GUIDELINE MANUAL FOR THE MANAGEMENT OF ABATTOIRS AND OTHER WASTE OF ANIMAL ORIGIN

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ACKNOWLEDGEMENTS

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ABBREVIATIONS

AWMF	Abattoir Waste Management Facilities
BOD	Biochemical Oxygen Demand
BSE	Bovine Spongiform Encephalopathy
CE	Consulting Engineers
COD	Chemical Oxygen Demand
DWEA	Department of Water and Environmental Affairs
ECO	Environmental Control Officer
GDARD	Gauteng Department of Agriculture and Rural Development
ELO	Environmental Liaison Officer
MSA	Meat Safety Act, 2000 (Act No. 40 of 2000)
NWA	National Water Act, 1998 (Act No. 36 of 1998)
SEMP	Standard Environmental Management Plan
SABS	South African Bureau of Standards
SAHRA	South African Heritage Resource Agency
SAMOAC	South African Manual for Outdoor Advertising Control
TDS	Total Dissolved Solids
TSS	Total Soluble Solids

DEFINITIONS

"**Alkaline hydrolysis"** – a technique for destroying prions that cause BSE. Because the process hydrolyses proteins, BSE-infected material and any infectious material (i.e. prions), can also be safely degraded. By-products are biodegradable.
"By-products" – abattoir wastes from the carcass, other than the carcass and edible offal during the slaughter process
"Condemned area or room" – an area or room dedicated to keeping condemned material.
"Condemned material" – an animal or parts of an animal inspected and judged, or otherwise determined, to be unacceptable for human and animal consumption and requiring sterilising or destruction.
"Decommissioning" – a process that entails the retiring of a facility that is no longer necessary.
"Exsanguination" – a process to drain blood from a body.
"Evisceration" – to disembowel and remove entrails of a carcass.
"Health care general waste" – the non-hazardous component of waste generated by a generator and can include liquids, but excludes:
health care risk waste;
health care waste generated from isolation wards; and
'health care risk waste' means waste capable of producing any disease and includes but is not limited to the following:
Laboratory waste;
Pathological waste;
Isolation waste;
Genotoxic waste;
Infectious liquids and infectious waste;
Sharps waste;
Chemical waste; and
Pharmaceutical waste.
"Health care risk waste container" – a rigid puncture resistant and leak resistant receptacle in which health care risk waste is placed.
"Health care waste" – health care general waste and health care risk waste.
"Inedible material" – parts of an animal unsuitable for human consumption but not requiring destruction.
"Infectious agent" – a type of micro organism including spores, bacteria, fungi, a parasite, or a virus which normally causes, or significantly contributes to the cause of, increased morbidity or mortality of human beings.
"Infectious waste" – waste which is:
Suspected to contain pathogens; and
Which normally causes, or significantly contributes to the cause of increased morbidity or mortality of human beings;
but excludes baby-nappies and sanitary pads which are not isolation waste.
"Lairage" – a structure at abattoirs to temporarily house animals before slaughtering.
"Leak resistant receptacle" – a receptacle which is constructed of impermeable material, and which has no side or bottom openings, and which has a strength sufficient to preclude ripping, tearing, or bursting under normal conditions of usage and handling when full.
"Major generator" – a generator that generates more than 20 kilograms per day of health care risk waste, including the container, calculated monthly as a daily average.
"Manage" – to handle or deal in any way with health care risk waste, including but not limited to; plan for, collect, receive, segregate, containerise, transport, treat or finally dispose of such waste.

"Minor generator" – a generator that generates up to 20 kilograms per day of health care risk waste, including the container, calculated monthly as a daily average, but does not include a domestic generator.

"**Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste"** – the Minimum Requirement's document which forms part of the Waste Management Series (second edition), produced by the Department of Water Affairs and Forestry in 1998, as amended from time to time.

"Non-hazardous waste" – waste that does not cause an immediate or long term threat to human health or to the environment.

"Paunch" – The first division of the stomach of a ruminant animal, in which most food collects immediately after being swallowed and from which it is later returned to the mouth as cud for thorough chewing.

"Pharmaceutical waste" –

(a) Pharmaceutical products and medicinal chemicals that are no longer usable in human or animal treatment, and that have become outdated or contaminated or are no longer required; and

(b) Items contaminated with cytotoxic Pharmaceuticals.

"Protocol" – a particular procedure or specific measures intended to minimise risk in a particular situation that have been agreed to by the parties concerned and approved under these regulations by the provincial executive officer.

"Puncture resistant receptacle" – a rigid receptacle which is not easily penetrated under normal use.

"Putrefaction" – Decomposition of organic matter, especially protein, by microorganisms, resulting in production of foul-smelling matter (The American Heritage® Stedman's Medical Dictionary Copyright © 2002, 2001, 1995 by Houghton Mifflin Company. Published by Houghton Mifflin Company).

"Red offal" – the lungs, heart, liver, diaphragm, spleen, tongue and demasked head of the slaughtered animal

"Rendering facility" – a facility that uses heat to disinfect the carcass.

"Rough offal" – stomach, intestines, feet and skin-on head of the slaughtered animal except in the case of pigs, where the head and feet are part of the carcass

"Sharps receptacle" – a puncture resistant receptacle which when sealed cannot be opened without great difficulty, and which is spill resistant under normal handling conditions.

"Sharps waste" – waste having acute rigid corners, edges, or protuberances capable of cutting or piercing, including, but not limited to the following:

(a) Hypodermic needles, syringes, blades, and needles with or without attached tubing; and

(b) Broken glass items, such as Pasteur pipettes and blood vials contaminated with health care risk waste.

"Sludge" – sediment resulting from treating waste or sewage.

•**"Sterilise"** – with respect to an object, the total destruction of all microbial forms to make the object free from all live bacteria or other micro-organisms.

"Stunning" – to render an animal senseless before commencing with the bleeding and dressing process.

"Storage" – the keeping of health care risk waste in a manner that does not constitute treatment or disposal of such health care risk waste.

"Viscera" – the soft internal organs of the body that are usually contained in the abdominal and thoracic cavities, the intestines.

PART 1: TECHNICAL COMPONENT

1. INTRODUCTION

The National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) forms the basis of environmental management in South Africa. The management of abattoir- and other waste of animal origin
fall under the ambit of NEMA.
Waste management is considered to be a broad field, which includes the generation, storage, transport, treatment and the ultimate disposal of all types of waste streams. As a result of such a broad definition, the management of waste spans the jurisdiction of several government departments, across all three spheres of government (National, Provincial and Local).

The new Environmental Impact Assessment Regulations, as promulgated in April 2006, under section 24(5) of the NEMA and published in Government Notice No 385 require that an environmental impact assessment procedure be undertaken for activities that would require the disposal, and treatment of waste and hazardous waste.

In addition to GDARD's regulatory authority with respect to Abattoir Waste Management Facilities (AWMF's), GDARD intends to commence with the evaluation of the environmental performance of Gauteng's existing AWMFs. This will be done in accordance with the broad environmental mandate assigned to the Gauteng Provincial Government by the Constitution, with the goal of improving service delivery to Gauteng's people.

Given the complexity and wide range of issues relating to AWMF's, GDARD has decided to develop an Abattoir Waste Management Guideline Manual (AWM Guideline Manual) to assist with the undertaking of tasks relating to AWMF's in a consistent manner.

Following an invitation to tender in the above regard Strategic Environmental Focus (Pty) Ltd (SEF) was appointed for the development of an Abattoir Waste Management Guideline for the evaluation of EIA applications and the undertaking of performance evaluations.

Please note that the AWM Guideline Manual is meant to be a guideline document and is not regarded as legislation. The abattoir facility is to strive to strictly adhere to the contents of the document until such time as the implementation period has lapsed. The implementation period will be stipulated by the GDARD which is at least 5 years from the implementation of this guideline.

2. BACKGROUND TO THE ABATTOIR INDUSTRY AND PROCESSES ASSOCIATED WITH THE ABATTOIR INDUSTRY

An abattoir is loosely defined as any registered facility that is responsible for the conversion of animals to meat via a slaughtering process. This includes livestock, poultry and special classes of animals, e.g. crocodiles and game.
The slaughtering process remains critical in ensuring that consumers receive a hygienically safe product. The Meat Safety Act, 2000 (Act 40 of 2000) (MSA) governs and addresses measures to promote the safety of meat and animal products and to establish and maintain essential national standards in this regard. Prior to the deregulation process, the abattoir industry in South Africa comprised mainly of larger abattoirs with high throughputs. Until the early 1990's most slaughtering took place in controlled areas. These abattoirs were built with sterilising plants to provide for the handling of blood and condemned products.

In some cases, abattoirs were only equipped with pre-breaking facilities following which the pre-broken products were transported to a central sterilizing plant in bulk containers.

Following deregulation, medium sized abattoirs with a throughput between 50 and 100 units per day increased their contribution to the total annual slaughter significantly.

The number of abattoirs increased to over 470 in South Africa with a vast numbers of smaller abattoirs with a low throughput, included in this number.

Many of these smaller abattoirs relied on denaturing as a sole option for the disposal of condemned products and blood. With the increase in slaughtering and structural changes to these abattoirs over the past ten years, by-product treatment, in any form, was not included as a prerequisite.

In 1986 the emergence of Bovine Spongiform Encephalopathy (BSE or "mad cow disease") led to restrictions being imposed on animal waste from cattle, which can be used to produce meat-and-bone meal for incorporation in animal feeds (Red Meat Abattoir Association, 2000). These restrictions rest on the judgment that certain specified bovine offal, namely the brain, spinal cord, thymus, spleen, tonsils and intestines, are the tissues most likely to contain the agent that causes BSE. From September 1990, the law banned the use of meat-and-bone meal derived from such waste in any animal or poultry rations.

With regards to the more technical background aspects, abattoirs require water with a very high quality due to the processing of materials destined for human consumption. The annual (high quality) water consumption by the red meat industry in 1989, was estimated at approximately 5,8 million cubic metres (m3). Approximately 84% of this water was discharged as wastewater effluent containing high organic loads, with the following range of characteristics:

- pH 5,7 to 8,4;
- COD 2 380 to 8 942 mg,
- Total Kjeldahl Nitrogen 0,71 to 24 mg/L
- suspended matter (typically suspended solids 189 to 3 330 mg/L; and
- TDS 595 to 2805.

Due to the wastewater effluent having high organic loads, it is regarded to be of poor quality.

Based on current knowledge, no South African abattoirs operate on a closed water circuit, as in general, it is prohibitively costly to treat waste water to a water quality standard fit for recycling and/or re-use. Thus, most abattoirs discharge (after appropriate pre-treatment) to municipal sewers. These effluents have to comply with municipal by- laws which could be typically described as having values around:

- a COD of 3000 to 5000 mg/L;
- TSS of 500 mg/L;
- NH3-N of 200 to 300 mg/L; and
- pH 6 to 10.

Discharge costs due to the high organic loads in the untreated abattoir waste water are relatively high. Abattoirs normally also have difficulty in meeting municipal by- law quality standards for fats, oils, greases and suspended solids. A degree of on-site pre-treatment is thus necessary. However, to minimise waste volumes, water conservation and optimum water housekeeping are essential. In addition to good abattoir housekeeping, abattoir waste management should be progressively implemented commencing with low-cost, low-technology practices and thereafter progressing to more sophisticated technologies.

The management of abattoir waste is regulated through NEMA, the National Water Act, 1998 (Act. 36 of 1998) (NWA) the MSA and sections 24a and 24b of the Constitution of South Africa, 1996.The development of the Manual will be guided by the pollution prevention philosophy based on the sequential approach of waste prevention, followed by waste minimization, re-use and recycling and only then waste discharge or land disposal at prescribed water quality or disposal standards (providing for exemption in well motivated cases).

2.1 ABATTOIR CLASSIFICATION AND GRADING

Abattoirs are registered in terms of the MSA. The design drawings of such a facility must be submitted to the provincial executive officer for evaluation and approval. All abattoirs then undergo a grading process and are bound to comply with statutory grading requirements. Currently there are 86 registered abattoirs in Gauteng Province. The grading of abattoirs is based on the throughput units, which is the amount of animals that can be hygienically processed in a specified time, in addition to structural requirements. A unit in relation to a quantity standard for determining throughput for abattoirs means:

Category	One unit equals
Red Meat	1 Cow, ox or bull (including heifers)
	2 Calves[1] (younger than 6 months)
	1 Horse
	6 sheep or goats
	4 small pigs
	2 bacon pigs
	1 sausage pig
Poultry	1 fowl, duck, pheasant or guinea fowl
	4 pigeons
	2 partridges
	12 quails
	3 baby fowl (petit pousons)
	Whereas 1 goose equals 2 units, and
	1 turkey equals 4 units
Game	1 Category A (large) game with special protocol only
	1 Category B (medium) game
	6 Category C (small) game
Ostriches	2 ostriches
Crocodiles	1 crocodile
Rabbits	1 rabbit

Abattoirs are then graded according to the structural requirements as well as the maximum throughput as specified in the Regulations promulgated under the MSA:

- Rural abattoirs
- Low throughput abattoirs
- High throughput abattoirs

Export abattoirs are usually but not necessarily, high throughput abattoirs that also meet the additional requirements of the importing countries (if any) and that have been allocated an Export number (ZA number) by the National Department of Agriculture.

2.2 ABATTOIR PROCESSES

This section provides an indication of the processes followed in the different types of abattoirs.

2.2.1 Red Meat Abattoir Processes

The animals are received on trucks at the reception area and are offloaded. An ante-mortem inspection is then conducted in the reception area to determine the animals' conditions.

Healthy animals are sent to the lairages. Animals with questionable health (e.g. animals that are sick) are sent to the

isolation pens for monitoring. Animals that arrive dead are sent to the post-mortem area for destruction. Animals that arrive injured are either sent to the emergency slaughter area or if unfit to the post-mortem area for killing and destruction.

Animals will be taken from the lairages and emergency slaughter area to where stunning, hoisting and bleeding takes place. Once killed the animals pass from the dirty area to the clean area where the following takes place:

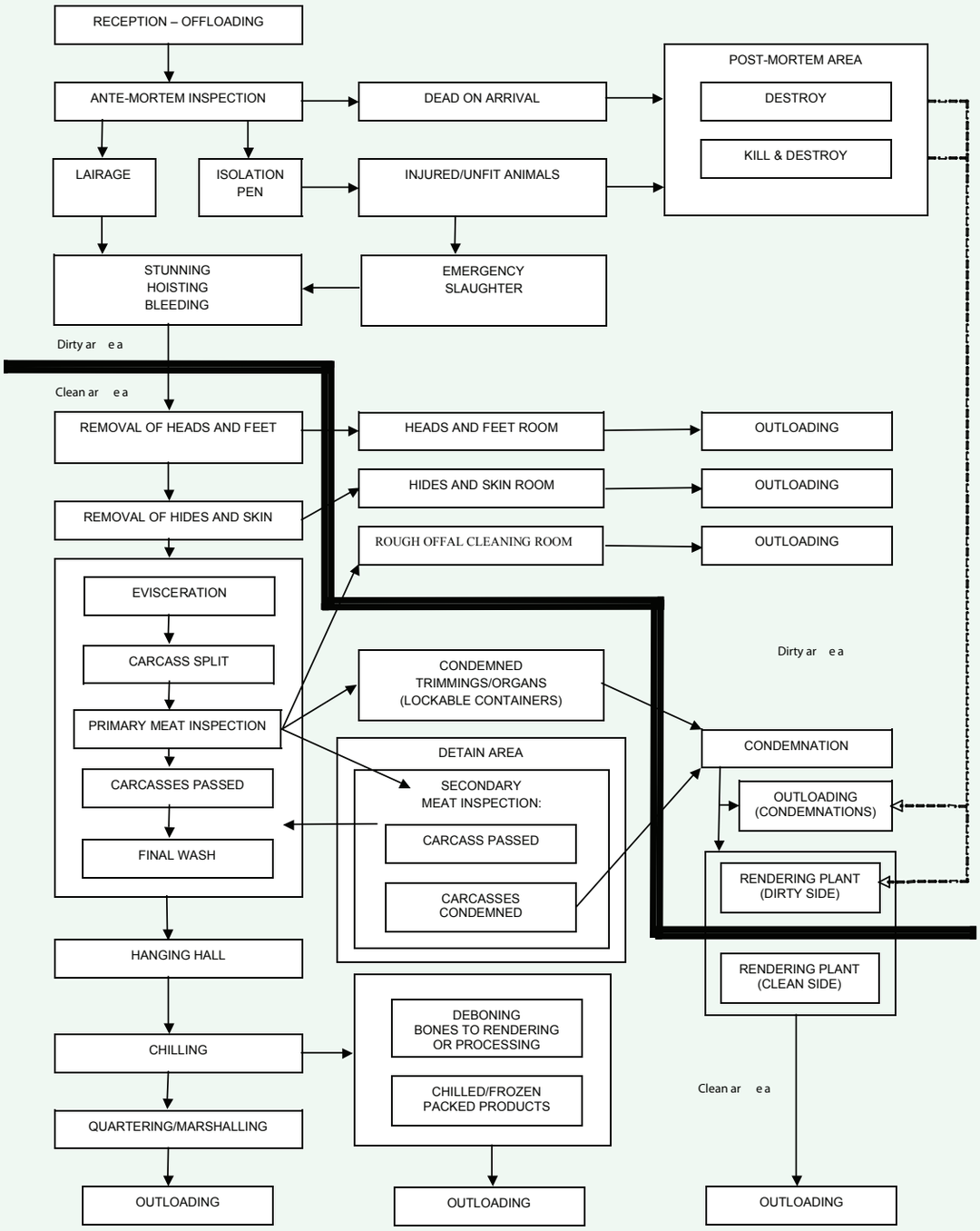
- Removal of heads and feet;
- Removal of hides or skins;
- Evisceration;
- Carcass is split;
- Primary meat inspections; and
- Secondary meat inspection.

If the carcasses pass the primary meat inspection, they pass through a final washing process and are sent for hanging and chilling. The offal is sent to the rough offal cleaning room and then sent to the outloading area. Condemned trimmings or organs are sent to the condemnation area in lockable containers for destruction. Carcasses, which do not pass the primary meat inspection will be put through a secondary meat inspection where they will be passed or condemned (Note: Any carcasses, that fail an inspection are condemned and sent to the rendering plants for destruction via processing). All non-usable by-products (except paunch contents) derived from the carcases are sent to the rendering plants. All heads, feet, hides and skins are sent to their respective outloading areas.

Once the carcasses have been chilled, they may be sent for quartering/marshalling and finally to outloading. After chilling some carcasses will be deboned, frozen and then packaged after which they will be sent to outloading. All bones from the deboning process are sent to the rendering plant where they will be destroyed or sent to outloading as carcass meal.

Figure 1 on the next page details the flow diagram of a larger red meat abattoir. Personnel movements within the respective sections are not shown.

Figure 1. General Flow Diagram of High Throughput Red Meat Abattoir Operations



2.2.2 Poultry Abattoir Operations

Large-scale poultry operation starts with the breeding of chicks through a number of stages of chicken production, to the processing plants despatch area at the end stage of processing. By-product processing is also carried out at several processing sites. Poultry processing consist of a number of steps. Each step is followed by the next in strict sequence. Each step entails a specific task, which has to be performed effectively and hygienically. It is essential to distinguish between hand operated lines and mechanical lines. In low throughput abattoirs most of the functions are carried out by hand where as the high throughput abattoirs, these functions are mechanised.The following flow diagram demonstrates the flow of the processes in an high throughput abattoir (Figure 2).

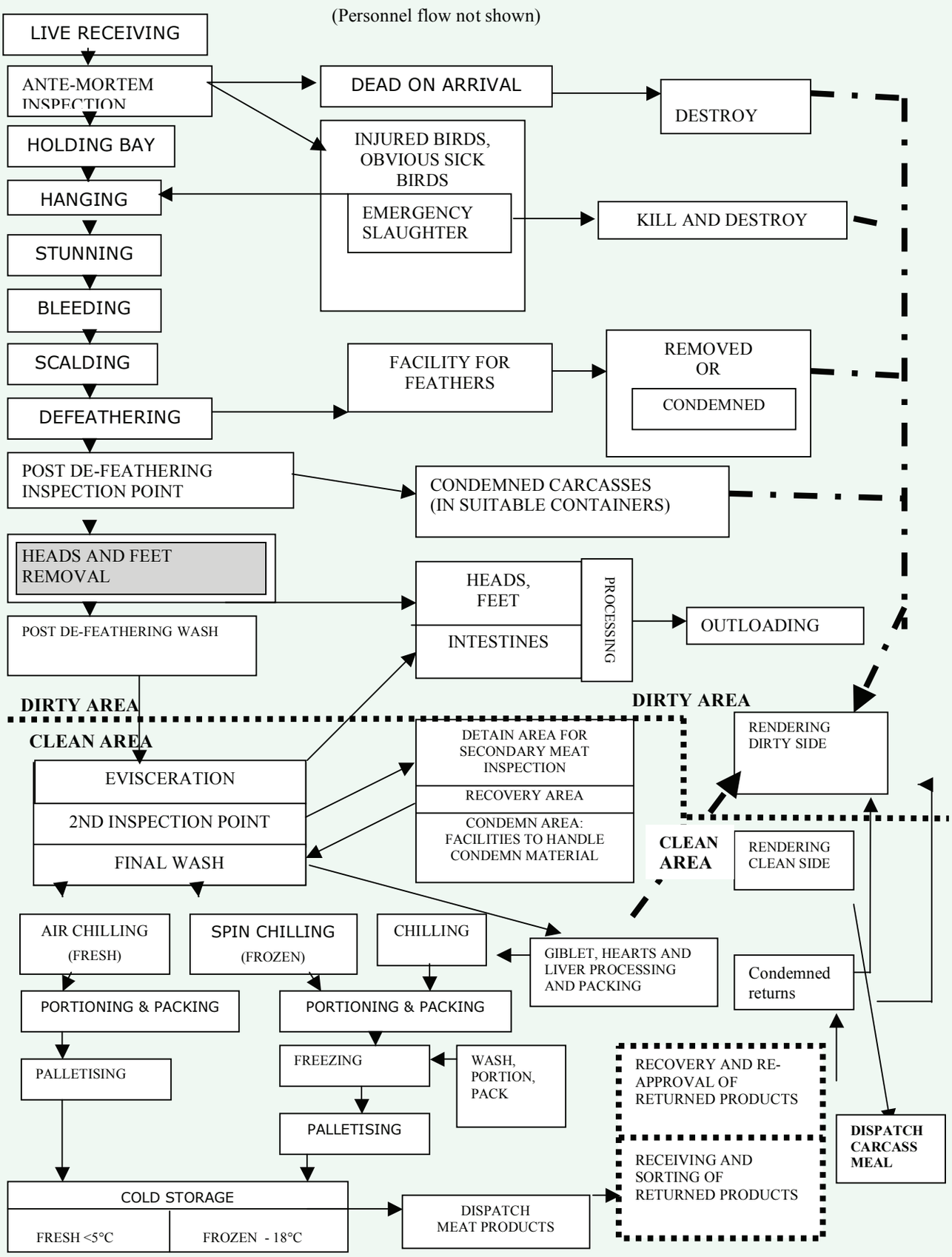


Figure 2 General Flow Diagram of High Throughput Poultry Abattoir Operations

2.2.3 Crocodile Abattoir Operations, Australian and Zimbabwean Examples

The slaughter of crocodiles is fairly labour intensive. Animals selected for slaughter are either culled and bled in the pen or stunned and immobilised before removal to the abattoir where the slaughter process is continued. If the crocodiles that were killed and bled in the pen cannot be moved to the abattoir immediately for processing they could be hanged by the tail under refrigeration but must then be eviscerated within 24 hours after killing.

With the slaughtering of crocodiles the skin is the first consideration of the process, meat is of secondary importance. Crocodiles are slaughtered mainly for the export market and very little of the meat and skin find its way into the local market.

The carcase is hung on a frame and allowed to bleed out. Once the crocodile has bled out, the cloaca is plugged. The carcasses are then washed and sanitised.

Carcasses are then passed by hand through to the processing room, where the carcasses are skinned. Once skinned, the carcasses are moved to the evisceration room for evisceration. The carcasses are then transported into the boning room and boned on tables and the tail and legs are removed.

Meat is then vacuum packed into bags and placed in a freezer until a sufficient number is available to fill a carton. Cartons are loaded and stored appropriately for shipment.

The following flow diagram summaries the slaughter process for crocodiles (Figure 3) on the next page.

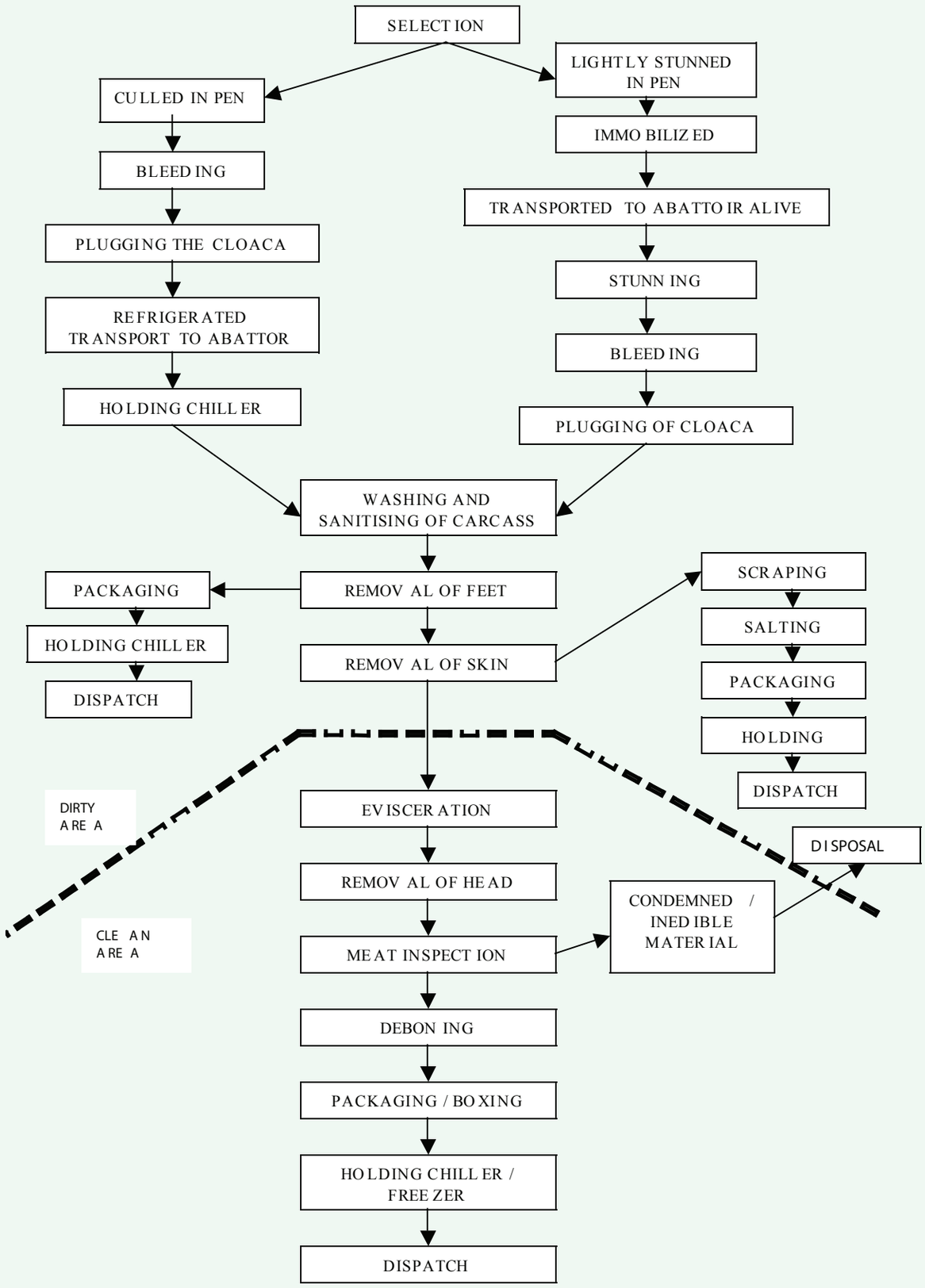


Figure 3 General Flow Diagram of Crocodile Abattoir Operations

2.2.4 Game Abattoir Operations

Game is obtained from two sources: harvesting by professional hunters for commercial use or non-commercial hunting for own use. Hunted game is classified according to size into the following categories (Draft Game Meat Regulations, 2003):

(1) Category A or large sized animals including:

African elephant	*(Loxodonta africana)*
Hippopotamus	*(Hippopotamus amphibius)*
Giraffe	*(Giraffe camelopardalis)*

(2) Category B or medium sized animals including:

Buffalo	*(Syncerus caffer)*
Eland	*(Taurotragus oryx)*
Kudu	*(Tragellaphus strepsiceros)*
Wildebeest (Blue)	*(Connochaetus taurinus)*
Wildebeest (Black)	*(Connochaetes gnou)*
Waterbuck	*(Kobus ellipsiprymnus)*
Gemsbok	*(Oryx gasella)*
Hartebeest (Red)	*(Damaliscus buselaphus caama)*
Tsessebe (Sassaby)	*(Damaliscus buselaphus lunatis)*
Zebra	*(Equus burchelli)*
Mountain zebra	*(Equus zebra)*

(3) Category C or small sized animals including:

Impala	*(Aepyceros melampus)*
Springbuck	*(Antidorcas marsupialus)*
Reedbuck (Rietbok)	*(Reduncar undinum)*
Reedbuck (Ribbok)	*(Reduncar fulvorufula)*
Vaal Rheebuck	*(Pelea capreolus)*
Blesbok	*(Damaliscus dorcas phillipsi)*
Bontebok	*(Damaliscus dorcas dorcas)*
Nyala	(*Tragelaphus angasi)*
Bushbuck	(*Tragelaphus scriptus)*
Bushpig	
Warthog	
Fallow deer	
Letchwe	
Steenbok	

The game is shot in the field, bled and eviscerated with the skin still on the carcass under supervision of a meat inspector who also performs primary inspection on the carcass and offal. If the head and feet are also removed it is referred to as a partially dressed carcass. The rough offal is then either left in the field for scavengers, or buried in the field, or burnt in the field or taken to a sterilizing plant. Best Practice would be to take it to a sterilizing plant.

The carcass is transported to a depot that is either fixed or movable (transferable/detachable) or to a nearby abattoir registered for slaughtering game.

A chiller truck is used to transport the carcasses to a game abattoir. The carcass that arrives at this abattoir has been eviscerated so the next step would be flaying. Care has to be taken at this process so as to not contaminate the meat whilst skinning. Best Practice would be to trim off the meat that has been contaminated.

The process and operation of the meat from this step on is the same as the red meat abattoir process and the waste is dealt with in the same manner.

Some game abattoirs collect the hides of the animals that have been slaughtered and send it to the fur industry. There are also some animal hides that go to tanneries for tanning. These are then processed as various textiles and garments.

Figure 4 on the next page outlines the Game Meat Abattoir operations.

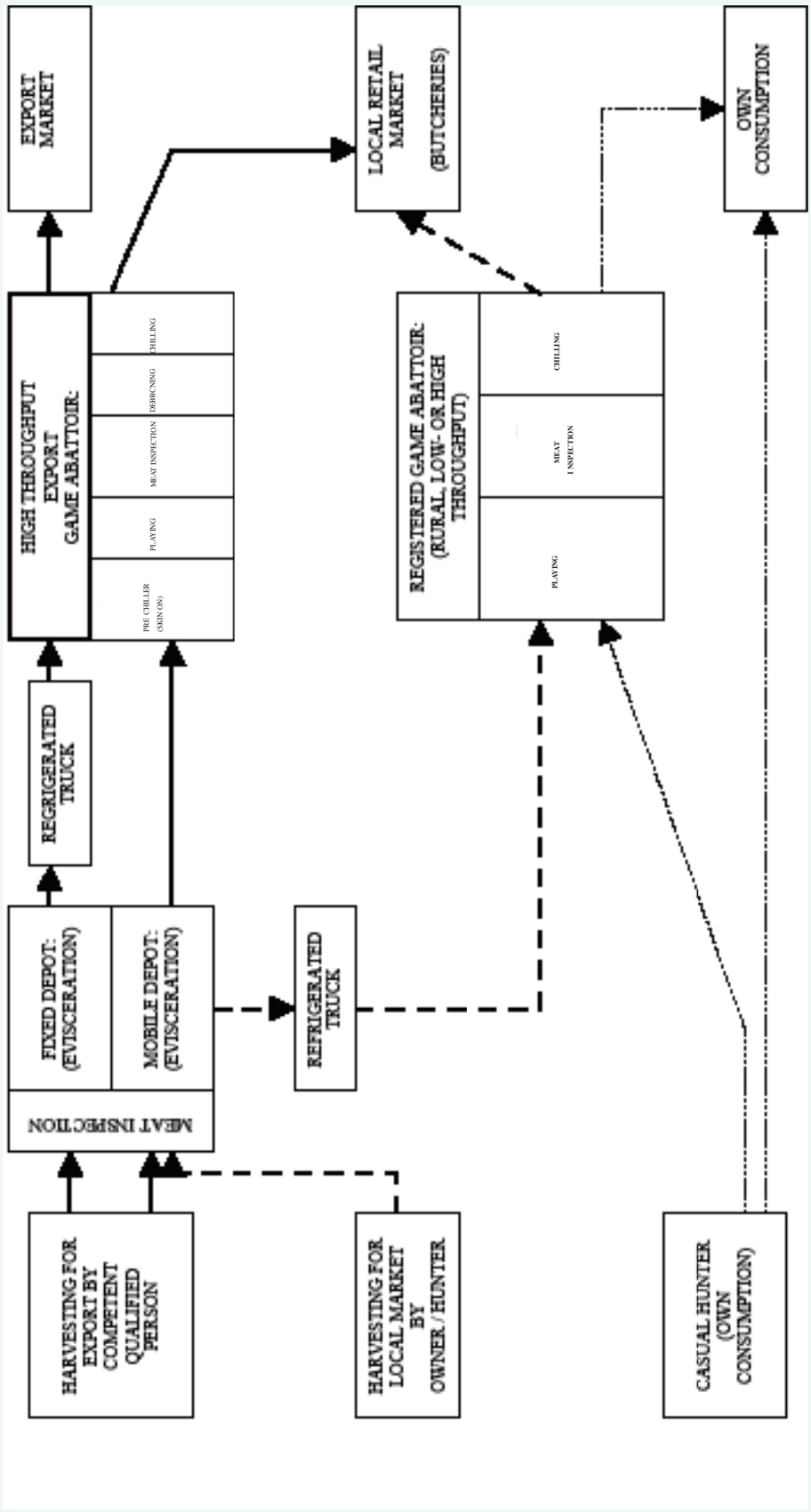


Figure 4: General flow diagram of Game Meat Abattoir

2.2.5 Ostrich Abattoir Operations

Ostriches slaughtered at ostrich abattoirs are commercially bred for this purpose and not hunted like game. From the breeding farms the ostriches are transported live to the abattoirs where they are kept in lairages until slaughtered. Like crocodiles, the skin of ostriches is the primary concern; the meat is only of secondary concern. The feathers are also used commercially. Ostriches are also slaughtered mainly for the export market and only a small portion of production finds it way into the local market.

The intestines of slaughtered ostriches are not considered edible offal and have to be disposed of with the condemned material. However, ostrich intestines are not suitable for rendering in a sterilisation plant and could currently only be disposed of through denaturing or incineration. Alternative methods of disposal e.g. composting could be considered. The following flow diagram summarises the slaughter process of ostriches (Figure 5).

