



الضوابط والأدلة الفنية لإدارة نفايات المسالخ

Technical Guidelines Slaughterhouse Waste Management

17 August 2023

TABLE OF CONTENTS

1	PURPOSE AND SCOPE	6
1.1	Purpose.....	6
1.2	Scope	6
2	LEGAL REQUIREMENTS	7
2.1	Waste Management Law.....	7
2.2	Implementing Regulations	7
3	ROLES AND RESPONSIBILITIES	8
4	SLAUGHTERHOUSE FACILITIES: TYPES AND SIZES.....	9
5	SLAUGHTERHOUSE WASTE OVERVIEW	11
5.1	Materials of Animal Origin and Slaughterhouse Waste	11
5.2	Waste Prevention	14
6	SLAUGHTERHOUSE WASTE GENERATION AND CLASSIFICATION	15
6.1	Slaughterhouse Waste Generation	15
6.2	Slaughterhouse Waste Classification.....	17
6.2.1	Hazardous Slaughterhouse Waste	19
7	WASTE SEGREGATION, STORAGE AND TRANSPORT	23
7.1	Overview	23
7.2	Segregation and Storage of Materials of Animal Origin	23
7.3	Transport.....	23
8	SLAUGHTERHOUSE WASTE TREATMENT TECHNOLOGIES.....	25
8.1	Background.....	25
8.2	Waste Treatment Options	27
8.3	Technology Scope Appraisal.....	27
9	MARKETING MANAGEMENT STRATEGIES	34
9.1	Market Assessment	34
9.2	Shared Treatment Facilities.....	36
10	HEALTH AND SAFETY REQUIREMENTS	37
11	DATA RECORDING, MONITORING AND REPORTING	39
11.1	Data recording.....	39
11.2	Monitoring.....	39
11.3	Waste Data Reporting	40

FIGURE INDEX

Figure 3-1: Stakeholders in slaughterhouse waste management.....	8
Figure 4-1: Type of animals processed by slaughterhouses	9
Figure 5-1: General classification of materials of animal origin for slaughterhouses.....	12
Figure 5-2: Yield of meat and waste from the slaughtering of different types of animals.	13
Figure 6-1: Classification of materials of animal origin.....	19
Figure 8-1: Waste hierarchy.....	25
Figure 8-2: Quantity of waste generated and their destination during the Hajj period.....	26

TABLE INDEX

Table 6-1: Waste of animal origin generated at different stages.....	15
Table 6-2: Waste codes applicable to slaughterhouses	17
Table 8-1: Technical feasibility of different slaughterhouse waste treatment technologies	29
Table 8-2: Slaughterhouse waste processing methods appraisal.....	30
Table 9-1: Commercial Applications of Materials of Animal Origin from Slaughterhouses	35

LIST OF ACRONYMS

AD	Anaerobic Digestion
BOD	Biological Oxygen Demand
BSE	Bovine Spongiform Encephalopathy
<i>E. coli</i>	<i>Escherichia coli</i>
IR	Implementing Regulations (of the <i>Waste Management Law</i>)
ISDB	Islamic Development Bank
KSA	Kingdom of Saudi Arabia
MEWA	Ministry of Environment, Water and Agriculture
MWAN	The National Centre for Waste Management
NCEC	National Center of Environmental Compliance
NCV	Non-Commercial Value
SFDA	Saudi Food and Drug Authority
SRM	Specified Risk Material
TSE	Transmissible Spongiform Encephalopathy
WML	Waste Management Law
WWTP	Wastewater Treatment Plant

DEFINITIONS

Municipal Solid waste	Includes Residential Waste, which is Waste resulting from the usual activity of households, whether or not they are collected mixed or separately and also includes Commercial and Administrative Waste, which is Waste that is produced from other sources that are similar in nature and composition to Residential Waste.
Hazardous waste	Waste classified as hazardous based upon the provisions of the Law and Regulations, which is resulting from industrial or non-industrial activities that contain toxic, flammable, or reactive materials, or corrosives, solvents, degreasers, oils, colorants, paste residuals, acids, or alkalis.
Agricultural waste	Any waste produced from activities and premises including growth of crops, animal, and livestock production, slaughtering, slaughterhouses, forestry, tree residuals, fishing, and aquaculture. Agricultural waste may include non-organic waste that is produced from such activities, including but without limitation: chemical fertilizers residuals, pesticides residuals, and feed bags.
Manure	Any excrement and/or urine of farmed animals other than farmed fish, with or without litter
Non-hazardous waste	Waste that does not impose any risk to general health or the environment, and that may not be classified as Hazardous Waste.
Waste Producer	Every person who produces classified waste according to the provisions of the Law.
Segregation of waste at source	The segregation of waste by the generator (the producer) into its components - as defined by the nature of such waste - to enable improved resource recovery (through recycling or reuse).
Service provider	A person licensed, or authorized, to engage in waste management activities.
Storage	Storing the waste components or some of them temporarily for transfer or later use.
Treatment	It means the use of physical, biological or chemical means, or a combination of these means, or others to bring about a change in the specifications of waste in order to reduce its volume, or facilitate the processes of treating it when reusing or recycling, or extracting some products from it or to remove organic pollutants and others in order to reduce or utilize some of the waste components or eliminate the possibility of harm to humans or the environment.
Waste	All materials that are discarded or disposed of, and that directly or indirectly affect public health or the environment.
Waste management	Organizing any activity or practice related to waste commencing from waste collection, transportation, sorting, storage, treatment, recycling, import, export, and safe disposal, including aftercare at waste disposal sites.

1 Purpose and Scope

1.1 Purpose

The purpose of this document is to provide the necessary guidance for the management of slaughterhouse waste in the Kingdom of Saudi Arabia (KSA), in accordance with the provisions of the *Waste Management Law* (WML) and the associated *Implementing Regulations* (IR).

This guideline has been drafted to assist the correct classification of waste from slaughterhouse activities and its proper segregation and management via different methods if necessary. It is practical, technical guidance designed to comply with the law.

The guideline makes it clear that each facility should produce a specific waste management plan that covers all the waste produced at that facility and implements the requirements of this technical guideline for classification, segregation, separation, storage, transportation, and treatment, as well as any other requirements detailed in this document, such as all health & safety.

1.2 Scope

The primary purpose of a slaughterhouse is to produce food for human consumption, but throughout the process an important part of the outputs is represented by other materials not intended for human consumption and waste.

The disposal of all animal products and materials not intended for human consumption as waste is not a realistic option, as it would lead to unsustainable costs and risks for the environment. There are clear benefits in using a wide range of materials of animal origin and derived products in various productive sectors.

However, these materials are a potential source of risks to public and animal health and are therefore generally tightly regulated by the food and health safety legislation. According to the international practice, when sent to final disposal in waste facilities, materials of animal origin fall under both food and safety and waste jurisdiction. This includes rules for collecting, storing, transporting, handling, processing, using, and disposing of waste of animal origin.

This Technical Guideline applies to materials of animal origin generated from slaughterhouses which are directed to waste facilities (from here onward referred to as “waste”). It does not cover materials from animal origin and derived products from slaughterhouses which are destined for human consumption or for the production of products such as the pharmaceutical, feed and leather industries.

2 Legal Requirements

This Technical Guideline on Slaughterhouse Waste Management complements information provided by the *Waste Management Law* (WML) and the associated *Implementing Regulations* (IR), with a more structured approach to guide users through the slaughterhouse waste management process. For legal requirements on slaughterhouse waste however, users are advised to consult both the WML and the IR.

2.1 Waste Management Law

The WML sets out the duties and responsibilities of waste producers, licensed waste transporters, and waste management service providers. The WML does not cover slaughterhouse waste specifically, however it sets the overall framework for waste management in Saudi Arabia and requires all those involved to recycle, recover resources, and ensure safe disposal of waste to achieve better environmental and economic outcomes.

The WML provisions dictate that waste producers should conserve natural resources and materials, reuse products, reduce waste, store it in the designated areas, and separate it for reuse or recycling. It also covers extended producer responsibility on products for manufacturers and importers, financial sustainability for the waste management sector and the concept of circular economy. The WML prescribes the responsibilities of those providing waste services, including compliance with the waste management standards and means of transportation set by the National Centre for Waste Management (MWAN).

This law also regulates the import and export of waste as well as dealing with emergency situations and prohibits the import of hazardous waste without a licence, as well as the import of recycled waste. It provides for both financial and custodial penalties for violators.

2.2 Implementing Regulations

According to the Implementing Regulations, slaughterhouse waste is classified under agricultural waste along with growth of crops, animal, and livestock production, forestry, tree residuals, fishing, and aquaculture. Other than its classification under agricultural waste, the Implementing Regulations do not provide specific slaughterhouse waste management provisions. As such, the general provisions of the IR regarding waste management and handling, including segregation, storage, transport, treatment, and disposal, apply to a large extent to slaughterhouse waste. Additional, bespoke provisions will be detailed throughout this document.

Among the different chapters of the IR - with relevance to slaughterhouse waste management - Chapter 4 is particularly relevant as it sets out provisions on the rules and procedures for all components of the waste value chain and different waste streams.

