CCP	-

Table 4.63 Process step CCP Determination Continue..

Process step	Hazard	Q1	Q2	Q2 a	Q3	Q4	Q5	CCP	Justification
7.Brine Injection	Biological	Y	Y	-	N	N	-	Not a CCP	This can control through the effective chamber operation and GMP.
	Physical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP and later processing steps.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
8.Tumbling	Biological	Y	Y	-	N	N	-	Not a CCP	This can control through the effective chamber operation and GMP.
	Physical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP and later processing steps.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
9.Molding	Biological	Y	Y	-	N	N	-	Not a CCP	This can control through the effective chamber operation and GMP.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
10. Transfer on to trays	Biological	Y	Y	-	N	N	-	Not a CCP	This can control through the effective chamber operation and GMP.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
11.Chamber operation	Biological	Y	Y	-	Y	-	-	**CCP –B 1**	This is the only step to control the microbial hazards.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
12.Showering	Biological	Y	Y	-	N	Y	Y	Not a CCP	This can control through the SOP and GMP.
	Physical	-	-	-	-	-	-	Not a CCP	-.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.

Table 4.64 Process step CCP Determination Continue..

Process step	Hazard	Q1	Q2	Q2 a	Q3	Q4	Q5	CCP	Justification
13.Chilling	Biological	Y	Y	-	N	N	-	Not a CCP	This hazard can be controlled through the GMP. This is consider as a CP.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
14.De-molding& Slicing	Biological	Y	Y	-	N	N	-	Not a CCP	This is control through effective SOP & GMP.
	Physical	Y	Y	-	N	Y	Y	Not a CCP	This can control through the proper GMP and later processing steps.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
15.Vaccum packaging	Biological	Y	Y	-	Y	-	-	**CCP-B 2**	This step is specially designed to reduce the microbial hazards.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	-	-	-	-	-	-	Not a CCP	-
16. Metal detection	Biological	-	-	-	-	-	-	Not a CCP	-
	Physical	Y	Y	-	Y	-	-	**CCP-P 1**	This is the only step to control the hazards from metals fragments
	Chemical	-	-	-	-	-	-	Not a CCP	-
17.Blast freezing	Biological	Y	Y	-	N	N	-	Not a CCP	This can be control through proper GMP. This is consider as a CP.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	-	-	-	-	-	-	Not a CCP	-
18. Dispatch storage	Biological	Y	Y	-	N	N	-	Not a CCP	This can be control through proper GMP. This is consider as a CP.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	-	-	-	-	-	-	Not a CCP	-
19.Loading and Distribution	Biological	Y	Y	-	N	N	-	Not a CCP	This can be control through proper GMP. This is consider as a CP.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	-	-	-	-	-	-	Not a CCP	-

4.1.9.3.4 Process step CCP Determination – Uncooked products

Table 4.65 Process step CCP Determination

Process step	Hazard	Q1	Q2	Q2 a	Q3	Q4	Q5	CCP	Justification
1. Raw meat receiving and weighing	Biological	Y	Y	-	N	N	-	Not a CCP	Through the implementation of SOP and GMP, this hazard can be controlled.
	Physical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP and later processing steps.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
2.Raw meat storage	Biological	Y	Y	-	Y	-	-	**CCP B 3**	There is no further step to control this hazard.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
3.Thawing	Biological	Y	Y	-	Y	-	-	**CCP B 4**	There is no further step to control this hazard.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
4. Band saw/ cutting	Biological	Y	Y	-	N	N	-	Not a CCP	This can control through the effective chamber operation and GMP.
	Physical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP and later processing steps.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.
5.Mincing	Biological	Y	Y	-	N	N	-	Not a CCP	This can control through the effective chamber operation and GMP.
	Physical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP and later processing steps.
	Chemical	Y	Y	-	N	N	-	Not a CCP	This can control through the proper GMP.

Table 4.66 Process step CCP Determination Continue..

Process step	Hazard	Q1	Q2	Q2 a	Q3	Q4	Q5	CCP	Justification
6.Vaccum packaging	Biological	Y	Y	-	Y	-	-	**CCP-B 5**	This step is specially design to reduce the microbial hazards.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	-	-	-	-	-	-	Not a CCP	-
7. Metal detection	Biological	-	-	-	-	-	-	Not a CCP	-
	Physical	Y	Y	-	Y	-	-	**CCP-P 1**	This is the only step to control the hazards from metals fragments
	Chemical	-	-	-	-	-	-	Not a CCP	-
8.Blast freezing	Biological	Y	Y	-	N	N	-	Not a CCP	This can be control through proper GMP. This is consider as a CP.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	-	-	-	-	-	-	Not a CCP	-
9. Dispatch storage	Biological	Y	Y	-	N	N	-	Not a CCP	This can be control through proper GMP. This is consider as a CP.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	-	-	-	-	-	-	Not a CCP	-
10.Loading and Distribution	Biological	Y	Y	-	N	N	-	Not a CCP	This can be control through proper GMP. This is consider as a CP.
	Physical	-	-	-	-	-	-	Not a CCP	-
	Chemical	-	-	-	-	-	-	Not a CCP	-

4.1.10 Establishment of Critical Limits, Monitoring procedures, Corrective actions and Verification procedures

4.1.10.1 CCP Records of Stuffing, Forming and Cold meat and Slices (Cooked and Baked)

Table 4.67 Critical Limits, Monitoring procedures, Corrective actions and Verification procedures for CCP C-1

CCP No	Ingredient	Hazard	Critical limit	Monitoring Procedure				Corrective actions	Verification	Records
				Who	What	When	How			
CCPC-1	Fresh Beef	B: Presence of Bacterial toxins	Microbiological analysis report for Random samples taken from each beef batch after receiving to the company. *Limits are; -*S. aureus* not more than 1000 per g. (SLS 1218: 2001)	Quality Assurance Executive (QAE)	Perform Microbiological testing for (*S. aureus*) random sample taken from the each beef lot.	At the point of receiving	Take the sample by QAE and send it to external Laboratory to perform testing	1. Reject the lot, which do not confirm to company specifications. 2. Avoid the use of beef batch until receive the microbiological analysis report. 3. Change the Supplier if necessary. 4. Retrain the QAE about the random sampling if necessary.	1. Review of Ingredients microbiological analysis report by HACCP Team leader received at that day. 2. Once a 3 month, carryout bacterial toxin testing for the beef in approved laboratory. 3. Audit of CCP monitoring activities and procedures by HACCP team leader approximately every 4 months.	1. Ingredients microbiological analysis report 2.CCP deviation/ corrective action Log 3.CCP monitoring activities Audit report

Table 4.68 Critical Limits, Monitoring procedures, Corrective actions and Verification procedures for CCP C-2

CCP No	Ingredient	Hazard	Critical limit	Monitoring procedure				Corrective actions	Verification	Records
				Who	What	When	How			
CCP C-2	Frozen Chicken	C: Presence of bacterial toxins	SQA report for microbiological analysis of *S. aureus* not more than 1000 per g of meat. (SLS 1218: 2001)	Supervisor	SQA Analysis Report	At the Point of receiving of each batch	Visually inspect the SQA report	1.Inform to Production manager and reject the lot when the SQA report are not satisfactory 2. Change the Supplier if necessary. 3. Retrain the supervisor on proper procedure if necessary.	1.Daily review of Raw meat receiving Check List by HACCP Team leader. 2. Once a 3 month, carryout the bacterial toxins testing for random samples taken from the frozen meat in approved laboratory. 2. Audit of CCP monitoring activities and procedures by HACCP team leader approximately every 4 months.	1.Raw meat receiving Check List 2. Random microbiological testing records 3.CCP deviation/ corrective action Log 4.CCP monitoring activities Audit report

Table 4.69 Critical Limits, Monitoring procedures, Corrective actions and Verification procedures for CCP C-3

CCP No	Process step	Hazard	Critical limit	Monitoring Procedure				Corrective actions	Verification	Records
				Who	What	When	How			
CCP C-3	Weighing and Formulation of additives	C: Excess Nitrite produce nitrosa-mines which believes Carcinog-enic.	100 mg/kg of meat in product formulation (SLS 1218: 2001)	Spice Room In charger	Weight of NO_2^-	during each batch	record the weight on Sensitive Ingredient Weighing Check list & Salt Preparation Check list	1.Adjust formulation by dilution or addition of more nitrite. 2. Check Scales and repair or replace if necessary. 3. Retrain employees on proper procedure if necessary.	1.Daily review of Sensitive Ingredient Weighing Check List & Salt Preparation Check List by HACCP Team leader for the product produced that day. 2. Audit of CCP monitoring activities and procedures by HACCP team leader approximately every 4 months.	1.Sensitive Ingredient Weighing Check List 2. Salt Preparation Check List 3. Scale Calibration Check List 4.CCP deviation/ corrective action Log 5.CCP monitoring activities Audit report

Table 4.70 Critical Limits, Monitoring procedures, Corrective actions and Verification procedures for CCP B-1

CCP No	Process step	Hazard	Critical limit	Monitoring Procedure				Corrective actions	Verification	Records
				Who	What	When	How			
CCP-B 1	Chamber operation	**B:** Survival of Pathogenic microorganism -s due to improper time-temperature combination	*Core Temperature of the product is 72^{0}C. (for Stuffing and Forming products) *Core Temperature of the product is 68^{0}C for 29 sec. Cold meat and Slices) (FSIS guidelines-Appendix1)	Chamber operator	Product core Temperature	In each batch	Take the temperature of core temperature Indicator & manually measure the core temperature using calibrated thermo couple. After reach to desire temperature hold the product for 30 seconds. Time is measured using Stop watch.	1. Adjust temperature of the chamber if any deviation occurs. 2. Inform to production manager and maintenance department immediately and readjust the temperature. 3. Quarantine the batch if necessary. 4. Reprocess the product if necessary.	1.Daily review of Chamber temperature monitoring log by HACCP Team leader for the product produced that day. 2. Audit of CCP monitoring activities and procedures by HACCP team leader approximatel y every 4 months.	1. Chamber temperature monitoring log 2. Chamber report 3. Chamber temperature indicator Calibration Log 4.Maintena-nce and Non-conformity record 5.CCP deviation/ corrective action Log 6.CCP monitoring activities Audit report

Table 4.71 Critical Limits, Monitoring procedures, Corrective actions and Verification procedures for CCP B-2