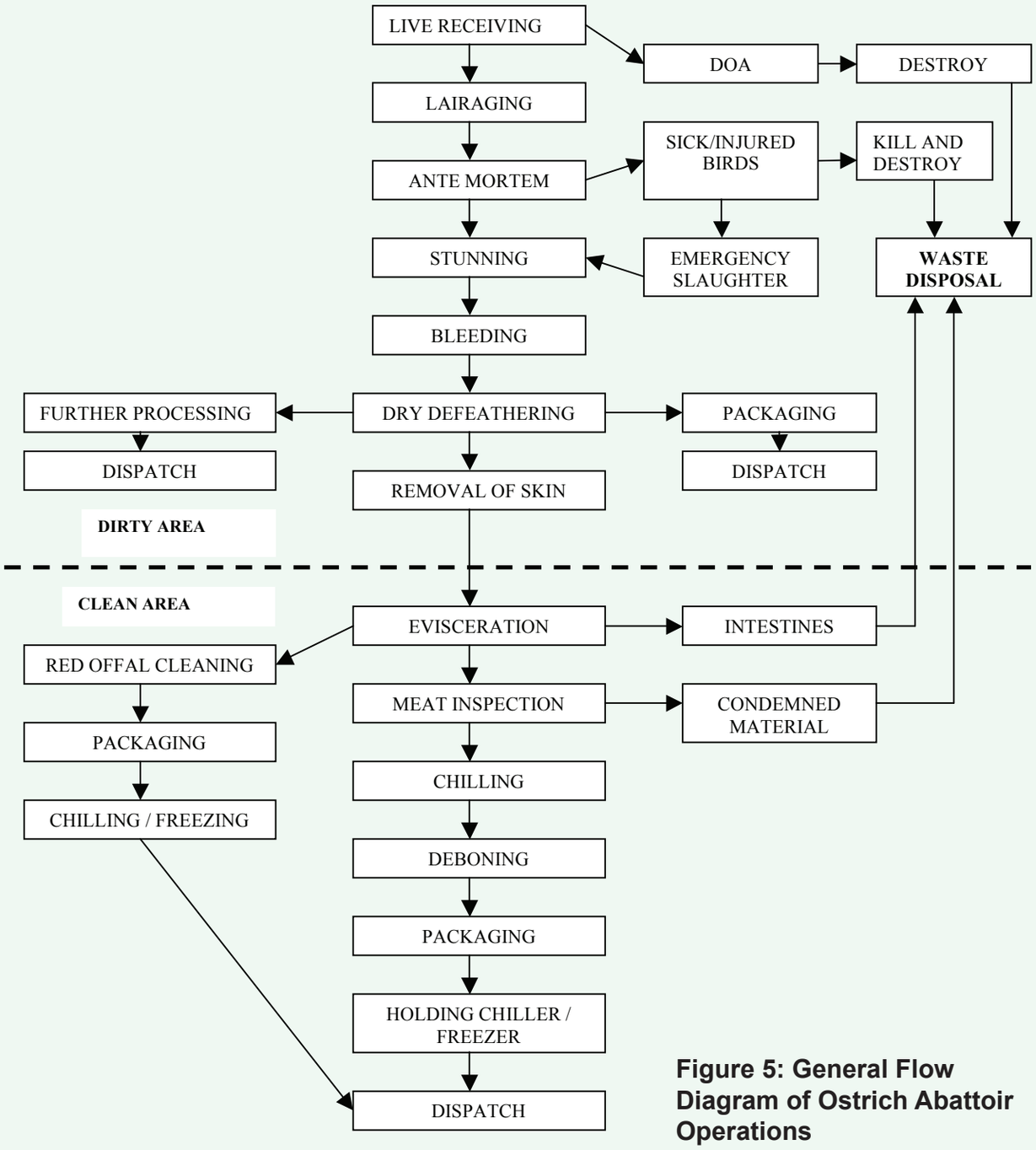


Figure 5: General Flow Diagram of Ostrich Abattoir Operations

2.2.6 Fish Processing Facilities

Catfish

Fish processing facilities receive their fish from fish farms. The fish is transported to the facility via an aerated water tank that unloads into holding tanks. From there the fish are removed and stunned with electrical current. The stunned fish are then mobilised into the processing plant by a conveyor that drops the fish into a holding bin from where the fish are orientated correctly for effective head removal by a band saw. The carcass is then moved to the evisceration area where the body cavity is opened by hand and viscera are withdrawn by use of a vacuum eviscerator. After the removal of the internal organs, the carcass is skinned by a membrane skinner after which it is spray washed and chilled.

The head of the fish is removed by a waste disposal conveyor and the viscera are conveyed to the offal collector from where some of the offal is thrown into catfish ponds for their consumption.

2.3 GENERAL USE OF BY-PRODUCTS SIZE

Abattoir wastes from the carcasses, other than the carcass and edible offal during the slaughter process, are referred to as by-products. By-products are thus inedible material less rejects and waste (Figure 6).

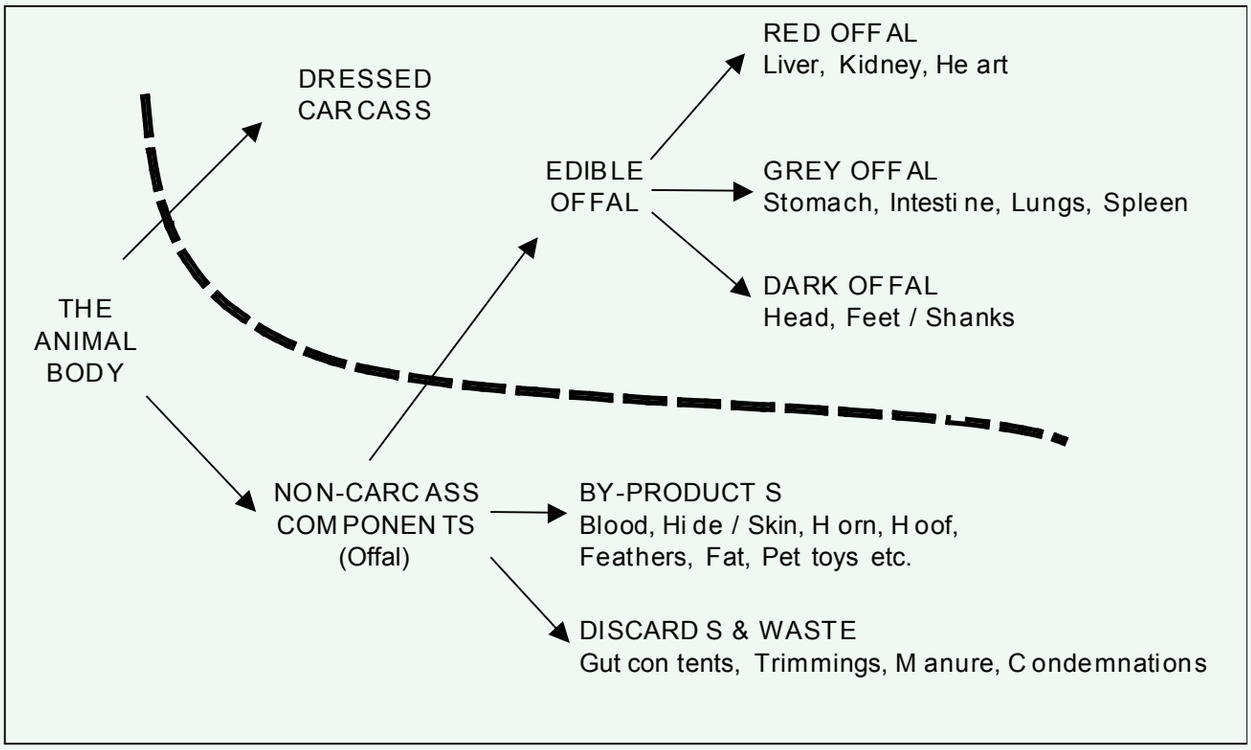


Figure 6:Diagram illustrating by-products (RMAA, 2006)

Apart from hides and skins, the following groups or items of by-products can be considered for processing, taking into consideration their agro-industrial significance:

(a) Soft organs – stomachs, intestines, lungs, carcass trimmings, reproductive structures etc, (where not utilised for food); floor sweepings, drainage trappings and condemned meat – together for rendering into meat/bone meal; It is also used for feeding to crocodiles;

(b) Hard organs – horn and hoof can similarly, though separately, be processed into horn/hoof meal and used as fertiliser, pet-chew toys or gelatine.

(c) Blood – can be sterilised and dried into blood meal and used in animal feed; and

(d) Gut contents and manure (from lairages and kraals) for compost or fertilser production; another possibility here is biogas production.

(e) Feathers / pig hair – protein meals

(f) Hands, feet and some internal organs of crocodiles are sold as food items in Far Eastern countries.

2.4 PROCESSING OF BY-PRODUCTS IN A STERILISATION PLANT

2.4.1 Background to the Production and Handling of By-products

Sterilisation installations are mainly used for the manufacture of stock fodder of animal origin. The raw materials for quality production of meat/bone meal are all parts of the animal, less the skin or hide, hair, horn, hoof, blood and gut contents. This means that they may include skinned heads, feet, bones, viscera and carcass trimmings which are not utilised for food. Condemned material and relevant parts of freshly dead animals can be included but not putrefactive material or that in a high state of decomposition. This material should be incinerated or buried in deep pits.

During the manufacturing of animal feeds containing bones or other material of animal origin the process is as follows:

- The bones or other substances of animal origin must be exposed to saturated steam at a pressure determined after all the air has been replaced by steam and kept at that pressure (133°C at a pressure higher than 3 bars for 20 minutes or longer). In the case of soap products, it must be sterilised by exposure to heat at a temperature determined by the MSA regulations.
- The animal feed must be handled after sterilisation in such a way that contamination from other non-sterile sources is eliminated. The animal feed must be free from pathogenic organisms including Bacillus anthracis and gangrene (clostridium) bacteria, and must not contain putrefactive or other organisms which might affect the health of animals, and all such animal feed must show no signs of decay.
- Animal feed must be sold in containers which are clean and undamaged and have been sealed in a manner suitable to the containers and contents.
- Apart from the terms of the Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act 36 of 1947), the sterilisation unit must also satisfy the terms of the Meat Safety Act.

Aspects concerning sterilising of condemned material:

(1) The premises of a sterilisation plant must be controlled to prevent the entry of unauthorised persons, vehicles and animals; this includes the following areas:
   - (i) The “dirty” area, consisting of the rooms or places where material is received, stored or prepared for sterilisation. The loading opening of the sterilisation apparatus must be in the “dirty” area; and
   - (ii) The clean area, consisting of the rooms or places in which the material is sterilised and dried, ground or otherwise prepared, packed, stored or dispatched.

(2) The clean and “dirty” areas must be physically separated by means of a solid wall and there must be no direct access between the two areas apart from the loading opening of the sterilisation apparatus.

(3) The “dirty” area must meet the following requirements:
   - (i) The entire area must be roofed over and surrounded by walls and must have a continuous floor which drains into the sewage system appropriately;
   - (ii) The entrance to any drain must be provided with a grid to prevent the entry of any solids. The drainage system must be provided with equipment to prevent the escape of offensive smells;
   - (iii) All openings in the wall which are on the same level as the floor must be provided with steps so that waste water cannot escape from the floor other than to the drainage system;
   - (iv) Hand-washing facilities in the “dirty” area must be provided with hot and cold running water, soap, disinfectant and disposable paper towels; and
   - (v) Footbaths with disinfectant must be provided at all exits for the disinfections of boots.

(4) The floors, walls and equipment of a "dirty" area must be cleaned with hot water and disinfected with a suitable disinfectant every day after the work is completed.

(5)

(i) Persons who work in the "dirty" area must:

(a) be provided with and, while on duty, must wear distinctive marked overalls and rubber boots;

(b) disinfect their hands and boots before leaving the "dirty" area; and

(c) remove their dirty protective clothing and boots and wash themselves thoroughly with soap and water before leaving the premises thus suitable facilities to enable them to do this must be provided.

(ii) No person who works in or enters the "dirty" area may enter the clean area or any section of the abattoir for edible products.

(6)

(i) The clean area must be roofed and surrounded with walls and must be provided with a continuous, impermeable floor.

(ii) Hand-washing facilities in the clean area must be provided with hot and cold running water, soap, disinfectant and disposable paper towels; and

(iii) The clean area of a sterilisation installation must be kept in a clean and sanitary condition at all times.

(7)

(i) No person may keep any animal, dog or cat on the premises of a sterilisation installation, or allow it to stay there.

(ii) All possible steps must be taken to keep the premises of a sterilisation installation free from flies, rodents and other vermin.

(8) A road vehicle used to transport condemned material may not be used for any other purpose. However, such a vehicle may be used for the transportation of hides and skins once it has been properly cleaned and disinfected.

(9) A vehicle used to transport condemned material must meet the following requirements:

(i) the freight section must be completely covered and be capable of being locked and sealed;

(ii) the inside lining must be watertight and made of smooth metal;

(iii) the floor must form a unit with the bottom of the sides and the door must be made in such a way that the leakage of fluids from the freight section is prevented; and

(iv) the floor must be provided with an outlet pipe at its lowest point, which can be tightly closed with a screw valve.

(10) The freight space of a vehicle, which has transported condemned material, must be effectively cleaned and disinfected at the end of each day's work in a place specially equipped for the purpose.

(11)

(i) No person may feed any animal in an abattoir with blood, offal or rubbish or allow it to be so fed.

(ii) No person may remove any blood from an abattoir without the permission of the veterinarian or meat inspector.

(12) The veterinarian may authorise the removal of condemned material for the purposes of research and teaching.

(13) If the veterinarian condemns an animal or carcass, meat, offal or animal product, he must provide the abattoir owner, on request, with a certificate describing the condemned product and giving the reasons for condemnation.

Incineration is another method for by-product handling; however, it appears to be more suitable for dealing with whole carcasses than for waste offal, which has high water content and a low calorific value.

The costs of incineration are however relatively high which places the use of this technology out of reach for most of the smaller abattoirs.

2.4.2 Denaturing and Burying

Operators may harvest or salvage certain condemned meat products for animal food with the consent of an official veterinarian. These products may be intended for crocodiles, fish, zoo animals and fur animals. Condemned meat products may be used for animal food provided:

(1) they are derived from carcasses, portions or organs that are not affected with a disease transmittable to the above mentioned animals;
(2) they are derived from carcasses, portions or organs that are not affected with a disease that is a potential cause of problems and hazards for handlers of this material; and
(3) they are derived from carcasses, portions or organs where lesions or conditions mentioned above are removed.

In the case of partial condemnation (i.e. condemnation of portions or organs), such consultation is not necessary, provided the condemned meat products have been trimmed to make them free of transmittable pathogens.

Operators wishing to engage in the harvesting or salvaging of condemned meat products for animal food must provide adequate facilities for the separation, chilling, packing, marking, storage and, if needed denaturing of the product. An approved protocol must be provided which guarantees the secure handling of such products.

3. ENVIRONMENTAL PROBLEMS ENCOUNTERED WITH ABATTOIRS

3.1 THE NEED FOR A MASS DISPOSAL AREA

The mass outbreak of a disease at an abattoir is unlikely, and is more likely on a farm or at a feedlot. It there is an outbreak, a mass disposal area must be identified in the area where the outbreak occurred because infected carcasses may not be removed from the area where the outbreak occurred, since removing them will increase the risk of spreading the disease. However, should there be a sudden outbreak of disease at an abattoir, a bulk animal disposal area must be identified. Such an area should be away from watercourses and must not have the potential to pollute groundwater. The soil should be suitably friable for digging but also as impermeable as possible. Due to the low probability of this occurring at an abattoir, it is not necessary to permanently allocate a suitable area for bulk disposal of diseased animals at the abattoir. The veterinary service authorities will in such an instance develop a solution together with the abattoir owner on a case by case basis.

3.2 LIQUID WASTES

For hygiene reasons abattoirs use large amounts of water in animal processing operations. This produces large amounts of wastewater that must be treated. Effective primary treatment before secondary treatment will increase the overall effectiveness and efficiency of wastewater treatment systems, as it is cheaper to physically remove the fat and solids than to treat later in secondary and tertiary treatment facilities.

3.3 EFFLUENT SALINITY

Skin preservation by dry salting is a common procedure at small abattoirs that are remote from tanning operations and often export their hides and skins for tanning. After salting, often in converted cement truck mixers, the hides are hung to dry for a minimum of 5 days. During this period, the salt draws the moisture out of the hide, together with the protein-filled fluids contained in the attached flesh.
The effluent from drying sheds is therefore highly saline and has a very high biochemical oxygen demand (BOD). It also contains high levels of fluoride, since the salt used contains up to 1 per cent sodium fluoride as a bactericide.

This may lead to salinity problems if the effluent is irrigated, and also to fluorosis problems with vegetation, including tree deaths. This waste stream must be segregated and diverted to an evaporation pond for conversion to a solid waste for potential recycling.

3.4 WASTEWATER

Wastewater produced in animal slaughter areas typically has a high BOD. It is also very saline and has high levels of nutrients, suspended solids and bacterial contamination. The following pond systems are commonly used for secondary treatment of abattoir effluent:

- anaerobic or settling ponds;
- facultative ponds ;
- mechanically forced aerated ponds ;
- naturally aerated ponds ;
- dissolved air flotation (DAF) cells ;
- septic tanks; and
- other package treatment plants.

3.5 STORM WATER

Storm water can become contaminated when it comes into contact with animal holding pens, sludge stockpiles and treated wastewater irrigation areas. This contaminated stormwater can have detrimental environmental effects on surrounding ecosystems.

3.6 SOLID WASTES

Sources of solid wastes generated at abattoirs include:

- animal holding areas;
- slaughterhouse and processing areas;
- waste treatment plant; and
- unwanted hide or skins, feathers and pieces, and unwanted carcasses and carcass parts.

Manure is generated in animal holding areas. Materials not suitable for rendering, such as unwanted carcasses, come from the processing areas, along with paper, cardboard and plastics. Primary and secondary effluent treatment sludges are generated in the treatment ponds.

3.7 NON-PROCESS WASTES

Non-process wastes originate from kitchens and offices, dispersed or uneaten feed and from general maintenance of gardens. Waste prevention and reduction, and separation of wastes for recycling or composting apply equally to these non-process wastes.

3.8 AIRBORNE WASTES

3.8.1 Odours

Potential sources of odours in abattoir operations are:

- the cooking and rendering process;
- waste effluent treatment plants;
- abattoirs;
- product storage and handling areas;

- material drying areas;
- waste disposal techniques such as burning dead stock;
- animal holding pens;
- livestock transport vehicles;
- holding of carcasses before disposal;
- odours from skin handling;
- odours from skin sheds;
- animal waste – skins, hides, hooves, reject carcasses, stomach contents etc; and
- untreated effluent.

Sources of odours in the rendering plant include stale materials and fugitive emissions from cookers. Odours in animal holding pens are produced by manure and urine.

Abattoirs odours come from solid wastes such as paunch contents and blood residues. Anaerobic waste treatment ponds may produce gases such as methane, ammonia and hydrogen sulphide, which give rise to objectionable odours. Livestock transport vehicles entering the abattoir through residential areas may cause odour problems.

3.8.2 Dust

Potential sources of dust emissions at an abattoir are:

- unsealed roads;
- paddocks, sale-yards and holding pens;
- stockpiled products and materials; and
- construction activities.

3.8.3 Fuel Burning Emissions

Fuel burning gives rise to atmospheric emissions. Materials burned at an abattoir include:

- coal or gas fuel for boilers and steam production;
- diseased animals;
- sludge;
- packaging; and
- unusable skins.

3.8.4 Greenhouse Gases and Other Gases

Animals produce methane gas (a greenhouse gas) during the process of digestion which is released to the atmosphere during processes such as defecation. Little can be done to prevent or reduce the amount of methane produced. However, by varying the food types and quality, methane generation may be reduced. The amount of fuel used should be minimised by heat conservation and re-use strategies to limit the emission of greenhouse gases. In existing abattoirs, a strategy needs to be adopted to replace ozone depleting gases. Chlorofluorohydrocarbons (CFCs) may be used in refrigeration and freezer plants. CFCs are ozone depleting gases and their production and use is subject to national and international regulation (Margot Saner, 2006). Odour control may be a significant issue, particularly when the abattoir is located near residential areas or in a hot environment. Ammonia based refrigeration systems may be required for cooling (EPA Operational Guidelines, 2001).Ozone depleting gases used in refrigeration units should be replaced in existing abattoirs and new abattoirs must install refrigeration units that do not utilise ozone depleting gases (Margot Saner, 2006).

3.9 DISEASES

In abattoirs (with the exception of crocodile abattoirs) there is a large potential for the transmission of zoonotic diseases such as Q-fever, anthrax to humans and Brucellosis.

3.10 NOISE

In abattoirs noise can be generated by several sources, including:

- animals, especially when in concentrated groups;
- processing activities within the slaughterhouse;
- plant machinery; and
- plant and service vehicles.

Noise from the slaughterhouse and by-products area is generated by mechanical plant (such as conveyors), ventilation plant, air conditioning, stunning boxes, compressed air equipment, pumps and rendering plant. Some of this equipment may need to operate 24 hours a day. An abattoir is serviced by a variety of vehicles including trucks and forklifts. A noise assessment conducted by JH Consulting (Appendix A) concluded that the noisiest equipment, from the viewpoint of environmental noise, are the ventilation fans.

As these fans operate continuously they contribute the most to the equivalent noise levels, on which environmental noise levels are based. The assessment further concluded that a typical abattoir will not exceed industrial noise level limits during operating hours, except where the ventilation fans are concerned, and only marginally at night.

The Australian NSW industrial noise policy has defined typical noise levels (T) for abattoirs (Table 1). After a noise level indicates that it is likely to have a tonal or impulsive character. No adjustments have been made to account for noise character. These levels may serve as best practice guidelines in South Africa.

Table 1: Typical abattoir noise levels
(http://www.environment.nsw.gov.au/resources/ind_noise.pdf)

Equipment/process	Noise level in dB(A) at 7 metres
Plant noise	55-65 (T)
Fan noise	55-69 (T)
Air compressors	46-69 (T)
Boiler blowdown	68-75 (T)
Rail transport	42-67 (T)
Trucks/forklifts	51-73 (T)
Front end loaders	63-71 (T)
Hooter/siren	57-70 (T)

4. MITIGATION MEASURES

4.1 PLANNING ISSUES

The planning stage of any abattoir activity is the best time to design the operation in a way that conforms to legal requirements and to examine all the options for minimising waste and preventing contamination. Detailed planning may also ensure that some waste streams are completely avoided.

4.1.1 Waste Minimisation

There should be a full examination of process by-products and wastes to identify options for waste minimisation. In some cases, substituting raw material may lead to changes in the process. Often, re-using or recycling by-products reduces waste production. Recovering valuable materials from waste streams can be economically and environmentally sensible.

Some waste minimisation options to consider during the planning stage are:

- changing the processes or equipment;
- changing the composition, packaging or durability of products;
- changing or reducing raw material inputs;
- improving the control of the process;
- improving the materials handling and cleaning operations;
- improving the maintenance and repair of equipment;
- recycling waste internally;
- re-using waste on site; and
- recovering materials from waste streams.

4.1.2 Management strategies

Techniques and procedures to integrate all waste management options should be adopted wherever possible. A beneficial re-use strategy should be initiated after the waste management strategy.

Cleaner production and waste minimisation aims directly at the source of the waste generation and attempts to eliminate waste before it is produced, or to reduce the amount generated. Wastes should be disposed of only after all preventive and minimisation measures have been taken.

All generators of waste are ultimately solely responsible for managing their own wastes. The abattoir operators should develop management strategies for proposed and existing premises. The strategies should aim to:

- minimise the quantity of wastes generated;
- prevent pollution arising from the disposal of wastes;
- prevent nuisance pollution such as odours, dust and smoke;
- minimise environmental health risks; and
- improve the efficiency of processes through energy savings.

Opportunities for recycling exist in all types of industry, in commercial and government organisations and for public groups. Operators should nominate a staff member to supervise the recycling schemes.

4.1.3 Site Selection

Site selection is a critical environmental issue for abattoirs. Careful site selection can greatly reduce the environmental nuisance.

Relevant site information should include:

- the closeness to existing and future housing developments, and to land zoned to permit housing or other land uses not compatible with the proposed development;
- the site hydrology: flood liability, site drainage and closeness to watercourses and groundwater resources used for domestic, agricultural or town water supply;
- the prevailing wind conditions;
- the landform and the likely direction of drift of odour or effects of noise;
- the adequacy of the land area to house all projected activities;
- the erosion hazard;
- the local road network;
- corridors for power and other services; and
- suitability of the site for possible land disposal.

In areas likely to be disturbed by construction of the proposed development, the site description should include data on plants and animals, such as:

- major plant communities;
- the status and conservation significance of vegetation;
- the occurrence of any rare or threatened species;
- the presence of any introduced species; and
- the heritage or cultural significance.

Check heritage listings before making a decision on the proposed development.

4.1.4 Buffer Zones

Buffer zones are particularly important as measures to separate conflicting land uses and to minimise any harmful effects of new developments in environmentally sensitive areas. Even if other control measures are used, odour, dust and noise emissions may still occur. Adequate buffer distances from nearby land users are the best way of avoiding nuisance from air and noise pollution. Occupiers should include buffers in management strategies, and local councils should include them in town planning approvals. New buffer zones should be created as part of the proposed development. Buffer distances are cheap control options if additional land does not have to be bought.

4.1.5 The Visual Environment

The choice of aesthetically pleasing colours and finishes will enhance the look of premises. Features such as trees, shrubs, rock walls and grassed slopes incorporated into the landscaping will not only help with the visual impact, but also diminish the effect of operational lighting beyond the boundaries of the premises. Planting may also help control dust. Planted buffer zones can serve as ecological corridors. To prevent light pollution the lighting orientation should be into the abattoir property as opposed to away from the abattoir property.

4.2 ENVIRONMENTAL MANAGEMENT PLAN

The operators of an abattoir need to establish an environmental management plan (EMP) for the premises. The plan needs to incorporate all the requirements of the relevant guidelines and incorporate a farm management plan for the beneficial operation of the waste management system. Such a farm management plan would address the performance of the cropping/stocking regime, protection of the soils and ground and surface waters and the removal of nutrients.

Please refer to the developed Standard Environmental Management Plan in Appendix C, which all abattoirs must subscribe to and implement. This EMP implementation should be one of the conditions of approval within the environmental authorisation.

4.3 WATER POLLUTION CONTROL MEASURES

4.3.1 Water Conservation

- Using high pressure water hoses will minimise the amount and therefore the cost of water used. Operators should be trained in water conservation and water monitoring;
- Provide roofing or isolate unloading areas, stockyards and processing plant so that the amount of contaminated stormwater, wastewaters and washwaters can be minimized;
- Contaminated stormwater, wastewaters and washwaters should be collected in lagoons and aerated and irrigated without any off-site runoff;
- Clean stormwater must be kept away from the contaminated areas and directed to the stormwater drainage system;
- All process areas must have concrete floors graded to wash down drains; and
- All chemical storage areas and chemical-based odour control equipment must be located on impermeable concrete floors with bunding capable of containing 110 per cent of any spillage.

4.3.2 Wastewater Treatment Plant

Treatment ponds should service all contaminated stormwater, washwater and wastewater and be designed with the following characteristics.

- Incorporate stone pitching on or across the external walls to decrease the potential for erosion.
- Incorporate stone pitching or a concrete plinth interior on the walls to decrease the potential for erosion.
- Design anaerobic ponds for an appropriate retention time (generally accepted as being 7 days) to achieve a satisfactory level of breakdown.
- Because effluent treatment plants are sensitive to overloading, these must be well designed in the planning stage.

4.3.3 Treated Wastewater Re-Use and Disposal

Options for the disposal of treated wastewater are as follows:

- Irrigation to land.
- Disposal to local sewer. This will require nutrient removal and organic loading reduction; and
- Licensed disposal to a watercourse. It would normally be difficult to treat abattoir effluent to a level suitable for discharge to sewer and this is thus not the preferred option.

For existing abattoirs in areas where there are significant land constraints, discharge to sewer is considered acceptable. Suitably treated wastewater can be used for crop production, to irrigate farmland, gardens and parks or for washing down stock holding yards.

The area of land required for irrigation disposal depends on the volume and constituents of effluent discharged, the landform soil type, the rainfall and the frequency of flooding in the area. Irrigation disposal should meet the following requirements:

- Effluent must not leave the site;
- There must be no irrigation in times of high rainfall; this could lead to contaminated stormwater runoff;
- A sampling point should be maintained on the pipe transporting to the effluent irrigation system; and
- The effluent irrigation rate should be metered.
  Monitoring programs are needed to ensure that long-term irrigation disposal does not affect soil and ground water quality. Irrigation sites should be chosen and/or designed so that the crop/soil system can assimilate the wastes and maintain the hydraulic balance so that surface runoff does not occur. Vegetated buffer zones help protect watercourses from potentially con taminated runoff.

4.3.4 Stormwater Runoff

Storm water should be controlled using the following techniques:

- Stormwater should be diverted away from intensively used holding areas, bulk chemical storage and liquid waste collection areas and treatment and disposal areas. This can be done by roofing or isolating unloading areas, stockyards and processing plant,
  as well as by building diversion drains and bunding;
- Contaminated stormwater should be collected in lagoons, aerated and irrigated without any off-site runoff, and
- Clean stormwater must be kept away from contaminated areas and directed to the stormwater drainage system. It may be collected for stock watering or washing down.

4.4. SOLID WASTE DISPOSAL MEASURES

4.4.1 Recycling

Below are suggested appropriate techniques for disposing of solid waste generated by abattoirs:

- Composting in pits and lined bunkers. Paunch contents can be efficiently and economically disposed of by composting as long as offensive odours are not generated;
- Manure can be spread directly on land for assimilation of wastes into soil. There is a balance between effective waste disposal and creation of pollution problems using this disposal technique. Manure needs to be mixed with surface soil to prevent fly breeding, reduce odour and avoid water pollution from surface runoff.
- Manure can also be stockpiled and dried before spreading on land. This technique needs to be managed to prevent fly outbreaks and odours developing and to prevent seepage of the liquid phase into soil and groundwater.
- Sludge removed from treatment ponds should be allowed to dry and spread as for manure. It is best to dry out sludge in summer to quickly develop a sealing crust and
  prevent odour emissions;
- Biogas production although this is generally not economically viable; and
- Disposal of wastes to appropriately permitted landfills.

4.5 AIR EMISSION CONTROL

4.5.1 Odour

Below are recommended techniques for minimising odour emissions from various abattoir activities.

Rendering Plants

- The building housing the rendering works must be vented to the atmosphere via a discrete stack to allow retrofitting of odour control equipment. The stack should be at least 3m above the building roof ridge, have an efflux velocity not less than 15 m/s, and be fitted with emission sampling provisions. Retrofitting would only be permitted with existing installations. New or upgraded installations must have full odour controls installed.
- The most common odour abatement method in the cooking process is condensation and condensate subcooling, followed by incineration or afterburning of the non-condensibles.
- Alternative odour abatement methods include the use of biofilters, chemical scrubbers using hypochlorite, multi-stage acid and alkali scrubbing followed by chlorination and incineration in boilers.
- Biofiltration is very effective for managing odour problems. All odorous gases are released underneath the ground to a biofilter bed. The biofilter bed is constructed of materials such as concrete, blockwork and earth, and the beds layered with products such as compost, coarse gravel, sand, pinebark and woodchips. Micro-organisms in the bed break down organic and inorganic odours in aerobic microbial activity under damp conditions (humidification of odours).
- Odour control equipment should be fitted with monitoring equipment with recorders for the monitoring of key parameters.
- Good housekeeping is essential to stop odours developing. Dropped material or spilt tallow should not be left to develop odours.
- Quick processing of materials to minimise odour generated from bacterial degradation is essential.
- Rendering material should be stored in an enclosed receptacle, and any material not removed for rendering within 24 hours of production should be refrigerated as per the MSA regulations until it is removed from the site or processed.
- Equipment and machinery are to be kept clean of raw materials and residues.
- Effective and reliable operation of burners and chemical scrubbers is essential.
- Using continuous cookers over batch cookers can reduce odours.
- Bins for holding raw material and rendering products need to be shrouded or covered, and grinding, processing and conveying equipment must be completely enclosed.
- Storage bins can be designed to prevent the accumulation of any liquid or solid wastes; the wastes should be drained or pumped from a sump on a continuous basis.
- Storage bins may need to be designed so that they can be cleaned with high pressure hot and/or cold water at least once a day.
- A procedure for monitoring odour as well as investigating and resolving complaints should be implemented.
- All processed meats that have become tainted or putrid must be stored in enclosed containers and refrigerated until they are removed from the premises.
- All boilers, steam raising plant and afterburners must use clean fuels free of heavy metals and toxic wastes.
- All conveyors and pipe runs for waste animal matter transfer operations are capable of being dismantled for effective cleaning. Offal and waste animal matter must be received in a fully enclosed building.

Abattoir and Processing Areas Use:

- Airtight bags and bins;
- Enclosed conveying and filling systems; and
- Good housekeeping.

Animal Holding pens, auction yards and feedlots

- Odours produced from manure and urine in animal holding areas can be greatly reduced by scraping up and removing the manures in sealed holding yards, then washing down using low volume high pressure sprays.
- Manure should be collected daily and stored in vermin-proof containers.
- Lime should be added to the soil in unsealed holding areas.

Effluent Treatment Plants

During commissioning, odours produced by anaerobic waste treatment ponds can be reduced by:

- allowing some grease and manure solids to pass through the primary treatment system, establishing a crust of 100 mm thick on the surface
- layering of hay on the surface of the anaerobic pond
- using an artificial cover (such as plastic) that breaks down over time and mixes with the fat on the surface.

- During the operational phase, all detergents and chemicals used in the abattoir should be suit able for the biological treatment process.
- An appropriate starter culture or enzyme must be used to re-establish pond equilibrium in the event of a pond failure.
- Continuous desludging of ponds by siphon prevents disturbance of the pond crust.
- Effluent treatment plants need to be adequately designed, operated and maintained to minimise emission of odours.

Skin Drying Areas

These areas should be vented through an odour control system. Fly outbreaks on skins should be prevented. The normal open skillion roof sheds are well ventilated, and fly strike is usually not a major problem in them.

4.5.2 Dust

Below are techniques that reduce dust emissions from various abattoir operations.

- Fabric filter type dust collectors should be used for dust control.
- Surfaces of saleyards, holding pens, unsealed roads and parking areas should be sealed.
- Windbreaks (incorporating lines of trees) should be used near large coal stockpiles.
- Stockpiles should be dampened with water sprays and have their axes parallel to the direction of the strongest winds.
- Dusty process operations should be serviced by filtered ventilation hoods.
- Warehouses should use good housekeeping to alleviate dust generation.
- Dry materials, such as meat meal, must be handled in such a manner as not to give rise to dust emissions to the atmosphere.

4.5.3 Fuel Burning Activities

Some abattoirs may wish to dispose of sludge and other wastes by incineration. Coal fired boilers may also be used in the rendering process. All fuel burning equipment will release greenhouse gases.
Practical control measures needed to minimise the effects of fuel burning equipment on surrounding land users are as follows.

- All boilers, steam raising plant and after burners should use clean fuels free of heavy metals and toxic wastes.
- Combustion equipment and air pollution control equipment should be designed and operated to minimise the production and emission of air pollutants.
- Stacks should be high enough to prevent ground level concentrations of pollutants from reaching undesirable levels.

4.6 NOISE CONTROL

4.6.1 Operating Hours

Some abattoirs operate outside normal working hours. Noise complaints may result from early or late operations and from weekend activities.

4.6.2 Existing Premises

The following noise control measures should be considered for existing premises.

- Erect noise barriers such as screens around noisy equipment and operations.
- Use visual signals and portable telephones instead of hooters and telephone bells in operational areas.
- All ventilation and extractor fans should be noise efficient or fitted with silencers, and all ducts should be lined with sound-absorbent material.
- Restrict external workshop activities and vehicle access to between 7 AM and 6 PM, Monday to Friday and between 7 AM and 1 PM on Saturdays. Generally, only work conducted inside noise-insulated workshops should be permitted during the evening (6 pm to 10 pm) and night time (10 pm to 7 am).
- Limit vehicle movement (especially trucks) to and from the site to normal working hours only.
- Fit efficient exhaust mufflers to diesel forklift engines, other noisy vehicles and air-powered tools.
- Keep equipment in good repair and attend promptly to loose or rattling covers, worn bearings and broken equipment.
- Locate mechanical equipment on mounts designed to isolate structure-borne vibration and noise.

  Noise from existing abattoir operations should not exceed the levels in Table 2.

4.6.3 Proposed Premises

The noise control measures mentioned above for existing premises can be incorporated more cheaply and efficiently into the proposed development during the design stage. Other measures worth considering are:

- installing noisy equipment into one or more plant rooms or specially designed acoustic enclosures;
- positioning noisy operations as far away as possible from current or future noise-sensitive areas;
- locating vehicle parking and noisy equipment away from noise-sensitive areas; and
- using the layout and orientation of the buildings to advantage, using buildings as noise barriers and using the natural topography as an acoustic barrier where possible.

  Below are specific techniques that minimise noise from abattoir operations.