3 Roles and Responsibilities

This technical guideline should be used by all parties involved in all the stages of the management of slaughterhouse waste from producers to waste service providers. The parties involved in the waste management as defined in the WML, include: the competent authorities (the government, the Centre/MWAN), waste generators and waste service providers (of collection, transport, storage, treatment, and disposal facilities). Figure 3-1 lists the main entities responsible for slaughter waste management and some of their responsibilities, including MEWA which is now the competent authority in charge of regulating and licensing slaughterhouses in the KSA.

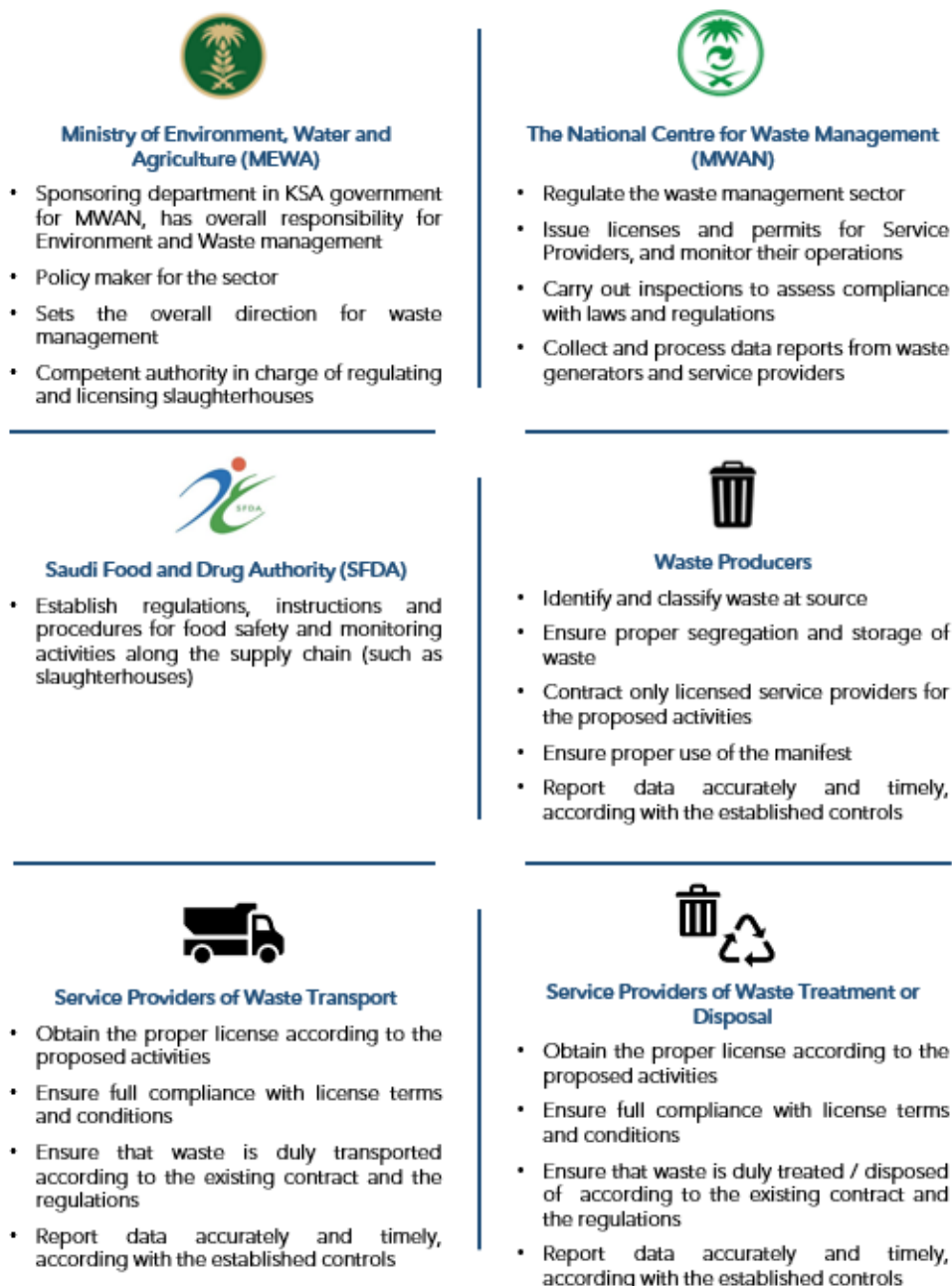


Figure 3-1: Stakeholders in slaughterhouse waste management

4 Slaughterhouse Facilities: Types and Sizes

Slaughterhouses are one of a range of variously named places, where animals are slaughtered, providing a range of products (primary and secondary), and generating a diversity of wastes as well.

The facilities can range from:

- small ones that process a few dozen animals a day (e.g., slaughter slabs and slaughter sheds); to
- medium-sized slaughterhouses which process up to 500 carcasses a day; and
- very large industrial complexes (more commonly referred to as 'abattoirs') that can process thousands of animals each hour.

For poultry the numbers are slightly different, with a small facility (kitchen or restaurant) processing at least 50 animals a day, a medium facility processing up to 10,000 birds daily, and a large facility more than 10,000 birds a day.

Regardless of the size, all slaughterhouses generate waste that needs to be managed, in order to prevent or minimize the environmental and human health issues arising from slaughterhouse operations.

Different facilities will generate different quantities and types of waste, and one of the main factors influencing the type of waste generated is the type of animals being processed. Generally, slaughterhouses can be divided into categories according to the types of animals they process, namely:

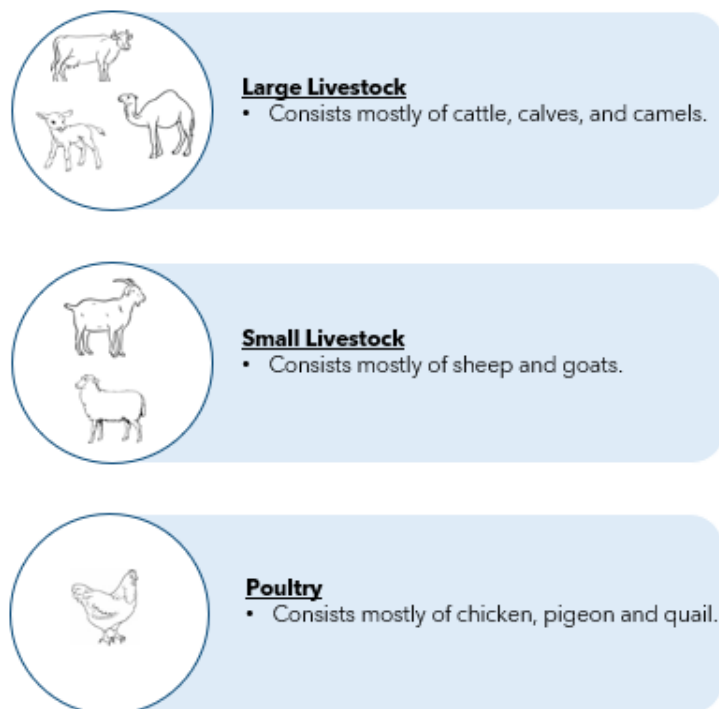


Figure 4-1: Type of animals processed by slaughterhouses

The fact that slaughterhouses tend to process one type of animal does not prevent them from processing others, as long as they have the required equipment and processing capacity. For example, both cattle and poultry could be processed at the same facility as long as they can be kept separated at all times and there is no overlap of products nor incompatible wastes.

Slaughterhouse facilities in Saudi Arabia process several different types of animals, typically producing meat and making use of different body parts not meant for human consumption for a range of applications. However, during Hajj, the annual Islamic pilgrimage, a large number of people travel to Mecca, even from outside the Kingdom of Saudi Arabia, and during these 5 to 6 days period the slaughter of animals increases significantly as part of the Hajj religious ritual.

According to the *General Authority for Statistics*, in 2018, the most common animals grown in agricultural holdings in Saudi Arabia had the following approximate numbers:

- Sheep – 9,420,000;
- Goats – 3,711,000;
- Camels – 493,000;
- Cows – 32,000;
- Poultry – 6,421,000.

According to the same source, poultry animals include several species such as chicken, pigeon, duck, turkey, goose, quail, rabbit, ostrich, and peacock, of which the most relevant are Pigeon (3,445,000), followed by chicken (2,136,000) and quail (457,000). These numbers provide some insight of the most commonly processed animals in slaughterhouses and, therefore, the most relevant sources of waste.

5 Slaughterhouse Waste Overview

5.1 Materials of Animal Origin and Slaughterhouse Waste

As previously mentioned, materials of animal origin from slaughterhouses can be destined for human consumption but can also be sent for the production of other products of animal origin such as the pharmaceutical, feed and leather industries. When not destined for either of those, the material will be considered a waste.

Materials of animal origin can offer important benefits, as they have a high nutritional value and therefore can be used to make products such as fertilizers, feed, biofuels, and cosmetics. Animal fat can also be used in the production of alternative energy sources such as biodiesel or renewable fuels. However, they are also a potential source of risks to public and animal health, and improper use of these materials has resulted in outbreaks of serious diseases such as foot and mouth disease, classical swine fever, avian *influenza*, and the spread of *Bovine Spongiform Encephalopathy* (BSE).

Different slaughterhouse facilities will generate different materials of animal origin and wastes depending, among other things, upon the size of the facility, the range of activities (whether just slaughtering, or the holding of animals in lairage pens enclosures, processing of meat processing, preservation of hides and skins, etc.), and the type of animals being processed. Generally, these materials and wastes can be classified, according to the source, as follows:

- Stockyard (lairage/holding pens) manure;
- Gut contents consisting of partially digested grass, grains, etc.;
- Carcase trimmings, fat, blood, bones, hide/skin, internal organs, etc.