CCP No	Process step	Hazard	Critical limit	Monitoring Procedure				Corrective actions	Verification	Records
				Who	What	When	How			
CCP B-2	Vacuum Packaging	**B:** Entry of Microbes due to improper vacuum packaging	No any Vacuum leaked product allowed.	Vacuum Packaging Machine Operator	Packaging Integrity	Each and every pack	Visual Inspection	1.Adjust the Pressure and time of the Vacuum Packaging Machine if any deviation occurs. 2. Re-pack the product 3. Inform to production manager and maintenance department immediately and readjust the vacuum packaging machine.	1.Daily review of Vacuum performance log by HACCP Team Leader. 2. Audit of CCP monitoring activities and procedures by HACCP team leader approximately every 4 months.	1.Vacuum performance log 2.Maintena-nce and Non-conformity record 3.CCP deviation/ corrective action Log 4.CCP monitoring activities Audit report

Table 4.72 Critical Limits, Monitoring procedures, Corrective actions and Verification procedures for CCP P-1

CCP No	Process step	Hazard	Critical limit	Monitoring procedure				Corrective actions	Verification	Records
				Who	What	When	How			
CCP P-1	Metal Detection	B: Pass the metal fragments due to inadequate metal detection	Metal detector fully functional detects 1/32 inch metal fragment (Toledo, T. R-1997)	Metal Detector Operator	Check the function & sensitivity of metal detector	Every one hour basis	Insert the testing metal sample into a selected product & check the sensitivity	1. Adjust the sensitivity of the metal detector if any deviation occurs. 2. Inform to production manager and maintenance department immediately and readjust the metal detector. 3. Quarantine the batch if necessary. 4.Recheck the product if necessary.	1.Daily review of Metal detector performance log by HACCP Team Leader. 2. Audit of CCP monitoring activities and procedures by HACCP team leader approximately every 4 months.	1.Metal detector performance log 2.Maintenance and Non-conformity record 3.CCP deviation/ corrective action Log 4.CCP monitoring activities Audit report

4.1.10.2 CCP Records of Uncooked products

Table 4.73 Critical Limits, Monitoring procedures, Corrective actions and Verification procedures for CCP B-1 and CCP C-1

CCP No	Ingredient	Hazard	Critical limit	Monitoring procedures				Corrective actions	Verification	Records
				Who	What	When	How			
CCP B-1 & CCP C-1	Frozen meat	B: Presence of pathogenic microorgan-isms C: Presence of Bacterial toxins	SQA report for microbiological analysis. Limits are; -*S. aureus* not more than 1000 per g. -*E.coli* not more than 100 per g. -*Salmonella spp.* absent in 25g. (SLS 1218: 2001)	Supervisor	SQA Analysis Report	At the point of receiving of each batch	Visually inspect the SQA report	1.Inform to Production manager and reject the lot when the SQA report are not satisfactory 2. Change the Supplier if necessary. 3. Retrain the supervisor on proper procedure if necessary.	1.Daily review of Raw meat receiving Check List by HACCP Team leader. 2. Once a month, carryout the microbiological testing for random samples taken from the frozen meat in approved laboratory. 2. Audit of CCP monitoring activities and procedures by HACCP team leader approximately every 4 months.	1.Raw meat receiving Check List 2. Random microbiological testing records 3.CCP deviation/ corrective action Log 4.CCP monitoring activities Audit report

Table 4.74 Critical Limits, Monitoring procedures, Corrective actions and Verification procedures for CCP B-2 and CCP C-2

CCP No	Ingredients	Hazard	Critical limit	Monitoring Procedure				Corrective actions	Verification	Records
				Who	What	When	How			
CCP B-2 & CCP C-2	Fresh Beef	**B:** Presence of pathogenic organisms **C:** Presence of Bacterial toxins	Microbiological analysis report for Random samples taken from each beef batch after receiving to the company. *Limits are; -*S. aureus* not more than 1000 per g. -*E.coli* not more than 100 per g. -*Salmonella sp.* absent in 25g. (SLS 1218: 2001)	QAE	Perform Microbiologi-cal Testing (*E.coli*, Salmonella *Spp* and *S. aureus*) for random taken from each beef lot.	At the point of recei-ving	Take the samples by QAE and send it to Laborato-ry to perform the testing	1. Reject the lot, which do not confirm to company specifications. 2. Avoid the use of beef batch until receive the microbiological analysis report. 3. Change the Supplier if necessary. 4. Retrain the QAE about the random sampling if necessary.	1. Review of Ingredients microbiological analysis report by HACCP Team leader received at that day. 2. Once a 3 month, carryout microbiological testing for the beef in approved laboratory. 3. Audit of CCP monitoring activities and procedures by HACCP team leader approximately every 4 months.	1. Ingredients microbiolo-gical analysis report 2.CCP deviation/ corrective action Log 3.CCP monitoring activities Audit report

Table 4.75 Critical Limits, Monitoring procedures, Corrective actions and Verification procedures for CCP B-3

CCP N0	Process step	Hazard	Critical limit	Monitoring Procedure				Corrective actions	Verification	Records
				Who	What	When	How			
CCP B-3	Raw meat storage	**B:** Growth and proliferation of Pathogenic microorganism due to improper freezer temperature during raw meat storage.	*Freezer temperature during raw meat storage operation is (-18^{0}C) – (-22^{0}C). (Meat science section-Department of Animal science-US)	Freezer in charger	Freezer temperature	Every one hour basis	Take the temperature of the freezer temperature indicator and inside air temperature using digital thermometer	1. Adjust the temperature of Freezer if any deviation occurs. 2. Inform to production manager and maintenance department immediately and readjust the temperature. 3. Transfer the raw meat to another freezer immediately if necessary.	1.Daily review of Freezer temperature monitoring log by HACCP Team leader. 2. Audit of CCP monitoring activities and procedures by HACCP team leader approximately every 4 months.	1.Freezer temperature monitoring log 2. Freezer temperature indicator Calibration Log 3.Maintena-nce and Non-conformity record 4.CCP deviation/ corrective action Log 5.CCP monitoring activities Audit report

Table 4.76 Critical Limits, Monitoring procedures, Corrective actions and Verification procedures for CCP B-4

CCP N0	Process step	Hazard	Critical limit	Monitoring Procedure				Corrective actions	Verification	Records
				Who	What	When	How			
CCP B-4	Thawing	**B:** Growth and proliferation of Pathogenic microorgan--isms during thawing due to improper chiller temperature.	*Chiller temperature during raw meat thawing operation is 0^0C -5^0C. (Meat science section-Department of Animal science-US)	Chiller in charger	Chiller temperature	Every one hour basis	Take the temperature of the chiller temperature indicator and inside air temperature using digital thermometer	1. Adjust the temperature of chiller if any deviation occurs. 2. Inform to production manager and maintenance department immediately and readjust the temperature. 3. Transfer the raw meat to another chiller immediately if necessary.	1.Daily review of Chiller temperature monitoring log by HACCP Team leader. 2. Audit of CCP monitoring activities and procedures by HACCP team leader approximately every 4 months.	1.Chiller temperature monitoring log 2. Chiller temperature indicator Calibration Log 3.Maintena-nce and Non-conformity record 4.CCP deviation/ corrective action Log 5.CCP monitoring activities Audit report

CCP No	Process step	Hazard	Critical limit	Monitoring Procedure				Corrective actions	Verification	Records
				Who	What	When	How			
CCPB-5	Vacuum Packaging	**B:** Entry of Microbes due to improper vacuum packaging	No any Vacuum leaked product allowed.	Vacuum Packaging Machine Operator	Packaging Integrity	Each and every pack	Visual Inspection	1.Adjust the Pressure and time of the Vacuum Packaging Machine if any deviation occurs. 2. Re-pack the product 3. Inform to production manager and maintenance department immediately and readjust the vacuum packaging machine.	1.Daily review of Vacuum performance log by HACCP Team Leader. 2. Audit of CCP monitoring activities and procedures by HACCP team leader approximately every 4 months.	1.Vacuum performance log 2.Maintenance and Non-conformity record 3.CCP deviation/ corrective action Log 4.CCP monitoring activities Audit report

Table 4.78 Critical Limits, Monitoring procedures, Corrective actions and Verification procedures for CCP P-1

CCP No	Process step	Hazard	Critical limit	Monitoring procedure				Corrective actions	Verification	Records
				Who	What	When	How			
CCP P-1	Metal Detection	B: Pass the metal fragments due to inadequate metal detection	Metal detector fully functional detects 1/32 inch metal fragment (Toledo, T. R-1997)	Metal Detector Operator	Check the function & sensitivity of metal detector	Every one hour basis	Insert the testing metal sample into a selected product & check the sensitivity	1. Adjust the sensitivity of the metal detector if any deviation occurs. 2. Inform to production manager and maintenance department immediately and readjust the metal detector. 3. Quarantine the batch if necessary. 4.Recheck the product if necessary.	1.Daily review of Metal detector performance log by HACCP Team Leader. 2. Audit of CCP monitoring activities and procedures by HACCP team leader approximately every 4 months.	1.Metal detector performance log 2.Maintenance and Non-conformity record 3.CCP deviation/ corrective action Log 4.CCP monitoring activities Audit report

1.11 Establishment of Effective Record keeping system

Food Products (Pvt) Ltd.

Document Refer: ID/ HACCP/ CCP B-1 and B-2 & CCP C-1 and C-2
Serial no: ID 04-001

Ingredients Microbiological analysis records

Material:.....

Supplier name	Date of			Testing parameters	Results	Action taken	Signature
	Receiving	Sample collection	Send to the laboratory				

Verified by:..... **Date:...../...../.....**

gure 4.12 Checklist of Ingredients Microbiological Analysis record

Food Products (Pvt) Ltd.

Document Refer: ID/HACCP/ CCP C-3

Serial no: ID 04-002

Salt preparation Checklist

Date	Vacuum salt amount	Curing salt amount	Signature	Monitored by	Remarks

)ate:..... Verified by:.....

'igure 4.13 Checklist of Salt Preparation

Food Products (Pvt) Ltd.

Document Refer: ID/HACCP/ CCP C-3
Serial no: ID 04-003

Sensitive ingredient weighing Checklist

Date	Product	Batch Weight	Item	Required amount	Measured amount	Signature	Monitored by	Remarks

Date:.....

Verified by:.....

Figure 4.14 Checklist of Sensitive ingredient weighing

GILLS® **Food Products (Pvt) Ltd.**

Document Refer: ID/ HACCP/ CCP B-3 and B-4
Serial no: ID 04-004

Cold Room Temperature Log

Cold Room Identification number:.....

Date	Time	Temperature of indicator	Inside air Temperature	Deviation from CL (Check if yes)	If yes, Action	Monitored by

Verified by:..... Date:...../...../.....

Figure 4.15 Cold Room Temperature monitoring Log

GILLS® Food Products (Pvt) Ltd.