- Animal holding areas and noisy mechanical plant equipment should be located as far away as possible from the local community and employ the local topography as a noise barrier.
- Cattle and pigs being processed at abattoirs should be processed on the same day and not kept overnight in the stockyards.
- Mechanical plant noise is best controlled by good initial design and choice of equipment.
- Equipment should be maintained regularly and noisy operations should be enclosed.
- Noisy operations such as stock handling should be done during the noise tolerant periods of the day (that is, when background noise levels are highest).
- Buildings should be located so as to attenuate on-site vehicle noise.
- Heavy vehicle routes should be chosen to avoid intrusion on the local community, and if needed, restricted from operating during the noise-sensitive hours.
- Sound proof if necessary.

Noise from proposed abattoir operations should not exceed the levels in Table 2 when measured at any residential premises, or commercial premises.

Table 2:Noise levels from proposed abattoir operations not to be exceeded when measured at a residential premises (http://www.environment.nsw.gov.au/resources/ind_noise.pdf)

Time period	Dwelling or other noise-sensitive place	Commercial place
Daytime (7 am to 6 pm)	Background + 5 dB(A)	Background + 10 dB(A)
Evening (6 pm to 10 pm)	Background + 5 dB(A)	Background + 10 dB(A)
Night-time (10 pm to 7 am)	Background + 5 dB(A)	Background + 10 dB(A)

Notes:

- *Compliance limit levels are measured as the average of the maximum A-weighted sound levels adjusted for noise character measured over a 15 minute time interval.*
- *Compliance noise limits (based on background sound levels) for proposed sources or places to protect established dwellings and other noise-sensitive places or commercial areas*

4.7 TRAINING EMPLOYEES

Training employees is a vital part of any environmental management practice. Abattoir staff should be aware of the environmental management program and environmental controls at varying levels of detail, depending on their duties. All staff need to be advised that if they fail in their duties, they are just as liable to prosecution and penalty as is their employer in terms of several bodies of legislation.

Training programs should contain common elements such as familiarisation with the company environmental policy and commitment to waste prevention, recycling and raw materials conservation. Employees should be encouraged to suggest new ideas.

It is the responsibility of the occupier of the premises to ensure all operational staff are instructed in the use of equipment, processes and emergency conditions that might result in pollution.

5. ABATTOIR WASTES

5.1 THE HANDLING OF ABATTOIR WASTE

Abattoirs produce a large percentage of animal wastes during the slaughtering processes. Many smaller abattoirs in South Africa do not have rendering plants and are prohibited from burying condemned material and blood. Due to the legal obligation to remove abattoir waste in a safe and sustainable manner, abattoirs attach great importance to having an efficient and reliable collection service (wastes are collected daily and/or on a regular basis).

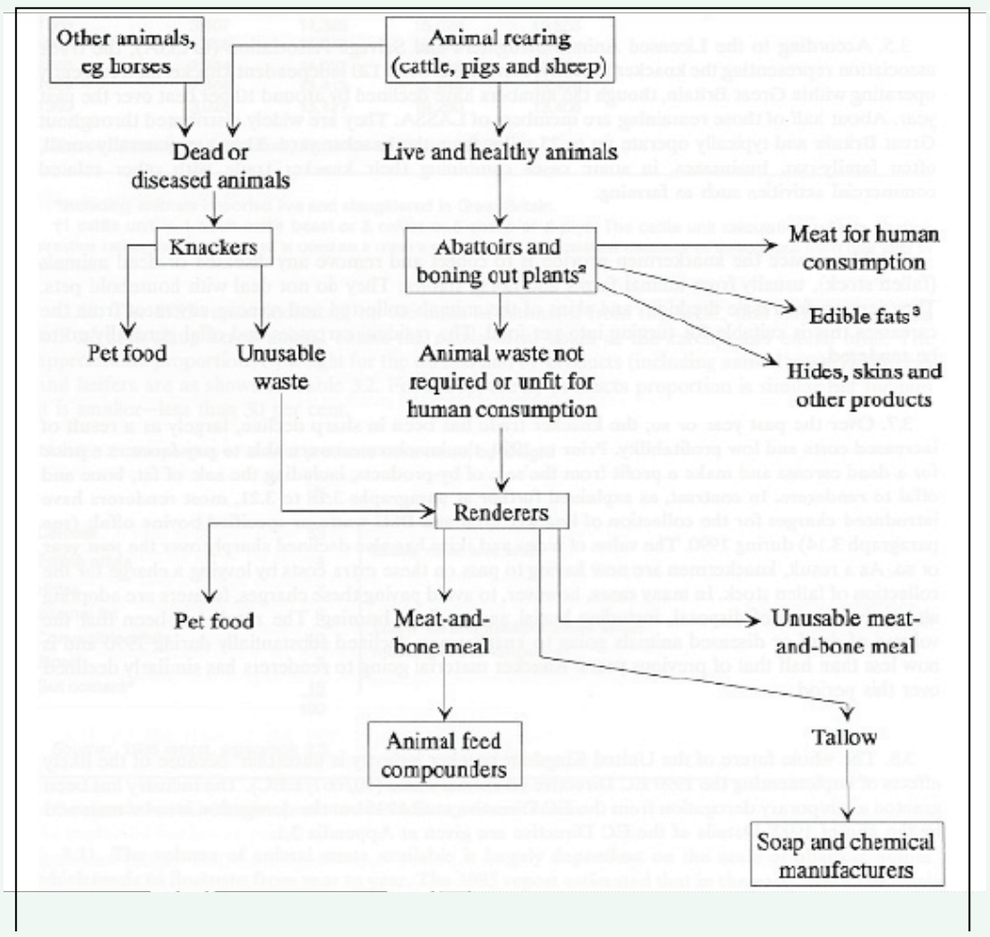


Figure 7: Typical sources and uses of wastes in a red meat abattoir (RMAA, 2006).

The various categories of waste created at abattoirs are as follows:

- Faecal material (manure);
- Blood;
- Ruminal / Intestinal content;
- Condemned material;
- Fat and trimmings;
- Water effluent;
- Feathers, fur, skins, horns & hooves; and
- Bone.

Figure 7 denotes the typical sources and uses for these wastes in a red meat abattoir.

5.1.1 Waste Processing/Rendering Technology

Rendering of raw animal waste involves a series of drying and separating processes by which the material is sterilised and the fats and proteins are extracted to produce tallow, blood and meat-and-bone meal. At the start of the process, the waste material has a water content of up to 70%. Water is removed from the waste material via several methods (depending on the abattoir). The water effluent produced also needs to be treated to avoid

pollution. The organic nature of the material creates further problems of odour pollution, requiring additional pollution abatement technology.

Batch processing, using a series of separate cookers, and continuous process plant, using a fully integrated operation, are the two types of technology employed. Smaller plants, processing under 1,000 tons per week, generally use the older technology of batch processing.
Batch processing involves generally higher direct processing costs (principally energy and labour costs) than for continuous plants but lower capital costs, and offers greater operational flexibility.The legal requirement to segregate and process BSE waste material separately from other waste has created particular difficulties for the rendering industry in countries where BSE positive cases are commonly encountered. For continuous plants, a separate line or plant needs to be allocated for the processing of such waste.

With batch processing, the operational difficulties of effectively segregating BSE waste are somewhat less since at least one of several cookers can be used for BSE processing whilst other cookers are processing normal waste.

Pollution control and environmental protection are of central importance to the rendering industry. The main difficulties facing it are the control of odour pollution and the treatment of water effluent. Regulations concerning pollution control within the rendering sector have become more rigorous.

New entrants to the industry face a number of major difficulties and cost barriers. Finding a suitable green field site and obtaining local authority planning permission are considerable obstacles because rendering is classified as an offensive trade and is subject to close environmental regulation. Pollution abatement equipment can represent a significant proportion of the capital costs of new entry. Additionally, a new entrant, or an existing renderer that wishes to expand, would need to secure supplies of waste material in a market which is inherently limited in size by the throughput of abattoirs and which
the renderers themselves cannot therefore influence.

The main technical alternatives to the rendering process are landfill, incineration and anaerobic digestion. Only small amounts of animal waste are currently disposed of to landfill because only a few sites are licensed to take it and due to the legal requirements that abattoir waste must be adequately sterilised before disposal to landfill.

Incineration appears to be more suitable for dealing with whole carcasses than for waste offal, which has high water content and a low calorific value. The costs of incineration are also relatively high. Incineration of materials throughout South Africa is generally being phased out and is not supported by most of the government departments.

Anaerobic digestion is a process whereby organic material such as animal waste is broken down or degraded by micro-organisms operating in an oxygen-free environment. The capital and other costs of anaerobic digestion are more uncertain than for other forms of waste treatment and disposal and the technology for handling abattoir wastes is still in the process of development. Developments in this area show considerable promise as both a low-cost and low-pollution means of dealing with raw animal and other waste, although these newer technologies have yet to be fully tested and commercially proven.

5.1.2 Markets for Rendered Products

The principal end products from the rendering process for red meats are tallow, blood-, meat and bone meal. Tallow is widely used in the manufacture of soap where coconut oil is a close substitute and in oleochemicals where in contrast there is no suitable substitute for it. Meat-and-bone meal is sold as an additional protein source to animal feed manufacturers. The principal source of protein used is Soya bean meal and cereals provide the main ingredient of animal feed.

5.1.3 The Collection and Rendering of Blood

Livestock are slaughtered by exsanguination following an approved stunning method. An emergency entrance to the slaughter area must be provided for livestock that are unable to walk. A paved and drained area will also have to be provided in front of the entrance for the bleeding of these animals. Facilities for the collection and storage of blood in closed containers prior to removal and disposal must be provided.

The minimum time allowed for bleeding and the amounts of blood per species are:

- Cattle: 8 minutes, 13–15 litres blood
- Calf: 6 minutes, 2–7 litres blood
- Sheep: 6 minutes, 1,3–2 litres blood
- Pig: 6 minutes, 2–4 litres blood
- Poultry: 90 seconds

Blood is rich in nutrients, especially protein, but it readily collects dirt once it leaves the animal's body as it is a liquid. Dirt starts putrefaction which lowers the blood's usefulness, and if drained outside on the slaughterhouse grounds, sanitation problems arise by virtue of its clotting property. Other nuisances created by clotted blood are stench, filth, attraction of rodents and the breeding of flies. It is of utmost importance that when blood is collected that it be handled in a hygienic manner and processed with minimum delay.Regulations prohibit the disposal of blood in drainage systems as blood overloads the purification works and unpleasant odours may emanate from septic tanks into which it is drained. Unfortunately, this remains a common practice in smaller abattoirs in South Africa. Abattoirs that dispose of blood via the municipal sewers are normally charged a municipal levy. Larger abattoirs, in particular, experience problems with blood due to the quantities generated. The following different disposal methods are used:

- Municipal drainage;
- Oxidation dams;
- Burial;
- Run off or spraying onto fields and covering with a layer of soil;
- By products; and
- Septic tanks that are periodically collected by the Municipality.
  Small-Scale Processing

Where only a few animals are slaughtered in a day, small-scale low-technology processing can be undertaken rather than spilling the blood to municipal sewers and creating sanitation problems. Thus, from 10 cows and 3 sheep, approximately 64 kg of fresh blood can be obtained, which can yield at least 12 kg of dried blood. To process this, the blood is cooked in a tank to coagulate it and is drained of liquids that collect on top after cooling. The coagulum is then broken up and spread on a tarpaulin or plastic sheeting for drying. Alternatively, the coagulated mass can be placed in a simple solar dryer for drying.

Wet Rendering

In plants that have steam-rendering tanks, the fresh blood can be mixed with selected non-carcass components and wet-rendered. In this instance, the blood should substitute for water in the tank. An advantage here is that the protein content of the offal meal will be raised quantitatively with the addition of blood, although some amino acids may be damaged by the strong action of the heat while others may leach into the cooking water.

Commercial Drying

A more productive approach is to process the blood under relatively reduced temperature conditions using a commercial blood drier. In principle, the blood-drier is a dry-rendering tank disposed horizontally and invested with a steam-jacket. Special devices are provided within the tank to prevent blood from coating on the interior walls and reducing drying efficiency.

Blood is introduced into the tank as a coagulated mass, previously obtained by steam action. As much liquid as possible should be squeezed from the coagulum. Heating is initiated according to the MSA regulations. Drying is complete when the final moisture level in the dried product is about 12% (as per the MSA regulations). During drying, moisture is removed rapidly and constantly from the tank by means of condensers to which the tank is connected. Complete moisture removal is not desirable otherwise the final product would darken or char, while above the 12% level the residual moisture can cause deterioration and loss of nutrients. The protein content of the finished product is about 80%.

For environmental and sanitation reasons, the composting of manure should be done in pits or bunkers instead of stacks and heaps. A pit is an ordinary hollowing of the earth, while a bunker is a chambered structure constructed with cement blocks or bricks above the ground. Both structures must be roofed or provided with sheds for security against rain.

Similarly, waterlogged areas must be avoided when locating the structures. The pits and bunkers are filled with alternate layers of kraal and lairage manure which should be wetted slightly with some liquid waste water from the slaughterhouse. They are then topped with leaves and covered with heavy boards or roofing sheets. Breakdown of the material proceeds slowly. After 2-3 weeks, the contents should be turned and mixed, repeating the process after 4-5 weeks. In about 8 weeks or less, the compost should be ready. Well-rotted manure must be fine textured without much straw in it.

Compost of even higher fertilising characteristics is obtained as a by-product in the breakdown of manure in special devices called digesters for the production of biogas. Biogas is so called because it is a mixture of gases produced as a result of anaerobic breakdown of organic matter by bacteria. The gases in the mixture are methane, 60%, which is the main component and a source of fuel; carbon dioxide, 36%, and hydrogen, oxygen, nitrogen and hydrogen sulphide making up the rest (RMAA, 2006).

As a rule, biogas production with abattoir wastes is not economically viable (RMAA, 2006), as the return yield is very low (the yield of biogas is lowest for cattle; pigs are intermediary with poultry being highest on the scale). Additionally, operational problems exist affecting the charging of the system and continuous flow of gas. The gases liberated during the digestion process are also hazardous as they pose an explosion hazard. Proven commercial plants must be procured if biogas production from animal wastes is contemplated. In this case, the digester gas utilisation must be based on a practical necessity such as requirement for heating water (by direct burning) to maintain sanitary services in the slaughterhouse. Because of its low yield, another consideration can be the advantages offered by biogas production in the treatment of organic wastes including the removal of offensive and unsanitary influences from the environment.

Whichever application is selected, compost is always produced from the operation, which with treated liquid waste, can be used in vegetable cultivation to yield revenue to offset costs.

5.2.2 The Handling of Hides and Skins

Hides and skins are very important in the abattoir industry. In the case for example of the fur industry, skins and hides have the highest yield and value of all products other than the carcass, and in some livestock-rich developing countries such as Somalia and the Sudan, they account for substantial portions of export revenue (RMAA, 2006). The approximate yield of green (or fresh) hides and skins in pastoral tropical livestock is listed in Table 3 below:

Stunning, hoisting and bleeding

Facilities for collecting and storing of blood in closed containers prior to removal and disposal must be provided.

Meat inspection facilities
Marked, leak proof and lockable containers or other means to handle and hold condemned and inedible material prior to removal, must be provided.

The following requirements must be followed for the washing of rough offal:
Rough offal must be removed from the dressing room to the offal room directly adjacent and connected thereto, after being passed, where paunches and intestines must be –

- separated and emptied of its contents;
- washed with clean running water; and
- hung on hooks for cooling and drip drying before and during chilling.

Equipment must be provided for the emptying of rumens and intestines and the ruminal and intestinal content must be removed continuously.

Implementing of a Hygiene Management Programmes (HMP)

The owner of an abattoir must implement a HMP for waste disposal, including condemned material, in terms of which:

- the owner of the abattoir must provide a written control programme for the removal of each different category of waste material including general refuse removal for approval by the provincial executive officer; and
- security arrangements to prevent condemned material from entering the food chain must be described;

Handling of dead animals

All “dead on arrival” and “dead in pen” animals must be disposed of as condemned material in terms of Part VIII.

No carcass or part thereof that has been condemned may be brought into any part of the abattoir containing edible products.

5.1.4 TREATMENT OF CONDEMNED MATERIAL AS PER THE MEAT SAFETY ACT

5.1.4.1 Handling of condemned material

Carcasses, portions thereof or any edible products in an abattoir, which cannot be passed for human or animal consumption, must be:

- portioned and placed in a theft proof container which has been clearly marked “CONDEMNED”, in letters not less than 10 cm high, or conspicuously marked with a stamp bearing the word “CONDEMNED”, using green ink;
- kept in a holding area or a room or dedicated chiller provided for the purpose, except if removed on a continuous basis; and
- removed from the abattoir at the end of the working day or be secured in a dedicated chiller or freezer at an air temperature of not more than minus 2 °C.

No person may remove a carcass, part thereof or any edible product which has been detained or condemned from an abattoir, except with the permission of a registered inspector who is a veterinarian and subject to such conditions as he or she may impose.

The abattoir owner is responsible for complying with the legal requirements or conditions relating to the safeguarding and disposal of any carcass, part thereof or any edible product which cannot be passed for human or animal consumption.

5.1.4.2 Disposal of condemned material

Any condemned material must be disposed of by –

- total incineration;
- denaturing and burial of condemned material at a secure site, approved by the provincial executive officer and local government, by –
- slashing and then spraying with, or immersion in, an obnoxious colorant approved for the purpose; and
- burial and immediate covering to a depth of at least 60 cm and not less than 100 m from the abattoir, providing such material may not deleteriously affect the hygiene of the abattoir; or
- processing at a registered sterilising plant.

5.1.4.3 Requirements for sterilising plants

- A sterilising plant must comply with the general requirements for premises, structures and equipment set out in regulations 8 to 18, which apply with the necessary changes.
- The premises of a sterilising plant must be fenced and secured so as to prevent the entry of unauthorised persons, vehicles and animals, and must include-
- unclean areas, comprising the rooms in which material is received, stored or prepared for sterilising as well as the entrance to the sterilising apparatus; and
- clean areas, comprising the rooms in which the sterilised material is dried, milled or otherwise prepared, packed, stored or dispatched.
- A solid wall must separate the unclean and clean areas, and there may be no direct contact between these areas.

5.1.4.4 Unclean area

- Material of animal origin may only be received in the unclean area of a sterilizing plant and no such material may be removed from this area otherwise than through the operations of the sterilising equipment.
- Foot-baths with disinfectants must be provided at all exits, as well as a wheel bath for vehicles at the unclean receiving area.
- The floors, walls and equipment of the unclean area of a sterilizing plant must be sanitized daily after the cessation of operations.
- Workers employed in the unclean area must –
- wear distinctively marked overalls and rubber boots;
- wash their hands and disinfect their boots before leaving the unclean area; and
- change from their soiled protective clothing and footwear and clean themselves with soap and water before leaving the premises.
- A person who has entered the unclean area may not enter the clean area or any area where any edible products are handled in the abattoir unless he or she has cleaned and changed as contemplated in sub regulation (4)(c).

Product Specifications as set in the regulation:

- A person may not sell the products of a sterilising plant unless they conform with the specifications set by the Registrar in terms of the Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947).

Any material produced by processing or treatment under the provisions of this Part and intended for animal consumption or as a fertilizer must be subjected to such examination and tests as the said Registrar may specify.

5.1.4.5. Vehicles for condemned material

- A vehicle used for the transport of condemned material may not be used for any other purpose, but after cleaning and disinfection the vehicle may be used for the transport of inedible material.
- A vehicle may only be used for the transport of condemned material if the –
- load space is lockable, theft proof and sealable;
- internal surface is leak proof and constructed of durable material; and
- floor is provided at its lowest point with a drain pipe capable of being securely closed by a screw valve.
- The load space of a vehicle used for transporting material to a sterilizing plant must be cleaned and disinfected to the satisfaction of a registered inspector at the end of each delivery, at a place specially constructed for the purpose.

Although the use of water in an abattoir varies hugely (depending on the type of animals that are slaughtered at the abattoir), it is considered useful to give an indication of the volumes of water that are used in red meat abattoirs, which are some of the most common abattoirs in Gauteng.The average water consumption of a red meat abattoir is approximately 900 litres per slaughter unit (dependant on the abattoir's size). This volume of water consumed can be analysed in terms of percentage usage per area within the abattoir. The following percentages are an indication of the typical usage:

- lairage 10%;
- slaughter and dressing 20%;
- offal processing 25%;
- heating water 25%;
- creating steam 5%;
- cooling 8%; and
- ablution & laundry, 7%.

These volumes provide an important indication to applicants who want to start the operation of red meat abattoirs as to the volumes of water they may need, and enables such applicant to properly plan to ensure that sufficient water will be available for proper operation of the abattoir. Failing the availability of such water volumes, the applicant should consider obtaining water from alternative sources, moving the abattoir site to another site where sufficient water is available.The volume of effluent is approximately 80 – 85% of water intake and typically contains blood, pieces of meat, fat and gut, constant urine and manure in suspension. Each of these contributes to a very high organic load. As a comparison, crocodile abattoirs use less than 5% of the above-mentioned volumes.

5.2. DISPOSAL OF WASTE PRODUCTS

Hides and skins, feathers, hooves, horns, fat, blood, manure, paunch and viscera contents must be disposed of in a manner which will not create a sanitary problem on the premises of the registered slaughter establishment. Storage of such wastes in the vicinity of the registered establishment is unacceptable.

5.2.1 Manure, Compost and Biogas

Digestive and excretory wastes of ruminants, collectively referred to as manure are a mixture of dung and urine and occur in two forms. Firstly, as sweepings from lairages which are built into heaps outside the slaughter building and occasionally collected in small quantities by small-scale farmers to improve soil fertility. Secondly, as kraal manure which may remain permanent on the holding ground. Kraal manure is less preferred because it is often sodden with water (from rains) or mixed with earth from treading by the animals as well as straw from bedding, which creates problems during collection and spreading on farms.

In both forms; the quality and usefulness of manure reduces with exposure to the open air without protection or sheds or roofing. This causes loss of valuable nutrients, e.g. nitrogen by evaporation and soluble substances (potassium and phosphorus) by leaching during rains. Otherwise, manure is a good source of phosphorus, while the urine yields liberal amounts of nitrogen and potassium. Furthermore, the organic matter component of the manure remains longer in the earth when applied to soils to provide crops with a steady source of nutrients.

Fresh, straw-free manure with its urine mixture can be collected and held in special sheds or enclosures to decay slightly before being put on the soil. If placed on the soil surface without prior decay or improper mixing with the soil, the manure loses considerable nitrogen, apart from physically smothering plant growth.

Composting is a process of breaking down organic matter in dead plant material, crop residue and leaves by decay before returning it to the soil. This can also be applied to old manure. Farm composts are normally heaped above the ground, alternate layers of plant residue being sprinkled with ammonium sulphate, lime and water to facilitate decay. The pile is protected from rain and strong winds by being covered with heavy logs, a mud wall, or PVC plastic sheeting and old vehicle tyres and then left to decompose.

For environmental and sanitation reasons, the composting of manure should be done in pits or bunkers instead of stacks and heaps. A pit is an ordinary hollowing of the earth, while a bunker is a chambered structure constructed with cement blocks or bricks above the ground. Both structures must be roofed or provided with sheds for security against rain. Similarly, waterlogged areas must be avoided when locating the structures. The pits and bunkers are filled with alternate layers of kraal and lairage manure which should be wetted slightly with some liquid waste water from the slaughterhouse. They are then topped with leaves and covered with heavy boards or roofing sheets. Breakdown of the material proceeds slowly. After 2-3 weeks, the contents should be turned and mixed, repeating the process after 4-5 weeks. In about 8 weeks or less, the compost should be ready. Well-rotted manure must be fine textured without much straw in it.

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Table 1: Approximate yield of green (or fresh) hides and skins in pastoral tropical livestock (RMAA, 2006)

	Percentage of Live weight	Aver. wt. kg
Cattle	6–8	18
Large Sheep & Goats	14–16	6
Dwarf Sheep & Goats	10–12	4

5.2.3 The Handling of general refuse

Some examples of general refuse include:

- Kitchen refuse from canteens, e.g. left over food, etc.;
- Paper from the administrative offices;
- Sweet papers, cold drink cans and bottles, cigarette packets and butts, fast food containers, etc, from the premises; and
- Garden refuse (cut lawn grass, dead leaves, weeds, old dead plants).

This waste must be collected at different locations on the abattoir premises in waste containers with tight fitting lids (Figure 9) that will prevent the entry of rodents, insects and animals. They should be made of durable, corrosion resistant, easily cleanable, light coloured material. The containers must be cleaned regularly inside and outside, including the handles on the lid and on the sides of the bin, without contaminating the surrounding areas. The area where the bins are placed should have the following:

- Controlled access, lockable gates to avoid scavengers;
- Enclosed with wall, and roofed to avoid exposure to weather conditions;
- The walls should be painted with a light washable colours; and
- The floor should be constructed with impermeable material and should have a proper drainage system with a trapper. The area should be washed regularly with a disinfectant to avoid smell and cross contamination.

Skip waste is not effective to store condemned material, as it is open and it can result in public health problems (e.g. odour generation, infestation of rodents, etc.) and can be easily accessed by cats, dogs etc. A recommended system for bulk storage containers is the static compactor.

The waste area is often neglected in terms of cleaning and sanitation but it is still very important to keep it clean.

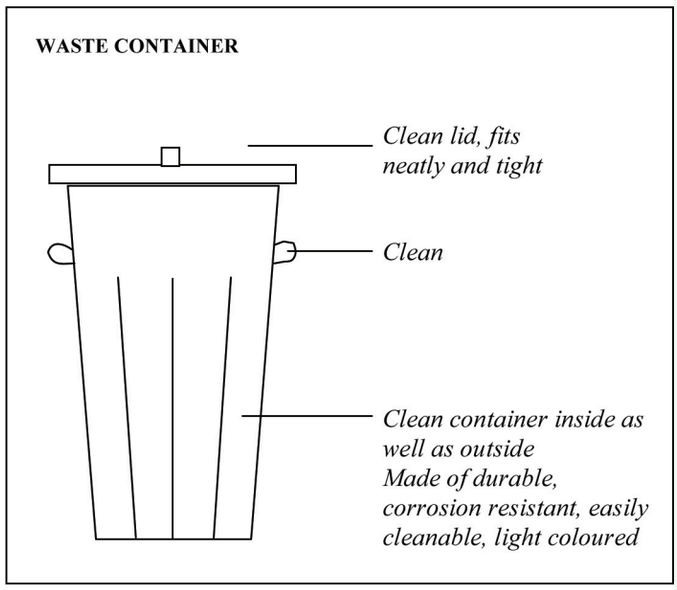

Figure 1: A typical refuse container (RMAA, 2006)

Figure 9: A typical refuse container (RMAA, 2006)

5.3 THE USE OF WATER IN THE ABATTOIR

Although the use of water in an abattoir varies hugely (depending on the type of animals that are slaughtered at the abattoir), it is considered useful to give an indication of the volumes of water that are used in red meat abattoirs, which are some of the most common abattoirs in Gauteng.

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These volumes provide an important indication to applicants who want to start the operation of red meat abattoirs as to the volumes of water they may need, and enables such applicant to properly plan to ensure that sufficient water will be available for proper operation of the abattoir. Failing the availability of such water volumes, the applicant should consider obtaining water from alternative sources, moving the abattoir site to another site where sufficient water is available

The volume of effluent is approximately 80 – 85% of water intake and typically contains blood, pieces of meat, fat and gut, constant urine and manure in suspension. Each of these contributes to a very high organic load. As a comparison, crocodile abattoirs use less than 5% of the above-mentioned volumes.

5.3.1 Water Management Recommendations

Lairages

Water used for general washing should be pressurized. If abattoirs find the cost of compressed air to be too prohibitively expensive, consideration should be given to using overhead header tanks to improve water pressure.

a) All hoses should be fitted with self-closing nozzles to prevent wastage when not in use.

5.4 HANDLING OF EFFLUENT

As a result of the nature of the work done in an abattoir, effluents are generated. These effluents need to be disposed of in a sustainable manner. The effluent is made up of blood from slaughtered animals, solids (i.e. meat or skin trimmings, hair, pieces of bone, hooves, etc), and grease/fat. The easiest method of getting rid of effluent would be to send the effluent into existing pools, rivers or lakes. However this is clearly not in compliance with current legislation and is not in accordance with international legislation. Thus, for the safe disposal of liquid and solid waste, the following action must be taken:

(a) Separation of Blood

The blood from slaughtered animals will coagulate into a solid mass, which may block up both open and closed drains. It is therefore recommended that the blood is collected and used for human consumption, stock feed production, fertilizers or the pet food market.

(b) Screening of Solids

Solids (meat or skin trimmings, hair, pieces of bones, hooves, etc.) must be screened. This may be done by providing the drains with vertical sieves which act as a filter, catching the solids but letting the water through (Figure 8).

5.4.1 Approach to Effluent Disposal

A strategic approach towards water and waste management at abattoirs, in accordance with the Department of Water Affair's water conservation, waste minimisation and progressive waste treatment philosophies (commencing with good housekeeping and low-cost technology and sequentially proceeding to sophisticated recovery and treatment technologies), should almost routinely be followed.

Water-use licenses and disposal site permits should make provision for conditions which will force abattoirs to incrementally progress towards predetermined water quality and waste management objectives within specified time frames. In the interim (until the legislation is finalised) general areas of waste management improvement should include:

- minimisation of waste generation at source (including maximising the recovery of useful materials),
- seriously curbing the practice of washing solids into drains (which transfers waste solids to the liquid medium), and
- promoting research into cleaner technology and recovery of higher value products from the waste stream.

The Septic Tank system is a commonly used effluent disposal system. However there are other systems that are in use, such as the Lilliput system. The use of new technological systems that assist in the management of effluent disposal should be used with the consent of the Veterinarian.

Effluent Management Recommendations

Lairages

a) The use of drain covers should only be considered as a safety measure and should not be used as a "solids trap".
b) The drainage system from the lairages must be separated from other effluents.
c) Where municipal sewage connections exist, all effluents from the lairages should be discharged to such. In cases where municipal sewage connections do not exist, the discharge of such effluents should be to lined pits. Discharge to the natural environment is unacceptable.

Process

a) Solid wastes must be prevented from entering the drainage system. All areas should be dry swept/ squeegeed prior to wash-down of floors, walls, etc.
Minimising water use reduces the effluent volume requiring handling and disposal. Even if measures to reduce pollutant mass loadings are not enacted proportionately, and the strength of the final effluent therefore increases to some extent, handling of the resultant effluent is facilitated.
b) Fat, meat and blood from carcass trimming and hide removal should be dry-swept, collected, and passed to suitable solids handling and disposal facilities rather than being flushed to drain.
c) Where no other options exist, discharge of effluent to the municipal sewage works may be tolerated.
d) The discharge of untreated effluents to the natural environment is unacceptable. If no other option exists but to discharge to the natural environment, such effluent should then be discharged to lined evaporation or treatment ponds.
e) The use of a dual outlet system on blood troughs, i.e. one for trough wash effluent and one for blood should be a design criterion.
f) Effluents from the various areas should be separated. It is recommend that as a minimum criterion, different effluent drain systems should be provided for the lairages, for the process floors (including offal rooms) and for domestic effluent.
g) Drains should be installed in straight lines with as few joints as possible to reduce costs and the risks of leakage. Drain covers should be effectively secured.
h) Mesh baskets are not effective as solids and fat traps (RMAA, 2006). It is recommended that these be replaced by other forms of solid and fat traps.

General

Effluent streams should be separated as far as possible to facilitate treatment, isolation or disposal.

All process areas should possess drain outlets. Humps should be constructed at all doorways to prevent the escape of effluent to stormwater drains.

a) Boiler coal supplies should be covered by a roof (non - flammable) and bunded to prevent stormwater run-off from entering the natural environment.
b) Effluent loadings and volumes must be established in order to deal with such effectively.
c) Abattoir grading systems must be enforced, or alternatively, abattoirs must be designed for their proposed grading +50% of capacity.
d) All transformers should be bunded. Waste refrigeration oil must be disposed of through reputable waste contractors.
e) Grease and solid traps with suitable grease removal facilities should be installed upstream of major collection sumps, to minimise the problem of grease removal from large volumes of effluent or plant items. Various grease trap designs are favoured by the larger municipalities, who are pleased to advise on design, installation and operation.

Water/liquid passes through, solids remain behind

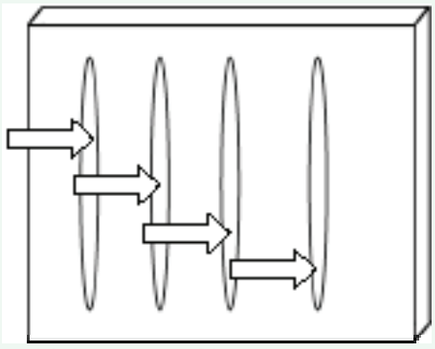
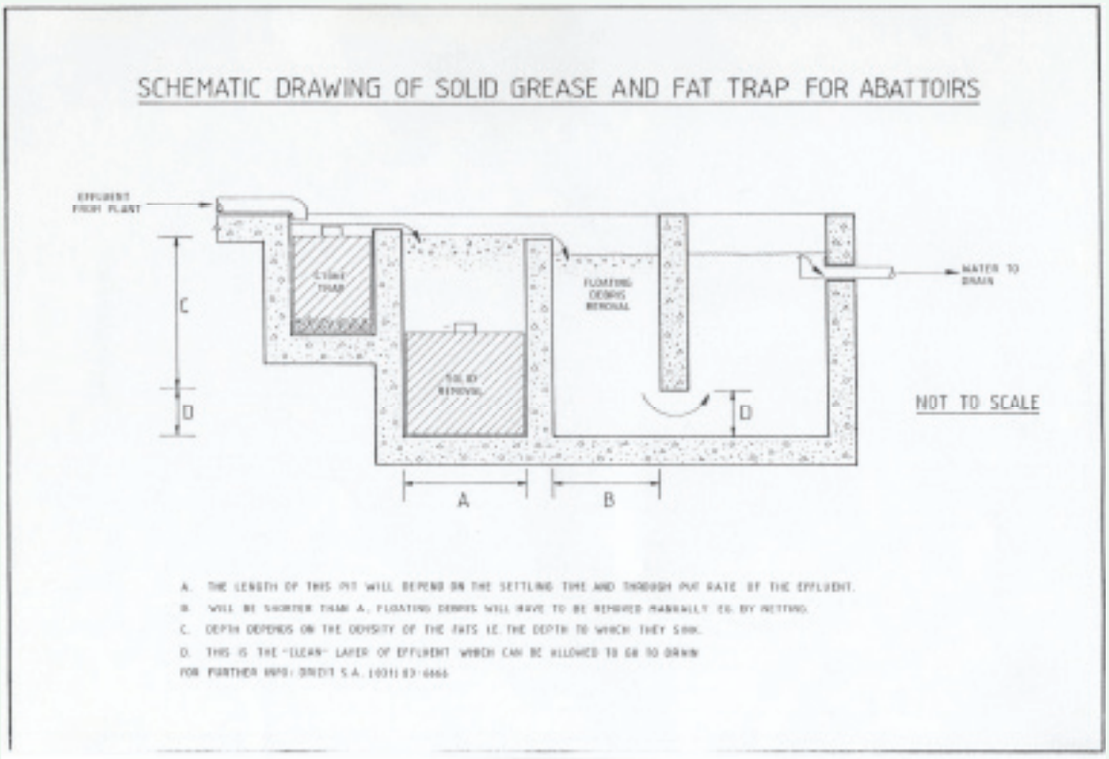
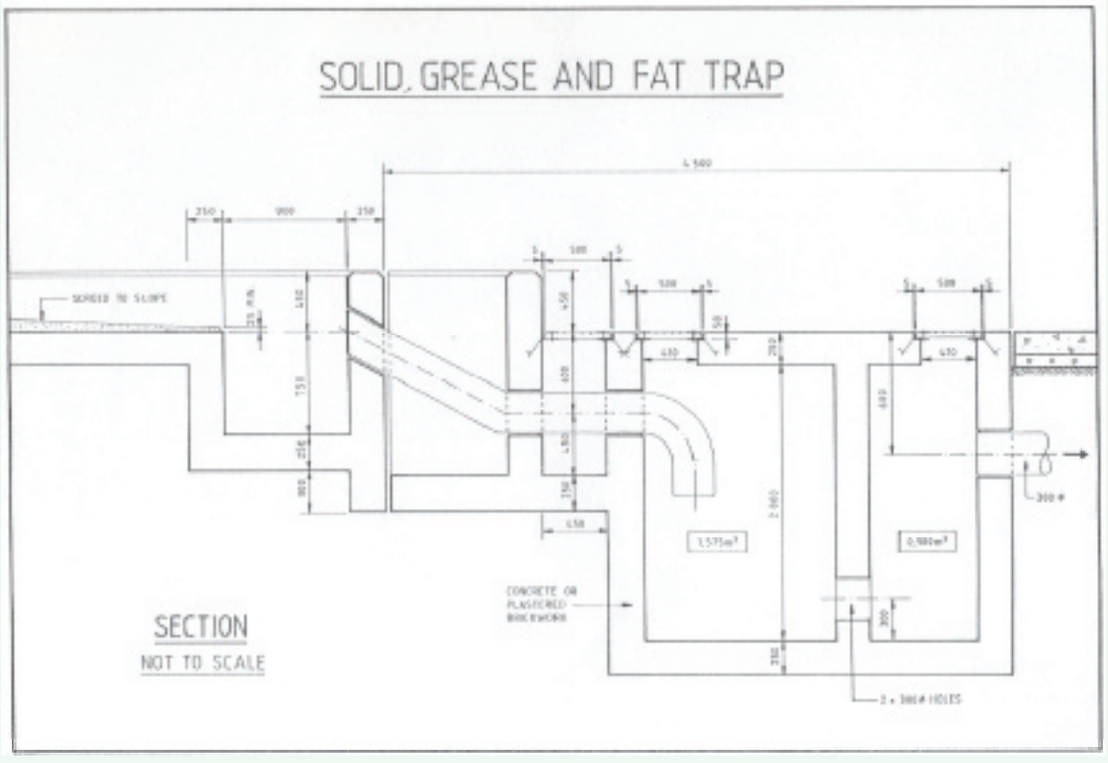


Figure 8:Solids vertical sieve screen which act as a filter (RMAA, 2006)

(c) Trapping of Grease

Effluents from slaughterhouses always contain small amounts of fat (melted fat or small pieces of fatty tissues). Grease traps should be installed in the drains to collect these waste products. The fat solidifies, rises to the surface and can be removed regularly. The final effluent disposal will depend on local conditions and legislation.