The classification of material or substances arising from slaughterhouses will be highly reliant on their intended destination. Materials intended for human consumption are considered a product, while other materials will either be used for the production of products of animal origin or disposed of as waste. To identify these, the materials destined to be incinerated, landfilled, used in biogas plants, or composted are classified as waste, while the materials destined to other treatment processes and intended to further use are considered “useful” materials of animal origin. Figure 5-1 displays a general classification process for the materials commonly arising in a slaughterhouse.

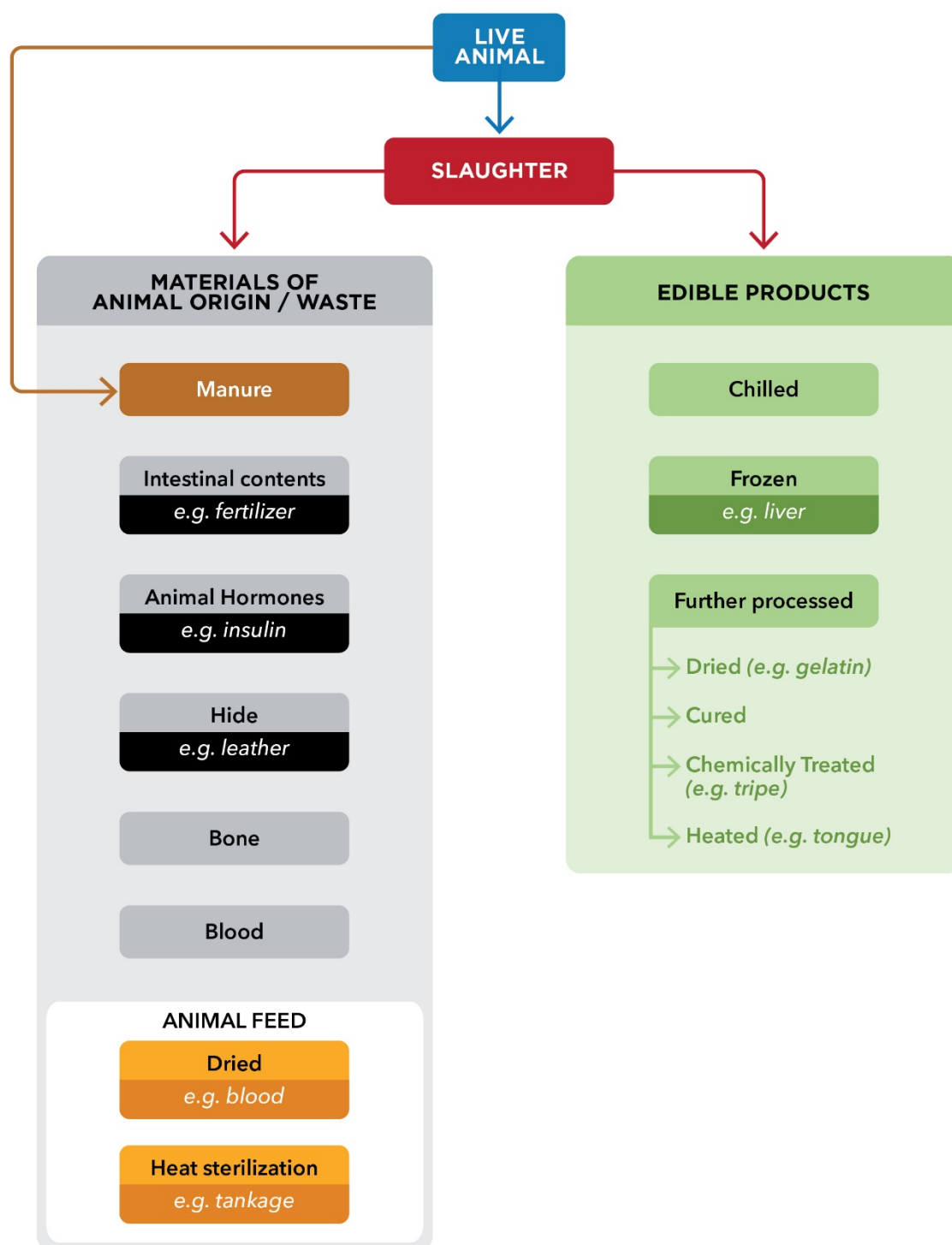


Figure 5-1: General classification of materials of animal origin for slaughterhouses

Materials of animal origin can also be divided into:

- Primary materials - harvested directly from the animals (e.g., hides and skins); and
- Secondary materials - derived from primary materials (e.g., gelatine from bones).

The yield of waste and other materials from animals varies tremendously depending on the type of animal, sex, liveweight, level of fat, methods of collection, etc. Estimates of the amount of meat and other materials produced from some animals during the slaughtering process are presented in Figure 5-2.

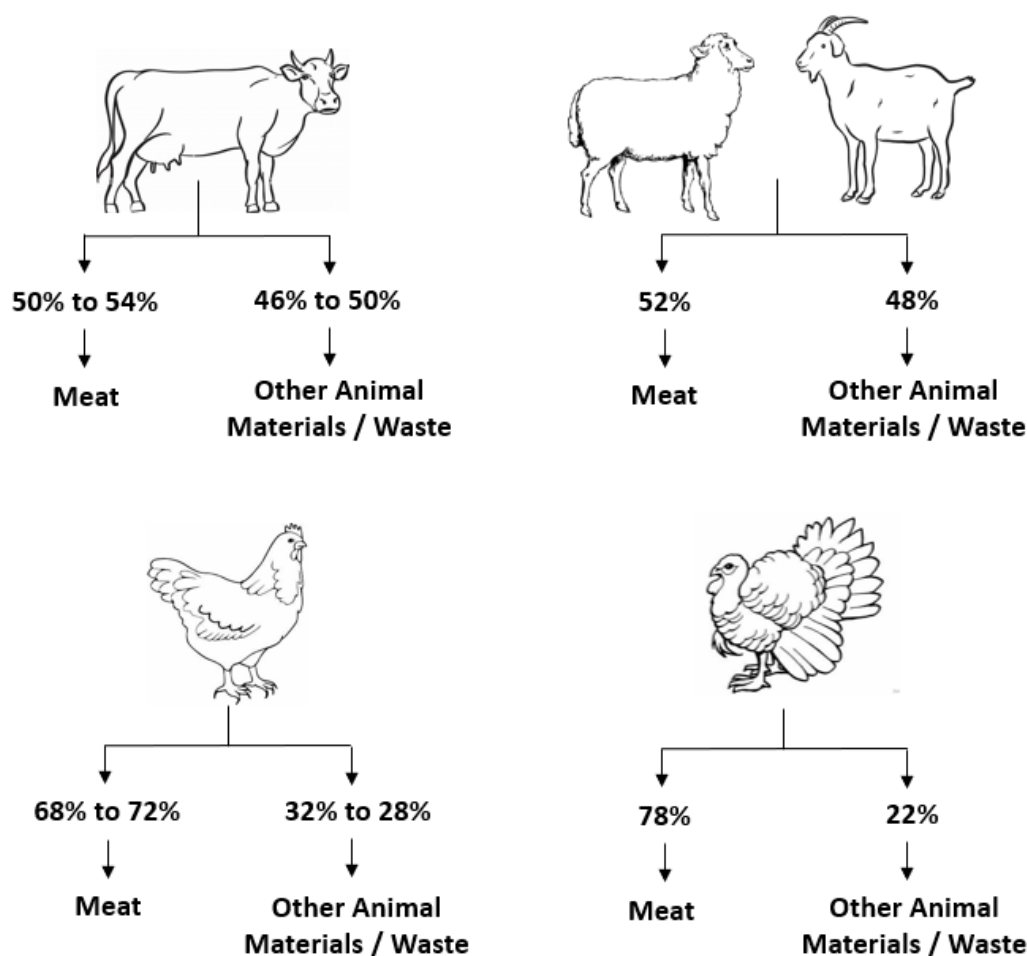


Figure 5-2: Yield of meat and waste from the slaughtering of different types of animals.¹

Materials of animal origin, may be treated, processed, or disposed of, in different ways. Some materials may require further processing before use, and wastes will be dispatched for treatment or disposal. Regardless of the final destination of these materials, the facility generating them should demonstrate that the chosen routes for recovery or disposal are in line with the best available techniques and with the waste hierarchy, and the processes and methods best suited to provide the lowest possible environmental and human health impacts should be adopted.

Detailed information regarding waste generation by slaughterhouses is presented in *Section 6 Waste Generation and Classification*.

¹ [Mozhiaradi, V., Natarajan, T. \(2022\), "Slaughterhouse and poultry wastes: management practices, feedstocks for renewable energy production, and recovery of value added products", Springer Link](#)

5.2 Waste Prevention

During the different stages of the slaughtering process, various quantities, and types of materials of animal origin will arise, some of which corresponding to waste that is unavoidable to a certain extent (e.g., blood, if not intended for further use). However, there are a number of practices that can be adopted to minimise the generation of waste (and the associated environment and social impacts) as far as feasible.