Document Refer: ID/ HACCP/ CCP B-1
Serial no: ID 04-005

Chamber Temperature monitoring Log

Date	Time	Product	On going Process	Chamber Temperature	Core Temperature			Corrective action	Signature
					Indicator	Using thermocouple	Holding time		

Verified by:..... Date:...../...../.....

Figure 4.16 Chamber Temperature monitoring Log

Food Products (Pvt) Ltd.

Document Refer: ID/ HACCP/ CCP B-2 and B-5
Serial no: ID 04-006

Vacuum Performance monitoring Log

Date	Time	Vacuum Pressure	Vacuum time	Vacuum Performances	Number of Non-vacuum packs founded in last time duration	Corrective action	Signature

Verified by:.....

Date:...../...../.....

Figure 4.17 Vacuum Performance monitoring Log

Food Products (Pvt) Ltd.

Document Refer: ID/ HACCP/ CCP P-1
Serial no: ID 04-007

Metal Detection Performance Check List

Date	Time	Performance	Corrective action	Remarks	Signature

Verified by:.....

Date:..../...../.....

Figure 4.18- Metal detector Performance Log

Food Products (Pvt) Ltd.

Document Refer: ID/HACCP
Serial no: ID 04-008

Non-Compliance Audit Report

Location:	Date:
Area under review:	HACCP plan Ref. No:

Non-compliance :

Action required by (date):.....

Auditors:
1. 2. 3.

Accepted by Auditee:.....

Corrective action:

Verified (Auditor): ..... Date: .....

Figure 4.19 Non-compliance Audit report

Document Refer: ID/HACCP
Serial no: ID 04-009

GILLS® **Food Products (Pvt) Ltd.**

Corrective Actions Log

CCP	Deviation/ Problem	Corrective action Procedures/ Explain	Disposition of product	Responsible person	Date/ Time

Verified by: ..... Date:.....

Figure 4.20 Corrective actions Log

Food Products (Pvt) Ltd.

Document Refer: ID/HACCP
Serial no: ID 04-010

Maintenance Records

Date:..... Time:..... department:.....

(1). Maintenance:

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

(2). Accepted & Checked by:.....

Authorized
person:.....

Department:.....
.....

Comments:.....
.....
.....
.....
.....

Verified by:..... Date:...../...../.....

Figure 4.21 Maintenance records

Food Products (Pvt) Ltd.

Document Refer: ID/HACCP
Serial no: ID 04-011

Non-Conformity Report

Date:..... Time:..... department:.....

(1). Non-conformity:

.....
.....
.....
.....
.....
.....
.....

Signature:..... Lost of time duration:.....

(2). Case handling/ Investigation by:.....

Corrective
action:.....
.....
.....
.....
.....

(3). Accepted & Checked by:.....

Authorized person:.....

Department:.....

Comments:.....
.....
.....

Date:..... Signature:.....

Verified by:..... **Date:...../...../.....**

Figure 4.22 Non-Conformity report

4.1.12 Microbiological testing of Selected Comminuted meat products

According to the Specification of Comminuted meat products (SLS 1218:2001), Five selected products were tested for three parameters. The results were as follows.

Table 4.107 Microbiological analysis records of Selected meat products

Product	Tested Parameters (SLS 1218:2001)						Comments
	Staphylococcus aureus (cfu/1g)		*Salmonella* Spp. (cfu/25g)		*Escherichia coli* (cfu/1g)		
	Test result	Permissible limit	Test result	Permissible limit	Test result	Permissible limit	
Chicken Sausage	<10	<100	Absent	Absent	Absent	Absent	Comply with Standard
Fish balls	<10	<100	Absent	Absent	Absent	Absent	Comply with Standard
Chicken ham	<10	<100	Absent	Absent	Absent	Absent	Comply with Standard
Beef Bacon	<10	<100	Absent	Absent	Absent	Absent	Comply with Standard
Minced chicken	<10	<1000	Absent	Absent	< 4	<100	Comply with Standard

4.2 Discussion

HACCP is a systematic approach to the identification, evaluation and control of food safety hazards. It was introduced by NASA in USA, however now it is being applied across the world, with leading countries such as Australia, New Zealand and UK. The effective implementation of HACCP in the meat industry remains difficulties and controversial. It provides a survey of principles and practices and guide to making verification systems work to meat industry.

The development process of hazard analysis plan, seven principles were concerned which guided a systematic process to identifying Critical Control Point to implementing of HACCP plan to the establishment. Food safety management is achieved by a combination of good hygiene practices and operational hygiene procedures. Before development of the HACCP plan (based on seven principles), effective pre-requisite programs should be implemented and maintained in order to avoid the unnecessary load of CCP numbers and reduce the complexity of HACCP plan. Pre-requisite programs are an effective way to manage the repetitive hazard that occurs throughout the facility at a number of possible locations.

The project work, I have introduced the GMP manual, SSOP Manual, SOP Manual and Supplier Quality Assurance, as the basic PRP's before addressing the hazards in HACCP plan. The PRP's should be effectively implemented to the processing plan.

Before developing the PRP's, I was analyzed the current existing procedures and practices of the company, their weakness and areas, which should have to modify. Therefore I have carried out Swab testing for monitoring the effectiveness of cleaning practices. According to results of swab testing 1:25 dilution of cleaning and sanitizing chemical was not satisfactorily removed the microorganisms from food-contact surfaces. Therefore the dilution was altered as 1:10 and repeated the swab testing. Those results were satisfactory and the dilution of chemicals used for cleaning of machineries was decided as 1:10. Those modifications were included in to the cleaning schedule.

Other PRP procedures were also observed. The pest controlling procedures and chemicals used for controlling of insects were not effective. Therefore those insects

are visible in factory premises after the pest treatment. Then it was informed to the contractor of pest treatment and request to modify or change the chemical used for insect control. Also Electric Fly Killer Unit was installed at the entrance point of the processing line to control the entry of flies and insects. Those modifications were included in to the pest-controlling schedule.

After studying the company and dealing with the workers, training and other requirements were identified. Those were supported to establish the Training schedule. Training is a basic requirement and essential tool for any management system implementation to any organization. The main requirement and weakness I have founded through my study is the lack of training and awareness of workers about sanitation and safety. Therefore internal or external training should be provided for workers with parallel to implementation of HACCP system to the company.

After successfully implementation of the PRP Programs, HACCP plan can be developed. The main responsibility of plan development is in the hand of HACCP team members. It is recommended for the team to get general knowledge about the team building, working rules and methods. The team should be understood that changes will be introduced to the organization and such changes need to be managed. The team should consist of multy disciplinary personals. Effective HACCP plan can maintain all performances and group effort. Team leader should give driving force and directions to achieve the main goal.

Factory flow and Process flow diagrams were very important tools to identify the hazards and points of cross-contamination occur. All hazards at each processing step should be listed to gather the information necessary for hazard analysis. Hazard analysis is the key point of determining CCP's in HACCP plan.
After the hazard analysis, CCP's were determined by using CCP Decision trees. Similar CCP's were obtained for Stuffing products, Forming products and Cold meat & Slices. Those all three product categories are heat-treated, therefore many of bacterial hazards can be successfully eliminated at chamber operation (heat treatment).

When determining CCP's, many process steps were considered as Control points as their controls are necessary for effective and smooth running of CCP's. For examples,

dispatch storage was not decided as a CCP; because drop of temperature in few centigrade will not significantly affected to the bacterial growth. But the temperature control is necessary because if any breakdown occurs it can be affected to the growth of survived microbes due to exposure of high temperatures. Therefore not only about the CCP's, it should also give attention about the CP's also in order to maintain effective HACCP system through out the plant.

CCP number one and two identified in Stuffing, Forming and Cold meat and slices were raw beef and frozen chicken reception for the presence of bacterial toxins. Toxins associated with the raw meat are mainly enterotoxins and exotoxins from *Staphylococcus aureus* and neurotoxin from *Clostridium botulinum*. Neurotoxins (From *Clostridium botulinum*) should be controlled during the processing such as Nitrite addition, brine injection or brine immersion and Freezing. The toxins from *Staphylococcus aureus* is highly heat resistant and won't destroy with heat-treatment and there is no any further step in production line to control this hazard. Therefore presence of toxins in raw beef and frozen meat was become a CCP for this product categories.

I have supposed the SQA analysis report for each batch received to the company as the critical limit for controlling of this CCP. As frozen chicken has SQA analysis report offering from supplier, this analysis report should be monitored during frozen chicken reception. But beef is not supplied from assured supplier, which offers SQA for their fresh beef. Therefore critical limit was determined as perform the microbiological testing for *Staphylococcus aureus,* which are not more than 100 per gram. When the number of *Staphylococcus aureus* increases, the amount of toxin formation will be accelerated and then it can be affected to the food poisoning. If the *Staphylococcus aureus* number is low, the toxin formation can not be significantly affected for food poisoning. As Cost for testing the toxins in meat is too high, use of this critical limit is reliable and cost-effective to ensure the safety of meat which free from toxins.

Third CCP of the heat-treated comminuted meat product categories are weighing of nitrites. It can be categorized as a chemical hazard, which introduce from excessive usage of nitrites during product formulations. If residual nitrite levels are not tested routinely, the nitrite weighing step should be taken as a CCP and adequate

concentration and supervision should be placed on that point. Nitrites should be used in recommended level according to the srilankan legislation of SLS 1218:2001- Specification of Comminuted meat products. (Nitrite level should be used maximum 125ppm). Gills food products are used 100ppm for their product formulations. If use excessive level, carcinogenic compounds like nitrosamines can be formed. Therefore Training and Supervision should be introduced at this point to control this chemical hazard.

Chamber operation is identified as a most significant CCP in the heat-treated comminuted meat products. It specially designed for the control of bacterial pathogens in comminuted meat products. According to the FSIS Guidelines, the time-temperature combinations for meat and meat products can be determined. As an example for stuffing and forming products, final core temperature was maintained at 72^0C. The FSIS guidelines emphasize that the core temperature should be reached to 70^0C or above; the required lethalities are achieved instantly. Therefore no need of maintaining time in the final core temperature for stuffing and forming products. But in Cold meat and slices products, core temperature was maintained at 68^0C for 29 sec. Practically the time is set for 30 seconds as the operating limit in the company. The core temperature should be monitored using calibrated thermo couple with experienced worker and stopwatch used to measure the time. To ensure the proper chamber operation; function of chamber, maintenance of chamber, calibration of chamber temperature indicators & thermocouple and proper cleaning procedures are essential. Therefore while maintaining CCP's under control, it is necessary to follow the other supporting programmes also.