SCHEMATIC DRAWING OF SOLID GREASE AND FAT TRAP FOR ABATTOIRS
EFFLUENT FROM PLANT
C
D
GREASE TRAP
SOLID REMOVAL
FLOATING DEBRIS REMOVAL
WATER TO DRAIN
D
NOT TO SCALE
A
B
A. THE LENGTH OF THIS PIT WILL DEPEND ON THE SETTLING TIME AND THROUGH PUT RATE OF THE EFFLUENT.
B. WILL BE SHORTER THAN A. FLOATING DEBRIS WILL HAVE TO BE REMOVED MANUALLY OR BY NETTING.
C. DEPTH DEPENDS ON THE DENSITY OF THE FATS I.E. THE DEPTH TO WHICH THEY SINK.
D. THIS IS THE "CLEAN" LAYER OF EFFLUENT WHICH CAN BE ALLOWED TO GO TO DRAIN
FOR FURTHER INFO: DINDY S.A. (031) 83-6666


SOLID, GREASE AND FAT TRAP
SCREED TO SLOPE
CONCRETE OR PLASTERED BRICKWORK
SECTION
NOT TO SCALE

5.4.2 The Use of Technology for Effluent Disposal

The Septic Tank system is a commonly used effluent disposal system. However there are other systems that are in use, such as the Lilliput system. The use of new technological systems that assist in the management of effluent disposal should be used with the consent of the Veterinarian.

5.4.3 Effluent Management Recommendations

Lairages

a) The use of drain covers should only be considered as a safety measure and should not be used as a "solids trap".
b) The drainage system from the lairages must be separated from other effluents.
c) Where municipal sewage connections exist, all effluents from the lairages should be discharged to such. In cases where municipal sewage connections do not exist, the discharge of such effluents should be to lined pits. Discharge to the natural environment is unacceptable.

Process

a) Solid wastes must be prevented from entering the drainage system. All areas should be dry swept/squeegeed prior to wash-down of floors, walls, etc.
Minimising water use reduces the effluent volume requiring handling and disposal. Even if measures to reduce pollutant mass loadings are not enacted proportionately, and the strength of the final effluent therefore increases to some extent, handling of the resultant effluent is facilitated.
b) Fat, meat and blood from carcass trimming and hide removal should be dry-swept, collected, and passed to suitable solids handling and disposal facilities rather than being flushed to drain.
c) Where no other options exist, discharge of effluent to the municipal sewage works may be tolerated.
d) The discharge of untreated effluents to the natural environment is unacceptable. If no other option exists but to discharge to the natural environment, such effluent should then be discharged to lined evaporation or treatment ponds.
e) The use of a dual outlet system on blood troughs, i.e. one for trough wash effluent and one for blood should be a design criterion.
f) Effluents from the various areas should be separated. It is recommend that as a minimum criterion, different effluent drain systems should be provided for the lairages, for the process floors (including offal rooms) and for domestic effluent.
g) Drains should be installed in straight lines with as few joints as possible to reduce costs and the risks of leakage. Drain covers should be effectively secured.
h) Mesh baskets are not effective as solids and fat traps (RMAA, 2006). It is recommended that these be replaced by other forms of solid and fat traps.

General

Effluent streams should be separated as far as possible to facilitate treatment, isolation or disposal.

All process areas should possess drain outlets. Humps should be constructed at all doorways to prevent the escape of effluent to stormwater drains.
a) Boiler coal supplies should be covered by a roof (non - flammable) and bunded to prevent stormwater run-off from entering the natural environment.
b) Effluent loadings and volumes must be established in order to deal with such effectively.

5.5 SEPTIC TANK SYSTEMS

(Based on a CSIR Technical Guide K86 of the Institute for Water Research)
The septic tank system is an effective and economic method of disposing of abattoir effluent. The only prerequisite for this system is that the soil in the area should drain effectively and that it should conform to the requirements of the local authority.
One of the biggest advantages is that it can be used within 24 hours of installation. Care should be taken to restrict the water flow to the tank in the first two days to allow sufficient bacteria growth.

The septic tank system can be installed as close as 10 metres from the abattoir. However, care should be taken that the septic tank system is not under roadways or working areas to avoid it being damaged.

A septic tank system usually consists of two main components:

- the septic tank
- the final disposal system, that is usually an underground seepage furrow.
  Each of these components has specific functions and should be designed accordingly.

5.5.1 The Functions of the Components

Raw sewerage will clog the soil, causing ineffective absorption by the sub-soil. The septic tank, however, will condition the incoming sewerage, separating the solids from the liquid phase by either settling to the bottom or collecting at the surface (float). This results in the formation of three distinct layers:

- A layer of sludge on the bottom,
- A floating layer of scum on top, and
- A relatively clear liquid layer in the middle.

Bacterial digestion of organic material will cause liquefaction of the solids with associated gas formation – thus reducing the volume of the solids.
The only function of a soil disposal system is to get rid of the effluent from the septic tank in a safe and inoffensive manner.

5.5.2 Designing Requirements

The septic tank must function both as a sedimentation tank as well as a digester. The capacity of the tank should be large enough to provide ample retention time for in-flowing sewerage.
Possible clogging of the inlet, outlet and internal pipes must be limited to a minimum.
Provision should be made for ventilation for gasses to escape.
The possibility of passage of sludge and scum to the soil percolation system must be avoided as far as possible.

5.5.3 Sub-soil Percolation System

- The nature of the soil to a large extent determines the shape and size of the system.
- Locations should be such that it does not create a danger to public health or pollute either ground or surface water.
- The clogging effect of the effluent on the surface soil must be avoided.
- Facilitate full use of the available infiltration area.

5.5.4 Public Health Aspects of Septic Tank Systems

In built-up areas, this system should be seen as a temporary measure. There is practically no difference between the effluent from a septic tank and raw sewerage as far as potential danger for public health is concerned. Organisms causing disease can be present in the effluent of the septic tanks. In communities where drinking water is obtained from bore holes, it is usually unwise to make use of a septic tank system.

5.5.5 Combined and Separate Disposal Systems

Two types of disposal systems are in use:

- A separate system for the ablution facilities (cloakrooms, toilets and kitchens) utilising a septic tank and a separate or common soil percolation system.
- A second system for the abattoir effluent incorporating the necessary solids/fat traps and sedimentation tanks to remove solids (pieces of meat and fat). Effluent from this system can be discharged in a separate part of the same common soil percolation system.

5.5.6 Designing Criteria

Volume Sewerage Water

Abattoirs require a water supply of at least 900 litres per slaughter unit. The water must be available at an effective pressure and be protected against pollution. Average water consumption at an A-grade abattoir can be subdivided into:

Holding pens	10%
Slaughter and dress	20%
Offal area	25%
Warm water	25%
Steam	5%
Chilling	8%
Ablution	7%

The volume of effluent is approximately 80 – 85% of water intake.
Typical abattoir effluent contains blood, pieces of meat, fat and gut, constant urine and dung in suspension. Each of these contributing to a very high organic load.

5.5.7 Location of Septic Tanks

Local authorities usually have by-laws determining the minimum distances for the placing of septic tanks from buildings and boundaries. It is recommended that the tank be located near to a driveway to facilitate cleansing by means of a vacuum tanker. From a health point of view it is sufficient to have a soil cover of 150 to 200mm over the system.

5.5.8 Capacity

Calculation of capacity is based on usage per person per day with a retention period of 24 hours in the septic tank to provide for separation of scum and sludge thus providing for a relatively clear effluent.

5.5.9 Shape Proportions and Compartmentation:

For tanks of a given capacity and depth, the shape of the tank is relatively unimportant. The liquid depth should be between 1 and 2 meters. Single compartment tanks usually give acceptable performance but if a tank is divided vertically into two compartments with the first compartment half to two thirds of the total volume, the amount of suspended solids removed from the effluent is greater.

5.5.10 Inlet, Outlet and Inter-compartment Arrangements

The illustration (at the end of this section) indicates the positioning of the above in terms of the water level. To accommodate the accumulation of scum, the distance between the waterline and the roof of the tank should at least 20 percent of the water depth.

5.5.11 Access and Ventilation

The different compartment's components should be accessible for inspection and maintenance. The location of manholes should be as such that admission is easily obtained to pipes that could block. Ventilation is usually through the inlet sewer to the vent pipe against the wall of the building.

5.5.12 Materials

Septic tanks should be constructed of materials such as concrete, bricks, coated steel or any other materials which are not subject to excessive corrosion.

5.5.13 Design and Construction of Soil Percolation System

Location

Percolation trenches should be located where dangerous pollution of ground water is least likely to occur.

5.5.14 Suitability of the Soil

There is no simple test to accurately determine if soil is suitable to absorb the effluent. The standard SABS-test gives an indication and can be used as a guide-line. The relative proportions of sand, silt and clay determine the texture of the soil and influence the absorbing ability. The larger and more uniform the particles, the faster the percolation rate. Yellow and reddish-brown soils usually have good absorption quality, whereas a dull-grey (high clay content) has not.

5.5.15 Trench Design

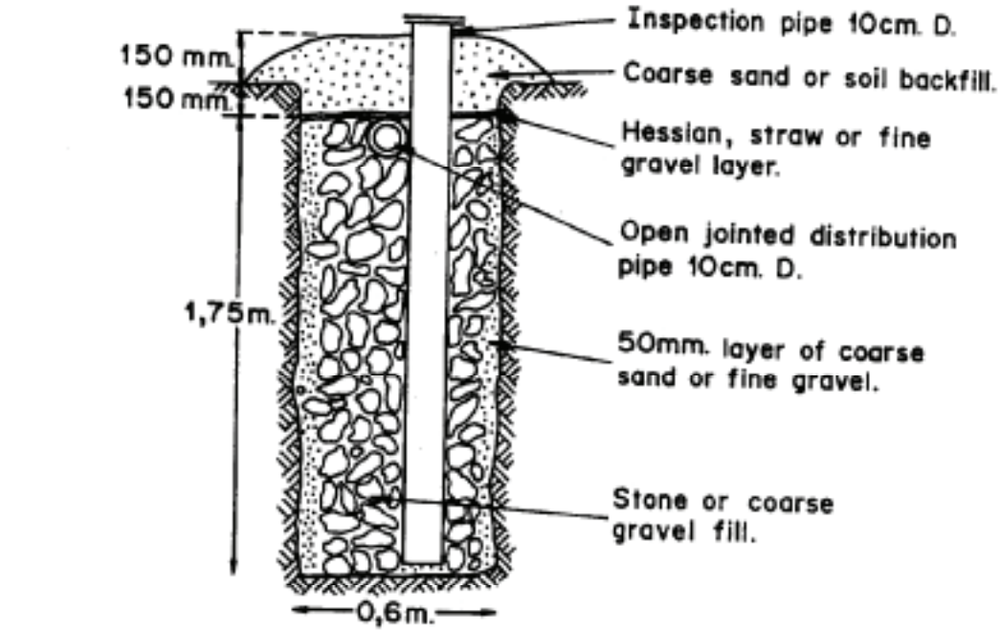
The bulk of the effluent enters the soil through the side walls of the trench. Deep narrow trenches are therefore preferable to wide shallow trenches. A permeable (allows liquids to pass though) layer, covered with impervious (nothing passes though) strata will require a deep trench, while the permeable topsoil, with permeable sub-soil will call for shallow trenches.

5.5.16 Trench Construction

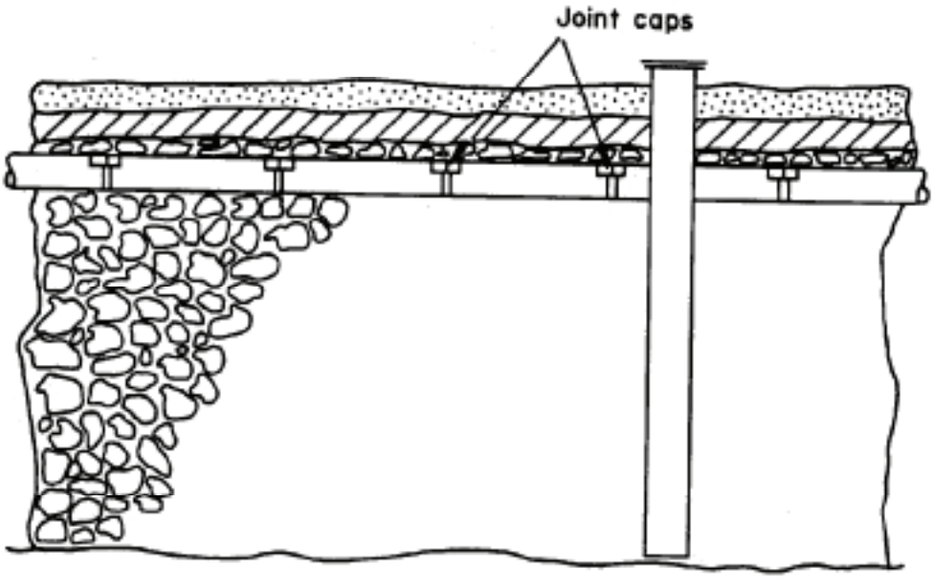
Trenches should be constructed along the contours. Where two or more trenches are adjacent to each other the distance in between should be twice the depth. After excavation the sides of the trenches should be roughened to restore the natural surface. Filling material should be clean and free of dust or silt. The size of the filling material is not critical and can be from 6mm to 75mm or more. It is advisable to have a layer of fine gravel or coarse sand against the infiltration surfaces. The trench should be filled with gravel to about 100 to 150mm from the top. Prior to back-filling, a layer of finer gravel should be placed on top to prevent soil from entering the trench. .If the length of the trench is in excess of 6 metres it will become necessary to provide an open jointed distribution pipe. The trench should be approximately 4 metres in length for every 1000 litres given the average absorption of the soil.

5.5.17 Maintenance

Septic tanks require effective maintenance. When scum and sludge gets discharged into the percolation trenches, the septic tank should be emptied and the silt and foam should be removed. If this is not done, the seepage system can be damaged permanently. When a ground seepage system starts clogging, there is little to be done, but proper usage of the septic tank can extend the life time of the furrows considerably.



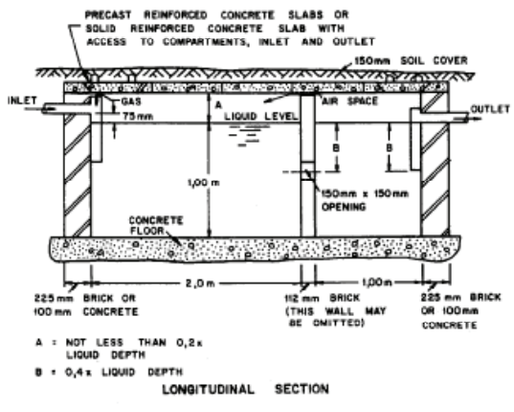
CROSS SECTION



LONGITUDINAL SECTION

Fig. 8 Details of trench construction.

CSIR Technical Guide K86



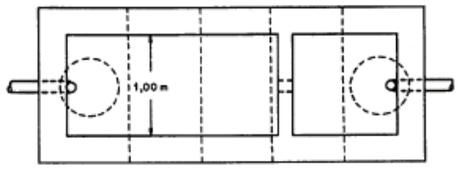


Fig. 5. Typical septic tank of 3 000 ℓ capacity.

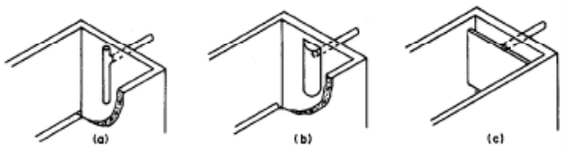


Fig. 6. Inlet and outlet arrangements.

CSIR Technical Guide K86

5.6 THE HANDLING OF GENERAL REFUSE

Some examples of general refuse include:

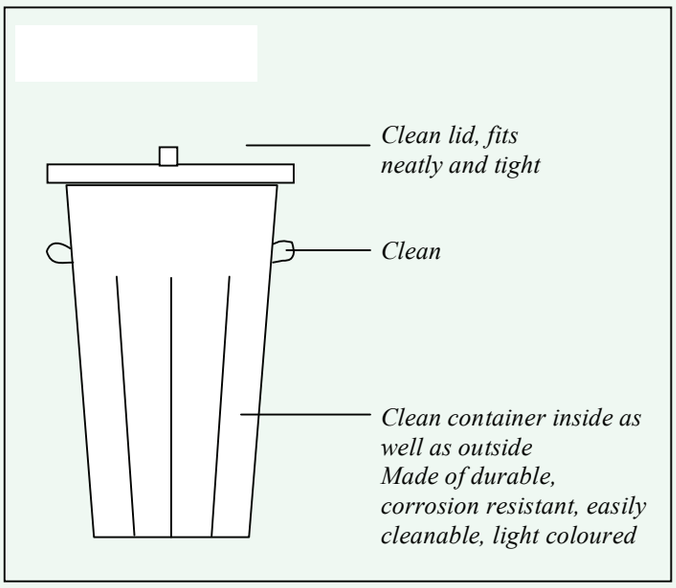
- Kitchen refuse from canteens, e.g. left over food, etc.;
- Paper from the administrative offices;
- Sweet papers, cold drink cans and bottles, cigarette packets and butts, fast food containers, etc, from the premises; and
- Garden refuse (cut lawn grass, dead leaves, weeds, old dead plants).

This waste must be collected at different locations on the abattoir premises in waste containers with tight fitting lids (Figure 9) that will prevent the entry of rodents, insects and animals. They should be made of durable, corrosion resistant, easily cleanable, light coloured material. The containers must be cleaned regularly inside and outside, including the handles on the lid and on the sides of the bin, without contaminating the surrounding areas. The area where the bins are placed should have the following:

- Controlled access, lockable gates to avoid scavengers;
- Enclosed with wall, and roofed to avoid exposure to weather conditions;
- The walls should be painted with a light washable colours; and
- The floor should be constructed with impermeable material and should have a proper drainage system with a trapper. The area should be washed regularly with a disinfectant to avoid smell and cross contamination.

Skip waste is not effective to store condemned material, as it is open and it can result in public health problems (e.g. odour generation, infestation of rodents, etc.) and can be easily accessed by cats, dogs etc. A recommended system for bulk storage containers is the static compactor. The waste area is often neglected in terms of cleaning and sanitation but it is still very important to keep it clean.

Figure 9. A typical refue container (RMAA, 2006



5.7 RECOMMENDATIONS

5.7.1 Solid Waste Management Process

a) Bleeding troughs should be provided with a drip tray to prevent excessive amounts of blood from entering the drainage system. Alternatively, a separate drain could be built under the hoof and head removal area, sloped back to the blood trough, so that excess blood can be recollected in the blood trough. Pipes from the blood trough should be diverted to a container on the outside of the building and should not be connected to the effluent system.
b) Plastic trays must not be used as bleeding troughs or blood containers.
c) Blood should not be dumped informally.
d) The use of any sludge (from septic tanks, etc.) by irrigation or any other method of dispersal with the aim of increasing soil fertility or any other aim is/should not be permitted.
e) The disposal of abattoir sludge on landfill sites, co-disposal with domestic waste and other waste is subject to permit requirements as stipulated in terms of the Environmental Conservation Act 73 of 1989 (RMAA, 2006).
f) In terms of the Department of Health's, "permissible utilisation and disposal of sludge", a contractual agreement should be signed between "all individuals and authorities responsible for handling a particular sludge from the place it is produced" (abattoir) "to the area where it is utilised or disposed of".
g) Paunch contents should not be dumped informally.
h) Suitable acid resistant materials should be used for bleeding trough construction.

General

a) Care must be taken of the spillage risk posed by various trailer designs.
b) All trailers/tankers should be licensed and kept roadworthy at all times to minimise the risk of spillage while in transit.
c) Abattoirs can make use of local hospital incinerators to burn carcasses. Mortality pits (ottway pit) are recommended only if they are adequately lined to prevent ground water contamination.

5.8 POTENTIAL ALTERNATIVE SOLUTIONS

A number of potential solution areas are found when abattoir wastes are dealt with holistically. While these cannot be ignored, they cannot be proposed as rigid recommendations, due to the fact that they are all relatively innovative solutions which will require further investigation and pilot studies.

Although it is strongly recommended that these avenues be further investigated, it must be pointed out that it will be necessary to establish the loadings and volumes of wastes generated by the relevant abattoirs, prior to any further steps being taken. It must be further emphasised that site specific conditions prevailing at each different abattoir must not be overlooked, e.g. arid versus humid conditions.
Although the use of alternative methods of waste disposal is encouraged, it must be kept in mind that an abattoir owner must first obtain the written permission of the Provincial Executive Officer to use a method other than those described in the MSA.

Internationally, a number of alternative technologies are available for sterilisation infectious waste. The "Sterifant" system, for instance, works through the sterilisation of waste through the injection of heated water into sealed containers and maintaining a saturated steam atmosphere in the containers through microwave action, followed by shredding (see www.sterifant.com).

This is only one of a multitude of technologies available, and abattoir owners are encouraged to explore these technologies to assess what works best in the South African industry.

The following points should be considered as further recommendations:

a) The feasibility for abattoir owners to transport their waste to a rendering facility at a larger nearby abattoir should be considered as a priority, where this is financially feasible. The disadvantage of this approach is, however, that waste is transported by road. In such cases, it must be ensured that the risk of spillage of abattoir waste en route is minimised.

b) Waste minimisation and separation of wastes at the source first.

c) As advocated in the body of this report, solid and grease traps should be installed downstream of effluent sources to separate gross solids and fats from all effluents prior to discharge. Where present, mesh basket trap structures exist, it is recommended that that these be replaced by solid and fat traps as presented on page 106.

d) Dewatering screens should be used for the paunch contents. Similarly, drying beds similar to that used in sewage works may possibly be used to dewater paunch contents.

e) The use of microbes for the bio-remediation of all abattoir effluents and solid wastes should be investigated further.

f) Vermiculture - the use of earthworms to decompose and filter abattoir wastes, including paunch contents and blood.

g) The use of man-made, lined, wetland (reed bed) or vlei systems to treat the effluent.

h) Where no other options are available, the use of properly designed septic tanks may be considered to pre-treat the effluent generated. Please note that the final flow from the septic tanks should be discharged to a municipal sewer line and not to the natural environment, as this is unacceptable.

i) A number of affordable physical and chemical treatment processes and systems may become available locally to treat Abattoir waste volumes.

PART 2: LEGISLATION COMPONENT

1. NATIONAL ENVIRONMENTAL MANAGEMENT ACT 107 OF 1998

1.1 The waste generator's "cradle-to-grave" responsibility

The National Environmental Management Act of 1998 (NEMA) was promulgated in response to citizens' environmental rights protected by Section 24 of the Constitution of the Republic of South Africa, 1996.

One of the Act's objectives is to provide for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment. To this end, a set of national environmental management principles is listed in Chapter 2. These principles apply to actions of all organs of state that may significantly affect the environment, including, for example, the authorisation of abattoirs. Although not targeting citizens directly, the principles must be reflected in permits, exemptions or other government authorisation and will thus impact indirectly on citizens.

The following principles are noteworthy in the context of abattoir waste management:

Sustainable development requires the consideration of all relevant factors including the following:
that waste is avoided, or where it cannot be altogether avoided, minimised and re-used or recycled where possible and otherwise disposed of in a responsible manner."

Responsibility for the environmental health and safety consequences of a policy, programme, project, product, process, service or activity exists throughout its life cycle."

The costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment".

Chapter 2 of NEMA therefore –

(i) establishes the so-called "cradle-to-grave" (life cycle) responsibility for waste generated by abattoirs, and

(ii) also provides GDARD (and other organs of states) with a statutory mandate to incorpo rate these principles into Abattoir authorisations.

1.2 Personal liability for contraventions of waste-related legislation

Another very important provision of NEMA is the personal liability imposed by Section 34 for violations of offences listed in Schedule 3 to the Act.
The essence of Section 34 is that employees cannot escape personal liability for offences of these laws, UNLESS they can demonstrate that the offence is a result of the failure of their employer to take reasonable measures to prevent the offence. Section 34 (5) & (6) is reproduced below.

34 (5) Whenever any manager, agent or employee does or omits to do an act which it had been his or her task to do or to refrain from doing on behalf of the employer and which would be an offence under any provision listed in Schedule 3 for the employer to do or omit to do, and the act or omission of the manager, agent or employee occurred because the employer failed to take all reasonable steps to prevent the act or omission in question, then the employer shall be guilty of the said offence and, save that no penalty other than a fine may be imposed if a conviction is based on this subsection, liable on conviction to the penalty specified in the relevant law, including an order under subsections (2), (3) and (4), and proof of such act or omission by a manager, agent or employee shall constitute prima facie evidence that the employer is guilty under this subsection." (Emphasis added) "34 (6) Whenever any manager, agent or employee does or omits to do an act which it had been his or her task to do or to refrain from doing on behalf of the employer and which would be an offence under any provision listed in Schedule 3 for the employer to do or omit to do, he or she shall be liable to be convicted and sentenced in respect thereof as if he or she were the employer". (Emphasis added)

1.3 Environmental emergencies

Whenever an environmental emergency incident involving waste of any description occurs, the following clean-up and reporting obligations imposed by Section 30 of NEMA must be observed. The ambit of Section 30 is broader that the emergency provisions of the National Water Act of 1998 (discussed in paragraph 1.1.3.5 below), and covers incidents impacting on all environmental media, not only water.

Section 30 of the National Environmental Management Act states that in the event of an unexpected sudden occurrence, including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed, the employer, must, as soon as it becomes aware of the incident, report through the most effective means reasonably available-

(a) The nature of the incident;
(b) Any risks posed by the incident to public health, safety and property;
(c) The toxicity of substances or by-products released by the incident; and
(d) Any steps that should be taken in order to avoid or minimise the effects of the incident on public health and the environment to-
    (i) The Director-General of Environmental Affairs and Tourism;
    (ii) The South African Police Services and the relevant fire prevention service;
    (iii) The relevant provincial head of department or municipality;

AND

    (iv) All persons whose health may be affected by the incident.

Management must, as soon as reasonably practicable after knowledge of the incident:

(a) Take all reasonable measures to contain and minimise the effects of the incident, including its effects on the environment and any risks posed by the incident to the health, safety and property of persons;
(b) Undertake clean-up procedures;
(c) Remedy the effects of the incident;
(d) Assess the immediate and long-term effects of the incident on the environment and public health.

In addition, a report must be submitted to the Director-General, provincial head of department and municipality within 14 days of the incident, including such information as is available to enable an initial evaluation of the incident, including:

(a) The nature of the incident;
(b) The substances involved and an estimation of the quantity released and their possible acute effect on persons and the environment and data needed to assess these effects;
(c) Initial measures taken to minimise impacts;
(d) Causes of the incident, whether direct or indirect, including equipment, technology, system, or management failure; and
(e) Measures taken and to be taken to avoid a recurrence of such incident.

"Relevant authority" means-

- A municipality with jurisdiction over the area in which an incident occurs;
- A provincial head of department or any other provincial official designated for that purpose by the MEC in a province in which an incident occurs;
- The Director-General;
- Any other Director-General of a national department.

It follows therefore that the clean-up and reporting obligations imposed by Section 30 of NEMA must be captured in emergency preparedness and response procedures.

2. ENVIRONMENT CONSERVATION ACT 73 OF 1989

2.1 Introduction & guiding principles

A multitude of legal obligations are imposed on the generator of waste. Most of these requirements are imposed by the Environment Conservation Act of 1989 (ECA). Before discussing these, it is important to take note of the legal definition of "waste", for the purpose of interpreting the provisions of the Environment Conservation Act of 1989.

Legal definition of "waste"

Waste is defined in GN R 1986 to the Environment Conservation Act of 1989 as follows:

"Waste", for the purposes of interpreting Section 20 includes –

- Any matter (whether gaseous, liquid or solid or any combination thereof)
- which is an undesirable or superfluous by-product,
- Emission,
- residue or remainder of any process which originates from any residential,
- commercial or industrial area and which is:
  (a) Discarded by any person; or
  (b) Is accumulated and stored by any person with the purpose of eventually discarding it, with or without prior treatment connected with the discarding thereof; or
  (c) Is stored by any person with the purpose of recycling, re-using or extracting a useable product from such matter; or
  (d) Building rubble used for filling or levelling purposes.

Excluded from the definition is:

(a) Wastewater disposed of in accordance with the National Water Act;
(b) French drains and septic tanks;

(c) Radio-active waste;
(d) Mining waste, such as tailings, slimes and waste rock.

Other laws regulate the excluded categories. Wastewater is, for example, regulated under the National Water Act of 1998 and municipal bylaws, discussed below in paragraphs 1.1.3.2 and 1.1.11.2 below.

From this definition it is clear that abattoir waste, such as dead and condemned animals, hides, skins and fat, as well as other industrial wastes streams (e.g. mercury containing thermometers, fluorescent tubes, old oils and lubricants) fall within the definition of "waste" for the purposes of the Environment Conservation Act of 1989.

- All industrial waste deemed hazardous until proven otherwise

It is furthermore important to understand that the Department of Water and Environmental Affairs regards all industrial waste as hazardous, until proven otherwise (as discussed in paragraph 1.1.2.2 below).

- Waste generator's "cradle-to-grave" responsibility

Before turning to the requirements imposed by the Environment Conservation Act, it is also important to understand that the generator of waste is in our law ultimately responsible for safe disposal. "Generator" means an industry or other party whose activities result in the production of waste. This means that control over sub-contracted waste contractors is required, coupled to detailed waste tracking and auditing systems. All of these are discussed in more detail below.

2.2 Determining the correct disposal methods for industrial waste

- Characterising the waste

In order to identify the correct disposal technology for all wastes, the first step is to accurately distinguish between hazardous and general waste.

Hazardous waste is defined by the Department of Water and Environmental Affairs (DWEA) as waste that may, by circumstances of use, quantity, concentration or inherent physical, chemical or infectious characteristics, cause ill health or increase mortality in humans, fauna and flora, or adversely affect the environment when improperly treated, stored, transported or disposed of. From this definition it can be seen that many variables determine whether a waste is hazardous or not. In terms of DWEA's approach, all industrial wastes are presumed to be hazardous unless proven otherwise.

If it is probable that the waste is a hazardous waste (e.g. spent mercury containing thermometers used in cold rooms, infectious waste, fluorescent tubes, old oils and lubricants, water treatment sludge, empty chemical containers) the substances, compounds, properties and characteristics must be determined, either through tests and analyses, or from literature review. The waste characterization method is described in Chapter 5 of the aforesaid Minimum Requirements (including literature review of less
complex and/or well known wastes, and leach & acid rain tests by accredited laboratories for more
complex waste streams). Due to the specialist knowledge required to accurately classify and rate hazardous wastes, waste classification is best performed by toxicologists.

The waste characterization is followed by a classification in accordance with the 9 classes described in SANS 10228. This Code provides a system for classifying hazardous substances for transport purposes, but is also used for waste classification. In the Code, hazardous substances are divided into the following nine classes:

Class 1 Explosives
Class 2 Gases
Class 3 Flammable liquid
Class 4 Flammable solid
Class 5 Oxidising substances & organic peroxides
Class 6 Toxic and infectious substances
Class 7 Radioactive substances
Class 8 Corrosives
Class 9 Other miscellaneous substances

A more detailed description of the 9 classes is provided in Annexure 2 below.

The SANS Code 10228 class allocation determines the minimum requirements for disposal, as outlined in Diagram III (page 6 –7) and Table 6 of DWAF's Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste, Second Edition (See Annexure 1 to this section). For example, Class 8 (corrosive) waste may not be landfilled unless the pH is treated to pH 6 – 12. It is the waste generator's duty to ensure that these requirements are observed.

- "Delisting" hazardous waste

At a certain concentration in the environment, any compound classified as hazardous, would be within an acceptable risk, if the concentration and hence, total amount, is low enough (excluding certain carcinogens and teratogins) . This means that a compound must be able to "move out", i.e. "delist" from its primary classification rating to a lower rating or even to a situation where it can be regarded as "non-hazardous". The important factors which play a role in delisting are, inter alia, concentration, total amount, speciation of compound (e.g. Chrome6+ or Chrome3+). A formula for delisting is provided in Chapter 8 of the said DWEA Minimum Requirements. It is also important to note that delisting must be officially approved by DWEA. Again, the procedure to delist a hazardous waste requires specialist input.

2.3 On-site accumulation of waste

In terms of Section 20(1) of ECA, abattoir operators may not establish and/or operate a waste disposal site without a permit or exemption issued by the Minister for Environmental Affairs and Tourism in terms of section 20(1) of ECA.

The definition of a "disposal site" is not confined to a typical landfill site, and includes "a site used

for the accumulation of waste with a view to treatment or further disposal". As evident from the legal definition of waste (reproduced above in paragraph 1.1.2.1), recyclable and reusable by-products or remainders of processes (e.g. skins, hides & fat) are also regarded as waste.

All on-site waste disposal and/or accumulation areas therefore constitute the "operation of a waste disposal site".

The Department of Environmental Affairs (DEA) regulates these on-site accumulation areas through a system of "Conditional Exemptions" from the permitting requirements. The Department of Water Affairs & Forestry's policy on Exemption from permitting requirements is reproduced at the end of this section as Annexure 3. (DWEA administered these provisions prior to 3 January 2006.)

2.4 Off-site disposal

As regards waste that is removed from the abattoir, Section 20(9) requires disposal to "appropriately permitted" facilities. Abattoir operators must accordingly confirm that the receiving site is appropriately permitted (or exempted) in terms of section 20(1) of ECA, and further that the waste is in fact received at the site and disposed of in accordance with the prescribed disposal method – see Annexure 1 at the end of this section.

Wastes that may not be received at these sites are normally listed in Annexures to the s20 (1) site permits. It is therefore important to obtain a complete copy of the permit and its annexures in order to ensure that prohibited wastes are not send to landfill.

It follows from the above that a documented waste tracking system must be designed and implemented in order to be able to account for all wastes removed to off-site facilities. This system will typically consist of:

- A log of quantities generated (per type);
- Records of waste removed from site – these records must reflect the correct description of the waste (with reference to class and hazard rating) and the agreed destination;
- Records that the waste arrived at the agreed destination – these records must reflect the signature of the operators of the receiving site or a weighbridge stamp;
- If any special requirements for disposal exists (e.g. fluorescent tubes), records that the prescribed disposal method has been applied;
- A mechanism whereby the records of waste disposed of are reconciled (balanced) with the log of quantity of waste generated.