Although some measures are more applicable for slaughterhouses dedicated to either red (non-poultry) meat production or poultry, some others are universal and can be applied to any facility, such as:

- Minimise lairage holding time;
- Provide proper animal welfare to avoid stress-related losses;
- Improve slaughtering and processing efficiency through new technologies and equipment;
- Use water recycled from one process into another (when applicable);
- Use continuous collection of segregated materials of animal origin throughout the slaughter-line;
- Design and construct facilities that are easy-to-clean;
- Use vehicles and equipment designed for easy cleaning;
- Collect floor waste using “dry” methods, followed by wet cleaning;
- Consider the marketability of materials of animal origin when planning new facilities.

To prevent waste generation, operators should undertake periodic examinations of processing equipment and procedures in order to identify options for waste minimization.

6 Slaughterhouse Waste Generation and Classification

6.1 Slaughterhouse Waste Generation

In Slaughterhouses, materials of animal origin will arise from the different stages of operations, starting with animal reception, to slaughter and meat processing.

As previously mentioned, materials of animal origin include waste, and the differentiation will occur depending on the destination. Table 6-1 summarizes the materials generated at each stage in a slaughterhouse.

Table 6-1: Waste of animal origin generated at different stages

Slaughterhouse Process	Waste streams of animal origin generated
A. Stockyards and pens (reception)	
After arrival at the slaughterhouse, animals are generally kept in pens or stockyards until slaughtering	- Manure; - Urine; - Feed; - Miscellaneous dirt.
B. Slaughtering	
The type and amount of waste to be generated in a slaughterhouse will depend, for the most part, on the type of animals being processed and the processing methods used	- Blood; - Head and hoof; - Rumen, including its contents; - Stomach, including its contents; - Intestines, including their contents; - Hide, skin, feathers; - Several other organs (offal). <u>Blood</u> represents a major environmental concern, being the constituent with the highest polluting value due to its high biological oxygen demand (BOD), along with high nitrogen and phosphorus contents. <u>Rumen, stomach, and intestine contents</u> represent also one of the most important sources of pollution in slaughterhouses, substantially contributing to the total waste load if not properly handled. This waste consists mainly of undigested vegetation (grass, hay, and grains), water, partially digested food, and body fluids, including saliva. <u>Offal</u> includes: - Edible offal (heart, liver, and kidneys) and - Inedible offal (that can be used in the production of pet food, for example, or disposed of as waste).

Slaughterhouse Process	Waste streams of animal origin generated
	In the KSA, sheep intestines are commonly exported to make surgery threads (sutures) or for use as sausage casings.
C. Meatpacking	
Many large-scale slaughterhouses (and combined meat processing plants) provide whole, graded carcasses to retail markets, while others perform some on-site processing to produce retail cuts	In slaughterhouses with meatpacking stations, cutting and deboning operations will produce: - Trimmings; - Blood; - Bones; - Bone dust.
D. Other sources	
Cleaning, washing	<u>Wastewater</u> is a major component of slaughterhouse activities, typically being generated at almost every stage from animal reception to slaughter and processing. Wastewater treatment typically includes one of the following: - On-site treatment (typically only applicable for large facilities or groups of facilities (see Section 9.2)); - Connection to the sewage network; or - On-site storage for collection and treatment off-site. It should be noted that some level of pre-treatment may be needed in order to meet the regulatory requirements regarding wastewater constituents.
Casualty animals	
Animals may die during transport to the slaughtering facility, or in the pens while awaiting slaughter. When this happens, operators must undertake all necessary steps to confirm if the animal died of natural causes, accident, or disease. In the event of accidental injury, preventative measures must be adopted to ensure no future accidents occur. If the cause is determined as disease, studies should be performed to assess the possibility of contagion to other animals, and the potential threat to human health. Rendering is the recommended method for disposal of dead stock, but in cases where it is not an option, commercial landfill and composting may be used. This may not apply to dead animals considered to be contagious/infectious.	

In addition to the materials of animal origin, slaughterhouses will also generate other wastes such as packaging materials consisting mainly of plastics, cardboard/paper, etc. These are not expected to represent a major stream when compared to waste of animal origin, nor are expected to be difficult to manage. However, as any waste, without proper care and handling can lead to environmental issues and as such should be managed accordingly.

6.2 Slaughterhouse Waste Classification

Under KSA's IR, slaughterhouse waste falls into the "Agricultural Waste" category and is defined as:

"Any waste produced from activities and premises, including growth of crops, animal and livestock production, slaughtering, slaughterhouses, forestry, tree residuals, fishing, and aquaculture. Agriculture waste may also include non-organic waste that is produced from such activities, including but without limitation: chemical fertilizers residuals, pesticides residuals and feed bags".

According to the provisions of the Technical Guideline on Waste Classification, slaughterhouse waste usually can be classified under "Chapter 2 - Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing, food preparation and processing" of the List of Waste, specifically subchapters 01 and 02. Subchapter 02 01 "Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing" is destined for waste generated prior to slaughter (i.e., manure, feathers, hair, etc), while 02 02 "Wastes from the preparation and processing of meat, fish and other foods of animal origin" is destined for waste generated at slaughter and processing stages.

Other wastes associated with medical care and prevention of infection, both for animals and humans, should be classified under "Chapter 18 - Wastes from human or animal health care and/or related research (except kitchen and restaurant wastes not arising from immediate health care)", specifically subchapter 02 "Wastes from research, diagnosis, treatment or prevention of disease involving animals".

Table 6-2: Waste codes applicable to slaughterhouses

Code	Designation
02	Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing, food preparation and processing
02 01	Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing
02 01 01	Sludges from washing and cleaning
02 01 02	Animal-tissue waste
02 01 03	Plant-tissue waste
02 01 04	Waste plastics (except packaging)
02 01 06	Animal faeces, urine, and manure (including spoiled straw), effluent, collected separately and treated off-site
02 01 07	Wastes from forestry
02 01 08*	Agrochemical waste containing hazardous substances
02 01 09	Agrochemical waste other than those mentioned in 02 01 08
02 01 10	Waste metal
02 01 99	Wastes not otherwise specified
02 02	Wastes from the preparation and processing of meat, fish, and other foods of animal origin

Code	Designation
02 02 01	Sludges from washing and cleaning
02 02 02	Animal-tissue waste
02 02 03	Materials unsuitable for consumption or processing
02 02 04	Sludges from on-site effluent treatment
02 02 99	Wastes not otherwise specified
18	Wastes from human or animal health care and/or related research (except kitchen and restaurant wastes not arising from immediate health care)
18 02	Wastes from research, diagnosis, treatment, or prevention of disease involving animals
18 02 01	Sharps (except 18 02 02)
18 02 02*	Wastes whose collection and disposal are subject to special requirements in order to prevent infection
18 02 03	Wastes whose collection and disposal are not subject to special requirements in order to prevent infection
18 02 05*	Chemicals consisting of or containing hazardous substances
18 02 06	Chemicals other than those mentioned in 18 02 05
18 02 07*	Cytotoxic and cytostatic medicines
18 02 08	Medicines other than those mentioned in 18 02 07

The waste codes marked in blue in Table 6-2 are applicable to slaughterhouses. In addition to this, other general waste is typically generated such as packaging, materials specific to the maintenance of equipment etc. Table 6-2 includes only waste codes specific to the slaughter process.

All materials of animal origin, with the exception of those classified as food for human consumption, should follow a specific classification system, in addition to the waste classification described above, as provisions from Table 6-2 are only applicable to animal materials intended for incineration, landfilling or use in a biogas or composting plant, therefore considered waste. This means that any material of animal origin being generated in a slaughterhouse that is considered waste should be classified, simultaneously, through two classification systems: the one displayed in Table 6-2 and the one described below following the three categories for products of animal origin.

Materials of animal origin not destined for one of the mentioned treatment or disposal methods shall be regulated by the food and health safety legislation. As mentioned in Section 1.2, these products are not covered by the current technical guideline, but an indicative classification is provided below.

In line with the international best practice, the classification system for materials of animal origin considers three categories as displayed below, according to the degree of risk the materials represent for both human and animal health, particularly:

- Category 1 – very high-risk material;

- Category 2 – high risk material; and
- Category 3 – low risk material.

Figure 6-1 details some of the materials of animal origin typically associated with each category.