The fourth product category; Uncooked products contain the products which not heat-treated and marketed in the raw form. As heat-treatment was not involved in the processing, there are more hazards and CCP's.
Raw meat reception is a critical step of manufacturing uncooked products. If the raw meat was entered to the process line with high bacterial count, there will be no any further step to identify, control or destroy it. Therefore raw meat should be complied with the SLS 1218:2001- Specification of Comminuted meat products (raw) to ensure the quality of raw meat (free from bacterial and chemical (toxins) hazards). As Critical limits to control this hazard were identified as for meat, SQA analysis reports

according to SLS 1218:2001 specifications. The requirements are *Staphylococcus aureus* is not more than 1000 per gram, *Escherichia coil* is not more than 100 per gram and *Salmonella* spp. is absent in 25 gram. For raw beef, the critical limits were proposed as external laboratory analysis report for above parameters. After raw beef receiving to the company, QAE should collect the samples and send it to external laboratory for testing. So training should essential for QAE regarding representative sample collection, sampling methods, techniques and tools. Until the testing reports were not delivered to the company, the meat lot should be not processed.

Proper storage of meat is essential for maintaining the integrity of the product. Storage temperature is important for extending shelf life and controlling growth of pathogens. Proper techniques for freezing and thawing meat will help to keep the quality of product. Because lean meat contains approximately 70% water and 25% proteins which these ingredients can be lost during the freezing and thawing process. This can be occurred in the form of evaporation, purge or drip. The main importance of freeze storage is the controlling of bacterial growth. For heat-treated comminuted meat products, this raw meat freezer storage is not considered as a CCP because there is a chamber operation in later process to destroy bacterial pathogens. But in uncooked products, this should be critical. Therefore raw meat storage is a CCP for processing of uncooked product. Critical limit is maintaining raw meat cold stores at (-18^0C) - (-22^0C).

Here performed the Process capability analysis with temperature data's collected in raw meat freezer storage during three weeks. Data's were collected in every one-hour basis.

Process capability is the long-term performance level of the process after it has been brought under statistical control. In other words, process capability is the range over which natural variation of process occurs as determined by the system of common causes. Process capability is also the ability of the combination of people, machine, methods, material, and measurements to produce a product that will consistently meet the design requirements or customer expectation. HACCP control charts were used to analyze and monitor the application of critical limits for all CCP's. The upper control limit can be used as a measure to indicate drift in the process and it is help to adjust

the process to maintain control before the CCP's are actuality deviates from its critical limits.

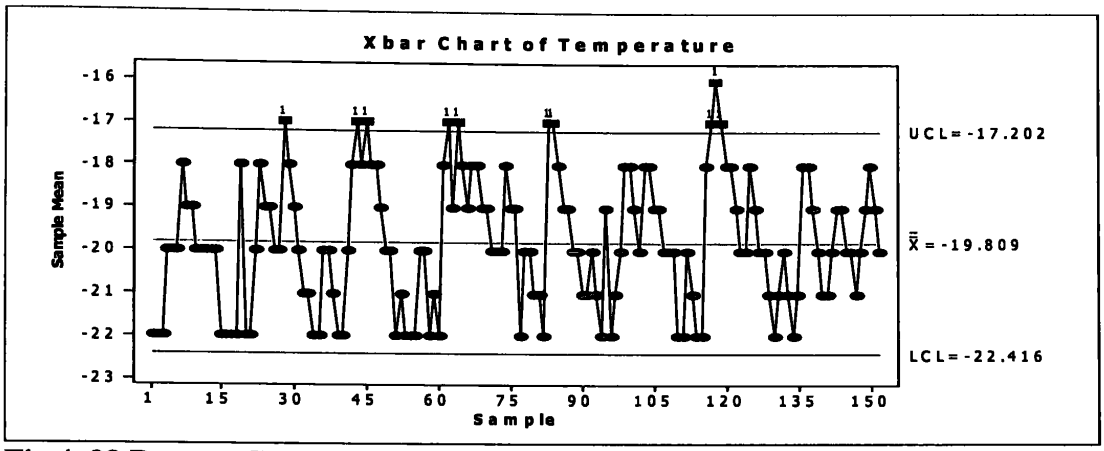


Fig 4. 23 Process Control Chart- Raw meat Storage Freezer

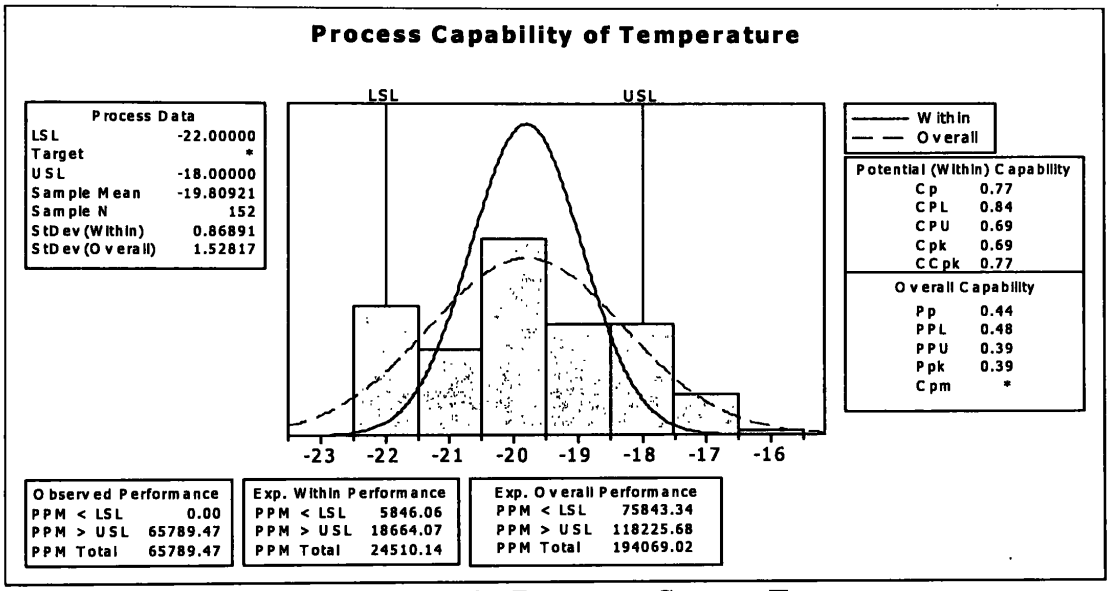


Fig. 4.24 Process capability analysis- Raw meat Storage Freezer

According to the calculated data C_PK value was 0.69 is value below the reference C_PK value of 1.33 symbolized processes. Therefore this process is not capable and the management should be modify or take precautions to develop the process capable. By the implementation of proper cold room storage practices, this operation can be shifted to the capable direction.

Thawing is another CCP, which may be cause microbial hazards by growth and proliferation of microbes due to improper temperature control during thawing. Thawing should be done slowly at refrigerated temperatures (< 4°C). Thawing at this temperature will allow for the ice crystals to dissipate with minimal structural damage to the meat product. Also pathogenic and spoilage microbial growth is minimized in

this temperatures. In Gills food products (Pvt0 Ltd. thawing is done in Chiller where temperature is maintained at 0°C-4°C. If there any temperature arises during thawing, it can leads to growth of microbes, which can seriously affected to the uncooked product, as there are no steps to destroy the regenerated bacteria during the later process during production. Therefore proper care and supervision should be placed at this step to ensure the effective control of bacterial hazard during uncooked product manufacturing.

Thereafter I have performed the Process capability analysis with the data's collected in raw meat Chiller storage (thawing) temperature during three weeks. The data's were collected in every one-hour basis.

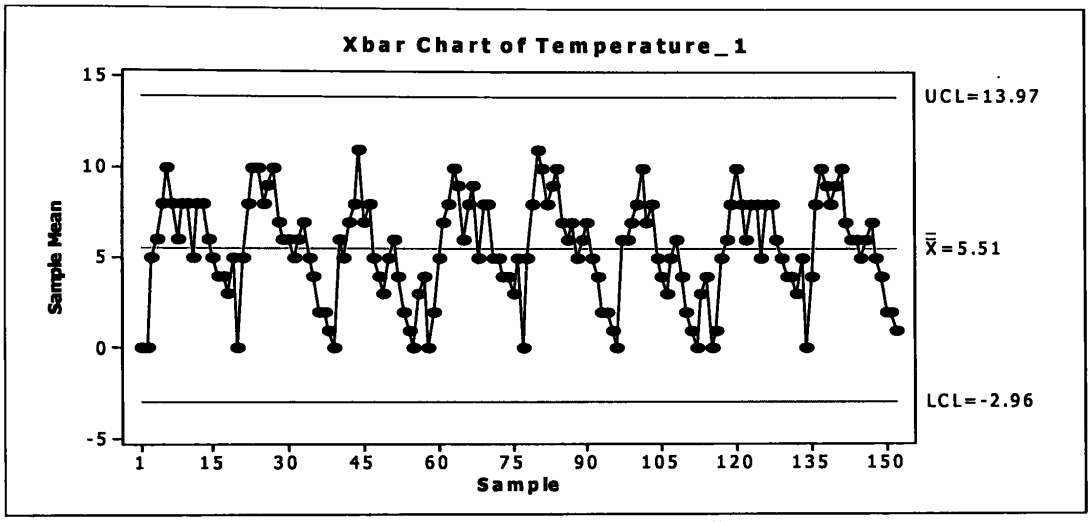


Fig 4. 25 Process Control Chart- Raw meat Chiller Storage

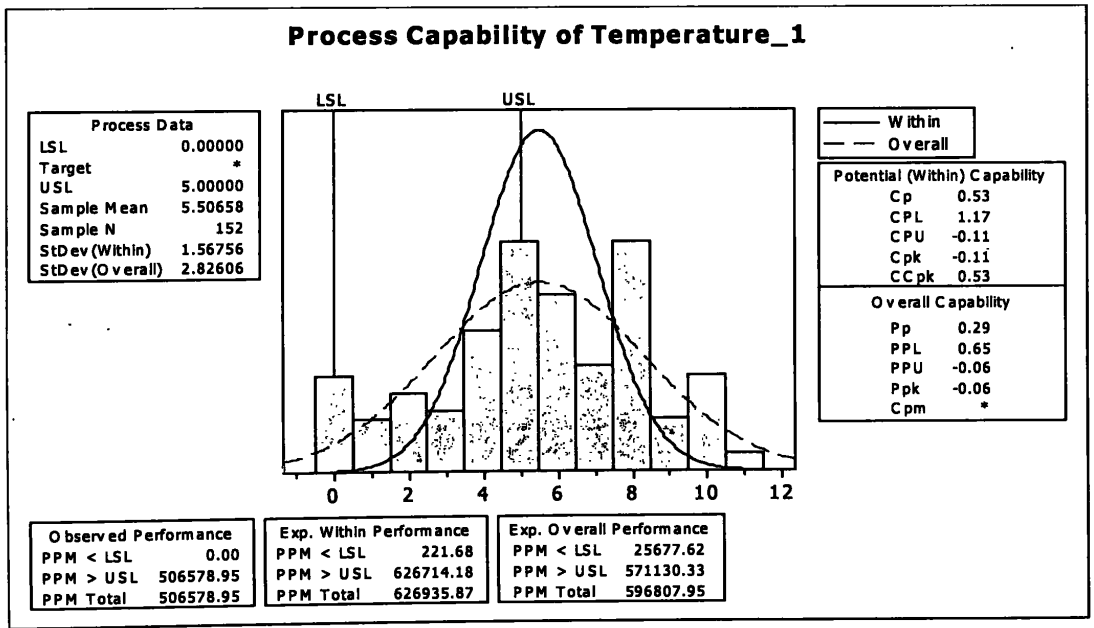


Fig. 4.26 Process capability analysis- Raw meat Chiller Storage

According to calculated data C_PK value was –0.11 is value below the reference C_PK value of 1.33 symbolized process. Therefore this process is highly incapable and the management should be modify or take precautions to develop this process capable. By the implementation of proper cold room storage practices, this operation can be shifted to the capable direction.