Such a documented waste tracking/auditing system will enable the Abattoir Operator to account for all waste removed from their premises and to ensure that no hazardous waste is "lost". The detailed tracking system described above is only required for hazardous waste. As far as general waste is concerned, it will suffice to ensure that the receiving landfill site is permitted in terms of section 20(1) of ECA as discussed above.

2.5 Additional requirements applicable to certain waste streams

Fluorescent tubes

Note the following specific requirements (contained in policies developed by the Department of Water Affairs and Forestry) applicable to old fluorescent tubes:

1. All fluorescent tubes originating from industrial or commercial activities are considered to be collected in "large quantities" and must be disposed in a controlled manner.
2. These tubes are therefore to be collected in purpose made tube crushers, usually a 220 l drum containing the treatment solution (see point 5 below) with a close fitting cap. This cap is equipped with a small device on top through which the tubes are pushed into the drum, and crushed inside the drum with a breaking mechanism. Once the drum is full, the cap equipped with the breaking mechanism is removed and the drum is sealed with a tight fitting cap.
3. The sealed drums may be disposed of on a H: H waste disposal site according to the permit conditions under which such site is operated.
4. The acceptable risk level for Mercury for disposal on a H:H waste site, is 0.9 ppb (0.0009 mg/kg or mg/l), and even if the concentration in the waste is lower than this, it may only be disposed of on a H:h landfill site if the concentration in the waste is less than 0,009 ppb (9x10-6 mg/kg or mg/l) AND the mercury component is less than 1% of the total waste stream, since it is a known carcinogen.
5. Fluorescent tubes collected in large quantities are considered extremely hazardous waste, since it contains a minimum of 2 mg/kg of Mercury per tube. It may therefore only be disposed of on a H: H waste disposal site, and only after treatment aimed at fixing the mercury to an immobile state. This treatment involves the addition of a 50% Sodium Sulphide – 50% Sulphur solution in a 1:10 (vol/vol) ratio to the tubes crushed under controlled conditions in drums.

Medical waste

The Gauteng Provincial Government promulgated the Gauteng Health Care Waste Management Regulations, 2004 (Notice 3035 of 2004) (Regulations).

These regulations address all aspects of health care waste management and as such apply to on-site clinics operated by abattoirs. The general requirements and obligations imposed on a minor generator (generating less than 20 kg per day, based on monthly average) are summarized below.

Regulation 2: General prohibitions and duty of care

Abattoir operators may not manage health care risk waste other than in accordance with these Regulations.
In terms of regulation 2(4), a container of health care risk waste that weighs in excess of 15 kilograms, including the container, may not be lifted manually.

Regulation 3: Storage

Health care risk waste must be stored in accordance with the Minimum Requirements set out in Schedule 9, reproduced below as Annexure 4.
Health care risk waste may be stored for up to 30 days from the date the waste is generated or received by the relevant generator. This 30 day limit excludes any time the waste is stored at a temperature below -2 (minus two) °C.
Abattoir operators must ensure that the time period between the collection of a consignment by a transporter from their premises and the treatment of that health care risk waste does not exceed 72 hours.

This time limit excludes any time that the health care risk waste is stored at a temperature below -2 (minus two)°C at a transfer facility for not more than 90 days.
Notwithstanding anything contained elsewhere in these Regulations-
(a) Abattoir operators may store sharps waste and pharmaceutical waste for up to 90 days;
(b) if the odour from stored health care risk waste cannot be controlled and the odour poses a nuisance to any person, abattoir operators must effect more frequent removal; and
(c) pathological waste not treated within 24 hours of generation must be stored at a temperature below -2 (minus two)°C.

Regulation 4: Final disposal

Abattoir operators may not finally dispose of treated health care risk waste except-
(a) by a method approved in writing by the Department of Environmental Affairs
(b) In the manner set out in item 3 of Schedule 9 (See Annexure 4 below).

Regulation 5: General

Within 30 days of any material change to the information specified in any application form submitted to the Department in terms of these Regulations, the applicant must submit an updated application form.

All records required in terms of these Regulations must be kept for a period of 3 (three) years.

Regulation 7: Segregation

Abattoir operators are required to segregate health care risk waste from health care general waste at the point of generation, and take all reasonable measures to maintain such segregation at all times thereafter.

Health care risk waste may not be treated together with health care general waste.

Regulation 8: Waste minimisation

Abattoir operators must, where reasonably practicable, minimise the volume of health care risk waste in its operations by minimising the generation of health care risk waste at source. The Department of Environmental Affairs may set targets for waste minimisation, in general or for a specific sector or institution, by publication of a

notice in the Provincial Gazette.
Regulation 9: Packaging

For the purposes of transport and storage, abattoir operators must pack health care risk waste in health care risk waste containers which clearly indicate the contents and which are colour coded and marked in accordance with SANS Code of Practice 10248: Management of Health Care Waste, or the international ISO Biohazard symbol, or other internationally recognised symbol.

Abattoir operators may only pack health care risk waste in containers which comply with the Minimum Requirements for packaging of health care risk waste, as set out in Schedule 1 (reproduced below as Annexure 4).

Abattoir operators must clearly indicate on all containers containing its health care risk waste that the contents were generated at a minor generator by using marking or digital identification.
When necessary, containers must be sealed to prevent leakage or expulsion of contents.

For the purposes of internal transport, health care risk waste must be placed in one or more leak resistant receptacles.

A leak resistant container containing health care risk waste must be placed in a health care risk waste container in accordance with items 1 and 2 of Schedule 9. (See Annexure 4 below.)

Liquid health care risk waste must be placed in a capped or tightly secured leak resistant and spill resistant container.

Sharps waste must be placed in a sharps container at the point of generation and keep such waste in a sharps container at all times thereafter.

Sharps containers must be sealed when it is full with a non reversible sealing design, to prevent the release of sharps waste from the container.

Regulation 11: Health and safety

Abattoir operators must take all reasonable measures to ensure that once health care risk waste is placed in a health care risk waste container, the waste is not removed from that container for the purposes of:

(a) Decanting it into another container;
(b) Sorting it; or
(c) Any other purpose;
until the waste is received by the relevant treatment facility.

To avoid injuries to or infection of people, abattoir operators must:

(a) take all necessary measures to ensure that reusable containers are effectively disinfected before re-use, according to the standards specified in Schedule 2 (reproduced below as Annexure 6); and
(b) Provide and require all persons who manually handle containers of untreated health care risk waste to wear clean, protective gloves and overalls, changeable lab coats or other appropriate personal protective equipment.

Regulation 14: Minor generators
A Municipality must ensure that a service is provided for the safe collection and treatment of health care risk waste generated by minor generators.

2.6 Waste recycling

Mindful of the obligation imposed by Section 20(9) of ECA to dispose of waste at "appropriately permitted" facilities only, coupled to the definition of waste (reproduced in 1.1.2.1 above, it follows that abattoir operators must also verify the legal handling of recycled wastes. The three most important aspects to follow up in this regard are:

- the accumulation of waste at the recyclers' premises (the accumulation of waste with a view to treatment or further disposal constitutes a disposal site that requires a permit or exemption from DWEA – see Annexure 3 below);
- the processes to which the waste are subjected, with specific reference to the list of scheduled processes contained in the second schedule to the Atmospheric Pollution Prevention Act of 1965 (e.g. metal recovery and hydrocarbon refining processes). These processes may not be carried out without a registration certificate issued by the Chief Air Pollution Control Officer, Department of Tourism; and
- A permit to discharge trade effluent to the municipal sewers (see paragraph 1.1.11.2 below).

The detailed waste tracking system described above in the context of hazardous waste disposed of at landfill sites is not required for recycled wastes, since the risk of dumping at unauthorized facilities is reduced by the fact that the waste is removed for the purposes of extracting a usable product from the waste.

2.7 Littering

Section 19 of ECA imposes an obligation on abattoir operators to keep their premises clean and free from filth, debris, rubbish, glass, paper, rags, tins, lumber or any other litter that may become a nuisance or injurious to the health of members of the public having access to such site.

2.8 Environmental impact assessment requirements

Activities that are listed in terms of Section 24(2)(a) and 24D of the NEMA may not commence without the relevant environmental authorisation being granted by the "competent authority," in terms of Section 24(1) of NEMA. the Minister for Environmental Affairs and Toursim has published two Listing Notices (Listing Notice 1 – GN R386 and Listing Notice 2 – GN R387). Included in these Listing Notices and of relevant to these Guidelines are the following activities:

Item 1 of GN R386
The construction of facilities or infrastructure, including associated structures or infrastructure, for:

(p) the temporary storage of hazardous waste;

Item 23 of GN R 386
The decommissioning of existing facilities or infrastructure, other than facilities or infrastructure that commenced under an environmental authorisation issued in terms of the Environmental Impact Assessment Regulations, 2006 made under section 24(5) of the Act and published in Government Notice R385 of 2006, for:

(d) the disposal of waste;
(e) the treatment of effluent, wastewater and sewage with an annual throughput capacity of 15 000 cubic metres or more;
(f) the recycling, handling, temporary storage or treatment of general waste with a daily throughput capacity of 20 cubic metres or more; or
(g) the recycling, handling, temporary storage or treatment of hazardous waste.

Item 25 of GN R386
The expansion of or changes to existing facilities for any process or activity, which requires an amendment of an existing permit or license [sic] or a new permit or license [sic] in terms of legislation governing the release of emissions, pollution, effluent.

Item 1 of GN R387
The construction of facilities or infrastructure, including associated structures or infrastructure, for:

(f) the recycling, re-use, handling, temporary storage or treatment of general waste with a throughput capacity of 50 tons or more daily average measured over a period of 30 days;
(g) the use, recycling, handling, treatment, storage or final disposal of hazardous waste;
(p) the treatment of effluent, wastewater or sewage with an annual throughput capacity of 15 000 cubic metres or more;
(q) the incineration, burning, evaporation, thermal treatment, roasting or heat sterilisation of waste or effluent, including the cremation of human or animal tissue;
(r) the microbial deactivation, chemical sterilisation or non-thermal treatment of waste or effluent;

(Other listed activities relate to operational aspects of abattoirs – such as the construction of facilities or infrastructure, including associated structures or infrastructure, for- (g) the slaughter of animals with a product throughput of 10 000 kilograms or more per year; Only waste-related activities are highlighted in this report.)

The competent authority, in turn, may not adjudicate the application without first considering an environmental report, submitted by the Applicant in accordance with a prescribed procedure. This prescribed procedure provides for two types of environmental impact assessment, the "basic assessment" and a more comprehensive "scoping/ environmental impact assessment (EIA) ". The prescribed

procedure is currently contained in the Environment Impact Assessment Regulations (Government Notice R 385), and requires the Applicant to appoint an independent environmental assessment practitioner who must, on behalf of the applicant, comply with these regulations. The assessment may therefore not be carried out by the Applicant themselves. As the prescribed procedure will be followed by the independent environmental assessment practitioner, a detailed account of the prescribed procedures are not provided in this document.

Commencement with a listed activity without the required consent or exemption attracts a fine of up to R 5 000 000.00 (five million rand) or to imprisonment for a period not exceeding 10 years or to both such fine and such imprisonment. Read with the personal liability provisions of Section 34 of the National Environmental Management Act of 1998 (see paragraph 1.1.1.2 above), abattoir managers must carefully consider the relevance of Section 24 of NEMA in the context of the planning of all new activities.

3 NATIONAL WATER ACT 36 OF 1998

The National Water Act of 1998 (NWA) is administered and enforced by the Department of Water and Environmental Affairs. It regulates all aspects of water use, including wastewater handling and waste management practices that could potentially impact on water resources. Sections 19, 20, 21 and 22 impose obligations that are directly applicable to abattoir waste management.

3.1 Water pollution prevention

Section 19 requires abattoir operators, in their capacity as landowners and/or person in control of land, to take all reasonable measures to prevent the pollution of a water resource from occurring, continuing or recurring, including measures to:

- Cease, modify or control any act or process causing pollution;
- Comply with any prescribed waste standards or management practice;

- Contain or prevent the movement of pollutants;
- Eliminate any source of pollution;
- Remedy the effects of pollution; and
- Remedy the effects of any disturbance to the bed and banks of a watercourse.

Section 19 introduced a clear departure from the historical "end-of-pipe" treatment approach to the elimination of pollution at source (e.g. roofing and bunding of outdoor waste storage areas)

"Water resource" includes surface water, an estuary, aquifer, river or spring and a natural channel in which water flows regularly or intermittently.

"Pollution" means the direct or indirect alteration of the physical, chemical or biological properties of a water resource so as to make it-

(a) Less fit for any beneficial purpose for which it may reasonably be expected to be used; or
(b) Harmful or potentially harmful-
(aa) To the welfare, health or safety of human beings;
(bb) To any aquatic or non-aquatic organisms;
(cc) To the resource quality; or
(dd) To property.

The success of the water pollution prevention measures can be tested periodically by assessing the quality of the rainwater leaving the site. The Water Quality Objectives set by the Department of Water Affairs and Forestry for the receiving water resource should be used as a benchmark against which to assess the monitoring data so collected. If no such objectives have been set, the SA Water Quality

Guidelines for the potentially affected water users should be used as a benchmark.
Eight such guidelines have been published, each outlining the specific water user sector's water quality requirements. If, for example, contaminated run-off from an abattoir should impact on a downstream crop farmer, the Water Quality Guidelines for Agriculture: Irrigation, must be used as a specification against which to assess the extent to which the rainwater leaving the site is polluted (i.e. rendered less fit for other users, in this example a crop farmer.) Note also that aquatic organisms are very sensitive to fluctuations in water quality and temperature, and the Water Quality Guideline for aquatic ecosystems should almost always be used as a benchmark in instances where rainwater runoff will enter a water resource.

3.2 Water use licences

The ambit of the licensing provisions of the National Water Act of 1998 (NWA) covers almost all aspects of water use. The water uses listed in Section 21 of the NWA must be licensed by the Department of Water Affairs and Forestry, UNLESS the use in question -

a) is an existing lawful water use;
b) is permissible under a general authorisation;
c) is listed in the First Schedule to the Act;

Uses that are authorised in terms of Schedule 1 are limited to recreational use, use for basic human needs and, more importantly, discharge of wastewater to another person/institution that is authorised to receive and treat the discharge concerned – such as the municipality.

This means that wastewater discharge the municipality need not be licensed under the National Water Act of 1998, provided that it can be shown that the municipal works are duly authorised under this Act. (Note, however, the permit requirements imposed by municipal bylaws, discussed below in paragraph 1.1.11.2).

d) The responsible authority has waived the need for a license

Included in the water uses that require licences in terms of the NWA, are the following wastewater-related uses. As mentioned, these uses require water use licenses from the Department of Water snd Environmental Affairs, (unless the use qualifies for unlicensed use, as highlighted above):

Section 21 (e): Irrigating land with waste or water containing waste generated through any industrial activity or by a waterworks ("waterworks" includes any borehole, structure, earthwork or equipment installed or used for in connection with water use). Irrigation means crop or pasture irrigation.

Section 21 (f): Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit. The water use entails the discharge of waste or wastewater directly into a water resource. "Waste" for the purposes of the National Water Act, is defined as including any solid material or material that is suspended, dissolved or transported in water (including sediment) and which is spilled or deposited on land or into a water resource in such volume, composition or manner as to cause, or to be reasonably likely to cause, the water resource to be polluted.

Section 21 (g): Disposing of waste in a manner which may detrimentally impact on a water resource. This is typically disposal that takes place into on-site facilities such as French drains, conservancy tanks and wastewater treatment systems such as oxidation ponds and evaporation ponds that do not have an outlet into a water resource.

Section 21 (h): Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process.

General authorisations have been published (in Government Notice 399) for Section 21 (e), (f) and (g) uses. These authorisations contain geographical (and other) exclusions and must therefore be considered on a site-specific basis. If carrying out any of the aforesaid water uses, abattoir operators are advised to contact the Department of Water and Environmental Affairs for assistance with licensing requirements.

3.3 Emergency incidents potentially impacting on water resources

Section 20 of the National Water Act of 1998 deals with emergency incidents that could impact on water resources (including groundwater) and imposes an obligation on the "responsible person" to take all reasonable steps to contain and minimise the pollution, undertake clean-up procedures, remedy the effects of pollution, and take such measures as the responsible authority may direct.

"Responsible person" is defined as including the person responsible for the pollution incident, the owner of the substance involved in the incident and the person in control of the substance at the time of the incident, as well as anybody with knowledge of the incident.

In addition, such incident must be reported to the Department of Water and Environmental Affairs, the SA Police or the relevant catchment management agency. Abattoir operators must therefore ensure that their emergency procedures cover these clean-up and reporting obligations.

Legal aspects regarding the use of water in abattoirs

A water supply of at least 900 litres per slaughter unit must be available under pressure and protected against contamination. The water must be clean, potable and free of suspended material and substances that could put health at risk. The water must be subjected to flocculation, filtration, chlorination or other treatment to ensure that no coliform organisms are present and no more than 100 viable micro-organisms per millilitre are present.

An adequate supply of hot water at 60°C and of cold water under pressure must be available during working hours in convenient places. The water must also meet any other standards and conditions that the Director: Veterinary Services may lay down from time to time. The water usage of abattoirs is further regulated by The Water Act, 1956 (Act No. 54 of 1956), as amended by the Water Amendment Act 1984 (Act No. 96 of 1984) and by-laws issued by local authorities.

4 NATIONAL ENVIRONMENTAL MANAGEMENT ACT: AIR QUALITY ACT 39 OF 2004

The NEMA: Air Quality Act 39 of 2004 was promulgated in February 2005. Several of the Act's provisions came into force on 13 September 2005, but those relating to listed activities have not yet commenced. The fact that the majority of provisions are now in force, means that both national and local government must now develop air quality frameworks within a strict timetable. Clear standards for municipalities on monitoring surrounding air quality and source emissions will be set. Additional obligations on citizens are therefore expected in the foreseeable future. The Minister of Environmental Affairs has not yet brought into effect those sections of the Act that require specialist capacity that does not yet exist at local government level – and for the same reason the existing Atmospheric Pollution Prevention Act of 1965 has not yet been repealed.

In the context of abattoir waste management, it is important to note the provisions relating to odour control and the destruction of waste by burning (waste incineration).

4.1 Odour control

Section 35 (1) of the Air Quality Act of 2004 enables both the Minister of Environmental Affairs and Tourism and the MEC to prescribe measures for the control of offensive odours emanating from specified activities. No such measures have been prescribed as yet.

In addition, Section 35(2) imposes an obligation on the occupier of any premises to take all reasonable steps to prevent the emission of any offensive odour caused by any activity on such premises. This provision is clearly sufficiently broad to include offensive odours arising from waste management practices.

'Offensive odour' means any smell which is considered to be malodorous or a nuisance to a reasonable person.

4.2 Waste incineration

As mentioned above, the Atmospheric Pollution Prevention Act of 1965 has not yet been repealed. Section 9 of this Act stipulates that processes listed in the second schedule to the Act may not be carried out without a registration certificate issued by the Chief Air Pollution Control Officer, Department of Water and Environmental Affairs. Waste incineration is listed in the second schedule as Scheduled Process No 39.

These certificates are granted when the Chief Air Pollution Control Officer is satisfied that the best practicable means are being used to prevent or minimise the escape of noxious or offensive gases
into the atmosphere. The registration certificate is issued subject to certain conditions, which must be adhered to at all times.

Registration certificates are furthermore issued subject to the proper maintenance and operation of the equipment used for the carrying out of the process in question and of the equipment used for preventing and reducing the escape of noxious and offensive gases.

It is also important to note that the premises on which the scheduled process is carried out may not be altered or extended without the permission of the Chief Air Pollution Control Officer. Such permission is, however, not

necessary if the alteration or extension will not affect the release of noxious or offensive gases.

5. MEAT SAFETY ACT, 2000(ACT 40 OF 2000):

The MSA came into effect on the 1st November 2000 and was promulgated to provide for measures to promote meat safety and the *safety* of animal products; to establish and maintain essential national standards in respect of abattloirs; to regulate the importation and exportation of meat; to establish meat safety schemes; and to provide for matters coonected therewith, including the management of waste and condemned material from abattoirs.

The following regulations were promulgated under the MSA:

- Red Meat Regulations R 1072 of 17 September 2004
- Poulty Regulations R 153 of 24 February 2006
- Ostrich Regulations R54 of 2 February 2007
- The regulations for Crocodiles and Game are still in Draft format and not promulgated yet

These regulations are comprehensive and based on internationally acceptable practices and principles.

6. FERTILISERS, FARM FEEDS, AGRICULTURAL REMEDIES AND STOCK REMEDIES ACT36 OF 1947

A number of of operational requirements are imposed by this Act that fall beyond the scope of this documents (such as the provisions relating to registration of sterelising plants and the sale and packaging of farm feeds (Incuding stock licks)).

In the context of waste management, Section 7(bis) merits inclusion in this document, as it regulates the disposal of bonemeal. In terms of this Section, the Minister of Agriculture prohibited any person-

(a) From selling or supplying any bone product intended or offered for the feeding of domestic animals or livestock, or any stock lick, to any person outside the Republic; or
(b) From exporting bones from the Republic; or
(c) From using, disposing of or acquiring any farm feed for any purpose other than the feeding of domestic animals or livestock, except on the authority of a permit issued by the Department of Agriculture and subject to the conditions set out in such permit.

The effect of this notice is that no permit is required for the acquisition and disposal in the Republic of bonemeal used for the feeding of domestic animals and livestock or any stock lick and that a permit is only required for the export of bones, bonemeal and stock lick and for the use of any such farm feed for any purpose other than the feeding of domestic animals and livestock.

7. ADVERTISING ON ROADS AND RIBBON DEVELOPMENT ACT 21 OF 1940

This Act, in Section 8, prohibits the disposal of rubbish and machinery close to public roads (i.e. 200 m from the centre line). This provision is self-explanatory and no further comment is offered.

8. OCCUPATIONAL HEALTH AND SAFETY ACT 85 OF 1993: HAZARDOUS CHEMICAL SUBSTANCE REGULATIONS PROMULGATED IN TERMS OF THE (GN R 1179)

The primary focus of the Occupational Health and Safety Act is to provide for safe working conditions. However, several of this Act's provisions also influence environmental management. These include the regulations dealing with the labelling, packaging, handling, storage and safe disposal of hazardous chemical substances. (See definition below.)

As regards the disposal of hazardous chemical substances, Regulation 15 of GN R 1179 requires abattoir operators to, as far as is reasonably practicable:

- Recycle all hazardous chemical substance waste;
- Ensure that all vehicles, re-usable containers and covers which have been in contact with hazardous chemical waste are cleaned and decontaminated after use in such a way that the vehicles, containers or covers do not cause a hazard inside or outside the site concerned; and
- Ensure that if the services of waste contractors are used, a provision is incorporated into the contracts stating that the contractor shall also comply with the provisions of these regulations.

"Hazardous chemical substance" means any toxic, harmful, corrosive, irritant or asphyxiant substance, or a mixture of such substances for which -
(a) an occupational exposure limit is prescribed [listed in Table 1 of GN R 1179}; or an occupational exposure limit is not prescribed, but which creates a hazard to health [listed in Table 2 of GN R 1179].

9. OCCUPATIONAL HEALTH AND SAFETY ACT 85 OF 1993: REGULATIONS FOR HAZARDOUS BIOLOGICAL AGENTS (GN R 1390)

The objective of these regulations is to protect workers against hazardous associated with biological agents. Although safety oriented, the regulations also include a section dealing with the management of hazardous biological waste.

"Hazardous Biological Agent (HBA)" is defined as meaning hazardous biological agents which are micro-organisms, including those that have been genetically modified, pathogens, cells, cell cultures and human endoparasites that have the potential to provoke an infection, allergy or toxic effects, subdivided into the following groups:

(a) Group I HBA are HBA that are unlikely to cause human disease;
(b) Group 2 HBA are HBA that may cause human disease and be a hazard to exposed persons, which is unlikely to spread to the community and for which effective prophylaxis and treatment is usually available;
(c) Group 3 HBA are HBA that may cause severe human disease, which presents a serious hazard to exposed persons and which may present a risk of spreading to the community, but for which effective prophylaxis and treatment is available;
(d) Group 4 HBA are HBA that cause severe human disease and are a serious hazard to exposed persons and which may present a high risk of spreading to the community, but for which no effective prophylaxis and treatment is available.

Guidelines on the categorisation are contained in the regulations (as Annexure B1).
If any such agents are used, the following waste management requirements must be observed:

Regulation 17: Disposal of HBA

(1) Abattoir operators must:

(a) Lay down written procedures for appropriate decontamination and disinfection;

(b) Implement written procedures enabling infectious waste to be handled and disposed of without risk;

(c) Ensure that all fixtures and equipment including vehicles, reusable containers and covers which have been in contact with HBA waste are disinfected and decontaminated after use in such a manner that it does not cause a hazard inside or outside the premises concerned;

(d) Ensure that all HBA waste that can cause exposure is disposed off only on sites specifically designated for this purpose in terms of the Environmental Conservation Act, 1989 (Act 73 of 1989), in such a manner that it does not cause a hazard inside or outside the site concerned – See also paragraph 1.1.2 above;

(e) Ensure that all employees involved in the collection, transport and disposal of HBA waste and who may be exposed to that waste are provided with suitable personal protective equipment; and

(f) Ensure that if the services of a waste disposal contractor are used, a provision is incorporated into the contract stating that the contractor shall comply with the provisions of these Regulations.

10. NATIONAL BUILDING REGULATIONS AND BUILDING STANDARDS ACT 103 OF 1977 (GN R 2378, PARTS P & R)

This Act prescribes building standards and related matters. Although not directly related to waste management, abattoir operators are alerted to the drainage and storm water disposal requirements imposed by Parts P and R of GN R 2378.

In particular, Part P3 prohibits the release of any substances other than uncontaminated rainwater to storm water systems, whereas Part R imposes design requirements for storm water systems. In addition, regulation P3 (2) stipulates that no part of a drainage installation may at any time be constructed or designed to allow rainwater to enter the drainage installation.

“Drainage installation” means any installation which is intended for the reception, conveyance, storage or treatment of sewage, and may include sanitary fixtures, traps, discharge pipes, drains, ventilating pipes, septic tanks, conservancy tanks, sewage treatment works, or mechanical appliances associated therewith.

This prohibition is necessary to ensure that rainwater reaches the down stream environment in an unpolluted state.

'Sewage' means waste water, soil water, industrial effluent and other liquid waste, either separately or in combination, but does not include storm water.

11. LOCAL AUTHORITY BYLAWS

11.1 Solid waste

Several of the metropolitan municipalities, district municipalities and local municipalities in Gauteng promulgated local bylaws relating to solid waste removal. Based on the more modern bylaws promulgated by the City of Johannesburg and the City of Tshwane, the following obligations may be regarded as an example of typical aspects regulated at local authority level:

- Obligation to use the Council's refuse removal system for domestic waste UNLESS the Council's written exemption has been granted.
- All private entities/contractors removing refuse must be registered with the Council.
- The Council must determine the type of bins required for the collection of waste. Abattoir operators are responsible for ensuring that the Council supplies the correct number and type of bins.
- The areas used for refuse storage may not be visible from a street, a public place or any other premises except if determined otherwise by the Council.
- The Council has the right to insist on the compacting of waste
- Industrial and trade refuse must also be stored in the containers or other approved containers delivered by the Council.
- Garden, builders and other bulky refuse must be disposed of in a REASONABLE time frame, provided that garden refuse may be retained on the premises in an approved manner for the making of compost if it will not cause a nuisance. The Council's permission is not required to use a private person/contractor to remove garden refuse.
- Persons removing builders rubble MUST however, be registered with the Council. Builders' rubble must be disposed of at a sanitary disposal site approved by the Council. No building rubble may be disposed of at a small ("mini") waste disposal site. Proof of safe disposal of garden, builders and other bulky refuse must, however, be submitted to the Council as and when required, meaning that records of the receiving destination and volume so disposed need to be maintained.
- Abattoir operators must notify the Council within 7 days of the generation of special industrial, hazardous, medical or infectious refuse. Information so supplied must include the composition thereof, the quantity generated, method of storage, the proposed duration of storage, and the manner in which it will be removed.

"Special industrial refuse" means refuse, consisting of a liquid or sludge, resulting from a manufacturing process or the pre-treatment for disposal purposes of any industrial waste, which may not be discharged into a drain or a sewer. See paragraph.

11.2 Liquid effluent to municipal sewers

Section 21(1) of the Water Services Act, 1997 (Act No. 108 of 1997) requires every water services authority to promulgate bylaws, which contains conditions for the provision of water services. The Minister of Water Affairs and Forestry provided model bylaws in 2001 to be used as a guide by water services authorities in complying with the obligation in terms of Section 21(1).

Most of the metropolitan, district and local municipalities in Gauteng promulgated their own wastewater / industrial effluent bylaws, most of which are based on the said model bylaws.

The five most important requirements imposed by typical industrial effluent bylaws are:

(i) The prohibition against the discharge of industrial effluent to municipal sewers without a permit written authorisation issued by the municipality; and

(ii) Full compliance with the prohibited and restricted substances listed in the bylaws. (The two or three variables sampled by the municipality are monitored for tariff calculations, and will not be adequate to demonstrate compliance with all the potentially applicable variables regulated by the bylaws);

(iii) Drainage installations, grease traps, effluent plants and septic plants and connections to sewers may not be made without the prior written consent of the local authority;

(iv) Prohibition against storm water contamination; and

(v) Prohibition against water wastage.

Approximately twelve different sets of industrial effluent / drainage / water supply bylaws apply in Gauteng. The prohibited and restricted substances reproduced below are taken from the Department of Water Affairs and Forestry's aforesaid model bylaws. Abattoir operators are, however, required to obtain their own local authority's bylaw upon applying for the require discharge permit. If no such bylaws exist in their particular jurisdiction, the model bylaws below may be used as a benchmark against which to monitor the acceptability of industrial effluent.

EXTRACT FROM DWAF MODEL BYLAWS

SCHEDULE A: Acceptance of industrial effluent for discharge into the sewage disposal system

No industrial effluent shall be accepted for discharge into the sewage disposal system unless it complies with the following conditions.

The effluent shall not contain concentrations of substances in excess of those stated below:
Large Works general quality limits are applicable when an industry's effluent discharges in a catchment leading to a sewage works of greater than 25 M/d capacity. Small Works quality limits apply for catchments leading to sewage works with less than 25 M/d capacities.

PART 3: AUDITING COMPONENT

1. INTRODUCTION

GDARD intends to commence with the evaluation of the environmental performance of Gauteng's existing Abattoir Waste Management Facilities. This will be done in accordance with the broad environmental mandate assigned to the Gauteng Provincial Government for Constitution, with the goal of improving service delivery to Gauteng's people.

An Abattoir Waste Management Guideline Manual (AWM Guideline Manual) was developed in order to provide guidance to a consistent manner in which activities, specifically related to Waste Management, should be carried out.

This AWM Guideline Manual will form the basis of the criteria documentation for the preparation of the on-site auditing activities. These criteria will also be supplemented, not limiting to, the following legislation:

- National Environmental Management Act (Act 108 of 1998)
- National Conservation Act (Act 73 of 1989)
- National Water Act (Act 36 of 1998)
- Air Quality Act (Act 39 of 2004)
- Meat Safety Act (Act 40 of 2000)
- Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies (Act 36 of 147)
- Occupational Health & Safety Act (Act 8 of 1993): Regulations for hazardous biological agents (GN 1390)
- Occupational Health & Safety Act (Act 8 of 1993): Hazardous chemical substances regulations promulgated in terms of the GN 1179
- Local Authority by-laws

Auditing forms an integral part of any proper management system, due to the fact that it is a basic control device to measure the effectiveness of the implementation of the Abattoir Waste Management and to monitor the improvement level in terms of the procedures followed.

Nearly every activity in an Abattoir could benefit from improvement measures, including the processes that monitor the quality of the products and services. The audit is a valuable management tool, which can reveal major opportunities for business improvements and cost reduction.

Management should promote the internal audit to identify strengths and identify opportunities for improvement, not merely fixing the problems. By identifying strengths, the workforce receives positive feedback and a valuable boost to morale. The strengths, once recognized, can simulate similar improvements in other areas.

When deficiencies are discovered or opportunities for improvement recommended, the audit team should be involved in identifying solutions and their implementations.

As this section (Part 3) only refers to the auditing of the waste management of abattoirs, it must be noted that these auditing principles, auditors selection and auditing tools can be used as a standard to the overall Audit / Assessment of any abattoir, based that there is a certain set of criteria available to measure against. In this case audit of the Waste Management will be done against the specifications in the Abattoir Waste Management Guideline Document.

2. CRITERIA FOR THE SELECTION OF AUDITORS:

Based on the assumption that auditors will be selected form current available staff in the relevant business unit of GDARD, the following criteria should be applied to ensure that auditors are competent to perform the tasks given to them and to ensure the objective of the audit is achieved.

EDUCATION:

There must at least be a tertiary qualification in a related field to gain the acquisition of the knowledge and skills described below

WORK EXPERIENCE:

Each auditor must have the required years of required work experience in the relevant area in terms of the industry. This work experience should be in a technical, managerial or professional position involving the exercise of judgement, problem solving, and communication with other managerial or professional personnel, peers, customers and/or other interested parties. Part of the work experience should be in a position where the activities are undertaken contributes to the development of knowledge and skills in the quality, health and safety and/or environmental management field. In this case experience within the Abattoir sectors would be an advantage as it will provide a clear background of the processes and basic knowledge on the legislation required compliance.

AUDITOR TRAINING:

Auditors should be trained in the area of "Auditing", using the ISO 9001:2004 and ISO 19011:2004 international standards as a guideline in terms of the auditing process, tools and principles.

AUDITOR EXPERIENCE:

New auditors must be mentored and gained experience under the direction and guidance of an auditor who is competent as an audit team leader in the same discipline.

3. AUDITING PRINCIPLES

The following principles are important for auditors to understand and apply during on-site audit activities:

a) Ethical conduct: the foundation of professionalism trust, integrity, confidentiality and discretion are essential to auditing.

b) Fair presentation: the obligation to report truthfully and accurately. Audit findings, audit conclusions and audit reports reflect truthfully and accurately the audit activities. Significant obstacles encountered during the audit and unresolved diverging opinions between the audit team and the auditee are reported.

c) Due professional care: the application of diligence and judgement in auditing. Auditors exercise care in accordance with the importance of the task they perform and the confidence placed in them by audit clients and other interested parties. Having the necessary competence is an important factor. Further principles relate to the audit, which is by definition independent and systematic.

d) Independence: the basis for the impartiality of the audit and objectivity of the audit conclusions. Auditors are independent of the activity being audited and are free from bias and conflict of interest. Auditors maintain an objective state of mind throughout the audit process to ensure that the audit findings and conclusions will be based only on the audit evidence.

Evidence-based approach: the rational method for reaching reliable and reproducible audit conclusions in a systematic audit process.

Audit evidence is verifiable. It is based on samples of the information available, since an audit is conducted during a finite period of time and with finite resources. The appropriate use of sampling is closely related to the confidence that can be placed in the audit conclusions.

Auditors should take note of these principles, as they have to be applied during the auditing process.

4. AUDITING TOOLS

The use of checklists is a key tool for most audits, regardless of audit depth or scope. The Abattoir Checklist for the AWM will be based on the specifications as set out in the Technical Components of this document as well as specified legislation.

Abattoirs will be graded according to the Meat Safety Act, 2000 (Act no 40 of 2000), and further categorised in terms of throughput. The Abattoir checklist will be developed separately for each of the following 3 categories:

- Rural Abattoir
- Low throughput abattoir
- High throughput abattoir

Checklists should be used for the following purposes:

- As a guide
- As a memory jogger
- As objective evidence that areas have been audited
- To help prepare the final report
- To provide useful information for those who have to implement the corrective action

In preparing checklists, the auditor should keep the following in mind:

- Compile questions, checklist with the specific company and its requirements in mind
- Take into consideration the scope of certification
- A good audit checklist will give the auditor instructions on the records, reports and examples of documentation to be requested during the audit. It should also help the auditor understand what to look for when reviewing them
- The checklist should provide enough space for the auditor to make remarks or add additional questions or information
- Most of the questions should allow for some discussion and robbing rather than just say “yes” or “no” answers

There are four basic resources of requirements to consider when preparing a checklist:

Applicable Standards: AWM Guideline Document; Other Food Safety standards
Customer: customer's requirements as expressed in orders or contractual agreements
Organisation: as expressed by internal documents
Legal: such as statutory and regulatory requirements

4.1 AUDITING PROCEDURE

4.1.1 Inputs to the Auditing Procedure will include:

- Audit Schedule (indicating dates of planned audits for a 12-month period)
- Audit Programme
- Audit Checklist / Hygiene Assessment System
- Audit Criteria (e.g. procedures, standards, regulations)
- Reference documents:
- Standard Operating Procedures
- Applicable standards
- Applicable regulations

4.1.2 Audit Preparation

Audit preparation includes the definition of the responsibilities of the different audit role players, the selection of the audit team, logistics, etc. Selection of the audit team should ensure the team possesses the overall experience and expertise needed to conduct the audit.