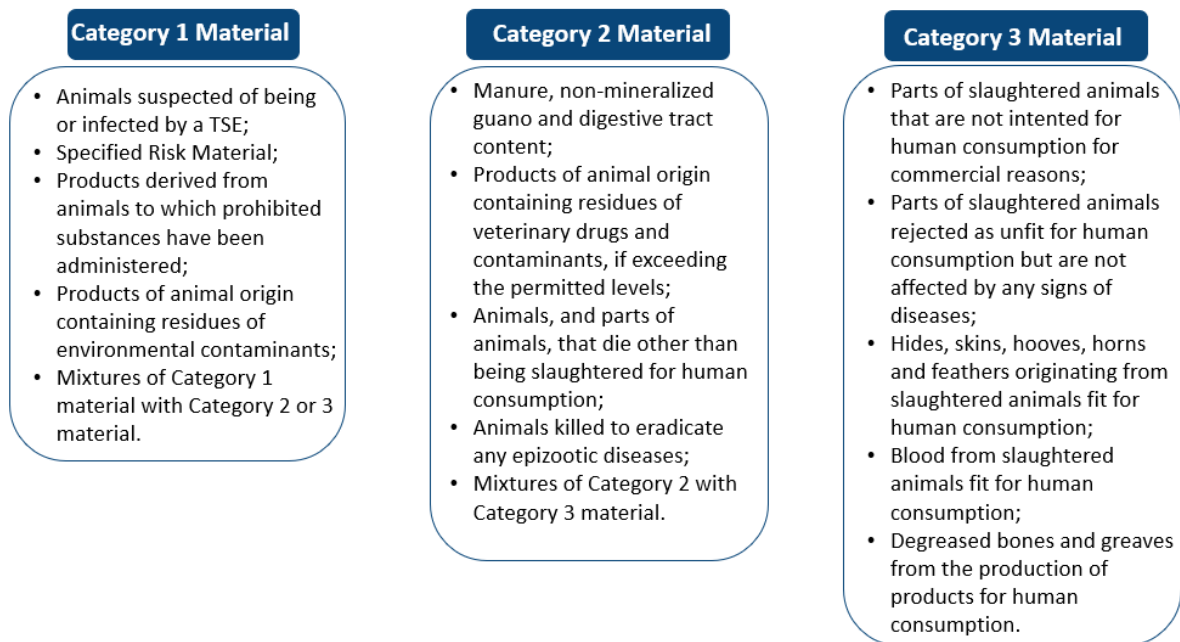


Figure 6-1: Classification of materials of animal origin²

Each category of materials of animal origin will have different treatment and processing requirements and certain restrictions regarding its further use. Category 1 materials, for example, are usually considered hazardous or potentially hazardous, for which reason they may be prevented from further usage and require more stringent treatment methods, commonly being incineration. Depending on the material and the treatment routes, some options may still exist to retain some value of the materials, however this should be assessed on a case-by-case scenario.

6.2.1 Hazardous Slaughterhouse Waste

Waste is classified as hazardous based upon international practices, as described as material which:

- May cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible incapacitation, or illness; or
- Poses a substantial present or potential hazard to human health, or the environment, when improperly treated, stored, transported, or disposed of, or otherwise managed.

For slaughterhouses, the most prevalent source of hazardous waste is related to diseased or contaminated parts of the animal, which (if not handled properly) can lead to pathogen transmission to humans, and

² [Regulation \(EC\) No 1069/2009 of the European Parliament and of the Council of 21 October 2009 laying down health rules as regards animal by-products and derived products not intended for human consumption and repealing Regulation \(EC\) No 1774/2002 \(Animal by-products Regulation\) \(europa.eu\)](#)

consequent health issues. Chemical waste will also arise from products used during daily operations such as cleaning agents or waste treatment elements. The following sections detail some of the most common hazardous wastes that can originate from a slaughterhouse.

6.2.1.1 Chemical Waste

Chemical Waste from slaughterhouses can originate from multiple sources such as cleaning products, maintenance, and daily operation products (i.e., lubricants), waste treatment processes (including pre-treatment chemicals, and post treatment residues), and can include the presence of prohibited chemicals, as fungicides, herbicides, pesticides, etc.

Chemical waste arising in slaughterhouses should be classified according to its hazardousness, following the provisions of the *Technical Guideline on Waste Classification*, and then handled accordingly.

6.2.1.2 Prohibited Substances and Environmental Contaminants

Animal parts and other waste from slaughterhouses exposed to environmental contaminants or to which prohibited substances have been administered shall be deemed hazardous waste and handled in line with Category 1 materials. This means that, for the most part, animal waste exposed to prohibited substances or environmental contaminants should be incinerated or landfilled after being sterilized.

Certain substances may require specific treatment approaches, for which the competent authorities must be consulted.

6.2.1.3 Infectious Waste

Infectious waste from slaughterhouses is all waste that is (or can potentially be) contaminated with infectious pathogens. Material that can lead to serious illness or health issues to any person exposed to it, whether through direct contact, inhalation, ingestion or in any other way exposure to contaminated products.

Given the nature of a hazardous incident, management is likely to create a large number of carcasses, along with other wastes such as manure, personal protective equipment, and liquid wastes. These products of decontamination activities are bound to be infected and will therefore require special handling. Although several different infectious pathogens can be associated with slaughterhouses, for the purpose of this guideline only three examples are described, namely *Transmissible Spongiform Encephalopathy* (TSE), *E. coli*, and *Influenza*, as addressed below.

Specified Risk Material

Specified risk materials (SRM) are those parts of cattle, sheep and goats that are most likely to pose a risk of infectivity if the animal from which the material comes is infected with a transmissible spongiform encephalopathy (TSE) disease for example. It is essential, therefore, that it is removed from both the human and animal food chains and destroyed.

Slaughterhouse facilities processing the aforementioned animals need to follow certain prescribed procedures in order to prevent and minimize the risk of exposure of workers and consumers to TSE. Current provisions dictate that certain animal body parts need to be removed soon after slaughter. For example:

- **Cattle:**

- All ages; the tonsils, the last four meters of small intestine, the caecum, and the mesentery;

- Over 12 months; the skull (excluding the mandible but including the brains and eyes, and spinal cord);
- Over 30 months; vertebral column (excluding the vertebrae of the tail, the spinous and transverse processes of the cervical, thoracic, and lumbar vertebrae, the median sacral crest and the wings of the sacrum but including the dorsal root ganglia).

■ **Sheep and goats:**

- All ages; the spleen and the ileum;
- Over 12 months, or have a permanent incisor erupted; skull including the brains and eyes, tonsils, and spinal cord.

All SRM waste should be completely removed according to the above provisions, and immediately stained with a dye applied over the whole cut surface and the majority of the head. The whole head of a sheep or goat and over the whole surface of other SRM material should be marked. The dye must be clearly visible and not easily removed.

The removal of SRM material from animals should not be performed in (or close to) where animal parts are also processed for food, cosmetic, pharmaceutical, or medical purposes. As soon as they are removed, materials must be placed in an impervious, covered container, labelled either “SRM” or “*Category 1 animal parts for disposal only*”. The containers used must be thoroughly washed and disinfected every time they are emptied.

Escherichia coli

Although not all strains of *E. coli* are harmful, contamination with some strains (mostly through infected meat) can lead to serious diseases and pose a significant threat to human health.

E. coli originate from the intestinal track of infected animals and can be found in their faeces and on the hides/skins and hoofs of animals. When processing animals for slaughter it is important to ensure careful handling when skinning and gutting, so that knives and other equipment (in contact with the hide/skin and intestines) do not reach the underlying meat of the carcass, therefore contaminating it.

Although this particular pathogen does not usually lead to the generation of waste at slaughterhouses (as it is difficult to assess whether the meat is infected or not) improper handling of the slaughter process can result in the contamination of meat and its eventual recall from the market. This, at a stage where some people are likely to already be infected and where whole batches of several tonnes of meat will end up as waste.

Influenza

Avian flu (influenza virus, also known as H5N1) is an infectious disease found among poultry processed in slaughterhouses, that has been known to infect humans. This pathogen continues to be a global health threat due to the fact that it has the potential to mutate into a more virulent form that can be transmitted from human to human.

When outbreaks are detected in slaughterhouses, all animals must be slaughtered and disposed of, leading to whole carcasses and several tonnes of other waste.

Given the potential for large numbers of bird deaths, it is recommended that facilities have waste management plans that cover the treatment and disposal of the waste during outbreaks. Any related situation identified, must be communicated to the relevant authorities, so the best line of action (to minimize environmental and human health impacts) is established and put to practice.

7 Waste Segregation, Storage and Transport

7.1 Overview

The segregation, storage, and transport of materials of animal origin which are classified as waste must be carried through a service provider licensed by MWAN, using the waste manifest. The arrangements for such operations will vary between facilities depending on the nature and characteristics of the waste, and the categories as described in the previous section, but generally, materials of animal origin generated in slaughterhouses are removed from food production areas as quickly as possible, particularly to avoid cross contamination, and should then be kept separated at all times. Any mix of different category materials will lead to all waste being classified under the category of highest risk (i.e., if category 3 material is mixed with category 2 material, all materials will be classified as category 2).

Materials of animal origin that are classified as waste should only be stored in established areas, for a short period of time, while awaiting processing or collection, and should not be stored in excess of the limits (on weights and periods stipulated in the facilities' licence).

7.2 Segregation and Storage of Materials of Animal Origin

Materials of animal origin stored on-site for collection should be kept separated from other waste, and each material category must be isolated from others throughout the whole process of segregation and storage. Additionally, these materials must not in any way contaminate foodstuff or be exposed to animals or pests of any kind.

At a minimum, materials of animal origin considered waste must be stored in clean, sealed, leak-proof containers, cleaned and disinfected as often as necessary, and all the recipients should be clearly and firmly labelled according to the category of the material contained, according to the following:

- Category 3 – not for human consumption;
- Category 2 – not for animal consumption;
- Category 1 – for disposal only.

Re-usable containers should be dedicated to a particular category to prevent cross contamination.

Materials of animal origin destined for disposal as waste should be segregated and stored according to the relevant waste management provisions from the competent authorities, while other materials destined for further use should be stored following any provisions from SFDA, along with category specific considerations.

7.3 Transport

In line with the provisions for segregation and storage of materials of animal origin, the transport of the related waste must be conducted in a way that prevents cross contamination of different categories, and the exposure of materials of animal origin to human or animal receptors outside of the appropriate facilities to handle them.