Vacuum packaging is a basic process step, which may be cause biological hazard both in heat-treated and uncooked products. In Vacuum packaging substantially all air has been removed prior to final sealing of the container. This method of packaging is actually a form of "Modified Atmosphere Packaging" since normal room air is removed from the package. Advantages of the vacuum packaging are Extends shelf life and aids in controlling oxidative rancidity. It also prevents the growth of aerobic pathogenic bacteria as well as normal spoilage bacteria such as *Pseudomonas* etc. The anaerobic bacteria like *Clostridium botulinum*, can grow little or no oxygen. But through the application of nitrite and temperature control under freezing condition, this problem can effectively solved. Also Leaks can be easily detected. A small puncture or pinhole in a vacuum pack is easy to detect by looking for loose packages. Therefore to monitor the critical limit of the vacuum packaging, visual inspection can be performed. But the training is very critical factor during the inspection of seal integrity of vacuum packs. Therefore well-trained and experienced person should be appointed for the inspection of vacuum packed products. Proper setting of Vacuum pressure and time is also necessary to obtain a well vacuum-sealed pack. Pressure at 0-0.04 Mpa with 40 second was the recommended pressure-time combination of vacuum packaging machine in Gills Food products (Pvt) Ltd. The operator should have proper knowledge and training about the function of vacuum packaging machine and Cleaning, Calibration & Maintenance procedures are also necessary for the effective biological hazard control associated with the Vacuum packaging.

Metal detection was the only step associated with the physical hazards. The metal detection was specially designed to avoid the metal fragments introduce into the process through the equipments, tools and other sources. The metal detector should be work with fully functionally and sensitivity which capable of detecting 1/32 inch metal fragment. The testing metal fragment should be inserted into the product sample and pass through the detector. If the packages are positive for the metal fragments

during metal detection, the packs should be opened and the individual product holding the metal fragment should be eliminated and re-packed. Training, Calibration and maintenance are crucial factors for the effective control of physical hazard associated with metal fragments.

Consumer awareness should be very important especially in marketing of Uncooked products. Because the consumer should properly aware for cooking of uncooked products (Minced chicken and Minced beef). Therefore proper labeling system should be maintained with mentioning the directions for usage.

Microbiological assessments of selected comminuted products were complied with the SLS 1218:2001. Therefore it can be suggested and estimated that normal procedures existing in the Gills Food products (Pvt) Ltd are satisfactory for obtaining safe products and Few modifications discussed under this chapter should be implemented to avoid the non-conformances. The microbiological testing should be carried out frequently to monitor the effectiveness of PRP's and HACCP plan.

Also effective documentation procedures should be implemented. As an important part of food safety management, Records should keep up to date as they provide evidence of the operator's thinking and decisions as well as for internal and external auditors for auditing purposes. Also top management commitment should be essential in order to maintain proper HACCP system and effective hazard control system.

CHAPTER 5

Conclusion and Recommendation

5.1 Conclusion

- Pre-requisite programs were developed for the Gills Food products (Pvt) Ltd and Number of hazards to be controlled by applying effective PRP's.
- Several biological, chemical and physical hazards were identified which associated with the Comminuted meat products under four categories. (Stuffing products, Forming products, Cold meat and Slices and Uncooked products)
- Critical Control Points were determined with application of CODEX decision tree.
- Following Critical Control Points were identified as common Stuffing, Forming and Cold meat and Slices.
  - Meat (Raw beef and Frozen chicken)- for toxins CCP C-1 and C-2
  - Weighing of Nitrites – for carcinogenic compounds CCP C-3
  - Chamber operation- for survival of bacterial pathogens CCP B-1
  - Vacuum packaging- for growth of bacterial pathogens CCP B-2
  - Metal detection- for inefficient detection of metals CCP P-1

- Following Critical Control Points were identified in Uncooked products.
  - Meat (Raw beef and Frozen chicken)- for toxins CCP C-1 and C-2
  - Meat (Raw beef and Frozen chicken)- for presence of bacterial pathogens CCP B-1 and B-2
  - Raw meat storage- for growth of bacterial pathogens CCP B-3
  - Thawing- for growth of bacterial pathogens CCP B-4
  - Vacuum packaging- for growth of bacterial pathogens CCP B-5
  - Metal detection- for inefficient detection of metals CCP P-1

- Following Critical Limits were identified as common Stuffing, Forming and Cold meat and Slices.
  - As a critical limit for toxin presence in Raw beef and Frozen chicken, microbiological analysis of *Staphylococcus aureus* for not more than 1000 per gram was purposed. Therefore during frozen chicken reception, SQA report for each chicken batch should be monitored for *Staphylococcus aureus* and for raw

beef, samples should be send to the external laboratory to perform *Staphylococcus aureus* testing.

- To control Chemical hazard associated with Nitrites should be overcome by using 100ppm of Nitrite during product formulation and supervision during weighing.
- Critical limits setted for the chamber operation were maintained core temperature 72^0C for Stuffing and forming products and 68^0C for 30 seconds for Cold meat and Slices.
- Vacuum packaging, no single vacuum leaked products were allowed during production and monitored by visual inspection with trained personnel.
- The critical limit of metal detection function was purposed as the detector capable of detecting 1/32 inch metal fragment.

Following Critical Limits were identified as Uncooked products.

- Critical limit for toxin and pathogenic bacteria presence in Raw beef and Frozen chicken, microbiological analysis of *Staphylococcus aureus* is not more than 1000 per gram, *Escherichia coil* is not more than 100 per gram and *Salmonella* spp. is absent in 25 gram was purposed. Therefore during frozen chicken reception, SQA report for each chicken batch should be monitored for *Staphylococcus aureus, Escherichia coil* and *Salmonella* spp. and for raw beef, samples should be send to external laboratory to perform *Staphylococcus aureus, Escherichia coil* and *Salmonella* spp. testing.
- To control the Biological hazard associated with the raw meat storage should be overcome by maintaining freezer temperature (-18^0C) - (-22^0C).
- Critical limit during thawing was purposed as maintain the chiller temperature at 0^0C- 4^0C.
- Vacuum packaging, no single vacuum leaked products were allowed during production and monitored by visual inspection with trained personnel.
- The critical limit of metal detection function was purposed as the detector capable of detecting 1/32 inch metal fragment.
- The Selected Comminuted meat products were Complied with the microbiological specifications of SLS 1218:2001- Specification of Comminuted meat products.

5.2 Recommendation

- PRP's should be implemented effectively before implementation of HACCP Plan.
- Current Supplier Certification and evaluation Process needed to be revised.
- Supplier acknowledgement should be practiced with every raw material receive in to the company.
- The locations of workers changing room and dinning room should be changed in order to reduce the cross-contamination introduce to packaging material preparation.
- Laboratory facilities should be located in-plant in order to reduce the delay of raw meat utilization.
- Chemical analysis for processed meat products should be carried out to ensure the residual nitrite level in the finished products.
- Training programs should be carried out for all levels of workers in the organization.
- Process steps that were identified at Statistical Process Capability Studies needed to be improved with considering Technical Process Capabilities.

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Appendix 1

Food Sanitation Check List

(David and Norah-1991)

PURPOSE OF A CHECK LIST

1. To identify sanitation problems in the establishment
2. To take corrective action.
3. To maintain sanitation records.

- Have to modify

Receiving and Storage	Yes	No	
1. Are foods purchased from licensed standard suppliers only?		✓	But most of are Purchase from certified Suppliers.
2. Are all food and other supplies inspected for damage, spoilage or infestation upon receipt?	✓		
3.Is the date of manufacture/expiry & temperature for perishables checked?	✓		
4.Are perishables frozen promptly?	✓		
5.Are empty crates, cartons, containers, etc. cleaned to the promptly?	✓		
6.Are supplies stored in a neat and orderly manner?		✓	• Raw meat items stacking each other.
7.Is the receiving area kept clean?	✓		
8.Are shelves placed away from the wall?	✓		
9.Are the dry stores cool, clean and well ventilated?	✓		
10.Is the floor or the dry store clean and dry?	✓		
11.Are shelves and racks free of dust and debris?	✓		
12.Are any empty crates, cartons and trash or outdated supplies lying in the stores?	✓		
13.Is the dry store free from moisture or dampness?	✓		
14.In the first-in first-out policy being observed?	✓		• But not 100%.
15.Are non-food items stored separately from food supplies?	✓		
16.Are all poisonous substances like pesticides, cleaning agents, etc., stored in their original containers or conspicuously labeled?	✓		Stored in their original containers.
17.Are these poisonous substances stored in a special cupboard well away from food?		✓	• Have to modify.