4.1.3 Audit Programme

To ensure monitoring and measurement of the management system is done effectively and consistently, it is required that an Audit Programme is drafted. Top management commitment is crucial to establish and maintain an effective audit programme. It must ensure the whole organization is audited within a 12-month period to determine where improvements can be made (Figure 1).

An audit programme may be including one or more audits, depending upon the size, nature and complexity of the organisation to be audited. These audits may have a variety of objectives and may also include joint or combined audits.

An audit programme is developed to indicate:

- The objective and extent
- Responsibilities (auditors and auditee's)
- Resources required
- Audit criteria (procedures and standards applicable)
- Audit Scope

4.1.4 Conducting document review

This includes the reviewing of the relevant management system documents, including records, and determining their adequacy with respect to audit criteria.

4.1.5 Prepare for the on-site audit activities

- Finalise the Audit Plan
- Assigning work to the audit team
- Prepare work documents, e.g. Checklists

4.1.6 Conducting on-site activities

- Conducting the opening meeting
- Site tour / indication of guides
- Collecting and verifying information
- Generating audit findings against the audit criteria
- Preparing audit conclusions
- Conducting closing meeting

4.1.7 Frequency of auditing

- Initially auditing of all abattoirs in Gauteng should be conducted on a yearly basis
- If the abattoir is operating poorly and in an environmentally unsustainable manner, it should be audited on quarterly until the issues have been resolved.
- If the abattoir has a record of good practice (history of good compliance with audited requirements) the auditing frequency could be reduced to a yearly cycle. This decision should rest with the Directors of the relevant sections in GDARD.

4.1.8 Preparing, approving and distributing the audit report

- Prepare the audit report
- Approving and distributing the audit report

4.1.9 Completing the audit

- Close off by following up on corrective actions

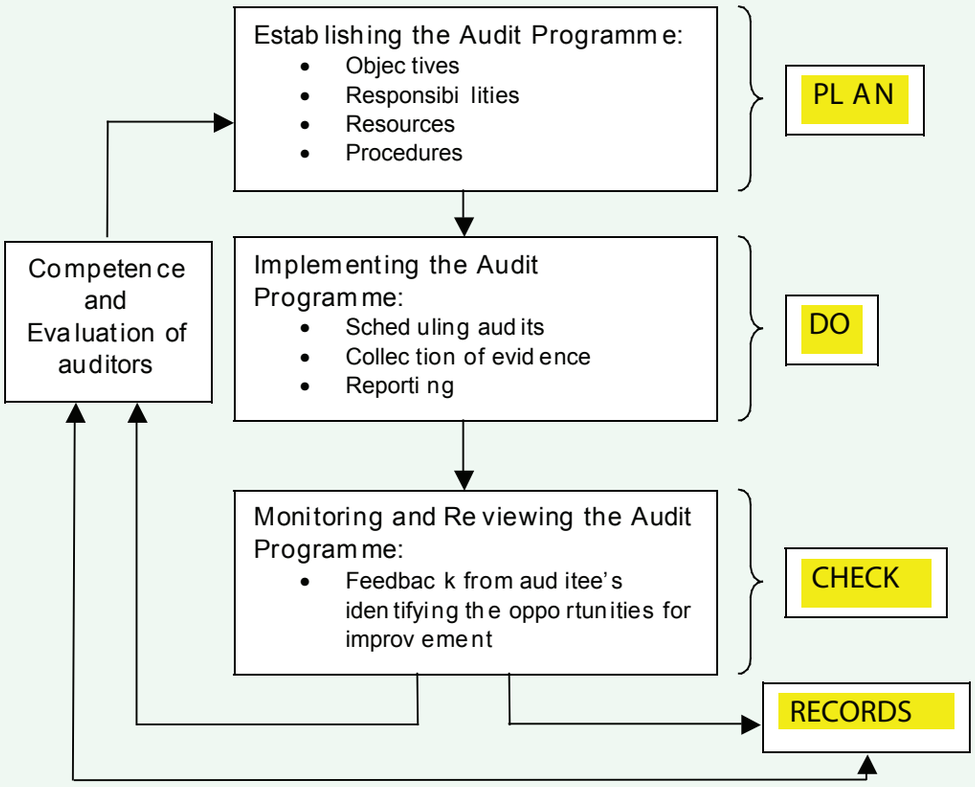


Figure 1 – Illustration of the process flow for the management of an audit programme

GENERAL QUALITY LIMITS		LARGE WORKS > 25 M/d	SMALL WORKS < 25 M/d	UNITS
1.	Temperature (°C)	< 44°C	< 44°C	Degrees Celsius
2.	pH	6 < pH < 10	6,5 < pH < 10	pH units
3.	Oils, greases, waxes of mineral origin	50	50	mg/
4.	Vegetable oils, greases, waxes	250	250	mg/
5.	Total sugar and starch (as glucose)	1 000	500	mg/
6.	Sulphates in solution (as $SO^{=}_{4}$)	250	250	mg/
7.	Sulphides, hydrosulphides (as $S^{=}$) & polysulphides	1	1	mg/
8.	Chlorides (as C^{-})	1 000	500	mg/
9.	Flouride (as F^{-})	5	5	mg/
10.	Phenols (as phenol)	10	5	mg/
11.	Cyanides (as CN^{-})	20	10	mg/
12.	Settleable solids	Charge	Charge	m /
13.	Suspended solids	2 000	1 000	mg/
14.	Total dissolved solids	1 000	500	mg/
15.	Electrical conductivity	-	400	MS/m
16.	Anionic surfactants	-	500	mg/
17.	C.O.D.	Charge	Charge	mg/

Heavy Metal Limits				
18.	Copper (as Cu)	50	5	mg/
19.	Nickel (Ni)	50	5	mg/
20.	Zinc (Zn)	50	5	mg/
21.	Iron (Fe)	50	5	mg/
22.	Boron (B)	50	5	mg/
23.	Selenium (Se)	50	5	mg/
24.	Manganese (Mn)	50	5	mg/
25.	Lead (Pb)	20	5	mg/
26.	Cadmium (Cd)	20	5	mg/
27.	Mercury (Hg)	1	1	mg/
28.	Total Chrome (Cr)	20	5	mg/
29.	Arsenic (As)	20	5	mg/
30.	Titanium (Ti)	20	5	mg/
31.	Cobalt (Co)	20	5	mg/
TOTAL METALS		100	20	mg/

Special limitations -- - -

1. No calcium carbide, radio active waste or isotopes
2. No yeast and yeast wastes, molasses spent or unspent
3. No cyanides or related compounds capable of liberating HCN gas or cyanogen
4. No degreasing solvents, petroleum spirit, volatile flammable solvents or any substance which yields a flammable vapour at 21 C

ANNEXURE 1: Minimum Requirements For Disposal Of Hazardous Waste To Landfill

TABLE 6 (EXTRACT FROM DWAF'S MINIMUM REQUIREMENTS OR THE HANDLING, CLASSIFICATION AND DISPOSAL OF HAZARDOUS WASTE, SECOND EDITION)

Subject	Minimum Requirement
Classification	In accordance with its properties and characteristics, a Hazardous Waste must be placed in a SANS Code 10228 class.
Unlisted compounds	Should a Hazardous Waste contain compounds NOT listed in SANS Code 10228, the Department must be consulted before classification is attempted.
Class 1	Direct disposal of Class 1 wastes is PROHIBITED Class 1 wastes to be pre-treated (destroyed)
Class 2	Flammable gases to be thermally destroyed. Non-flammable gases to be released to atmosphere, unless in contravention with the Atmospheric Pollution Prevention Act, 1965 (Act 45 of 1965) and the Montreal Protocol. Controlled destruction of poisonous gases.
Class 3	Landfilling of flammable liquids, flashpoint < 61°C is PROHIBITED. Flammable liquids to be treated to flashpoint > 61°C.
Class 4	Landfilling of flammable solids is PROHIBITED. Flammable solids to be treated to non-flammability.
Class 5	Landfill of Oxidising Substances and Organic Peroxides is PROHIBITED Treatment to neutralize oxidation potential.

Class 6	Infectious Substances to be sterilised. Residue of Infectious Substances to be given a Hazard Rating. Toxic Substance, Hazard Rating 3 or 4, to be disposed of at H:H or H:h sites, to have EEC multiplied by Department approved factor. Toxic Substance, Hazard Rating 1 or 2, to be disposed at permitted H:H sites, to Have EEC multiplied by Department approved factor. Note that in the SANS Code 10228, the nine classes are allocation a Danger Group for transport purposes. This should not be confused with the Hazard Rating for waste disposal described in sections 2 & 8 of the Minimum Requirements.
Class 7	Radioactive Substance with specific activity < 74 Bq/g, total activity < 3,7 kBq, to be incinerated or landfilled. Disposal of Radioactive Substance with specific activity > 74 Bq/g, total activity > 3,7 kBq, is PROHIBITED. Consult Department of Health.
Class 8	Disposal of Corrosive Substance, pH < 6 and/or pH > 12, by landfill is PROHIBITED. Corrosive Substance to be treated to pH 6 - 12.
Class 9	Department to be notified if a compound contains substances listed in Class 9 and Written approval must be obtained before disposal. Department to be notified if a compound contains substances NOT listed in Class 9.

ANNEXURE 2: Description of the 9 Classes of Hazardous Waste
SANS CODE 10228 "The Identification and Classification of Dangerous Substances and Goods": CLASS

DEFINITIONS

Class 1 - Explosives
Class 1 comprises:

a) Explosive substances except those which are too dangerous to transport or those where the predominant hazard is one appropriate to another class;
b) Explosive articles, except devices containing explosive substances in such quantity or of such a character that their inadvertent or accidental ignition during transport shall not result in any action external to the device either by projection, fire, smoke, heat or loud noise; and
c) Substances and articles not mentioned under a) and b) above which are manufactured with a view to producing a practical, explosive or pyrotechnic effect.

For the purpose of this Code, the following definitions apply:

a) An explosive substance is a solid or liquid substance (or a mixture of substances) which is in itself capable by chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings. Included in this category are pyrotechnic substances even when they do not evolve gases.
b) A pyrotechnic substance is a substance or a mixture of substances designed to produce an effect by heat, light, sound, gas or smoke or a combination of these as a result of non-detonative self-sustaining exothermic chemical reactions.
c) An explosive article is an article containing one or more explosive substances.

Class 1 is divided into five divisions:
Division 1.1 - Substances and articles which have a mass explosion hazard.
Division 1.2 - Substances and articles which have a projection hazard, but not a mass explosion hazard.

Division 1.3 - Substances and articles which have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard.
This division comprises substances and articles:

- Which give rise to considerable radiant heat; or
- Which burn one after another, producing minor blast or projection effects or both.

Division 1.4 - Substances and articles which present no significant hazard
This division comprises substances and articles which present only a small hazard in the event of ignition or initiation during transport. The effects are largely confined to the package and no projection of fragments of appreciable size or range is to be expected. An external fire must not cause practically instantaneous explosion of the entire contents of the package.
NOTE: Substances and articles in this division can be so packaged or designed that any hazardous effects arising from accidental functioning are confined within the package (unless the package has been degraded by fire). In this case, where all blast or projection effects are limited to the extent that they do not significantly hinder fire fighting or other emergency response efforts in the immediate vicinity of the package, the substances can be considered as part of Compatibility Group S.

Division 1.5 - Very insensitive substances which have a mass explosion hazard
This division comprises explosive substances which are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport. As a Minimum Requirement they must not explode in the external fire test.

NOTE: The probability of transition from burning to detonation is greater when large quantities are carried by ship.

Class 1- is unique in that the type of packaging frequently has a decisive effect on the Hazard rating and therefore on the assignment to a particular division. Where multiple hazard classifications have been assigned, they are listed on the individual schedule. The correct division is determined by use of the method outlined in the United Nations recommendation on Transport of Dangerous Goods.

Class 2 - Gases: compressed, liquefied or dissolved under pressure

Because of the difficulty in reconciling the various main systems of regulation, definitions in this class are of a general nature to cover all such systems. Moreover, since it has not been found possible to reconcile two main systems of regulation in respect of the differentiation between a liquefied gas exerting a low pressure at a certain temperature and a flammable liquid, this criterion has been omitted; both methods of differentiation are recognized.

Class 2 comprises:

a) Permanent gases
Gases which cannot be liquefied at ambient temperatures.

b) Liquefied gases
Gases which can become liquid under pressure at ambient temperatures.

c) Dissolved gases
Gases dissolved under pressure in a solvent, which may be absorbed in a porous material.

d) Deeply refrigerated permanent gases - e.g. liquid air, oxygen, etc.
These gases are normally under pressure varying from high pressure in the case of compressed gases to low pressure in the case of deeply refrigerated gases.

In this code, Class 2 is subdivided further, namely:
Class 2.1 - Flammable gases
Class 2.2 - Non-flammable gases
Class 2.3 - Poisonous gases

Some gases are chemically any physiologically inert. Such gases as well as others, normally accepted in toxic concentrations, will nevertheless be suffocating in high concentrations. Many gases of this class have marked narcotic effects which may occur at comparatively low concentrations, or may evolve highly poisonous gases when involved in a fire. All gases which are heavier than air will present danger if allowed to accumulate in the bottom of the holds.

Class 3 - Flammable liquids

Class 3 comprises:
Liquids, or mixtures of liquids, or liquids containing solids in solution or suspension (e.g. paints, varnishes, lacquers, etc., but not including substances which, on account of their dangerous characteristics, have been included in other classes) which give off a flammable vapour at or below 61°C (141°F) closed cup test (corresponding to 65,6°C (150°F) open cup test).

In this Code, Class 3 is subdivided further, namely:
Class 3.1 - Low flashpoint group of liquids; flashpoint below –18°C c.c
Class 3.2 - Intermediate flashpoint group of liquids; flashpoint of –18°C up to 23 °C
Class 3.3 - High flashpoint group of liquids; flashpoint of 23°C up to, and including, 61°C c.c. Substances which have a flashpoint above 61°C (141°F), closed cup test, are not considered to be dangerous by virtue of their fire hazard. Where the flashpoint is indicated for a volatile liquid, it may be followed by the symbol "c.c.", representing determination by a closed cup test, or by the symbol "o.c.", representing an open cup test.

Class 4 - Flammable solids or substances
Class 4 - deals with substances other than those classed as explosives, which, under conditions of transportation, are readily combustible, or may cause or contribute to fires.

Class 4 is subdivided further into:

Class 4.1 - Flammable Solids

The substances in this Class are solids possessing the properties of being easily ignited by external sources, such as sparks and flames, and of being readily combustible, or of being liable to cause or to contribute to fire through friction. Some of these substances may evolve toxic and flammable gases when heated or when on fire.

Class 4.2 - Substances liable to spontaneous combustion

The substances in this Class are either solids or liquids possessing the common property of being liable spontaneously to heat and to ignite. Some of these substances are more liable to spontaneous ignition when wetted by water or when in contact with moist air. Some may also give off toxic gases when they are involved in a fire.

Class 4.3 - Substances emitting flammable gases when wet

The substances in this Class are either solids or liquids possessing the common property, when in contact with water, of evolving flammable gases. In some cases these gases are liable to spontaneous ignition. In some cases these gases are liable to spontaneous ignition due to the heat liberated by the reaction. Some of these substances also evolve toxic gases when in contact with moisture, water or acids.

Class 5 - Oxidising substances (agents) and organic peroxides

Class 5 - deals with oxidising substances (agents) and organic peroxides.

Class 5 - is subdivided further into:
Class 5.1 - Oxidising substances (agents)
These are substances which, although in themselves not necessarily combustible, may, either by yielding oxygen or by similar processes, increase the risk and intensity of fire in other materials with which they come in contact. Depending on the amount and nature of combustible impurities they may contain, some substances in this Class are sensitive to impact, friction or to a rise in temperature.

In addition, certain substances react vigorously with moisture, so increasing the risk of fire. Mixtures of these substances with combustible material are readily ignited, in some cases even by friction or impact. Such a mixture may burn with explosive force. There will be a violent reaction between most oxidising substances and strong liquid acids evolving highly toxic gases. Such gases may also be evolved when certain oxidising substances are involved in a fire.

Class 5.2 - Organic peroxides

Organic substances which contain the bivalent -0-0- structure and may be considered derivatives of hydrogen peroxide, where one or both of the hydrogen atoms have been replaced by organic radicals. Organic peroxides are thermally unstable substances which may undergo exothermic self-accelerating decomposition. Most organic peroxides will burn rapidly and are sensitive to heat. Some may also be sensitive to friction or impact. In liquid, paste or solid from many organic peroxides may react dangerously with other substances.

Violent decomposition may be caused by traces of impurities such as acids, metallic oxides or amines. Decomposition may give rise to the evolution of toxic and flammable gases.

Class 6 - Poisonous (toxic) and infectious substances
Class 6 is subdivided as follows:
Class 6.1 - Poisonous (toxic) substances

These are substances liable either to cause death or serious injury or to endanger human health if swallowed or inhaled, or by skin contact. The technical basis used for classification into hazard ratings is: *

(* This basis holds for the SANS Code 10228 for transport purposes and was changed and adapted in the SANS Code 10228 for waste disposal purposes.)

Hazard Rating	Oral toxicity LD50 (mg/kg)	Dermal toxicity LD50 (mg/kg)	Inhalation toxicity LC50	
			Vapours (ml/m^3)	Dusts and mists (mg/ml)
1	Up to 5	Up to 40	Up to 50	Up to 0,5
2	More than 5	More than 40	More than 50 Up to 200	More than 0,5 Up to 2
3	Solids: More than 50 Up to 200 Liquids: More than 50 up to 2 000	More than 200 Up to 1 000	More than 200 Up to 1 000	More than 2 Up to 10

For practical reasons Class 6.1 has been further subdivided into two subsidiary groups, namely:

Class 6.1(a): This category comprises all poisonous (toxic) substances including pesticides in Hazard Ratings 1 and 2.

Class 6.1(b): This category comprises all poisonous (toxic) substances including pesticides in Hazard Rating 3. The dangers of poisoning which are inherent in these substances depend upon contact with the human body: Unsuspecting persons at some distance from the substance can inhale vapours and the immediate dangers of physical contact with the substance must also be considered.Nearly all toxic substances evolve toxic gases when involved in a fire or when heated to decomposition. Some toxic substances also possess other hazards, such as flammability.

Class 6.2 - Infectious substances

These are substances containing viable micro-organisms or their toxins which are known, or suspected, to cause disease in animals or humans.

NOTE: "Biological products" and “Diagnostic specimens" are not considered to be dangerous goods provided they do not contain, or are reasonably believed not to contain, an infectious substance, and do not contain other dangerous goods.

Class 7 - Radioactive substances

Radioactive materials are too dangerous to allow direct disposal on a landfill site. Special provision has been made for Class 7 materials in terms of the Nuclear Energy Act, 1982 (Act 92 of 1982) and the Hazardous Substances Act, 1973 (Act 15 of 1973).

Class 7 comprises substances which spontaneously emit a significant radiation and of which the specific activity is greater than 74 Bq per gram. All radioactive substances are dangerous to a greater or a lesser degree because they emit invisible radiation which may damage body tissue. This damage arises either from external irradiation or from internal irradiation following the intake of radioactive material into the body. Two other properties of radioactive substances are heat emission and liability to criticality. The former is significant only with very large quantities of the radioactive substance whereas the latter is peculiar to fissile radioactive substances. These provisions are based upon the principles of the International Atomic Energy Agency's (IAEA) Regulations for the Safe Transport of Radioactive Materials, 1973, revised edition.

The Atomic Energy Corporation and the Department of Health are the responsible authorities for all aspects of radioactive substances and must be consulted for specific information.

Class 8 - Corrosive substances

Class 8 comprises substances which are solids or liquids possessing, in their original state, the common property of being able more or less severely damage living tissue. Many substances in this Class are sufficiently volatile to evolve vapour irritating to the nose and eyes.

A few substances may produce toxic gases when decomposed by very high temperatures. In addition to a direct destructive action in contact with skin or mucous membranes, some substances in this Class are toxic. Poisoning may result if they are swallowed, or if their vapour is inhaled, some of them may even penetrate the skin. All substances in this Class have a more or less destructive effect on materials such as metals and textiles. Many substances in this Class only become corrosive after having reacted with water, or with moisture in the air.

The reaction of water with many substances is accompanied by the liberation of irritating and corrosive gases. Such gases usually become visible as fumes in the air.

Class 9 - Miscellaneous dangerous substances

Substances of this Class present a danger not covered by other classes.
Class 9 provides for compounds that may be difficult to classify according to the definitions in SANS Code 10228. Examples of such compounds are acenapthene, acetylaminofluorene, adipic acid, aerosol dispensers and anthracene. When wastes contain such compounds or products and the compounds are listed in SANS Code 10228, the Department has to be explicitly notified before classification according to Class 6 Toxic and Infectious Substances.

ANNEXURE 3: DWAF Policy on Exemption from Waste Site Permitting Requirements

WM/10077106/KR
PROCEDURE WITH REGARD TO THE ISSUING OF EXEMPTIONS
UNDER SECTION 20 OF THE ENVIRONMENT CONSERVATION
ACT, 1989 (ACT 73 OF 1989)

PURPOSE OF THIS PROCEDURE

To serve as a guideline document for applying for an exemption under section 20 of the Environment Conservation Act, 1989 (Act 73 of 1989). To outline the procedure to be followed and the type of information to be submitted for consideration for the issuing of an exemption.

BACKGROUND

The Department of Water and Environmental Affairs (DWEA) is mandated to issue permits for disposal sites in terms of section 20 of the Environment Conservation Act, 1989 (Act 73 of 1989). According to section 20(1) "no person shall establish, provide or operate any disposal site without a permit issued by the Minister of Water Affairs and Forestry". Section 20(1) also states that the Minister may exempt any person or category of persons subject from such conditions, as he may deem fit. Based on this DWEA issues permits and exemptions once the principles of the Minimum Requirements 2nd edition have been complied with by the applicant, in accordance with section 20(3).

In some instances, it is considered appropriate to issue an exemption rather than a permit, specifically for activities related to the recycling and/or the treatment of waste, for example where an applicant wishes to recycle waste material into a commercial product such as the conversion of ash waste into bricks **as well as the temporary storage of some types of waste material.** The Department can, after careful evaluation, exempt an applicant from complying with some of the requirements for permitting. This implies that, provided all the necessary information required for granting of an exemption have been submitted, an exemption to undertake a particular activity will be granted in terms of section 20 of the Environment Conservation Act, 1989 (Act 73 of 1989).

All waste management facilities must register, on the Department of Water and Environmental Affairs WARMS System, in terms of the National Water Act, 1998 (Act 36 of 1998) and as required in the National Waste Management Strategy (NWMS) Action Plan for Waste Disposal.

INFORMATION WHICH IS REQUIRED IN SUPPORT OF AN APPLICATION FOR AN EXEMPTION

1. The application should clearly state the reasons for the application.

2. A clear description of the activity is required, which should include:

- 2.1 Sources, descriptions and quantities of raw or waste materials used. Classification of the material should be done according to the Minimum Requirements for the Handling, Classification and Dis posal of Hazardous Waste (second edition, 1998).
- 2.2 Description and quantities of waste stream generated, as well as its classification according to the Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste (second edition, 1998)
- 2.3 Water management plan, including quantity and quality.
- 2.4 A site layout indicating specific details regarding construction of the storage or disposal site (de signs).
- 2.5 Specific information on the timeframe applicable to the establishment of the facility (in the case of new facilities) includes the life of the facility until closure and decommissioning.

3. The locality of the activity, which should include:
   - 3.1 Locality map.
   - 3.2 Approved zoning.

4. Details regarding the operation of the activity, especially management of impacts likely to result from the activity e.g. stormwater management, waste, effluents, leachate etc.

5. The human health, environmental and the risk implications associated with the storage or disposal of this material e.g. risk of odours, noise, dust and both surface and underground water etc.

6. Mitigation measures to be implemented to mitigate these risks.

7. Proposed monitoring.

8. In the event of this being a recycling activity:

   - 8.1 The material used as well as the product must be classified according to the Minimum Requirements, and include a comparison of the classificationof the product to another similar commercial material already in the market.
   - 8.2 Should the product made from the waste be used in the building industry proof of confirmation that the proposed material complies with SABS specifications for building materials is required.

9. A Record of Decision or proof of an exemption of the EIA Regulations promulgated in terms of section 26 of the Environment Conservation Act, 1989 (Act 73 of 1989), from the Provincial Department of Environmental Affairs in accordance with Section 21 and 22 of this Act is required, as well as authorisation required in terms of other legislation.

10. Detailed information on the decommissioning of the activity.

    Please note that the underground storage of hazardous material has the potential to impact on the ground water environment. The Department does not recommend such storage unless it can be proved through proper motivation, that the operation will not adversely impact on the environment, especially on the groundwater environment. This motivation should inter alia include detailed designs of containment aspects, monitoring for effectiveness of the proposed system and contingency plan in the case of failure of containment.

It should however be stressed that the decision to issue an exemption solely lies with the Department and should it be decided that a permit will be issued, the applicant will be required to furnish the Department with all the necessary information to satisfy the requirements for a permit. Furthermore the Department may, during the process of evaluation of the application, require any additional information from the applicant that may be necessary to reach a decision.

RESPONSIBILITIES

TASK	RESPONSIBILITY
1. Invistigations on proposed activity	Applicant
2. Classification	Applicant
3. Zoning	Applicant
4. Compliance with EIA Regulation	Applicant and the relevant Provincial Department of Environmental Affairs
5. Register WARMS	Applicant and the relevant Regional Office Department of Water and Environmental Affairs
6. Submitt applications	Applicant
7. Evaluation of an application	Department of Water and Environmental Affairs
8. Issuing and Amendments of an Exemption	Department of Water and Environmental Affairs Head Office

The Department does not approve the technology to be applied in a particular activity, but only issue exemptions for the use of such technologies. It is the responsibility of the applicant to ensure that the technology in question is approved by the relevant organ of State or Department or any other recognised body authorised to do so before the application for an exemption is submitted to the Department of Water and Environmental Affairs.

Compiled by: J.C. Maluleke
Updated by: Wilna Moolman - 25 April 2002

ANNEXURE 4: Minimum requirements for transport, storage, collection and disposal of health care risk waste

SCHEDULE 9

Minimum requirements for transport, storage, collection and disposal of health care risk waste in terms of regulations 3(1), 4(1), 10(1) and (2), 20(3) and 20(6) and (7)

1. Minimum requirements for the internal transport and storage of health care risk waste in terms of regulations 10(1) and (2).

Minimum requirements for internal transport and storage

(a) Collection from point of generation:
   (i) A major generator must collect and remove health care risk waste from all wards, departments and similar on a daily basis, and store such waste in a safe area;
   (ii) where reasonably practicable no health care risk waste may be handled by health care risk waste management staff unless contained in a container, bottle or HCRW container; and
   (iii) The required personal protective equipment must be used when handling health care risk waste containers.

(b) Internal transport:
   (i) Internal transport of health care risk waste must occur in such a manner so as not to cause a risk of harm to any person;

(ii) Where it is reasonably practicable, given the number of containers to be transported, health care risk waste must be transported on trolleys suitable for that purpose, with sufficient storage space and designed to avoid spillage, breakage and other damage;
(iii) Containers must not be loaded onto transportation trolleys higher than the design level, and unsecured containers may not be loaded onto the trolleys;
(iv) Unless the contents of the trolley are reasonably inaccessible, the trolleys must be locked and must not constitute a risk of contact with infectious agents to others;
(v) Trolleys must not be left unattended when full, unless under secure lock; and
(vi) Health care risk waste must during any internal transportation over distances exceeding 100 metres, be protected by a HCRW container.

(c) Storage on site:

(i) All storage facilities at a major generator must have sufficient capacity to store up to 8 (eight) days of waste generated at the facility;
(ii) Any and all areas used for the storage of health care risk waste containers must be secured so as to prevent access to these areas to unauthorised persons;
(iii) A storage area at a generator must be clearly marked with warning signs on, or adjacent to, the exterior of entry doors, gates, or lids;
(iv) A storage area may be secured by use of locks on entry doors, gates, or receptacle lids;
(v) A storage area must be maintained so as to prevent the entry of animals and natural elements, and to prevent the storage area from becoming breeding sites or food sources for insect vectors or rodents;
(vi) For the purpose of item l(c) 'animals' includes those animals not kept at laboratories for the pur poses of biological or scientific research and testing.

2. Minimum requirements for external collection and transport in terms of regulation 20(3)

(1) Collection from on-site storage area:
(a) health care risk waste must not be handled by health care risk waste management staff unless containerised;
(b) health care risk waste storage areas must be closed and secured on completion of the collection round; and
(c) no health care risk waste container may be left unattended.

(2) Loading of health care risk waste containers:
(a) manual handling of health care risk waste containers must be minimised;
(b) access to health care risk waste vehicles must be safe and unobstructed;
(c) containers must be secured when loaded; and
(d) where containers are to be stacked, the maximum allowable stacking height for the particular types of containers must be adhered to.

(3) Vehicle design:
(a) health care risk waste collection vehicles must be equipped with spill kits; and
(b) health care risk waste collection vehicles must be clearly marked as transporting health care risk waste.

3. Minimum requirements for final disposal of treated health care risk waste in terms of regulations 4(1) and 20(6)

(1) General:
- (a) Disposal of treated health care risk waste may not occur in a manner which causes harm to the public health or the environment.
- (b) Health care risk waste which has been effectively treated, may be mixed with general waste, provided this is in accordance with the Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste.

(2) Disposal of residues:
Treated health care risk waste must be classified according to the Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste, and residues must be finally disposed of or landfilled accordingly.

(3) All health care risk waste, subject to the exception provided for in regulation 4(2), must be finally disposed of in the following manner:
- (a) For treated health care risk waste that is solid or semi-solid after treatment -final disposal at a waste disposal site permitted to receive such waste, and where duly authorised staff are available to complete any manifest or tracking document which may be required in terms of these Regulations or any other law.
- (b) For treated health care risk waste that remains liquid after treatment -discharge to a public sewage system in a manner that complies with all applicable wastewater discharge requirements of the relevant Municipality and the relevant National Government department.

ANNEXURE 5: Minimum requirements for packaging of health care risk waste

SCHEDULE 1

1. Minimum requirements for packaging of health care risk waste in terms of regulation 9(2)
- (1) A plastic bag with a capacity of 60 litres or more must be at least 80 microns in thickness.
- (2) A plastic bag with a capacity of less than 60 litres must be at least 60 microns in thickness.
- (3) A plastic bag used as a barrier in a container and which is at no time removed from the container, other than for the treatment of the contents, must be at least 40 microns in thickness.
- (4) A plastic bag which is used as a smaller intermediate barrier within a single ward or similar, and that is subsequently placed in a container or a further plastic bag must be at least 40 microns in thickness.
- (5) A plastic bag and a disposable container must be manufactured from polypropylene or poly ethylene polymers; or polymers that cause, at a maximum, equivalent environmental impacts to those caused by polypropylene or polyethylene polymers when finally disposed of by incineration, or treated by means of any available alternative technology.
- (6) A health care risk waste container must have a fitted cover, and be kept clean and in good re pair.

(7) A container used for the storage of pathological waste must be manufactured from suitable materials able to withstand the low temperatures at which such pathological waste is stored.

(8) A lid used for a disposable sharps container must be secured in such a way that it cannot be reopened once closed, without major structural damage to the container.

(9) A lid used for a pathological waste container must provide an airtight seal to prevent the emission of odours.

(10) For the purpose of ensuring sufficient tensile strength, the maximum allowable percentage of recycled materials in a liner is 10 (ten) percent; provided that for outer packaging the maximum allowable percentage of recycled materials is 15 percent.

ANNEXURE 6: Standards for disinfection of reusable health care risk waste containers

SCHEDULE 2

Standards for disinfection of reusable health care risk waste containers in terms of regulation 11(2) (a)

(1) There must be suitable written operating procedures for disinfecting a reusable health care risk waste container, which must include:

(a) approved testing methodologies for relevant biological and other indicators relating to the ad equate disinfection of a health care risk waste reusable container for each unit; and

(b) All pertinent operating parameters.

(2) The minimum frequency of testing to be conducted in terms of item 1, must be in accordance with the following:

(a) Initial testing prior to commencement of operations: daily swab tests of a sample of disinfected reusable health care risk waste containers for 5 (five) working days;

(b) testing during usual operation: weekly swab tests of a sample of disinfected reusable health care risk waste containers before dispatch and monthly swab tests of a sample of reusable health care risk waste containers after delivery to a generator;

(c) after 4 (four) consecutive months of achieving reasonably adequate levels of disinfection, the test frequency as required by (a) and (b) above, may be reduced to 50 percent: Provided that should any one sample fail to indicate a reasonably adequate level of disinfection, the frequency levels required by (a) and (b) above must be adhered to.

(3) Adequate disinfection of reusable health care risk waste containers must be tested and documented based on swab tests or similar sampling procedures for relevant biological indicators, which tests or sampling must be conducted by a competent person.

(4) Such samples must be processed by an accredited laboratory for the following biological indicators:

(a) Bacterial cultures; and

(b) Fungal cultures.

(5) A report must compiled quarterly by a competent person regarding the level of disinfection achieved by the facility, based on:

(a) a reasonable number of representative samples; and

(b) the results of the tests conducted in terms of item 1.

(6) A report required in terms of sub-item (5) must include details of all procedures used and must be retained for a period of 3 (three) years and must be made available to a generator on request.

(7) The number of swab samples taken for the purpose of monitoring in terms of this Schedule must be reasonable in relation to the number of reusable health care risk waste containers disinfected per day at the disinfecting facility and must be determined and signed off by a competent person.

(8) The specific area of a reusable health care risk waste container to be used for sampling, as well as the location at which a reusable health care risk waste container is intercepted and diverted for sampling must be determined by a competent person.

1. INTRODUCTION

GDARD intends to commence with the evaluation of the environmental performance of Gauteng's existing Abattoir Waste Management Facilities. This will be done in accordance with the broad environmental mandate assigned to the Gauteng Provincial Government for Constitution, with the goal of improving service delivery to Gauteng's people.

An Abattoir Waste Management Guideline Manual (AWM Guideline Manual) was developed in order to provide guidance to a consistent manner in which activities, specifically related to Waste Management, should be carried out.

This AWM Guideline Manual will form the basis of the criteria documentation for the preparation of the on-site auditing activities. These criteria will also be supplemented, not limiting to, the following legislation:

- National Environmental Management Act (Act 108 of 1998)
- National Conservation Act (Act 73 of 1989)
- National Water Act (Act 36 of 1998)
- Air Quality Act (Act 39 of 2004)
- Meat Safety Act (Act 40 of 2000)
- FertiliSers, Farm Feeds, Agricultural Remedies and Stock Remedies (Act 36 of 147)
- Occupational Health & Safety Act (Act 8 of 1993): Regulations for hazardous biological agents (GN 1390)
- Occupational Health & Safety Act (Act 8 of 1993): Hazardous chemical substances regulations promulgated in terms of the GN 1179
- Local Authority by-laws

Auditing forms an integral part of any proper management system, due to the fact that it is a basic control device to measure the effectiveness of the implementation of the Abattoir Waste Management and to monitor the improvement level in terms of the procedures followed.Nearly every activity in an Abattoir could benefit from improvement measures, including the processes that monitor the quality of the products and services. The audit is a valuable management tool, which can reveal major opportunities for business improvements and cost reduction.

Management should promote the internal audit to identify strengths and identify opportunities for improvement, not merely fixing the problems. By identifying strengths, the workforce receives positive feedback and a valuable boost to morale. The strengths, once recognized, can simulate similar improvements in other areas.

When deficiencies are discovered or opportunities for improvement recommended, the audit team should be involved in identifying solutions and their implementations.

As this section (Part 3) only refers to the auditing of the waste management of abattoirs, it must be noted that these auditing principles, auditors selection and auditing tools can be used as a standard to the overall Audit / Assessment of any abattoir, based that there is a certain set of criteria available to measure against. In this case audit of the Waste Management will be done against the specifications in the Abattoir Waste Management Guideline Document.