The transport of materials of animal origin must only be performed by authorized carriers, with vehicles able to retain segregation and prevent degradation of the materials when relevant (i.e., refrigerated vehicles). The minimum provisions to follow are:

- Vehicles and containers must be covered and leak-proof;

- Vehicles and containers must be cleaned and disinfected before and after every use;
- Different categories of materials of animal origin should be transported in different vehicles. If they are transported together, they must be in separate containers, and in separate parts of the vehicle.

The transport of materials of animal origin can be performed resorting to split trailers, which have a partition across the width of the unit and have therefore an advantage to the industry by allowing the transport of different categories in a single vehicle. Each section of the trailer must be adequately identified, and a visual inspection should be conducted by the driver to ensure that all the conditions are gathered for the safe transport of the waste. The separation should be extended also to the loading and unloading procedures, and the use of the vehicle as well. The lowest risk material should be loaded in the back of the vehicle so that it can be unloaded first, therefore preventing any risk of contamination.

When transporting category 1 materials, the competent authorities should be informed so that an adequate route and schedule for transportation can be established, in order to avoid densely populated areas, farms, plantations and rush hours.

Additionally, the transport of materials destined for disposal as waste must be performed on the basis of the waste manifest, and follow any orientations provided by the competent authorities, namely MWAN. The waste transport shall comply with the legal requirements and with the recommendation of the Technical Guideline on Waste Transport.

8 Slaughterhouse Waste Treatment Technologies

8.1 Background

When selecting a waste treatment technology, the waste hierarchy (as displayed in Figure 8-1) must be taken into account. Treatment methods that allow the reuse or recycling of slaughterhouse waste should be given priority, followed by energy recovery methods. Waste disposal through landfill should be considered a last resort.

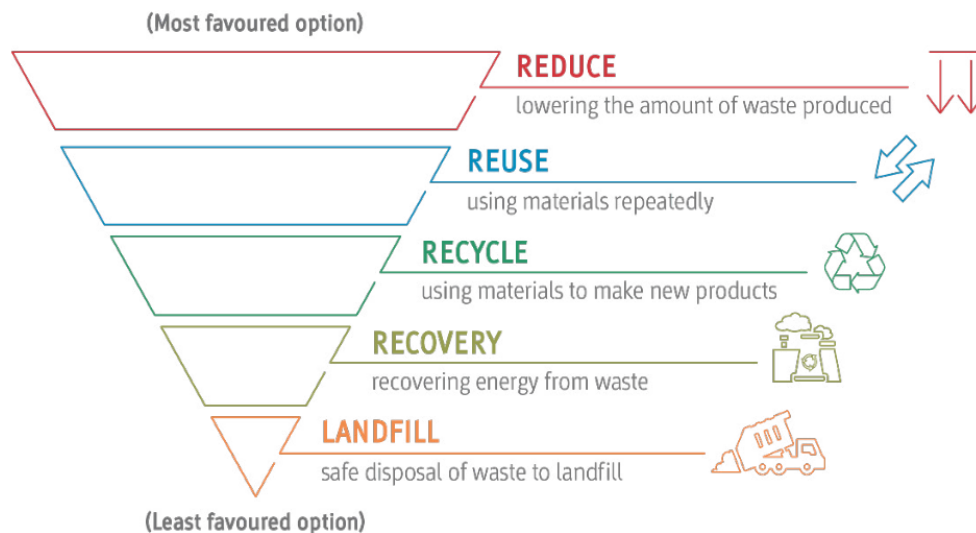


Figure 8-1: Waste hierarchy

In addition to the waste hierarchy, technical and logistical feasibility are major issues to consider when planning for slaughterhouse waste management. Not all waste generated can be easily reused or recycled, and some treatment opportunities are only accessible to larger facilities (due to feedstock requirements or prohibitive costs). Section 9.2 details some provisions related to economies of scale, and the opportunities for creating joint ventures specific for the treatment and/or disposal of slaughterhouse waste (directed at smaller facilities but to all sizes of facilities).

In KSA, during Hajj, for 5 to 6 days period the slaughter of animals increases significantly due to the Hajj religious rituals. Consequentially, slaughterhouses generate far more materials of animal origin than usual, including waste, that cannot be properly processed, leading to all animal materials generated during this period being either landfilled or incinerated.

Figure 8-2 presents a graphic illustration of the quantities of waste arising from sheep slaughter during the Hajj period and its final destination.

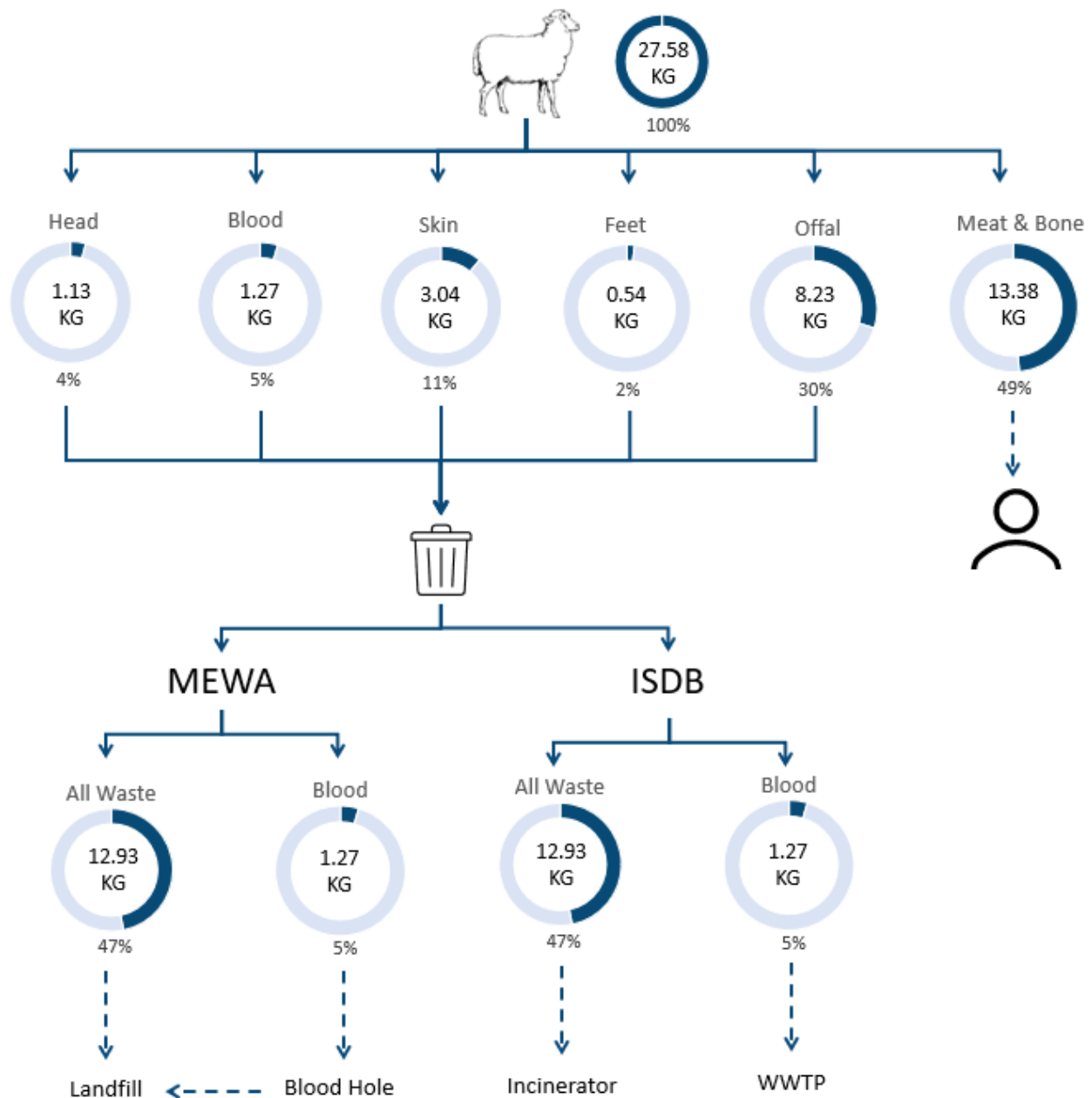


Figure 8-2: Quantity of waste generated and their destination during the Hajj period

Based on the data presented, from an approximately 28 kg sheep, 13 kg represent meat and bones for human consumption, being the remnant of the animal disposed of. Slaughterhouses in the Kingdom of Saudi Arabia are usually managed either by the government or private operators, with the *Islamic Development Bank (ISDB)* managing some facilities in Mecca. Based on the above chart, in Mecca, during Hajj, government owned facilities will landfill all waste generated, while ISDB facilities will incinerate it, with the exception of blood which will go to a wastewater treatment plant (WWTP).

The following sections describe some of the most common methods currently employed for the treatment of slaughterhouse waste along with notes on operations, including (when applicable) feedstock and output considerations.

8.2 Waste Treatment Options

Current practice regarding the treatment and disposal of materials of animal origin depend on several issues, as described previously in this document, such as available markets, facility size/capacity, or type of animal processed. Additionally, the end-use of any animal component will determine whether it shall be classified as waste or “useful” material of animal origin. The following list details some of the most common treatment and disposal methods for materials of animal origin, including treatment options for both waste and other materials:

- Rendering;
- Air Curtain Burners;
- Low pressure tissue processing systems;
- Alkaline Hydrolysis;
- Composting (Vermicomposting);
- Anaerobic Digestion;
- Incineration;
- Co-incineration;
- Pyrolysis;
- Sterilization;
- Landfilling.