Chiller

	Yes	No	
01.Are all chillers in use in good working condition?	✓		
02.Do they have accurate thermometers?		✓	• Some are braken .
03.Are high-risk foods maintained at temperatures below 5^{0}C?	✓		
04.Are chillers defrosted and cleaned regularly?	✓		
05.Are they free from objectionable odor?	✓		
06.Are foods stacked in such a way that it allows adequate ventilation and circulation of cold air?		✓	• Over stacked beyond the chiller capacity .
07.Are foods stored so as to allow first-in first-out use?	✓		
08.Are any visibly spoilt foods stored in the chiller?		✓	• Have to modify .
09.Are cooked foods kept apart from raw foods?	✓		
10.Are all parts of the chiller easily accessible for cleaning?	✓		
11.Are shelves clean and free from spills?	✓		
12.Are all foods covered to protect them from contamination?		✓	• Raw materials are not covered
13.Are chiller over stacked?	✓		• Have to modify .
14.Is the chiller door opened frequently?	✓		
15.Are opened containers of food stored in the chiller?	✓		
16.Are all parts of the chiller in a good state of repair?	✓		

Freezer

01.Are freezers in working condition (as per specifications)?	✓		
02.Are they fitted with accurate thermometers?	✓		
03.Is internal temperature maintained at – 18^{0}C or lower?	✓		
04.Is there excessive frost build-up?	✓		• Have to modify .
05.Is food stored in such a way that first-in first-out can be followed?	✓		
06.Are freezers opened very often?	✓		• Have to modify .
07.Are foods wrapped so as to prevent freezer burn?	✓		
08.Is proper cleaning and maintenance being done?	✓		
09.Are food items like raw meat and fish, place in containers before being weighed?		✓	
10.Is there a label and date on the frozen food?	✓		

Food Preparation and Handling practices

	Yes	No	
01. Is any cleaning operation like sweeping or dusting carried out during food preparation or service?		✓	
02. Is proper care taken to keep raw and cooked food apart during preparation?	✓		
03. Are high risk held at room temperature for long?		✓	
04.Are frozen foods left in the warm place to thaw?		✓	place in chillers.
05.Are foodstuffs or utensils containing food placed on the floor?		✓	place on tables or on stands.
06.Are pans which are not in use clean, sanitized and stored in a manner so as to prevent contamination?	✓		
07. Are toxic substances like pesticides or cleaning agents store in food preparation areas?		✓	
08.Are all parts of the equipment kept clean?	✓		
09.Is there any residual build-up chamber, mincer etc.?		✓	
10.Are all works surfaces made of impervious material and are they free from cracks?	✓		
11.Is sharp equipment like knives, peelers, etc. cleaned well before keeping them away?	✓		
12.Is all equipment which is not in regular use, clean?	✓		
13.Is equipment cleaned between changed use?	✓		
14.Is equipment used for processing, cleaned & sanitized after each use?		✓	Cleaned according to a scheduled intervals.
15.Is meat-cutting area clean and free from any objectionable odor?	✓		
16.Is raw meat waiting pre-preparation left at room temperature for long periods of time?		✓	
17.Is warm water used to thaw frozen meat, fish or poultry?		✓	use chiller.
18.Is raw meat left on the floor at anytime?		✓	
19.Is equipment in a good state or repair?	✓		
20.Are all joints and seams on equipment closed?	✓		
21.Can equipment be easily dismantled and reassembled for cleaning?	✓		
22.Are surfaces of utensils and equipment smooth and free from pits and crevices?	✓		
23.Do all electrical gadgets have three pin plugs and are the cords intact?	✓		
24.Is all electrical equipment properly earthed?	✓		
25.Is the floor of the processing department and other food preparation areas clean and dry?	✓		
26.Are all prepared food items kept covered?		✓	Semi-processed food items are not covered when placed on chiller.

Service

	Yes	No	
01.Is the dining area clean and dry?	✓		
02.Are tables, chairs, etc. wiped with clean sanitized cloths?	✓		
03.Is any dust visible in the service area?		✓	
04.Are cloths used for wiping food contact surfaces kept separate from other wiping cloths?	✓		
05.Are single service items (paper serviettes, gloves, straws & cups etc.) stored and dispensed in a sanitary manner?	✓		
06.Are single service items used more than once?		✓	Gloves, tissues are used only one time.
07.Are all food containers emptied after service and are leftover disposed off or stored immediately?	✓		
08.Is the vehicles used for transporting food absolutely clean & free from spills or refuse?	✓		
09.Are all foods spill on shelves or floor or trolley washed off after each use?	✓		
10.Is food carried in well-insulated containers?	✓		
11.Is temperature control maintained for potentially hazardous food?	✓		
12.Are service lifts cleaned regularly?	✓		
13.Is garbage and food carried in the left at the same time?		✓	

Waste Disposal

01.Is refuse and food waste collected separately?		✓	• All waste are collected to same tank
02.Are garbage containers adequate in number and size?	✓		
03.Are they lined with plastic or wet strength bags?	✓		
04.Are containers emptied frequently into the main garbage bin?	✓		
05.After garbage containers are empties, are they cleaned well?	✓		
06.Are they covered and in a good state of repair?		✓	• Have to cover some bins.
07.Is garbage removed from premises at frequent intervals?	✓		
08.Is garbage lying around in the vicinity?		✓	Collect for waste collection tanks.
09. Are there any empty crates, boxes, etc. lying in corners, under staircases, etc.		✓	
10.Are garbage containers clean on the outside?	✓		Taps situated away from the factory are used to clean the garbage containers.

Pest control

	Yes	No	
01.Are any pests visible in or around the establishment?	✓		• Fly, rats are visible
02.Are there any signs of pest infestation (droppings, eggs, marks etc.) in the premises?	✓		• Rat droppings are there
03.Are there any areas indoors which could harbors pests?	✓		• In ceilings
04.Are adequate precautionary measures taken in the construction to keep pests away?	✓		
05.Is there any stagnant water or tall grass in the compound?	✓		• Tall grasses are there
06.Is regular pest control carried out?	✓		• But i feel, it is lack of effective

Employees Facilities

01.Are adequate changing room facilities provided?	✓		
02.Are they well maintained?	✓		
03.Is all sanitary equipment in working condition?	✓		
04.Are sufficient hand washbasins provided?	✓		
05.Is soap and drying facilities provided?		✓	• No drying facility
06.Are washbasins located near sanitary accommodation?	✓		
07.Are containers provided for waste?	✓		
08.Are there any signs of pests?		✓	
09.Is ventilation and lighting adequate in these areas?	✓		

Personal practices

01.Are the hands of food handlers washed clean at the start of the day and whenever required?	✓		
02. Are the hands of food handlers clean and free from cracks?	✓		
03.Are hands sanitized with sanitizer solution?	✓		
04.Do any food handlers have infected cuts, burns, boils, etc.?		✓	
05.Are food handlers observed picking nose or pimples, scratching head or face, smoking or eating in food preparation areas?	✓		
06.Are hands washed after blowing the nose and coughing even when a handkerchief is used?	✓		
07.Is adequate hand washing facilities provided?	✓		

	Yes	No	
08.Are fingernails clean, trimmed and unvarnished?	✓		} checked daily
09.Are all employees in uniform?	✓		
10.Are uniforms/outer garments clean?	✓		
11.Are all males clean-shaven and is hair cut short (up to mid ear level)?	✓		
12.Is hair covered by a cap, hair net or scarf (any hair restraint)?	✓		
13.Have employees been observed spitting on the floor, in sinks or in garbage bins?		✓	
14.Do food handlers wear wristwatches, dangling bracelets, bangles, earrings or any other jewellery?	✓		• Some are wearing Jewellaries.
Construction			
01.Are there any depressions and low areas on floors and work surfaces?		✓	
02.Are walls near cooking and wash-up area adequately tiled?	✓		
03.Are all tiled areas and walls clean?	✓		
04.Are walls non-porous, free from cracks and cobwebs?	✓		
05.Are broken tiles and torn carpeting repaired immediately?	✓		
06.Are ceilings brushed and swept regularly?	✓		
07.Are floors durable, impervious and easy to clean?	✓		
Safety			
01.Are floors kept dry during food preparation?	✓		
02.Are safety guards used for machines?	✓		
03.Are fire extinguishers provided?	✓		
04.Are employees trained to use fire extinguishers?	✓		
05.Do employees use equipment in a safe manner?	✓		
06Are sharp tools like knives, slicer blades etc. carried and stored in a safe manner?	✓		
07.Is there adequate lighting and ventilation?	✓		
08.Are gas cylinders turned off when not in use?	✓		

Appendix 2

FSIS Appendix A-Guidelines for Time-Temperature combination of heat treated meat products

FSIS has provided discussion regarding disposition of product following heating deviations and advice for the development of customized procedures for meeting the lethality performance standards.

1. Cooked beef and roast beef, including sectioned and formed roasts, chunked and formed roasts, and cooked corned beef can be prepared using one of the following time and temperature combinations to meet either a 6.5-$\log_{10}$ or 7-$\log_{10}$ reduction of Salmonella. The stated temperature is the minimum that must be achieved and maintained in all parts of each piece of meat for a least the stated time:

Minimum Internal Temperature		Minimum processing time in minutes or seconds after minimum temperature is reached	
Degrees Fahrenheit	Degrees Centigrade	6.5-$\log_{10}$ Lethality	7-$\log_{10}$ Lethality
130	54.4	112 min.	121 min.
131	55.0	89 min.	97 min.
132	55.6	71 min.	77 min.
133	56.1	56 min.	62 min.
134	56.7	45 min.	47 min.
135	57.2	36 min.	37 min.
136	57.8	28 min.	32 min
137	58.4	23 min.	24 min.
138	58.9	18 min.	19 min.
139	59.5	15 min.	15 min.

140	60.0	12 min.	12 min.
141	60.6	9 min.	10 min.
142	61.1	8 min.	8 min.
143	61.7	6 min.	6 min.
144	62.2	5 min.	5 min.
145	62.8	4 min.	4 min.
146	63.3	169 sec.	182 sec.
147	63.9	134 sec.	144 sec.
148	64.4	107 sec.	115 sec.
149	65.0	85 sec.	91 sec.
150	65.6	67 sec.	72 sec.
151	66.1	54 sec.	58 sec.
152	66.7	43 sec.	46 sec.
153	67.2	34 sec.	37 sec.
154	67.8	27 sec.	29 sec
155	68.3	22 sec.	23 sec
156	68.9	17 sec.	19 sec
157	69.4	14 sec.	15 sec
158	70.0	0 sec.**	0 sec.**
159	70.6	0 sec.**	0 sec.**
160	71.1	0 sec. **	0 sec.**

**The required lethalities are achieved instantly when the internal temperature of a cooked meat product reaches 158°F or above. (FSIS-Appendix A-June 1999)

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	Calibration Schedule	

Equipment/ Instrument Machine	Identification No	Method of Calibration	Procedure	Frequency	Corrective action	Responsibility	Monitored by
Scale		Against Standard weight set	-Place the weight on to the scale -Check the display reading for the deviation from the standard weight. -Check any deviation	Once every bath	-Inform to P.M. -Call maintenance -Use of correction factor to avoid the error of weight measurement	Line leader	P.M. P.E. Supervisors
		External Expertise	-Send the scale to the external resource places to perform calibration	Once Six month	-	Operational Manager	P.M.
Thermometer		Against Standard Thermometer	-Measure the temperature recording from the thermometer -Check the display reading for the deviation from the standard thermometer	Once a day	-Inform to P.M. -Call maintenance -Use of correction factor to avoid the error of temperature measurement	Line Leader	P.M. P.E. Supervisors
		External expertise	-Send the thermometers to the external resource places to perform the calibration	Once six month	-	Operational Manager	P.M.