2. CRITERIA FOR THE SELECTION OF AUDITORS:

Based on the assumption that auditors will be selected form current available staff in the relevant business unit of GDARD, the following criteria should be applied to ensure that auditors are competent to perform the tasks given to them and to ensure the objective of the audit is achieved.

EDUCATION:

There must at least be a tertiary qualification in a related field to gain the acquisition of the knowledge and skills described below

WORK EXPERIENCE:

Each auditor must have the required years of required work experience in the relevant area in terms of the industry. This work experience should be in a technical, managerial or professional position involving the exercise of judgement, problem solving, and communication with other managerial or professional personnel, peers, customers and/or other interested parties. Part of the work experience should be in a position where the activities are undertaken contributes to the development of knowledge and skills in the quality, health and safety and/or environmental management field. In this case experience within the Abattoir sectors would be an advantage as it will provide a clear background of the processes and basic knowledge on the legislation required compliance.
AUDITOR TRAINING:
Auditors should be trained in the area of "Auditing", using the ISO 9001:2004 and ISO 19011:2004 international standards as a guideline in terms of the auditing process, tools and principles.

AUDITOR EXPERIENCE:

New auditors must be mentored and gained experience under the direction and guidance of an auditor who is competent as an audit team leader in the same discipline.

3. AUDITING PRINCIPLES

The following principles are important for auditors to understand and apply during on-site audit activities:

a) Ethical conduct: the foundation of professionalism trust, integrity, confidentiality and discretion are essential to auditing.

b) Fair presentation: the obligation to report truthfully and accurately. Audit findings, audit conclusions and audit reports reflect truthfully and accurately the audit activities. Significant obstacles encountered during the audit and unresolved diverging opinions between the audit team and the auditee are reported.

c) Due professional care: the application of diligence and judgement in auditing. Auditors exercise care in accordance with the importance of the task they perform and the confidence placed in them by audit clients and other interested parties. Having the necessary competence is an important factor. Further principles relate to the audit, which is by definition independent and [systematic.

d) Independence: the basis for the impartiality of the audit and objectivity of the audit conclusions. Auditors are independent of the activity being audited and are free from bias and conflict of interest. Auditors maintain an objective state of mind throughout the audit process to ensure that the audit findings and conclusions will be based only on the audit evidence.

Evidence-based approach: the rational method for reaching reliable and reproducible audit conclusions in a systematic audit process. Audit evidence is verifiable. It is based on samples of the information available, since an audit is conducted during a finite period of time and with finite resources. The appropriate use of sampling is closely related to the confidence that can be placed in the audit conclusions.

Auditors should take note of these principles, as they have to be applied during the auditing process.

4. AUDITING TOOLS

The use of checklists is a key tool for most audits, regardless of audit depth or scope. The Abattoir Checklist for the AWM will be based on the specifications as set out in the Technical Components of this document as well as specified legislation.Abattoirs will be graded according to the Meat Safety Act, 2000 (Act no 40 of 2000), and further categorised in terms of throughput. The Abattoir checklist will be developed separately for each of the following 3 categories:

- Rural Abattoir
- Low throughput abattoir
- High throughput abattoir

Checklists should be used for the following purposes:

- As a guide
- As a memory jogger
- As objective evidence that areas have been audited
- To help prepare the final report
- To provide useful information for those who have to implement the corrective action

In preparing checklists, the auditor should keep the following in mind:

- Compile questions, checklist with the specific company and its requirements in mind
- Take into consideration the scope of certification
- A good audit checklist will give the auditor instructions on the records, reports and examples of documentation to be requested during the audit. It should also help the auditor understand what to look for when reviewing them
- The checklist should provide enough space for the auditor to make remarks or add additional questions or information
- Most of the questions should allow for some discussion and robbing rather than just say “yes” or “no” answers

There are four basic resources of requirements to consider when preparing a checklist:

Applicable Standards: AWM Guideline Document; Other Food Safety standards
Customer: customer’s requirements as expressed in orders or contractual agreements
Organisation: as expressed by internal documents
Legal: such as statutory and regulatory requirements

4.1 AUDITING PROCEDURE

4.1.1 Inputs to the Auditing Procedure will include:

- Audit Schedule (indicating dates of planned audits for a 12-month period)
- Audit Programme
- Audit Checklist / Hygiene Assessment System
- Audit Criteria (e.g. procedures, standards, regulations)
- Reference documents:
- Standard Operating Procedures
- Applicable standards
- Applicable regulations

4.1.2 Audit Preparation

Audit preparation includes the definition of the responsibilities of the different audit role players, the selection of the audit team, logistics, etc. Selection of the audit team should ensure the team possesses the overall experience and expertise needed to conduct the audit.

4.1.3 Audit Programme

To ensure monitoring and measurement of the management system is done effectively and consistently, it is required that an Audit Programme is drafted. Top management commitment is crucial to establish and maintain an effective audit programme. It must ensure the whole organization is audited within a 12-month period to determine where improvements can be made (Figure 1).

An audit programme may be including one or more audits, depending upon the size, nature and complexity of the organisation to be audited. These audits may have a variety of objectives and may also include joint or combined audits.

An audit programme is developed to indicate:

- The objective and extent
- Responsibilities (auditors and auditee's)
- Resources required
- Audit criteria (procedures and standards applicable)
- Audit Scope

4.1.4 Conducting document review

This includes the reviewing of the relevant management system documents, including records, and determining their adequacy with respect to audit criteria.

4.1.5 Prepare for the on-site audit activities

- Finalise the Audit Plan
- Assigning work to the audit team
- Prepare work documents, e.g. Checklists

4.1.6 Conducting on-site activities

- Conducting the opening meeting
- Site tour / indication of guides
- Collecting and verifying information
- Generating audit findings against the audit criteria
- Preparing audit conclusions
- Conducting closing meeting

4.1.7 Frequency of auditing

- Initially auditing of all abattoirs in Gauteng should be conducted on a yearly basis
- If the abattoir is operating poorly and in an environmentally unsustainable manner, it should be audited on quarterly until the issues have been resolved.
- If the abattoir has a record of good practice (history of good compliance with audited requirements) the auditing frequency could be reduced to a yearly cycle. This decision should rest with the Directors of the relevant sections in GDARD.

4.1.8 Preparing, approving and distributing the audit report

- Prepare the audit report
- Approving and distributing the audit report

4.1.9 Completing the audit

- Close off by following up on corrective actions

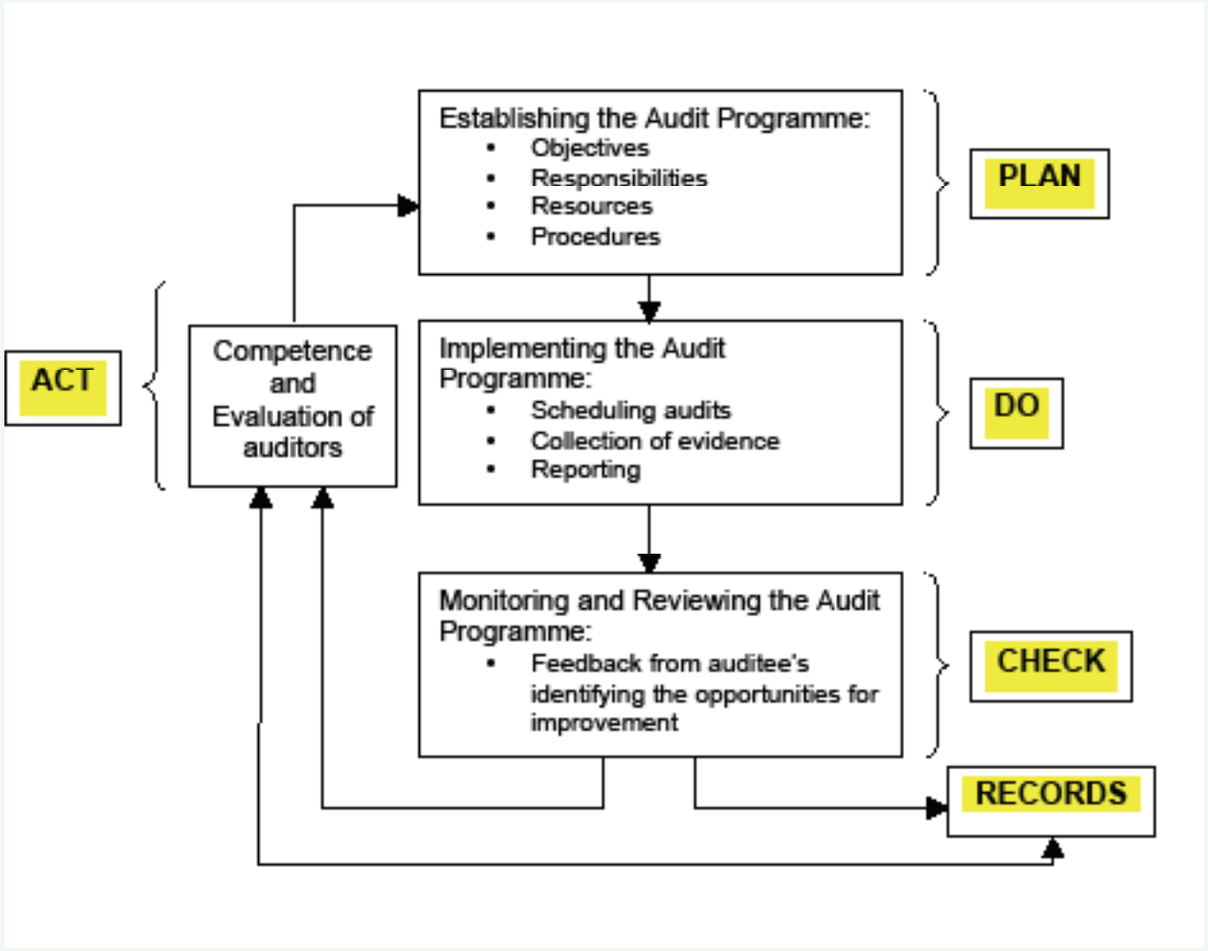
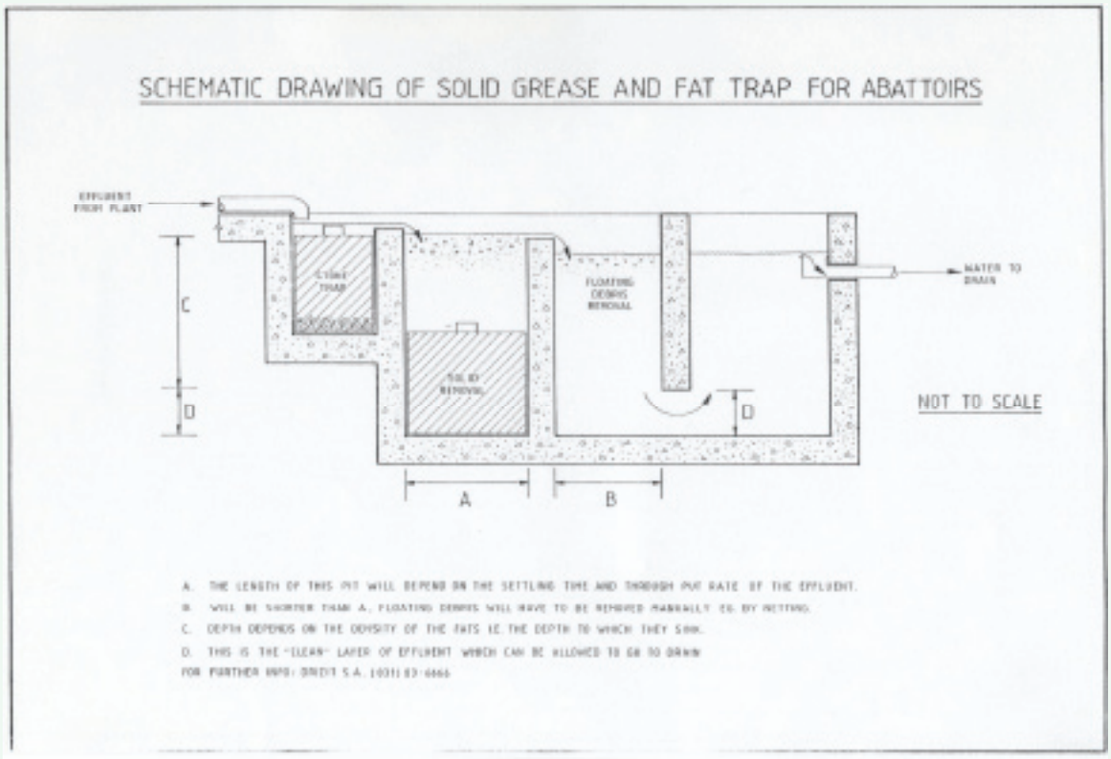
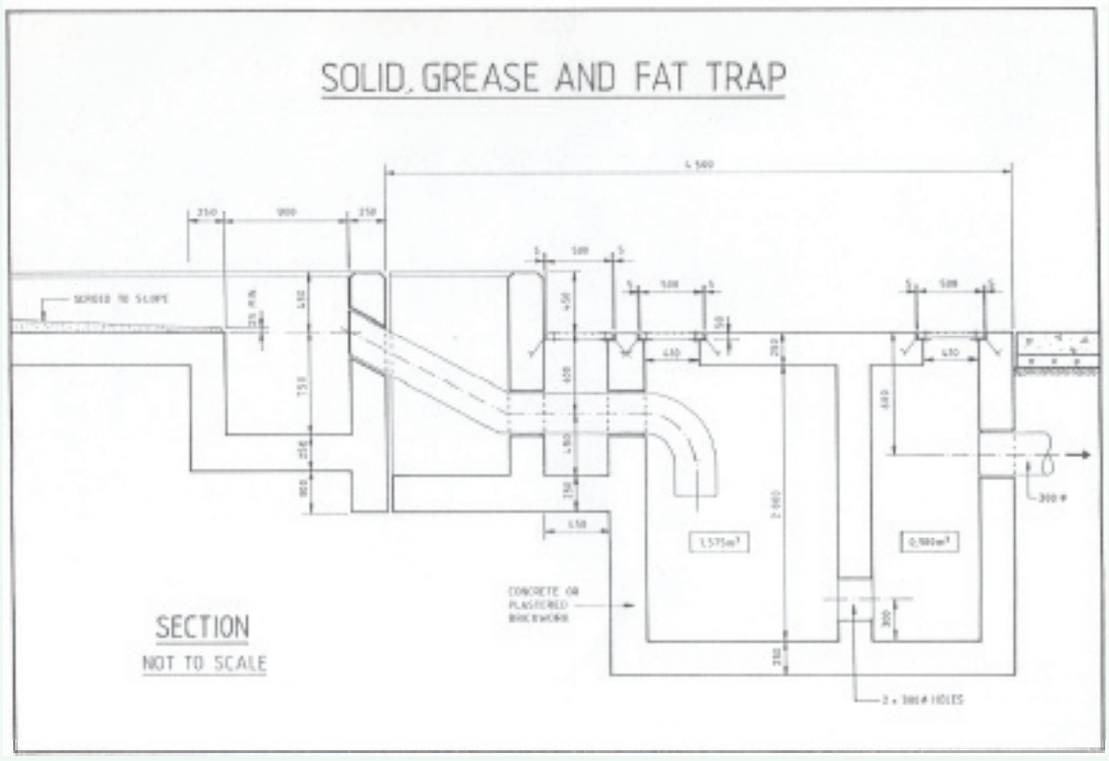


Figure 1 - Illustration of ther process flow for the management of an audit programme


SCHEMATIC DRAWING OF SOLID GREASE AND FAT TRAP FOR ABATTOIRS
EFFLUENT FROM PLANT
C
D
SOLID REMOVAL
FLOATING DEBRIS REMOVAL
D
WATER TO DRAIN
NOT TO SCALE
A
B
A. THE LENGTH OF THIS PIT WILL DEPEND ON THE SETTLING TIME AND THROUGH PUT RATE OF THE EFFLUENT.
B. WILL BE SHORTER THAN A. FLOATING DEBRIS WILL HAVE TO BE REMOVED MANUALLY EG. BY NETTING.
C. DEPTH DEPENDS ON THE DENSITY OF THE FATS IE THE DEPTH TO WHICH THEY SINK.
D. THIS IS THE "CLEAN" LAYER OF EFFLUENT WHICH CAN BE ALLOWED TO GO TO DRAIN
FOR FURTHER INFO: DRIDYT S.A. (031) 83-6666


SOLID, GREASE AND FAT TRAP
SLOPED TO SLOPE
CONCRETE OR PLASTERED BRICKWORK
SECTION
NOT TO SCALE

Department of Agriculture and Rural Development

PART4: STANDARD ENVIRONMENTAL MANAGEMENT PLAN

DETAILED STANDARD ENVIRONMENTAL MANAGEMENT PLAN (SEMP) FOR THE CONSTRUCTION AND OPERATION OF ABATTOIRS

ABATTOIR NAME & LOCATION _____

ABATTOIR CLASSIFICATION AND GRADE _____

DATE: _____
GDACE REF No: _____

1. BACKGROUND

Under the EIA Regulations, 2006 all abattoirs are to undergo an environmental impact assessment process. One of the requirements of this process is that the abattoir must submit an Environmental Management Plan. GDARD has thus formulated a Standard Environmental Management Plan (SEMP) which all abattoir owners/operators must sign and agree to implement. Only once this document has been signed and all other requirements under the legislation met, will GDARD issue the Record of Decision (approval) for the abattoir.

A SEMP for abattoirs is advantageous to GDARD as it allows for the easy use of a standardised auditing procedure to audit against the standard conditions contained within the SEMP document to determine whether on not the abattoir is in compliance. Furthermore is ensures that GDARD receives an environmental management plan in a standard format with a consistent level of quality which will speed up the assessment process as it will reduce the administrative load on officials and assessment time.

The advantage to the abattoirs is that they do not have to develop their own Environmental Management Plans. They have to sign and implement the standardised SEMP to the best of their ability.

2. INTRODUCTION

Any development can pose risks to the environment as well as the inhabitants in the surrounding area. These possible risks must be taken into account during the planning, design phase of the development and during the construction, operational and decommissioning phases of the proposed development. The purpose of this document is to provide management responses that will ensure that the impacts of the development/operation are minimised. This SEMP is, therefore, a stand-alone document, which must be implemented on the site during each phase of the development.

This document is flexible so as to allow any contractors, the developer, managers and staff to conform to the management commitments without being prescriptive. The management commitments prove that the anticipated risks on the environment will be minimised if they are adhered to consistently. The onus set out in the SEMP rests with any contractors, the developer, managers and staff, which will promote responsibility and commitment. Any parties responsible for transgression of the underlying management measures outlined in this document will be held liable for non-compliances and will be dealt with accordingly.

3. EXTENT OF ACTIVITIES AND THE POTENTIAL ENVIRONMENTAL IMPACTS

As stated above, the purpose of this document is to serve as an on-site reference document in order to adhere to best environmental management practice in the abattoir industry.

The tables below indicate the identified key issues per development phase in relation to possible impacts that could ensue as a result of the above mentioned activities, as well as the section of the SEMP where it is addressed.

4. PHASES OF THE PROJECT

The process which was followed in compiling the SEMP is in compliance with the New Environmental Impact Assessment Regulations and applies the principles of Integrated Environmental Management (IEM). The purpose of this SEMP is to formulate mitigation measures that are binding on all contractors involved during the construction, decommissioning and operational phases by the abattoir owners/operators.

The point of departure for this SEMP is to take a pro-active route by addressing potential problems BEFORE they occur. This must limit corrective measures required during the construction and operational phases of the development. Additional mitigation will be included throughout the project's various phases, as required and if necessary.

In particular, this SEMP deals with the following phases as detailed below:

4.1 PLANNING AND DESIGN PHASE

The SEMP offers an ideal opportunity to incorporate pro-active environmental management measures with the goal of attaining sustainable development. Pro-active environmental measures minimise the chance of impacts taking place during any construction or decommissioning phase and operational phase. There is still the chance of accidental impacts taking place; however, through the incorporation of contingency plans (e.g. this SEMP) during the planning and design phase, the necessary corrective action can be taken to further limit potential impacts.

4.2. CONSTRUCTION PHASE

The bulk of the impacts during this phase will have immediate effect (e.g. noise and dust pollution). If the site is monitored on a continual basis during the construction phases, it is possible to identify these impacts as they occur. These impacts will then be mitigated through the contingency plans identified in the planning phase, together with a commitment to sound environmental management from the developer.

4.3 THE OPERATIONAL PHASE

By taking pro-active measures during the operational phase, potential environmental impacts emanating during the operational phase will be minimised. This, in turn, will minimise the risk and reduce the monitoring effort, but it does not make monitoring obsolete.

4.4 THE DECOMMISSIONING PHASE

By taking pro-active measures during the decommissioning phase, potential environmental impacts emanating during the decommissioning (includes rehabilitation) phase will be minimized.

4.5 RESPONSIBILITIES OF THE ROLE PLAYERS

4.5.1 Developer/abattoir owner

The developer/abattoir owner has a "duty of care" in terms of Section 28 of NEMA . This is a generic Duty of Care that is applicable to all forms of environmental impacts and potential impacts and by implication includes the management of waste.

The developer/abattoir owner remains ultimately responsible for ensuring that the development is implemented according to the requirements of the SEMP. Although the developer/abattoir owner appoints specific role players to perform functions on his/her behalf, he/she ultimately retains the responsibility. The developer/abattoir owner is responsible for ensuring that sufficient resources (time, financial, human, equipment, etc.) are available to the other role players (e.g. the ECO, ELO and contractors) to efficiently perform their tasks in terms of the SEMP. The developer/abattoir owner is liable for restoring the environment in the event of negligence leading to damage to the environment.The developer/abattoir owner must ensure that the SEMP is included in any tender documentation so that contractors who are appointed are bound to the conditions of the SEMP. The developer/abattoir owner must appoint an independent Inspection service provider and/or Environmental Health Officer with appropriate background and training during all phases of the development to oversee all the environmental aspects.

4.5.2 Contractor

Any contractors, as the developer's/abattoir owner's agents on site, are bound to the SEMP conditions through his/her contract with the developer/abattoir owner, and is responsible for ensuring that s/he adheres to all the conditions of the SEMP. The contractor must thoroughly familiarise himself/herself with the SEMP requirements before coming onto site and must request clarification on any aspect of these documents, should they be unclear.

The contractor must ensure that he/she has provided sufficient budget for complying with all SEMP conditions at the tender stage. The contractor must comply with all orders (whether verbal or written) given by the ECO, project manager or site engineer in terms of the SEMP.

4.5.3 The abattoir employees

Employees are responsible for ensuring that the SEMP is implemented during the operational phase in accordance with the requirements of the SEMP. However should they fail, the abattoir owners retain the ultimate responsibility. As discussed in Part 2 (paragraph 1.1.1.2), employees incur personal liability for violations of laws listed in Schedule 3 to the National Environmental Management Act of 1998, unless they can show that the offence occurred as a result of the employer's failure to take reasonable measures to prevent the violation. Therefore, any complaints must by logged in the Complaints Sheet (Table 6).

4.5.4 Environmental Control Officer (ECO)/independent environmental auditor

The Environmental Control Officer (ECO) is appointed by the developer/abattoir owner as an independent monitor of the implementation of the SEMP during any construction phases. Thus, the ECO position is not relevant to existing abattoirs. The ECO must form part of the project team and be involved in all aspects of project planning that can influence environmental conditions on the site. The ECO must attend relevant project meetings, conduct inspections to assess compliance with the SEMP and be responsible for providing feedback on potential environmental problems associated with the development. In addition, the ECO is responsible for:

- Liaison with relevant authorities;
- Liaison with contractors regarding environmental management; and
- Undertaking routine monitoring and appointing a competent person/institution to be responsible for specialist monitoring, if necessary.

The ECO has the right to enter the site and undertake monitoring and auditing at any time, subject to compliance with health and safety requirements applicable to the site (e.g. wearing of safety boots and protective head gear).

(a) Liaison with Authorities

The ECO must be appointed during the planning and design phase and must form part of the project management team.

The ECO will be responsible for liasing with the Local Municipalities and GDARD. The ECO must submit environmental audit reports to the authorities before; during and after construction phases (decommissioning and rehabilitation). Audits need to be submitted thereafter at least quarterly. These audit reports must contain information on the contractor and developer's levels of compliance with the SEMP.The audit report must also include a description of the general state of the site, with specific reference to sensitive areas and areas of non-compliance. The ECO is to suggest corrective action measures to eliminate the occurrence of the non-compliance incidents. In order to keep a record of any impacts, an Environmental Log Sheet (Table 5) must be kept on a continual basis.

(b) Liaison with Contractors

The ECO is responsible for informing the contractors of any decisions that are taken concerning environmental management during the construction phase (decommissioning and rehabilitation). This would also include informing the contractors of the necessary corrective action to be taken.

4.5.5 Environmental Liaison Officer (ELO)

(a) ELO for Construction

The main contractor must appoint an Environmental Liaison Officer (ELO) for Construction to assist with day-to-day monitoring of construction activities. Any issues raised by the ECO will be routed to the ELO for Construction for the contractors' attention. The ELO for Construction must be permanently on site during the construction phases to ensure daily environmental compliance with the SEMP and must ideally be a senior and respected member of the construction crew or permanent workforce. Past experience has revealed that ELO for Construction's that can relate to the work force are the most effective for information transfer and ensuring compliance with the SEMP.

(b) ELO for Operation

The developer/abattoir owner must appoint a ELO to assist with the day-to-day monitoring of the operation of the abattoir. Following an induction/training session by the ECO on the requirements of the SEMP, the ELO for operations will be responsible for the implementation of the SEMP. Any issues raised by the ECO during operational audits if required, will be routed to the ELO for operation for the developer/abattoir owner's attention. The ELO for operation must have a thorough understanding of the processes involved in the abattoir and must be permanently on site to ensure daily environmental compliance with the SEMP. The ELO for operation does not need academic environmental training, but needs to be thoroughly conversant with the guidelines of the SEMP. The ELO for operation should ideally be a respected member of the operations management team at the abattoir e.g. Quality Manager or Safety Health and Environment Manager. Past experience has revealed that ELO for operations that can relate to the work force are the most effective for information transfer and ensuring compliance with the SEMP.

4.5.6 GDARD

GDARD, as a regulatory authority is mandated to oversee the protection of the environment within Gauteng. As part of this function, GDARD is required to audit abattoirs against the conditions stipulated in the Records of Decision and the SEMP. Auditors will be existing inspectors from GDARD Veterinary Services division who are familiar with the operation of abattoirs.

5. STANDARD ENVIRONMENTAL MANAGEMENT PLAN (SEMP)

The following tables form the core of this SEMP for all phases of the development. These tables must be used as checklists on site, especially during any construction phases. Compliance with this SEMP must be audited monthly during the construction phases and once immediately following completion of construction. During the decommissioning phase the site must be audited following completion and then three monthly to determine and monitor the success of rehabilitation. This can be left to the discretion of the authorities as well.If the abattoir is operating poorly and in an environmentally unsustainable manner, it must be audited on quarterly until the issues have been resolved. If the abattoir has a record of good practice (history of good compliance with audited requirements) the auditing frequency could be reduced to a yearly cycle. This decision must rest with the Directors of the relevant sections in GDARD.

Table 1: Standard Environmental Management Plan for the *Name of Abattoir* (PLANNING AND DESIGN PHASE)

Activity / issue	Action required	Responsible party	Frequency	Abattoir Rank
Approval	Construction of new premises must not commence and alterations to existing registered premises must not commence before the plans of the premises and associated specifications have been approved. Plan will not be approved unless in compliance with the infrastructure requirements imposed by regulation R 3505 to the Meat Safety Act 40 of 2000 and regulation R 2378 to the National Building Regulations and Building Standards Act 103 of 1977. In the case of new premises, the site (in particular the land use change/rezoning) must also be approved in advance. (Australian Regulations)	Developer / abattoir owner	Once-off	
General	Buildings intended to be on the site, having regard to the operations proposed to be carried on at the premises, must be a reasonable distance from any building used for human habitation and any factory, public road or public place that is likely to cause meat on the proposed premises to be contaminated or otherwise adversely affected. (Australian Regulations)	All	Once-off	
Appointment and Duties of ECO	The Developer/abattoir owner must appoint an independent Environmental Control Officer (ECO) who must monitor the contractor's compliance with the SEMP.	Developer / abattoir owner	Once-off	
	The developer/abattoir owner must provide all contractors with a copy of the SEMP.	Developer / abattoir owner	Once-off or as and when required	
	The priority of the ECO is to maintain the integrity of the development conditions outlined in the SEMP.	ECO	Continuous	
	The ECO must form part of the project management team and attend all relevant project meetings.		Continuous	

Activity / issue	Action required	Responsible party	Frequency	Abattoir Rank
Appointment and Duties of ECO	All contractors must ensure that their construction crews attend an environmental briefing and training session presented by the ECO prior to commencing activities on site.	Contractor, ECO	Once-off	
Appointment and Duties of ELO for Construction	The developer/abattoir owner must appoint an Environmental Liaison Officer (ELO) for Construction. This person will be required to monitor the situation with a direct hands-on approach, and ensure compliance and co-operation of all personnel. He must be fluent in the languages of the employees.	Contractor	Once-off	
SEMP	This SEMP must is binding to all contractors and must be included in tender documentation for construction contracts.	Developer / abattoir owner, ECO	Once-off	
Environmental incidents	All contractors must take corrective action to mitigate an incident appropriate to the nature and scale of the incident and must also rehabilitate any residual environmental damage caused by the incident or by the mitigation measures themselves. Major environmental incidents must be reported to the relevant authorities in accordance with the provisions of Section 30 of the National Environmental Management Act of 1998 and Section 20 of the National Water Act of 1998.	ELO, ECO, Contractor	Continuous	
Occupational Health and safety	All contractors must ensure that they have received occupational health and safety training in terms of the Occupational Health and Safety Act, 1985 (Act 85 of 1993) All contractors are to operate within the construction regulations of the Occupational Health and Safety Act, 1985 (Act 85 of 1993) All contractors are to comply with the Occupational Health and Safety Act, 1985 (Act 85 of 1993).	ELO, ECO, Contractor and Developer / abattoir owner	Continuous	
Drainage lines	All construction activities must remain within the boundaries of the development area, as demarcated at the start of construction. There must be no vehicular access to the drainage lines outside the development area.	Developer / abattoir owner, ECO	Once-off	
	No construction activities may occur within any drainage lines.	Contractor, ELO	Continuous	

Activity / issue	Action required	Responsible party	Frequency	Abattoir Rank
Environmental incidents	All contractors must take corrective action to mitigate an incident appropriate to the nature and scale of the incident and must also rehabilitate any residual environmental damage caused by the incident or by the mitigation measures themselves. Major environmental incidents must be reported to the relevant authorities in accordance with the provisions of Section 30 of the National Environmental Management Act of 1998 and Section 20 of the National Water Act of 1998.	ELO, ECO, Contractor	Continuous	
Occupational Health and safety	All contractors must ensure that they have received occupational health and safety training in terms of the Occupational Health and Safety Act, 1985 (Act 85 of 1993) All contractors are to operate within the construction regulations of the Occupational Health and Safety Act, 1985 (Act 85 of 1993) All contractors are to comply with the Occupational Health and Safety Act, 1985 (Act 85 of 1993).	ELO, ECO, Contractor and Developer / abattoir owner	Continuous	
Drainage lines	All construction activities must remain within the boundaries of the development area, as demarcated at the start of construction. There must be no vehicular access to the drainage lines outside the development area.	Developer / abattoir owner, ECO	Once-off	
	No construction activities may occur within any drainage lines.	Contractor, ELO	Continuous	
Drainage lines	Soil types subject to large expansion and contraction can adversely affect construction costs or cause serious damage to buildings. Heavy soils subject to water logging can create drainage problems and allow pools of stagnant water to form. (Australian regulations)	Developer / abattoir owner, Contractor & ECO	Continuous	
Erosion sedimentation and flooding	If possible, construction activities must be scheduled for the dry winter months to decrease the risk of erosion during heavy thunderstorms.	Developer / abattoir owner	Once-off	
	No construction activities may occur within any drainage lines.	Contractor, ELO	Continuous	
Services	Any new services system must be designed according to the minimum requirements of the Local Municipality, relevant by-laws and DWAF's minimum requirements	Developer / abattoir owner, ECO	Design phase	
Intensive housing systems	Clean source of drinking water is to be planned and designed for. Measures must be in place to ensure this water does not become contaminated. Depending on the volume of water abstracted from any borehole such use may require a water use licence, which must be applied for from DWAF.	Developer / abattoir owner	Design phase	

Activity / issue	Action required	Responsible party	Frequency	Abattoir Rank
Handling of waste	Strategies are to be devised and implemented to ensure that by-products do not become a nuisance. Purification, recycling of liquid effluent and alternative use of the effluent must be investigated.	Developer / abattoir owner	Design phase, continuous	
	Handling of solid manure is preferred to handling of liquid manure. This ensures that water usage and effluent generation is kept to a minimum.			
	Concrete slatted concrete flooring is recommended, and in some instances required by the Meat Safety Act of 2000, for effective manure handling and removal.	Developer / abattoir owner	Design phase, continuous	
	Management and design of flush tanks on 'manure removal systems' must be mindful of potential impact to the environment and its resources. Operation of and the condition of the equipment used for manure extraction must be controlled and managed to ensure no contamination of outside resources is possible.			
Disease control	The abattoir must have emergency plans to deal with disease outbreaks. This includes the design and planning for isolation pens and mass disposal areas.	Developer / abattoir owner	Design phase, continuous	
	The design of lay-out of the abattoir must consider: • The proximity of water sources that can be polluted by the flow-off from the unit. • Availability of sufficient water encourages proper cleaning. • Effective methods of manure handling to reduce the risk of disease. • The management and control of potential disease transfer from visiting farmers, sales representatives and delivery vehicles.			
	The design must take into account which ventilation systems (natural or mechanical) will be best suited to the operation, taking into account possible air contamination of the animals, manure and feed.			
	The control of bacteria must be considered in the design of the unit lay-out. For example, the breeding units and grower units must be on different sites.			