The operators/owners of slaughterhouses shall ensure that slaughterhouse waste is directed only to waste facilities which have been granted a licence in accordance with Section 2 of the Implementing Regulation.

Section below provides an appraisal of how each technology can contribute to the different waste streams arising when processing materials of animal origin.

8.3 Technology Scope Appraisal

As presented in Table 8-1, the same materials of animal origin may be processed through different treatment methods, depending, for the most part, on its intended destination. However, each method has its own provisions that will affect its feasibility for implementation in certain facilities. These include the design requirements (i.e., only suitable for small outputs), the type of end products generated (some that cannot be easily managed) and the prohibitive costs for some facilities.

In order to provide better insight into each of the previously described treatment technologies, Table 8-1 provides a colour-based matrix that matches the different streams of materials of animal origin expected to be generated at a slaughterhouse facility with each of the aforementioned technologies, based on technical suitability. This assessment, however, indicates only whether a specific technology is capable of processing the material to a reasonable degree, not if it is the ideal or even recommended approach.

In order to provide better insight, treatment technologies have been divided into 3 categories regarding their role in processing materials of animal origin, specifically:

- **Materials intended for further use** – these treatment processes address materials of animal origin which are destined to produce “useful” products, not falling under waste treatment category;
- **Pre-treatment of materials** – these treatment processes are commonly associated with other processes, either for “useful” materials of animal origin or waste, as a pre-treatment operation. Sterilisation, for example, is commonly used before rendering, but also before incineration;
- **Materials intended for disposal** – these treatment processes are usually destined for materials of animal origin considered waste.

Table 8-1: Technical feasibility of different slaughterhouse waste treatment technologies

Waste Streams	Materials intended for further use (derived products)		Pre-treatment for Materials of Animal Origin		Materials intended for disposal (waste)						
	Rendering	Low Pressure Tissue Processing Systems	Sterilisation	Alkaline Hydrolysis	Composting (Vermicomposting)	Anaerobic Digestion	Incineration	Co-incineration	Air Curtain Burners	Pyrolysis / gasification	Landfilling*
Manure / Paunch content											
Blood											
Fat											
Skin											
Meat trimmings											
Offal											
Hooves/ Horns											
Bones											
Feathers											
Hazardous waste (category 1)**											

*Green cells for Landfilling column do not indicate recommended practice since landfills, following the waste hierarchy, are the least recommended option for waste management. In this case, green cells represent only a common approach to deal with certain waste streams otherwise difficult to process.

**Category 1 materials of animal origin can be sent to landfill only after sterilisation and permanent marking, and only when not containing TSE or suspected of containing TSE. The landfill must also be appropriate to receive such waste.

Legend

	Common / recommended practice		Not appropriate / not feasible
	Possible but uncommon / not the best		Feasibility unclear

Table 8-2 provides a more detailed description regarding the expected end product for each treatment method, along with commonly considered advantages and disadvantages.

Table 8-2: Slaughterhouse waste processing methods appraisal

Processing Methods		Beneficial End Product(s)	Advantages	Disadvantages
Material of Animal Origin Intended for Further Use	Rendering	- Human and animal food; - Soap; - Greases; - Fertilizer.	- Inactivates pathogens; - Output is good source of income.	- Removing water from waste consumes a lot of energy; - Generates effluent that must be treated; - Odour generation.
	Low Pressure Tissue Processing Systems	- Hydrolysed protein.	- Energy efficient; - Minimal odour emissions; - Low labour requirements; - Can destroy pathogens; - Can be used for on-site treatment.	- Not recommended for large scale facilities; - Requires secondary process for energy recovery; - It cannot fully digest plant material.

Processing Methods		Beneficial End Product(s)	Advantages	Disadvantages
Pre-treatment of Materials of Animal Origin	Alkaline Hydrolysis	- Alkaline solution that can be sent to AD to be turned into fertilizer.	- Can destroy pathogens; - Significant volume reduction; - Limited odour generation; - Minimal gaseous emissions.	- End product can be difficult to manage; - Limited capacity makes it an option difficult to suit large facilities; - Significant energy requirements.
	Sterilisation	- High grade stock fodder; - Fuel to be incinerated in cement plants.	Destroys pathogens.	- It's mostly used as a complement to other treatment processes such as rendering or incineration.
Materials of Animal Origin Intended for Disposal	Incineration	- Energy production.	- High temperature incineration (1,650°C) can destroy pathogens; - Can produce energy.	- High capital costs; - Emissions may lead to significant air pollution, requiring significant air quality control.
	Air Curtain Burners	- Ash to be used as fertilizer.	- Produces ash that can be used for fertilizer; - Destroys pathogens; - Can be done on site (there are even mobile machines); - Can generate electricity from the burn.	- Lower air emissions than other incineration methods, still relevant emissions.

Processing Methods		Beneficial End Product(s)	Advantages	Disadvantages
	Anaerobic Digestion	- Biogas; - Nutrient rich digestate.	- Sterilizes pathogens; - Minimizes odour generation; - Produces renewable energy (biogas); - Produces digestate to be used as fertilizer.	- Slow and sensitive process; - Requires fairly advanced equipment; - Requires highly skilled and trained staff.
	Pyrolysis	- Oils; - Energy; - Ash; - Char; - Syngas.	- Low emissions due to limited use of oxygen; - Products generated can be used as alternative fuel or purified and used as feedstock for petrochemicals and other applications.	- Generates possible toxic residues such as inert mineral ash, inorganic compounds, and unreformed carbon; - Can produce toxic air emissions such as acid gases, dioxides, particulates, etc.; - Pyrolysis plants required significant feedstock to work effectively.
	Composting (Vermicomposting)	- Biogas; - Compost; - Animal feed (worms).	- Potentially inexpensive; - Low-tech requirements; - End product is usually easily marketable; - Energy efficient.	- Significant space requirements; - Difficult to maintain ideal composting conditions; - Low control over odour, leachate, pests, etc.; - Labour intensive; - Difficult to achieve consistent results; - Not ideal for most solid wastes from SH.

Processing Methods		Beneficial End Product(s)	Advantages	Disadvantages
	Landfilling	- Not Applicable.	- Simple operation; - Low costs (currently).	- Although currently the costs are not high, following KSA diversion targets they are likely to increase; - Can potentially contaminate soil and groundwater; - Poor- or non-engineered landfills lead to significant greenhouse gas emissions (methane and carbon dioxide); - Land degradation and loss of property value; - Loss of recoverable resources.
NOTE: Destruction of pathogens does not necessarily mean that all pathogens are destroyed. TSE for instance is harder to destroy than most pathogens and even some treatment methods will require specific provisions to eliminate it.				

The above provisions are merely indicative and should not exempt any facility from performing a feasibility study to assess the materials of animal origin that are (or will be) generated, and the best course of action for its management, treatment and/or disposal.

9 Marketing Management Strategies

9.1 Market Assessment

As mentioned in previous sections of this document, slaughterhouses generate essentially two types of materials:

- Edible Products (the main objective of the slaughter); and
- Other materials of animal origin (any material originated from an animal, not meant for human consumption).

Virtually 100% of the materials of animal origin generated in the slaughter process can be exploited to some extent and be considered a useful material (pending the fulfilment of any conditions as issued by the Authorities), instead of a waste. In order to avoid the classification as waste, the materials generated in any given slaughterhouse facility should be assessed taking into account certain considerations such as:

- **Local market.** The use of certain animal parts can depend on the local needs, both regarding eating habits and other uses such as agriculture. Local and regional delicacies, for example, may create niche market opportunities that allow the use of body parts that would otherwise become waste;
- **Regional facilities/infrastructure.** Processing certain animal materials into usable products requires specific facilities. The existence of such facilities in close proximity to the slaughterhouse will impact the costs (regarding distance and material handling, as organic waste requires special care in order not to degrade) and the overall feasibility of such opportunities;
- **Health constraints.** Given the nature of the materials processed and the possible health implication of handling and consuming certain animal parts (due to permanent restrictions such as SRM, or spontaneous outbreaks) certain opportunities may not be applicable in restricted areas;

The industry for materials of animal origin handles all of the raw materials that are not directly destined for human consumption, and some that may be eventually destined for human consumption. After processing, the raw materials can have various applications (e.g., food and feed, cosmetics, medicinal products, fertilisers, etc.). Due to food and feed safety concerns an increased proportion of these materials are disposed of as waste.

Efficient utilization of materials of animal origin has direct impact on the economy and environmental pollution. Non-utilisation or under-utilisation of these materials not only leads to loss of potential revenues but also to the added and increasing cost of disposal of the materials as waste. A list of some possible applications for materials of animal origin to divert from a classification as waste is presented in Table 9-1.