Calibration Schedule Continue..

Equipment/ Instrument Machine	Identification No	Method of Calibration	Procedure	Frequency	Corrective action	Responsibility	Monitored by
PH Meter		Against standard buffer solution	-Dip the ph meter into the standard buffer solution -Check the display reading for the deviation from the standard ph of the buffer solution	Once a day	-Inform to P.M. -Call maintenance -Use of correction factor to avoid the error of ph measurement	Line Leader	P.M. P.E. Supervisor
		External expertise	-Send the ph meters to be external resource places to perform calibration	Once six month	-	Operational Manager	P.M. P.E.
Chamber temperature Indicator		-Core temperature against thermocouple by external -Chamber T against digital thermometer by external	-Check the internal & chamber T's with the calibrated thermocouple and digital thermometer -Check for the deviation	3 time per day (Before loading of each batch)	-Inform to P.M. -Call maintenance	Machine Operator	P.E. Supervisor
Distribution vehicle Temperature indicator		Against calibrated digital thermometer	-Check the internal air flow temperature with calibrated thermometer	Once per day	-Inform to P.M. -Call maintenance	Machine Operator	P.E. Supervisor
Chiller / Freezer temperature indicator		Against calibrated digital thermometer	-Check the internal air flow temperature with calibrated thermometer	Once per day	-Inform to P.M. -Call maintenance	Machine Operator	P.E. Supervisor

Appendix 4

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	Maintenance Schedule	

Section/ Dept.	Machine/ Equipment	Maintenance procedure	Frequency	Responsibility	Monitoring responsibility
Meat preparation area	Band saw/cutter	1.Check the power connection	Daily	Machine operator (MO)	Production Supervisor (PS) Production manager (PM) Operational manager (OM)
		2.Check the condition of blades	Daily	MO	
		3.Greasing	Daily	MO	
		4.Wheel alignment	Every week	Maintenance Executive (ME)	
		5.Check and replace wheel bearing if necessary	Monthly	ME	
		6.Check and replace motor bearing if necessary	Every 6 month	ME	
		7.Full service of the machine	Every 1 year	External resource people	
	Mincer	1.Check the power connection	Daily	MO	PS
		2.Check any abnormal sound of the motor	Daily	MO	
		3.Check the condition of blades	Daily	MO	
		4.Greasing	Daily	ME	PM
		5.Check and refill gear box oil if necessary	Monthly	ME	
		6.Check and replace motor bearing if necessary	Every 6 month	ME	
		7.Full service of the machine	Every 1 year	External resource people	OM
Chopping area	Bowl chopper	1.Check the power connection	Daily	MO	PS
		2.Check and sharpening of blades	Daily	MO	
		3.Greasing	Daily	ME	
		4.Check the revenue counter	Daily	ME	PM
		5.Check the lid beading	Once a week	ME	
		6.Check the motor bearing and arm/ axial	Once a month	ME	
		7.Full service of the machine	Every 1 year	External resource people	OM
	Stuffing machine	1.Check the power connection	Daily	MO	PS
		2.Greasing	Daily	MO	
		3.Check portioning outlet or rings	Daily	ME	
		4.Check hydraulic oil level	Daily	ME	PM
		5.Check lid gasket	Daily	ME	
		6.Replace hydraulic oil	Once a 3 month	ME	
		7.Check and replace portioning piston gasket	Once a 6 month	ME	OM
		8.Full service of the machine	Every 1 year	External resource people	

Maintenance Schedule Continue..

Section/ Dept.	Machine/ Equipment	Maintenance procedure	Frequency	Responsibility	Monitoring responsibility
	Forming machine	1.Check the power connection	Daily	Machine operator (MO)	PS
		2.Greasing	Daily	ME	PM
		3.Full service of the machine	Every 1 year	External resource people	OM
Chamber area	Chamber	1.Check the power connection	Daily	MO	PS
		2.Check the temperature indicator	Daily	MO	
		3.Check the door beading	Daily	MO	
		4.Check Inches and handles of door	Daily	MO	
		5.Check blower motor	Daily	ME	
		6.Check air solanite valve	Daily	ME	PM
		7.Check Damper motor	Daily	ME	
		8.Check and replace motor bearing if necessary	Once a month	ME	
		9.Check and replace the gasket if necessary	Once a month	ME	
		10.Check the heating element and replace if weak	Once a month	ME	
		11.Full service	Every 1 year	External resource people	OM
Peeling area	Peeler	1.Check the power connection	Daily	MO	PS
		2.Check the condition of peeling blades	Daily	MO	
		3.Check any blocks of exhaust valve in pressure cooker	Daily	MO	PM
		4.Full service of the machine	Every 1 year	External resource people	OM
Packing area	Vacuum packaging machine	1.Check the power connection	Daily	MO	PS
		2.Check and tight the heating element	Daily	MO	
		3. Check vacuum performance	Daily	MO	
		4. Check and replace Teflon cloth if necessary	Daily	ME	PM
		5.Check vacuum pump oil level	Once a week	ME	
		6.Cleaning of succession line including filter	Once a week	ME	
		7.Changing vacuum pump oil	Once a 6 month	ME	OM
		8.Full service of the machine	Every 1 year	External resource people	
	Slicer	1.Check the power connection	Daily	MO	PS
		2.Sharpening of blades	Daily	MO	
		3.Check the condition of blades	Daily	MO	PM
		4.Oiling	Daily	MO	
		5.Full service	Once a 3month	External resource people	OM

Maintenance Schedule Continue..

Section/ Dept.	Machine/ Equipment	Maintenance procedure	Frequency	Responsibility	Monitoring responsibility
Chilling area	Chiller	**Indoor unit**			
		1.Check evaporator	Daily	ME	PS
		2.Check the temperature indicator	Daily	ME	
		3.Check the fan blade function	Daily	ME	
		4.Check the function of evaporator/coil heater	Daily	ME	
		Outdoor unit	Daily	ME	
		1.Check compressor temperature	Daily	ME	
		2.Check any abnormal sounds of compressor	Daily	ME	
		3.Check compressor oil	Daily	ME	PM
		4.Check compressor succession pressure	Daily	ME	
		5.Check compressor discharge pressure	Daily	ME	
		6.Check any blocks of condenser unit	Daily	ME	
		7.Check the function of condenser fan	Daily	ME	
		8.Check the control panel board	Daily	ME	
		9.Change the compressor oil	Once a 6 month	ME	
		10.Wash the condenser coil	Once a 6 month	ME	
		11.Clean the evaporator drain line	Once a 6 month	ME	OM
	Tumbler	1.Check the power connection	Daily	MO	PS
		2.Check the temperature indicator	Daily	MO	PM
		3. Check and replace gear oil if necessary	Once a week	ME	OM
		4.Full service of the machine	Once a 6 month	External resource people	
Freezing area	Freezer	Same as the chiller	,,	,,	,,
Packaging material preparation area	Injector printer	1.Check the power connection	Daily	MO	PS
		2.Check ink and additives. If necessary change it immediately	Daily	MO	PM
		3. Check the conveyer belt for any abnormal noise or block	Daily	MO	
		4.Greasing of bearing	Once a month	ME	OM
		4.Full service of the machine	After completion of 10000 working hrs	ME	

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Pest Treatment Schedule	

Type of pest	Treatment	Service providing Company	Chemicals used	Method of application	Frequency	Monitoring Responsibility
Rodents	Baits traps	Finlay-Rentokill	Difenacuom based fentrol chemical	Solid materials are allowed for ingest in all drainages, out sides and selected area	Continuous	Supervisors
Cockroach, Ants and other insects	Insecticides (Liquid spraying)	Finlay-Rentokill	Carbonates, Pyrethyroid based insecticides	Spray the liquid to all drainages, outside and premises	Once a month	Supervisor
Fly	Liquid spraying	-	Fly back	Spray with spraying bottles when flies are visible	Continuous	Supervisor
Fly, Cockroach, Ants, Rodents and other insects	Misting treatment	Finlay-Rentokill	Methyl bromide	-Close all windows and door -Cover food items and sensitive equipment -Spray the chemical -Keep the premises close for at least 3 hours -After misting, ventilation for 30 min before entering	Once every 3 month	Supervisor
Fly and Insects	Electronic Fly Killer	Finlay-Rentokill	-	-Use wall mounted lamp -Monitoring for killed pest	Continuous	Supervisor

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	Cleaning Schedule	**Approved:**

Equipment/ Tool/ Location	Method	Tools	Chemicals	Strength	Dilution	Contact time	Procedure	Frequency	Responsibility	Monitored by
Building Interior										
Floor	Dry Cleaning	Brooms	-	-	-	-		-End of batch production -Before & after production	Line leader in each section	Supervisor
	Wet Cleaning	High pressure Water guns, Mops, Whipper	B-100	5%	-	2min	-Wet the floor with water and Pour B-100 (Cleaning Chemical)			
			M-100	50 ppm	1:100	15 min	-Rinse with water and Pour detergent with recommended level (M-100) -Keep for complete the surface reaction -Mop well -Rinse well with water gun & baskets -Whipping all surfaces to avoid water log in surfaces.			
Walls	- do -	-do-	-do-	-do-	-do-	-do-	-do-	-do-	-do-	-do-
Tables	Wet Cleaning	Baskets, Water gun	ISO Propanyl Alcohol (IPA)	100% pure	-	1min	-After Cleaning & before start the meat preparation, Apply IPA to the tables.	End of every batch	Line leader	Supervisor
			M-100	200 ppm	1:25	2 min	-Wet tables with water and Apply M-100 -Allow for certain time to reaction -Rinse well with water.			

Cleaning Schedule Continue..