Table 9-1: Commercial Applications of Materials of Animal Origin from Slaughterhouses

Material of Animal Origin	Commercial Application	Observations and Examples
Hides and Skins	- Leather and Textiles	Leather is a commonly used by-product in clothes, belts, footwear, wallets, car and household upholsteries, etc.
Hoofs and horns	- Hoof and horn meal - Gelatin and keratin extraction	Hoofs and horns are commonly used for combs, buttons, fertilizer, collagen, glue, gelled food products, foaming in fire extinguishers, etc.
Bone	- Bone meal - Extraction of collagen	Bone can be used to produce cutlery handles, bone gelatine, bone meal, collagen, etc.
Blood	- Blood meal (human and pets) - Pharmaceuticals - Fertilizer	Blood contains easily assimilated iron, good for human or pet food. Also, blood proteins have a high nutritional value and a high-water binding capacity in processed products, valuable to use as a replacement for raw materials in other industries or as fertilizer.
Intestine	- Sausage casings - Surgical sutures - Musical Instruments	Intestines can be used in musical strings, collagen sheets, sausage casings, human food, pet food, tallow, prosthetic materials, etc.
Organs and glands	- Pharmaceuticals - Medicinal - Xenotransplantation	Organs and glands can be used for heart stimulants, heparin, corticotrophins, enzymes, steroids, oestrogen, progesterone, insulin, etc.
Hair/wool	- Textiles - Extraction of keratin	Hair and wool are used for cloths or woven fabrics, mattresses, keratin, carpets, knitted apparels, insulators, etc.
Oils and Fats	- Food (human and pets) - Cosmetics - Medicinal	Animal fats can be used to produce soaps, margarine, candles, face moisturizer, oils and balms, etc.

Compost from SRM and non-SRM have different possible uses. SRM compost can be used on-site and off. On site, this compost can be used on the lands owned by (and contiguous with) the slaughterhouse. It is recommended that the land to which the compost is applied should not be used for crops destined for human consumption, feed, or for grazing by domestic animals (for at least six years after the last application).

For use off-site, SRM compost cannot be sold, and approval for moving the material off-site is required along with approval for the method of application or disposal.

Non-SRM compost can be used on the land owned by the slaughterhouse, whether contiguous or not. This compost may also be sold for use off-site, in which case approval from the competent authority is needed.

9.2 Shared Treatment Facilities

Several technologies presented in Section 8 require large investment, which may render them unattractive for smaller slaughterhouses. Nevertheless, the treatment of slaughterhouse waste generated at these facilities is paramount. And there may be an opportunity to share waste treatment and/or disposal facilities, between two or more companies, adopting an operational strategy based on economy of scale.

Economies of scale represent cost reductions that occur when companies increase production, or facilities are shared amongst more than one company splitting costs like installation, administration, and maintenance, while reaping all the benefits of such a facility. While implementing a treatment facility for a single use is expensive - and not feasible for most slaughterhouses - the potential for implementation of shared facilities may pose a beneficial strategy to reduce costs with disposal of waste or preparation of certain materials of animal origin.

With access to shared treatment facilities, smaller slaughterhouses have the opportunity to generate income from a material that would otherwise be disposed of as waste and have disposal costs. There is also the advantage of reducing the environmental impacts of slaughterhouses, through the promotion of (and contributions to) the circular economy.

10 Health and Safety Requirements

Health and safety requirements can be defined as the regulations and procedures intended to prevent injury and ill-health to employees, and those affected by their work. In the KSA, slaughterhouse activities are regulated by MEWA and should therefore abide by their license and operating conditions above any others.

Slaughterhouse activities expose workers to a variety of work-related risks, such as: hazardous materials of various types, biological/infectious hazards, and powerful machinery, among others. For those reasons, health and safety provisions are of extreme importance for slaughterhouse activities - including waste management - to prevent harm of any kind for the people involved.

To provide adequate health and safe conditions, and information, to all individuals involved in slaughterhouse waste management, a health and safety plan should be developed for every facility; in line with legal provisions in the sector. The plan should include, at a minimum, the following:

- **Risk assessment.** Assessment of risks (presented by the activities expected to be performed, the materials involved, and the equipment to use, etc.) along with ways to minimize the exposure to these risks;
- **Waste handling provisions.** Proper collection, transportation, storage, or any other processing of the waste; to prevent any harm to the workers performing the task and any other people in the vicinity, or at later stages of waste processing;
- **Personal Protective Equipment.** For use in each waste and / or waste involving activity;
- **Training requirements.** All personnel working on site (or specific to undertake certain tasks) are expected to have been trained prior to starting work;
- **Emergency procedures and accident investigation.** Detailed procedures on how to act and who to contact following an emergency situation (such as fire, spill, accident, contact with hazardous waste, etc.) along with subsequent investigation procedures (to determine causes and potential measures to prevent reoccurrences).

Additionally, slaughterhouse facilities must follow a set of provisions targeted to the protection and wellbeing of everyone conducting activities on the premises, such as:

- All facilities must be equipped with changing rooms and toilets for personal hygiene, and somewhere safe to eat and drink;
- An internal communications or alarm system capable of providing immediate emergency instructions or warnings to all personnel;
- A device, such as a telephone (immediately available at the scene of operations) or a hand-held, two-way radio, capable of summoning emergency assistance from local fire departments, ambulance, or emergency response teams;
- Where combustible and/or flammable wastes are stored, areas should be equipped with automatic smoke detectors and, where necessary, fire suppression systems (such as automatic sprinklers);
- Portable fire extinguishers, fire control devices (including special extinguishing equipment, such as that using foam, inert gas, or dry chemicals), spill control materials, and decontamination supplies;

- Water of adequate volume and pressure to supply hoses; along with foam-producing equipment if appropriate.

Where combustible wastes are stored or processed, it is good practice to develop a fire prevention and management plan. This to be agreed with the relevant emergency services and approved by the Centre and covering: the management of combustible and/or flammable wastes, fire detection (suppression and fighting) equipment and emergency procedures.

In addition to personal protection equipment and the emergency equipment mentioned above, other collective protective equipment should be used whenever; possible to minimize the risks associated with certain areas or machinery in the slaughterhouse. Examples include the following:

- Ventilation and exhaust systems;
- Protection of circuits and electrical equipment;
- Fixed guards to enclose dangerous machinery parts;
- Use of high visibility signs to alert high risk operations;
- Movable guards when access to dangerous parts is essential. These guards should be fitted with interlocking devices so that the machines cannot be started before the guard is closed (or opened) while the machine is still moving;
- Perimeter guarding/fencing to prevent accidental exposure.

In addition to the above, slaughterhouse activities also present biological risks, both to the workers and the general public. These risks include potentially infectious diseases and exposure to bacteria that may cause harm to human health, and therefore require particularly careful planning and handling. In order to prevent and reduce the risk of illness, certain steps can be performed at the facilities, such as:

- Use of hot water sanitizers for utensils;
- Proper handwashing;
- Good manufacturing processes to prevent contamination;
- Use of adequate personal protection equipment.

When an animal is detected with signs of disease, all steps must be taken to isolate it and any other animals that were in contact with it. In the event of an infectious or potentially hazardous disease that may cause harm to the general population, the relevant authorities must be alerted.

At a minimum, all legal requirements regarding health and safety for slaughterhouse activities must be followed.

11 Data Recording, Monitoring and Reporting

11.1 Data recording

The operators of a slaughterhouse are advised to implement, use, and maintain a computerised waste tracking system, and hold up-to-date information regarding the waste generated, recovered, treated, or disposed of at the facility or a designated waste service provider.

The slaughterhouse operator is strongly advised record, monitor, and report data on waste according to the requirements established by the competent authorities. The minimum information to be kept up to date is as follows:

- Details of all waste generated on the site;
- Details of the outputs obtained after any waste treatment in the plant including the weight and the final destination;
- Details on the duration of the outputs stored within the site awaiting recovery/recycling;
- Any incidents that resulted, or could have resulted, in an uncontrolled or unpermitted release from the site, such as a spillage of waste into the surface water drainage system; and
- Any accidents involving waste or waste transporting vehicles or waste processed in the plant that resulted in injury to staff or the public or serious damage to property.

The waste recording system should be able to produce information about the waste streams generated in the waste facility, including the following:

- Total amount of waste present on site at any one time;
- Breakdown of the quantities of waste stored, pending on-site processing, or awaiting onward transfer;
- Location of batches of waste, based on a site plan.

In addition to the above, slaughterhouse operators should record, monitor, and report all environmental related parameters (water quality, air quality, noise, dust, etc.) according to the requirements of the Environmental Permit issued by the competent authority (NCEC) for the facility.

11.2 Monitoring

Each facility should designate a person who is responsible for monitoring the generation and management of slaughterhouse waste. This monitoring should be conducted as follows:

- Periodically but irregularly undertake inspections to check the integrity of the equipment in the facility to prevent/reduce the risk of major accidents, ensure that hazardous and non-hazardous wastes are properly accommodated, there is no overfilling of recipients, the waste transfer procedures are adequate, the labelling is accurate, and any temporary storage areas are not used for excessive periods of time, etc.;

- The responsible person should ask questions of those responsible for handling the waste as to whether they have encountered any problems and what suggestions, if any, they may have for improvements; and
- The data on waste outputs should be interrogated, and the amount and types of different wastes in store compared with the amount of waste visible in the storage area and any differences noted and acted upon.

11.3 Waste Data Reporting

The designated person should use the data recorded above to monitor the generation and the management of waste at the slaughterhouse, on an ongoing basis. The designated person must prepare reports regarding all aspects related to waste, such as: production, processing, after treatment storage (if applicable), waste redirected to service providers for recycling/recovery or final elimination. They should also provide a copy of these to the competent authorities periodically (as determined by these authorities).



موان MWAN

المركز الوطني لإدارة النفايات
National Center for Waste Management