Equipment/Tool/ Location	Method	Tools	Chemicals	Strength	Dilution	Contact time	Procedure	Frequency	Responsibility	Monitored by
Knives	Wet Cleaning	Brush, Sponge	ISO Propanyl Alcohol (IPA)	100% pure	-	1min	- Before start the meat cutting, Apply IPA to the knives in every 1-hour.	End of the batch	Line Leaders	Supervisor
			M-100	200 ppm	1:25	2 min	-Wet knives with water -Apply M-100 with Sponge -Allow for certain time to reaction -Rinse well with water.			
Crates	Wet Cleaning	Water gun	M-100	200ppm	1:25	2min	-Wet with water -Apply detergent and Keep for certain time -Rinse with water	End of the batch	Line leader	Supervisor
	Sterilization	Chamber	-	-	-	20min	-Sterilization using chamber set for 121^{0}C for 20 min.	Every week	Line Leader	Supervisor
Trolleys, Trays, Baskets, container and Molds.	Wet Cleaning	Water gun	M-100	200ppm	1:25	2min	- Wet with water - Apply detergent - Keep for certain time -Rinse with water	End of every batch	Line leader	Supervisor
Dustbin	Wet Cleaning	Water gun	B-100	5%	-	2min	-Dispose the polythene inside the dustbin -Wet with water -Apply cleaning chemical -Keep for certain time -Rinse with water -Allow draining and placing polythene.	End of the each batch	Cleaning labourer	Supervisor

Cleaning Schedule Continue..

Equipment/Tool/ Location	Method	Tools	Chemicals	Strength	Dilution	Contact time	Procedure	Frequency	Responsibility	Monitored by
Machinery • Band saw cutter • Mincer • Bowl Chopper • Stuffer-large & small • Forming machine • Tumbler • Slicer • Peeler	Wet Cleaning	Water gun Baskets	M-100	500ppm	1:10	10 min	-Switch-off the current and disconnect the power line -Dismantle the parts of machine -Allow to soak for 5 min in detergent solution -Clean well with water without leaving of cleaning residues	Before & end of production	Line leader	Supervisor
Machinery • Vacuum packaging machine • Metal detector	Wet Cleaning	Baskets piece of cloth	M-100	200ppm	1:25	2 min	-Switch-off the current and disconnect the power line -Wet using water and apply detergent -Remove with water dry with a piece of cloth.	-Before & end of production	Line leader in each section	Supervisor
Machinery • Chamber	Wet Cleaning	Water gun Baskets	Recommen-ded chamber cleaning and detergent	-	-	5min	-Switch-off the current and disconnect the power line -Wet using water and apply detergent -Remove with water and dry the chamber.	End of production	Chamber operator	Supervisor
• Chamber and smoke generation unit	CIP	-	Caustic soda	-	-	20 min	-Program the chamber. -Pour Caustic soda to the cleaning unit. -Stop the cleaning after Completion of running cycle.			

Cleaning Schedule Continue..

Equipment/Tool/ Location	Method	Tools	Chemicals	Strength	Dilution	Contact time	Procedure	Frequency	Responsibility	Monitored by
Chiller and Freezers	Dry cleaning Wet Cleaning	Steel rods Mops Baskets	- M-100	- 200ppm	- 1:25	- 15min	-Remove the solid waste fallen in to the floors manually - Defrost ice of coils -Wet the floors and walls with water - Allow to soak for 15 min in detergent solution -Clean well with water without leaving of cleaning residues	Before production start Floors-once a week Walls-once a month	Chiller, freezer inchargers	Supervisor
Scales	Dry Cleaning Wet Cleaning	Brushes Baskets	M-100	200ppm	1:25	2min	-Brush for remove dirt & soils -Meat loading scales are disinfected with application of detergent solution.	After end of production	Line leader	Supervisor
Wooden racks (pallets)	Dry Cleaning	Brushes, Brooms	-	-	-	-	-Brush and sweep to remove the dirt and waste.	End of production	Chamber operator	Supervisor
Electric fly killer	Dry cleaning	Brushes	-	-	-	-	- Remove trapped insects and clean with the brush.	End of the day	Cleaning labourer	Supervisor
Foot bath	Wet cleaning	Water gun	M-100	200ppm	1:25	2min	-Apply detergent and remove with water. -Pour water with 200ppm chlorine solution	Before and during the production	Cleaning labourer	Supervisor

Cleaning Schedule Continue..

Equipment/Tool/ Location	Method	Tools	Chemicals	Strength	Dilution	Contact time	Procedure	Frequency	Responsibility	Monitored by
Spice room	Dry cleaning	Brooms	-	-	-	-	-Remove the solid waste fallen in to the floors manually - Sweep the floor	End of production	Spice room inchargers	Super -visor
	Wet Cleaning	Brushes, Mops Baskets Whipper	M-100	50ppm	1:100	15min	-Remove the containers from the floor -Wet the floor with water -Brush and allow to soak for 15 min in detergent solution -Clean well with water without leaving of cleaning residues	Once a week		
Dry stores	- do -	-do-	-do-	-do-	-do-	-do-	-do-	-do-	-do-	-do-
Packaging material preparation area	Dry Cleaning	Brooms	-	-	-	-	- Sweep to remove the dirt and waste.	End of production	Cleaning laborer	Super -visor
	Wet cleaning	Brushes, Mops	M-100	50ppm	1:100	15min	-Mop with detergent solution and			
Dinning room	- do -	-do-	-do-	-do-	-do-	-do-	-do-	-do-	-do-	-do-
Changing room	- do -	-do-	-do-	-do-	-do-	-do-	-do-	-do-	-do-	-do-

Cleaning Schedule Continue..

Equipment/Tool/ Location	Method	Tools	Chemicals	Strength	Dilution	Contact time	Procedure	Frequency	Responsibility	Monitored by
Building Exterior										
Water collection tank	Wet cleaning	Brush, water baskets	B-100	5%	-	15 min	-Remove solid debris retain in the strainer -Wash the tank with water -Brush with cleaning chemical and allow for certain time Rinse well with water	Before, during and end of production	Cleaning labourer	Supervisor
Waste collection tank	Wet cleaning	Brushes, Mops, Baskets	B-100	5%	-	15 min	-Municipal council lorry take the waste from the waste collection tanks -After removing the waste, wash the tank with water -Brush with cleaning chemical -Allow for certain time and rinse with water	Once every 2 days	Cleaning labourer	Supervisor
Grounds/Gardens	Dry cleaning	Brooms	-	-	-	-	-Sweep to remove dirt and waste -Collect the waste to waste collection tank	Before and end of production	Cleaning labourer	Supervisor
Drainage lines	Wet cleaning	Brushes, baskets, horses	M-100	200ppm	1:25	15min	-Remove solid debris -Wash with water -Apply detergent solution and allow for certain time Rinse with water	Before and end of production	Cleaning labourer	Supervisor
Toilets and washing room	Wet cleaning	Brushes, baskets	Harpic	-	-	15min	-Apply water and then detergent chemical -Allow for 15 min -Brush well and rinse with water	End of the day	Cleaning labourer	Supervisor

Food Products (Pvt) Ltd.

Daily Cleaning Assessment Reports

Document Ref: ID/GMP/CS
Serial No: ID/ 01-006
Page No: 1 of 2
Revision:
Date:
Approved:

Equipment/ Location	Time					Remarks	Monitored by
	8.30 am	10.30 am	12.45 pm	03.15 pm	06.30 pm		
Building Exterior							
1. Outer Garden							
2. Outer Drainage Line							
3. Office Toilet-1							
4. Office Toilet-2							
5. Washing room							
6. Employee Toilets							
7. Garbage Storage							
8. Water Collection tank							
9.Garbage bins							
10.Car Park							
Building Interior							
1. Floor area							
2. Dry Storage-1							
3. Dry Storage-2							
4. Spice room							
5. Dust bin							
6. Changing room							
7. Dinning room							
8. Ceilings							
9. Foot bath							
10. Freezer room-1 (raw material)							
11. Freezer room-2 (end Product)							
12. Blast Freezer							
13. Chiller 1							
14. Chiller 2							
15. Tumbler			232				

Cleaning Checklist Continue..

Equipment/ Location	Time					Remarks	Monitored by
	8.30 am	10.30 am	12.45 pm	03.15 pm	06.30 pm		
Processing Area							
1. Floor							
2. Walls							
3. Tables							
4. Scales							
5. Crates							
6. Trolleys							
7. Racks							
8. Band Saw/ Cutter							
9. Mincer							
10.Bowl Chopper							
11.Stuffer 1							
12. Stuffer 2							
13. Forming machine							
14.Chamber							
15.Peeler							
16. Dust bins							
Packing Area							
1. Floor							
2. Walls							
3. Crates and Containers							
4. Table							
5. Slicer							
6. Vacuum packaging machine							
7. Metal detector							
8. Dust bins							
Packaging material Preparation area							
1. Floor							
2. Walls							
3. Tables							
4. Dust bins							
5. Injector Printer							

Appendix 7

GILLS®	**Food Products (Pvt) Ltd.**	**Document Ref:** ID/GMP **Page No:** 1 of 1 **Revision:** **Date:** **Approved:**
	Training Schedule	

Training Topic	Target Group			Time Duration	Nature of Training		Location	Details of Trainee	Date of Training
	T	M	F		I	E			
1. Basic Quality concept and company quality policy	■	■	■	10 min	■		Gills food products (Pvt) Ltd.	Quality Assurance Manager (QAM)	
2. Production process of the company		■	■	30 min	■		Gills food products (Pvt) Ltd.	Production manager (PM)	
3.Food Contamination sources			■	10 min	■		Gills food products (Pvt) Ltd.	Quality Assurance Executive (QAE)	
4.Good manufacturing practices	■	■	■	30 min	■		Gills food products (Pvt) Ltd.	External expertise	
5.Preparation of Cleaning chemicals and Cleaning procedures			■	15 min	■		Gills food products (Pvt) Ltd.	PM	
6.Responsibilities of each employee		■	■	30 min	■		Gills food products (Pvt) Ltd.	PM, Personnel manager	
7.Personnel hygiene	■	■	■	15 min	■		Gills food products (Pvt) Ltd.	PM	
8.Safty management	■	■	■	15 min	■		Gills food products (Pvt) Ltd.	PM, QAM	
9.Raw meat and end-product handling			■	10 min	■		Gills food products (Pvt) Ltd.	PM	
10.Product distribution			■	10 min	■		Gills food products (Pvt) Ltd.	QAE, PM	
11. Importance of HACCP and its basic principles	■	■	■	15 min	■		Gills food products (Pvt) Ltd.	QAE	
12.Process control and maintain documents		■	■	15 min	■		Gills food products (Pvt) Ltd.	PM, QAE	
13.Maintenace procedures and practical training			■	30 min	■		Gills food products (Pvt) Ltd.	Maintenance executive and PM	
14. Calibration procedures		■	■	-		■	Resource place	Resource person	

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