	Action required	Responsible party	Frequency
	Staff must be regularly trained in procedures pertaining to containment of disease outbreaks and destruction and disposal of diseased animals, hygiene in the working environment, and the regulations that must be complied with in national and provincial health legislation.	Developer / abattoir owner	Design phase, continuous
	At least 1 monitoring borehole must be drilled on the downstream slope of the site to monitor potential groundwater contamination. If a suitable available borehole is present for monitoring purposes, drilling will not be required. Monthly samples must be analysed for levels of *Copper, Zinc, Faecal Coliforms, Conductivity, pH, free and saline Ammonia, Nitrates and Nitrites, and Ortho phosphates*. "Domestic use standards" stipulated by **DWEA** for the above mentioned components must be used as a baseline for comparative analyses to monitor potential groundwater contamination by the activities. Confirmation of whether this type of monitoring is required must be sought by the abattoir owner, as this requirement may not be required depending on the abattoir classification.	Developer / abattoir owner, ECO	Immediately ar thereafter bi-monthly
	The security fence must be planned for and erected prior to any other construction activities on the site.	Developer / abattoir owner, Contractor	Once-off
	The planning of construction activities for the abattoir (construction site) must endeavour to minimise the visual impact on adjacent landowners.	Developer / abattoir owner, Contractor	Once-off
	The construction camp must preferably be positioned where it will not visually impact on adjacent landowners.	Developer / abattoir owner, Contractor	Once-off
	When planning the premises, careful consideration must be given to the design to allow space for future expansion. (Australian Regulations)	Developer / abattoir owner	Once-off
	Best Practice in Australia is for pits and tanks into which blood is received must be outside the slaughter floor. They may be located beneath the slaughter floor. (Australian regulations)	Developer / abattoir owner & Contractor	Once-off

Activity / issue	Action required	Responsible party	Frequency	Abattoir Rank
	Best Practice in Australia is for the equipment that comes in direct contact with the meat to be plastic and resin, high quality galvanised steel or rust resistant metal. Copper, all its alloys, aluminium, cadmium, painted surfaces, enamel, porcelain and lead may not be used (except lead may be used in dairy solder in an amount not exceeding 5 per cent). (Australian regulations)			

Table 2: Standard Environmental Management Plan for the *Name of Abattoir* (CONSTRUCTION, DECOMMISSIONING AND REHABILITATION PHASES)

Activity / issue	Action required	Responsible Party	Frequency	Abattoir Rank
General	Prior to establishment of any construction crew camp(s), the Contractor shall produce a plan showing the positions of all buildings, laydown yards, and other infrastructure for approval by the ECO.	Contractor, ECO	Once-off	
	On completion of the construction works, the Contractor shall clear away and remove from the site all construction paint, surplus materials, foundations, plumbing and other fixtures, rubbish and temporary works of every kind. Areas thus cleared shall be graded and scarified to restore the ground to its original profile as near as practicable before topsoil placement.			
	All persons employed by the Contractor or his subcontractors shall abide by the requirements of the general environmental protection specifications in the SEMP. Any employees of the Contractor or his subcontractors found to be in breach of any of the SEMP may be ordered by the ECO to leave the site forthwith. The order may be given orally or in writing. Confirmation of an oral order will be given as soon as practicable but lack of confirmation in writing shall not be a cause for the offender to remain on site. No extension of time will be granted for any delay or impediment to the Contractor brought about by a person ordered to leave the site.			
	Rubble must be removed from the construction, decommissioning and rehabilitation sites frequently and disposed of at a licensed landfill site.			
	All process areas must possess drain outlets. Humps must be constructed at all doorways to prevent the escape of effluent to stormwater drains.	Developer	Once-off	
	Abattoir grading systems must be enforced, or alternatively, abattoirs must be designed for their proposed grading +50% of capacity.	GDARD	Once-off	

Activity / issue	Action required	Responsible Party	Frequency	Abattoir Rank
General	All transformers must be bunded. Waste refrigeration oil must be disposed of through reputable waste contractors and the legal handling thereof must be verified.	Manager	Once-off, Continuous	
Erosion, sedimentation and flooding	Construction activities must preferably take place during the dry winter months to reduce the potential for erosion.	Developer	Once-off	
	Vegetation clearance must be kept to a minimum and stockpiles must be covered in excess windy conditions.	Contractor, ELO	Daily	
	No stockpiles or construction materials may be stored or placed within any drainage lines on site.	Contractor, ELO	Daily	
	To prevent erosion, material stockpiled for longer periods must be retained in a bermed area. Stockpiles are to be turned on a monthly basis to retain the natural seed bank.	Contractor, ELO	Monitor weekly	
	All trenches and excavation works must be properly backfilled in accordance with a qualified engineer.	Contractor, ELO	As required	
Rehabilitation	The contractor must rehabilitate the construction camp once construction activities have terminated. Compacted areas will be ripped and mulched in order to ensure recovery of the natural vegetation cover.	Developer / abattoir owner, contractor, ELO	End of construction phase	
	The cleared site after decommissioning is to be graded and scarified to restore the ground to its original profile as near as practicable before topsoil and vegetation is replaced.	Abattoir owner	Once-off	
	Where necessary damaged areas shall be cordoned off to enhance rehabilitation.	Developer / abattoir owner, contractor, ELO	Once-off	
	Should areas within the drainage lines be disturbed during the construction phase, these areas must be ripped and re-vegetated with the stockpiled topsoil to ensure recovery of the natural vegetation cover.	Developer / abattoir owner, contractor, ELO	Rehabilitation phase	

Activity / issue	Action required	Responsible Party	Frequency	Abattoir Rank
Rehabilitation	The drainage lines area must be declared as a no-go area, thereby ensuring that no activities (i.e. stockpiling, construction, driving and washing) take place within this area.	Developer / abattoir owner, contractor, ELO	Once off, monitor daily	
	Any contaminated soil is to be removed and disposed of at an appropriately permitted landfill site in accordance with the acceptable methods prescribed for the particular waste class and hazard rating, as prescribed by DWAF's Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste, Second Edition (1998).	Developer / abattoir owner, contractor, ELO	Continuous	
Decommissioning of the abattoir	The site and crew are to be managed in strict accordance with the Occupational Health and Safety Act, 1993 (Act No.85 of 1993) and the National Building Regulations.	Developer / abattoir owner, contractor, ELO	Once off, monitor daily	
	On closure and decommissioning of the abattoir, all infrastructure is to be removed. All rubble is to be removed frequently and disposed of in a licensed landfill site.			
	A soil contamination analysis is to be completed where units were demolished. Should the soil be contaminated, it must be removed and disposed of at registered landfill. The soil must be replaced and rehabilitated.			
	The cleared site after decommissioning is to be graded and scarified to restore the ground to its original profile as near as practicable before topsoil and vegetation is replaced.			
Management of topsoil	Topsoil shall be stripped from all areas that are to be utilized during the construction period and where permanent structures and access is required. These areas will include permanent works, pipeline trenches, stockpiles, access roads, construction camps and laydown areas. Topsoil shall be stripped after clearing of woody vegetation and before excavation or construction commences.	Developer / abattoir owner	Continuous, monitor when necessary	
	Topsoil removed for vegetation clearance must be stripped to a minimum depth of 150 mm and stockpiled on the demarcated topsoil stockpile areas.			

Activity / issue	Action required	Responsible Party	Frequency	Abattoir Rank
Management of topsoil	Herbaceous vegetation, overlying grass and other fine organic matter shall not be removed from the stripped soil.	Developer / abattoir owner	Continuous, monitor when necessary	
	Temporary soil stockpiles must not be higher than 2,5 m (to avoid compaction) and the slopes of soil stockpiles shall not be steeper than 1 vertical to 1,5 m horizontal. Stockpiles are to be turned monthly to ensure the seed bank is retained			
	No vehicles shall be allowed access onto the stockpiles after the topsoil has been placed.			
	Ripping shall be done to a depth of 250 mm in two directions at right angles. Topsoil shall be placed in the same soil zone from which it had been stripped.			
Decommissioning of slurry dams (relevant in certain abattoirs)	A qualified hydrologist must determine the capacity of the slurry dam, quantity, quality of effluent and recommend treatment options for the soil. The hydrologist must then produce a rehabilitation plan of any slurry dams that will be decommissioned to prevent contamination of groundwater and surface water.	Developer / abattoir owner	Continuous, monitor when necessary	
	Continuous monitoring after rehabilitation must be undertaken by relevant and qualified specialist.			
Destruction of vegetation	Areas of the natural vegetation that is to be conserved must be demarcated and cordoned off during construction, preferably using a temporary fence.	Developer / abattoir owner	Continuous	
	No fires may be ignited with the intent to destroy the flora on site and surrounding properties.			
	Large trees to be retained or transplanted must be marked and protected against damage by construction activities.			
	To eliminate vegetation destruction, any construction crew camps must be placed in an area that is not sensitive and already disturbed.			

Activity / issue	Action required	Responsible Party	Frequency	Abattoir Rank
Impact on animal life	All activities on site must comply with the regulations of the Animal Protection Act, 1962 (Act No.71 of 1962). In greenfield sites species and red data scans and sensitive area mapping must be conducted to determine if vulnerable species are present and which areas are the most sensitive. These sensitive areas are to be avoided during the development of the abattoir.	Developer / abattoir owner, contractor	Continuous	
Destruction of heritage resources	Construction personnel must be alert and must inform the local Council should they come across any findings.	Developer / abattoir owner, contractor	Monitor daily	
	Should any archaeological artefacts be exposed, during excavation, work on the area where the artefacts were found, shall cease immediately and the ECO shall be notified as soon as possible.			
	Upon receipt of such notification, the ECO will arrange for the excavation to be examined by an Archaeologist as soon as possible.			
	Under no circumstances shall archaeological artefacts be removed, destroyed or interfered.			
	Any archaeological sites exposed during construction activities may not be disturbed prior to authorisation by the South African Heritage Resources Agency.			
Effects of the construction camp	**Provision of water** Sufficient potable water shall be provided for drinking, cooking and ablutions. Great care is to be taken that the water supply is not contaminated in any way	Developer / abattoir owner, contractor	Monitor daily	
	Air pollution If necessary, construction camp shall be watered to control possible dust fallout. Excessive dust conditions shall be reported to the ECO.			

Activity / issue	Action required	Responsible Party	Frequency	Abattoir Rank
Effects of the construction camp	**Noise** Noise levels shall be kept within acceptable limits, and construction crew must abide by local by-laws regarding noise.	Developer / abattoir owner, contractor	Monitor daily	
	Cement Cement mixing shall only be done at specifically selected sites. Cleaning of cement mixing and handling equipment shall be done using proper cleaning trays. All empty containers shall be removed from the site for appropriate disposal at a licensed commercial facility. Any spillage, which may occur, will be investigated and immediate remedial action shall be taken.			
	Provision of storage for construction material A suitable and safe area for storage of the construction material must be provided. If the area has to be cleared of trees and/or bushes, care must be taken to leave as much grass covering as possible to prevent erosion.			
	Provision of storage or facilities for dangerous and toxic materials Materials such as fuel, oil, paint, herbicide and insecticides shall be stored in bermed areas or under lock and key, as appropriate, in well-ventilated areas. Sufficient care must be taken when handling these materials to prevent pollution. In the case of pollution of any surface or groundwater, the Regional Representative of the Department of Water Affairs must be informed immediately.			

Activity / issue	Action required	Responsible Party	Frequency	Abattoir Rank
Effects of the construction camp	**Rehabilitation of the campsite** On completion of construction, the campsite must be rehabilitated All areas devoid of vegetation or where spoils have been compacted due to the traffic must be scarified or ripped and, if necessary, fertilised and seeded with an indigenous seed mix.	Developer / abattoir owner, contractor	Monitor daily	
Safety and security	The site and crew are to be managed in strict accordance with the Occupational Health and Safety Act, 1993 (Act No.85 of 1993) and the National Building Regulations.	Developer / abattoir owner, Contractor	Once-off and as necessary. Monitor daily	
	Ensure the contact details of the police or security company and ambulance services are available on the site.			
	Ensure that the handling of equipments and materials is supervised and adequately instructed.			
	Limit access to the construction crew camp only to the workforce.			
Noise and atmospheric pollution	During construction or upgrading of abattoirs, ventilation fans must be positioned in such a manner that their affects on the noise levels will be attenuated.	Developer / abattoir owner, Contractor	Once-off and monitor daily	
	The construction crew must abide by the Gauteng Noise Control Regulations, promulgated in terms of the Environmental Conservation Act of 1989.			
	Dust production must be controlled by regular watering of roads and works area, should the need arise.			
	All vehicles transporting material that can be blown off (e.g. soil, rubble etc.) must be covered with a tarpaulin, and speed limits of 40 km/h must be adhered to.			
	Vehicles to be used during the construction phase are to be kept in good working condition so as not to be the source of excessive fumes and nuisance.			

Activity / issue	Action required	Responsible Party	Frequency	Abattoir Rank
Waste Disposal Management Plan (WDMP)	Material to be used, as backfill during a later building phase must be covered with a layer of soil to prevent litter from flying away and unhygienic conditions developing on the rubbish dumps.	Contractor, ELO	Continuous or as necessary	
	All solid and chemical wastes that are generated must be removed and disposed of at a licensed waste disposal site in accordance with the disposal methods prescribed for the particular waste class and hazard rating, as outlined in DWAF's Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste (second Edition, 1989).			
	Chemical containers and packaging brought onto the site must be removed for disposal in accordance with the disposal methods prescribed for the particular waste class and hazard rating, as outlined in DWAF's Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste (second Edition, 1989).			
	Burning or burying of waste is not allowed with the required consent in term of the Atmospheric Pollution Prevention Act of 1965 and Section 20(1) of the Environmental Conservation Act of 1989 respectively.			
	Litter accumulating on the site must be stored in closed containers, collected and disposed of at an approved waste disposal facility.			
	• Toilet facilities and waste water • An adequate number of portable/chemical toilets shall be supplied. • Regular inspections shall be carried out to ensure toilets are kept in a hygienic state. • Toilet paper shall be supplied to all toilets. • Staff shall be advised to use the provided toilets at all times.			
Stormwater management	Lairage floors must be raised above ground level and slope to at least 1:50 to divert stormwater run-off away from the floor areas into the effluent system. The stormwater design must meet the requirement of the Meat Safety Act of 2000 and the Building Regulations and Building Standards Act of 1977.	Developers	Once-off	

Activity / issue	Action required	Responsible Party	Frequency	Abattoir Rank
Best Practice	The lairage must be designed and constructed to hold an appropriate number of animals in relation to the throughput rate of the slaughterhouse without compromising the welfare of the animals. Refer to Classification and Grading of Abattoirs in PART 1 – Technical Manual	Developer / abattoir owner	Once-off	

Table 3: Standard Environmental Management Plan for the *Name of Abattoir* (OPERATIONAL PHASE)

GENERAL

Activity / Issues	Action required	Responsible Party	Frequency of Monitoring	Abattoir Rank
Site management	The owner must appoint a designated (competent) person, who will *inter alia* be responsible for the implementation of the SEMP and sound environmental management during the operational phase. The manager would be a good candidate to fulfil the role of ELO for Operation.	Abattoir Owner	Once-off	
	A maintenance plan for the development must be developed with regard to maintaining buildings and perimeter fencing etc. in order to ensure that they do not deteriorate and become aesthetically unpleasant.	Developer / Abattoir Owner, Manager	Developed and reviewed whenever abattoirs re-apply for their licences	
	Environmental accountability must be included in any purchase contracts, thereby controlling activities to be undertaken.	Developer / Abattoir Owner, Manager	Once-off, monitor bi-annually	
	Activities on the site must be in line with the current environmental legislation. To this end, all applicable legislation must be identified and documented with reference to the abattoir's activities and environmental impacts.			
Erosion, sedimentation and flooding	The stormwater management system must be regularly monitored and maintained (e.g. check for erosion of soil); especially any discharge and damaged areas must be repaired if and when required. No substances other than uncontaminated rainwater may be channelled via the stormwater drainage system.	Abattoir Owner, Manager	ongoing	
	Litter blocking storm water system, and ensure that excess sedimentation of the grassed drainage areas is cleared to prevent blockages.	Manager		
	If soil compaction occurs – rip compacted areas to improve infiltration, reduce runoff and ease of landscaping. Areas of high traffic use are to be compacted / paved. Other areas are to be grassed.			
Groundwater quality	Designate this to the feedlots/farms Any damages to open liquid manure channels at the units must be repaired immediately. Ensure that excess sedimentation, build-up of bedding and undigested cellulose (feed) is cleared timeously to avoid overflow.	Manager	ongoing	

Activity / Issues	Action required	Responsible Party	Frequency of Monitoring	Abattoir Rank
Groundwater quality	The slurry dam wall should be well lined i.e. impermeable. Inspect slurry dam walls for signs of leakage and repair/maintain as when necessary. Remove sludge when build-up is approximately half the total volume of the dam. Depending on the quantity and quality of the slurry, all slurry (and other dirty water) dams must be licensed by DWAF.	Manager	ongoing	
	During decommissioning and reconstruction of the slurry dam, and for a period of 4 months thereafter during operation of the dam, bi-monthly water samples must be analysed as detailed in the 'PLANING PHASE" above, and results submitted to the relevant authorities.			
	All French drains are to be monitored and maintained so as not to cause soil or groundwater contamination in accordance with Regulation 49 of GN399 of the National Water Act of 1998 (general authorisation applicable to disposal of domestic wastewater).			
Water supply, usage and effluent disposal	Inspect the site for burst, blocked or leaking water pipes. Water use management programs are to be designed and implemented to conserve water.	Manager	ongoing	
	Guideline aspects The abattoir must have an available water supply of at least 900 litres per slaughter unit under pressure and protected against contamination. The water must be clean, potable and free of suspended material and substances which could put health at risk. The water must be subjected to flocculation, filtration, chlorination or other treatment to ensure that there are no E. Coli organisms present and no more than 100 viable micro-organisms per millilitre are present. Ref SANS code 042 GDACE to give feedback per species. An adequate supply of hot water as stipulated in the Regulations to the Meat Safety Act 40 of 2000. The water must also meet any other standards and conditions which the Director: Veterinary Services may lay down		Daily	
	Minimisation of waste volumes, water conservation and optimum water housekeeping are essential. A water balance is therefore required to detect water losses. Water may not be re-circulated without the consent of the Chief Meat Hygiene Officer.		Daily	

Activity / Issues	Action required	Responsible Party	Frequency of Monitoring	Abattoir Rank
Water supply, usage and effluent disposal	Water Use licenses and disposal site permits must make provision for conditions which will force abattoirs to incrementally progress towards predetermined water quality and waste management objectives within specified time frames	DWAF, Manager	ongoing	
	Most abattoirs discharge (after appropriate pre-treatment) to municipal sewers. Records must be kept for compliance with the municipal by-laws for the effluent.	Manager, Local Municipality	Daily	
	Drainage of effluent discharging equipment including hand-wash basins, sterilizers and boot washes must not occur across floors in traffic zones	Manager	Daily	
	The management and treatment of waste water and effluent is a specialised subject and professional advice from consulting engineers is essential.	Manager	When required	
	Care must in all cases be taken to avoid contamination of natural streams and water sources with waste water and effluent and to be assessed by Municipality.	Manager	Daily	
	Water used for general washing must be pressurized. If the cost of pressurising is too high, overhead header tanks to improve water pressure must be used. SANS 042	Manager	Continuous	
	Subject to the requirements for separate drainage imposed by GN R 3505 to the Meat Safety Act of 2000. One system of troughs must be considered, whereby the level is controlled for all troughs through one ballcock regulator on the outside of the lairages. Subsequent troughs can be gravity fed from the level controlled one. A monitoring system needs to be implemented if there isn't one already in place.		Once-off and continuous	
	All hoses must be fitted with self-closing nozzles to prevent wastage when not in use. Where the hoses are in frequent use, pistol grips must be used, whereas pressure sensitive rubber nozzles must be used in areas on intermittent use. All flexible hoses used for washing purposes must be in a leak free condition. Teat-like drinking water dispensers must be used in preference to ballcock regulated drinking troughs in animal lairages. If the teat like-dispensers are impractical, the ballcock regulators must be situated on the outside of the lairages to prevent animals from damaging them.	Manager	Once-off and continuous	

Activity / Issues	Action required	Responsible Party	Frequency of Monitoring	Abattoir Rank
Sewage services	The sewage system must be inspected for leakages on a regular basis and any leakages must be attended to immediately.	Manager	ongoing	
	French drain system should go through a septic tank system for biodegrading (where applicable).			
Waste management	**Disposal at licensed facilities** The abattoir must have the facilities to manage its respective solid and liquid waste streams on the premises. Should they not have these on-site, contractual agreements with external service providers must be in place to ensure that their wastes can be disposed off in a sustainable manner at an appropriate rendering facility. Subject to compliance with the licensing requirements of the Environmental Conservation Act of 1989 and the Atmospheric Pollution Prevention Act of 1965, abattoir wastes may be disposed off by the following means: • Landfilling • Composting • Anaerobic digestion • Incineration • Special methods e.g. vulture stations (to be negotiated with the responsible authority) • Rendering New abattoirs must investigate and propose alternative methods of waste disposal (i.e. as early as the Planning Phase).	Abattoir Owner, Authorised By **DWEA,GDARD** Veterinary Services & DoH	Continuously	
	Solids traps consisting of three compartments must be installed in all drains (except closed systems) to collect these waste products. The municipality must approve the plans for any drainage installations, including solids traps.	Manager	Continuously	
	Operation of and the condition of the equipment used for liquid manure extraction (e.g. Honey suckers) must be controlled and managed to ensure no contamination of outside resources is possible. Regular inspections and maintenance of the relevant equipment must be enforced.		Weekly, monitor daily	

Activity / Issues	Action required	Responsible Party	Frequency of Monitoring	Abattoir Rank
	Subject to compliance with the municipality's refuse removal by-laws, the local council or an independent company must undertake disposal of all domestic waste. Abattoir must audit this to ensure safe disposal.			
Waste management	There must be a full examination of process by-products and wastes to identify options for waste minimisation. All wastes (e.g. solid animal wastes, liquid animal wastes or domestic wastes) must be classified and rated with a view to determining the appropriate disposal methods, as prescribed by DWAF's Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste, Second Edition (1998).		Continuously	
	Litterbins with tight-fitting lids must be placed at strategic points within the abattoir, to be determined during the initial design phase and implemented during the operational phase. The labelling and signage requirements for refuse receptacles and on-site waste storage areas imposed by GN R3505 to the Meat Safety Act of 2000 must be observed.		Continuously	
	Cold water must be used to clean surfaces soiled with blood (except periodic deep cleaning at the end of the day) as the use of hot water causes congealing of the blood, making cleaning more difficult, and results in unnecessary wastage of water.		Continuously	
	The use of squeegees on offal trays to remove the paunch contents off the trays is strongly recommended. The use of sloped continuous sliding trays is advocated as it reduces the water needed for final wash-down. The use of square trolley type trays is not recommended, as they require excessive amounts of water for solids removal.			
	In the interim (until the legislation is finalised) general areas of waste management improvement must include: • minimisation of waste generation at source (including maximising the recovery of useful materials), • seriously curbing the practice of washing solids into drains by using solid traps (which transfers waste solids to the liquid medium), and • promoting research into cleaner technology and recovery of higher value products from the waste stream.	Manager	Continuously	

Activity / Issues	Action required	Responsible Party	Frequency of Monitoring	Abattoir Rank
Waste management	Subject to municipal consent, solid and grease traps must be installed downstream of effluent sources to separate gross solids and fats from all effluents prior to discharge. Where present mesh basket trap structures exist, it is recommended that that these be replaced by solid and fat traps.	Manager	Once-off	
Bovine Spongiform Encephalopathy (BSE)	If BSE is detected at a facility, there are only three accepted methods that disinfect the prions that are related to BSE, provided that "Best Practices" are used: 1. Incineration 2. Autoclaving 3. Alkaline Hydrolysis	Manager, Veterinary Services	When required	
Atmospheric Pollution	A minimum buffer distance to the nearest residence or residential area must be at least 500 m downwind of an abattoir and 1000 m for a rendering plant. This depends on the prevailing winds and may need to be increased, if effective and reliable odour control equipment is not installed.	Manager	Continuously	
	External dustbins must be cleaned at least once a week in a maintenance plan for the abattoir to prevent odours.			
	All chemical storage areas and chemical-based odour control equipment must be located on impermeable concrete floors with bunding capable of containing 110 percent of any spillage.		Once-off	
	Ensure that the garbage (household/general waste) is collected on a regular basis to reduce the presence of vermin and flies and reduce odours.		Continuously	
	Biofiltration must be instituted wherever possible, as it is a minimum requirement, particularly in proximity to residential areas.			
	Animal holding pens and sale yards Manure must be removed daily from the holding yards, then washing down using low volume high-pressure sprays. This reduces odours and fly-breeding.		Daily	

/ Issues	Action required	Responsible Party	Frequency of Monitoring	Ab R
c Pollutior	**Effluent treatment plants** During commissioning, odours produced by anaerobic waste treatment ponds must be reduced by: • allowing some grease and manure solids to pass through the primary treatment system, establishing a crust of 100 mm thick on the surface; • layering of hay on the surface of the anaerobic pond; and • using an artificial cover (such as plastic) that breaks down over time and mixes with the fat on the surface. Effluent treatment plants must be adequately designed, operated and maintained to minimise emission of odours.	Manager	Once-off, continuous	
	Dust and Feathers Fabric filter type dust collectors must be used for dust control. Surfaces of saleyards, holding pens, unsealed roads and parking areas must be sealed. Windbreaks (incorporating lines of suitable indigenous trees) must be used near large coal stockpiles. Stockpiles must be dampened with water sprays and have their axes parallel to the direction of the strongest winds. Stockpiles constitute "disposal sites" by legal definition and must be permitted or exempted by DEA in terms of Section 20 of the Environment Conservation Act of 1989. All conditions imposed by such permit/exemption must be observed. Filtered ventilation hoods must service dusty process operations.		Once-off, daily	
	Warehouses must use good housekeeping to alleviate dust generation. Dry materials, such as meat meal, must be handled in such a manner as not to give rise to dust emissions to the atmosphere.		Continuously	
	Little can be done to prevent or reduce the amount of methane produced however by varying the food types and quality, methane generation may be reduced.			

Activity / Issues	Action required	Responsible Party	Frequency of Monitoring	Abattoir Rank
Noise **(in close proximity to residential areas)**	Erect noise barriers such as screens around noisy equipment and operations. All ventilation and extractor fans must be noise efficient or fitted with silencers, and all ducts must be lined with sound-absorbent material. Limit vehicle movement (especially trucks) to and from the site to normal working hours only. Fit efficient exhaust mufflers to diesel forklift engines, other noisy vehicles and air-powered tools. Locate mechanical equipment on mounts designed to isolate structure-borne vibration and noise. Similarly, locate this infrastructure as far as possible away from sensitive receptors.	Manager	Once-off	
	All activities on the abattoir must abide by the Gauteng Noise Control regulations promulgated in terms of the Environment Conservation Act of 1989.		Continuous	
Stormwater management	Boiler coal supplies must be covered by a roof and bunded to prevent stormwater run-off from entering the natural environment. Nothing other than uncontaminated rainwater is allowed to enter the stormwater system.	Manager	Once-off	
	Isolated unloading areas, stockyards and processing plant must be roofed so to reduce stormwater contamination.		Continuous	
	Stormwater must be kept away from the contaminated areas and directed to the stormwater drainage system.			
Recycling	Subject to compliance with R3505 to the Meat Safety Act of 2000 and DWAF's Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste, Second Edition (1998) composting of paunch contents in pits and lined bunkers can be an efficient and economical form of disposal as long as offensive odours are not generated. **Best Practice** Recycling manure nutrients for use in crop and pasture production.	Manager	Continuous	
Occupational Health, Safety and training	All relevant aspects of the Occupational Health and Safety Act, No 85 of 1993 are to be implemented.	Manager, Department Of Labour	Continuous	

Activity / Issues	Action required	Responsible Party	Frequency of Monitoring	Abattoir Rank
Training	The abattoir owner must undertake training of employees to make them aware of the SEMP for the abattoir. All staff needs to be advised that if they fail in their duties, they are just as liable to prosecution and penalty as is their employer in terms of several bodies of legislation (e.g. Schedule 3 of NEMA). Training programs must contain common elements such as familiarisation with the company environmental policy and commitment to waste prevention, recycling and raw materials conservation. Employees must be encouraged to suggest new ideas.	Manager	On-going	
Condemned Material	The abattoir owner and/or manager is responsible for complying with the legal requirements or conditions relating to the safeguarding and disposal of any carcass, part thereof or any edible product which cannot be passed for human or animal consumption e.g. Meat Safety Act, 2000 (Act No. 40 of 2000)., etc.	Manager	On-going	

HOLDING AREA

Activity / Issues	Action required	Responsible Party	Frequency of Monitoring	Abattoir Rank
Water supply, usage and effluent disposal	All water intakes, whether from mains supplies or other sources, must be metered and all water intakes must be routinely recorded either manually or automatically. It is recommend that 3 water meters be used, namely for the main water intake, the lairages and process water. Management must not be content with merely installing water meters, but must ensure that the results are obtained and monitored for each process by regular record keeping.	Manager	Once-off, Continuously	
Waste Management	All lairages must be squeegeed and/or dry swept to remove gross solids prior to washdown. The sweepings must be collected for disposal and must not be flushed to drain.		Continuously	
	Liquid wastes process Bleeding troughs must be provided with a drip tray to prevent excessive amounts of blood from entering the drainage system. Alternatively, a separate drain must be built under the hoof and head removal area, sloped back to the blood trough, so that excess blood can be recollected in the blood trough. Pipes from the blood trough must be diverted to a container on the outside of the building and must not be connected to the effluent system. Blood must not be dumped informally. Plastic trays must not be used as bleeding troughs or blood containers. Suitable acid resistant materials must be used for bleeding trough construction.			
	Solid waste process The use of a squeegee on offal trays to remove the paunch contents is strongly recommended. The use of any sludge (from septic tanks. etc.) by irrigation or any other method of dispersal with the aim of increasing soil fertility or any other aim is not permitted. In terms of the Department of Health's, "permissible utilisation and disposal of sludge[2]", a contractual agreement must be signed between "all individuals and authorities responsible for handling a particular sludge from the place it is produced" (abattoir) "to the area where it is utilised or disposed of". Paunch contents must not be dumped informally.			

[2] Sludge is the sediment resulting from treating waste or sewage

Effluent Management	**Lairages** All lairages must be squeegeed and/or dry swept to remove gross solids prior to washdown. This reduces the effluent generation The use of drain covers must only be considered as a safety measure and must not be used as a "solids trap". Effluents from the lairages must not be discharged in municipal sewers unless the local municipality grants permission. If no municipal sewage connections are available, the discharge of such effluents must be to impermeable lined pits subject to authorisation in terms of the National Water Act of 1998. Discharge to the natural environment is unacceptable.	Manager, employees	Continuous, once-off	
	All abattoirs must have a letter of consent from the relevant authorities.	DWEA & Local Authorities	Once-off	
	Lairages and holding pens must have well drained manure slabs for kraal manure prior to removal except if manure is removed directly into a vehicle.	Manager	Continuously	
Condemned Material	All “dead on arrival” and “dead in pen” animals must be disposed of as condemned material in terms of Part VIII of GN R 3505 to the Meat Safety Act. No carcass or part thereof that has been condemned may be brought into any part of the abattoir containing edible products. Condemned carcasses, portions thereof or any edible products in an abattoir, which cannot be passed for human or animal consumption, must be: • portioned and placed in a theft proof container which has been clearly marked “CONDEMNED”, in letters must not be less than 10 cm high, or conspicuously marked with a stamp bearing the word “CONDEMNED”, using green ink; • kept in a holding area or a room or dedicated chiller provided for the purpose, except if removed on a continuous basis; and • removed from the abattoir at the end of the working day or be secured in a dedicated chiller or freezer at an air temperature of not more than minus 2°C.	Manager	Continuously	

PROCESSING (DIRTY & CLEAN) GDARD

Activity / Issues	Action required	Responsible Party	Frequency of Monitoring	Abattoir Rank
Effluent Management	**Processes** Solid wastes must be prevented from entering the drainage system. All areas must be dry swept/squeegeed prior to wash-down of floors, walls, etc. Minimising water use reduces the effluent volume requiring handling and disposal. Fat, meat, feathers, hair and blood from carcass trimming and hide removal must be dry-swept, collected, and passed to suitable solids handling and disposal facilities rather than being flushed to drain. Where no other options exist, discharge of effluent to the municipal sewage works may be tolerated as per the authorisation of the municipality. If no other option exists but to discharge to the natural environment, such effluent must then be discharged to impermeable lined evaporation or treatment ponds as per DWEA authorisation under the National Water Act of 1998. The use of a dual outlet system on blood troughs, i.e. one for trough washes effluent and one for blood must be a design criteria.	Manager, employees	Continuous, once-off	
	Waste water may be considered for irrigation but permission from DWEA, GDARD and DoH (local/national authority) must be sought. No irrigation must take place during times of high rainfall. A sampling point on the pipe system must be available for monitoring purposes. The pipe must be metered.	Manager, DWEA, GDARD and DoH	Once off	
	Drains must be installed in straight lines with as few joints as possible to reduce costs and the risks of leakage. Drain covers must be effectively secured.	Manager, developer	Continuously	
	Mesh baskets are not effective as solids and fat traps. Other approved forms of solid and fat traps must replace these. Grease and solid traps with suitable grease removal facilities must be approved by the municipality and installed upstream of major collection sumps, to minimise the problem of grease removal from large volumes of effluent or plant items.		Once-off	

Effluent Management	Effluent streams must be separated as far as possible to facilitate treatment, isolation or disposal.	Manager, employees	Continuous	
	Effluent loadings and volumes must be established in order for monitoring purposes. Dewatering screens must be used for the paunch contents. Similarly, drying beds similar to that used in sewage works may possibly be used to dewater paunch contents. Drying beds constitute "disposal sites" by legal definition and as such require a permit or exemption from **DEA** in terms of Section 20 of the Environment Conservation Act of 1989.	Manager	Continuous, Once-off	
	The use of microbes for the bio-remediation of all abattoir effluents and solid wastes must be investigated further. Vermiculture, where possible, must be implemented to decompose and filter abattoir wastes, including paunch contents and blood. The use of man-made, lined, wetland or vlei systems to treat the effluent must also be investigated. All wastewater storage systems are, however, subject to the control measures of the National Water Act of 1998.	Manager	Continuously	
	Where no other options are available, the use of properly designed septic tanks must be considered to pre-treat the effluent generated as per authorisation of Municipality. Please note that the final flow from the septic tanks must be discharged to a municipal sewer line or septic tank and not to the natural environment.	Manager, developer	Once-off	
	A number of affordable physical and chemical treatment processes and systems for the treatment of abattoir waste must be investigated	Manager	Continuously	
Condemned Materials Management	Condemned material must remain under strict control from the time of condemnation until they are disposed of in an acceptable manner. No person may remove a carcass, part thereof or any edible product that has been detained or condemned from an abattoir, except with the permission of a registered inspector, who is a veterinarian and subject to such conditions as he or she may impose. Facilities (e.g. separate freezers) must be available in the abattoir for the safekeeping of any carcass, meat, intestines or animal product that has been condemned by the veterinarian or provisionally detained a meat inspector.	Manager, Veterinarian	Continuously	

Condemned Materials Management	If a carcass, meat, intestines or animal product in an abattoir has been condemned by the veterinarian it must, subject to compliance with Section 20 of the Environment Conservation Act of 1989 and Section 9 of the Atmospheric Pollution Prevention Act of 1965, be dealt with as follows: (i) by incineration (burnt to ashes); (ii) by denaturing, once the condemned material has been cut into strips, by spraying with or immersion in a solution of crude phenolic or cresolic acid, or another suitable disinfectant, and burying at a depth of at least 60 cm; (iii) by processing in an approved sterilisation / rendering plant; or (iv) by means of any other method that the Director: Veterinary Public Health may authorise. No condemned carcass, meat, intestines or animal product may be left at the end of a working day in any section of an abattoir meant for edible produce. Since methods (i) and (ii) above involve some logistical problems, it is advised that the abattoir must investigate whether the condemned product cannot be taken to a sterilisation installation.	Manager, Veterinarian	When required	
	If the veterinarian condemns an animal or carcass, meat, offal or animal product, he must provide the abattoir owner, on request, with a certificate describing the condemned product and giving the reasons for condemnation.	Veterinarian	On request	
	Sufficient theft, leak proof, lockable containers with tight fitting lids, complying with regulation 14 of the MSA, must be provided to keep and transport condemned material and they must be clearly marked “CONDEMNED”. Containers must also be provided to collect and hold inedible material until disposal. Facilities to collect and hold blood prior to disposal must be provided.	Manager		
Rough Offal	The following requirements must be followed for the washing of rough offal: Rough offal must be removed from the dressing room to the offal room directly adjacent and connected thereto, after being passed, where paunches and intestines are separated and emptied of its contents; washed with clean running water; and hung on hooks for cooling and drip drying before and during chilling.	Manager		
	Stunning, hoisting and bleeding areas must have facilities for collecting and storing of blood in closed containers prior to removal and disposal.			

General Waste Management	Refuse containers must be provided for the collection of general refuse at various points on the premises. Areas where waste or refuse containers are kept prior to removal must be impervious, curbed and drained and the containers must be enclosed or fitted with tight fitting lids. Equipment must be provided for the emptying of rumens and intestines and the ruminal and intestinal content must be removed continuously. The owner of the abattoir must implement a Hygiene Management Program/System (HMP/S) (Refer to Table 4 for HMP requirements)	Manager		

RENDERING FACILITIES

Activity / Issues	Action required	Responsible Party	Frequency of Monitoring	Abattoir Rank
Sterilising plants	Apart from the terms of the Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act 36 of 1947), the sterilisation units must also satisfy the terms of the Meat Safety Act, 2000 (Act No. 40 of 2000).	Manager	Continuous	
	Premises of a sterilisation plant must be controlled to prevent the entry of unauthorised persons, vehicles and animals; this includes the following areas: (i) the "dirty" area, consisting of the rooms or places where material are received, stored or prepared for sterilisation. The loading opening of the sterilisation apparatus must be in the "dirty" area; and (ii) the clean area, consisting of the rooms or places in which the material can be sterilised and dried, ground or otherwise prepared, packed, stored or dispatched. The clean and "dirty" areas must be physically separated by means of a solid wall and there must be no direct access between the two areas. Sterilizing plants must comply with the general requirements for premises, structures and equipment set out in regulations 8 to 18, which apply with the necessary changes.	Manager, Developers		
	The clean area of a sterilisation installation must be kept in a clean and sanitary condition at all times, be roofed and surrounded with impermeable walls and must be provided with a continuous, impermeable floor. No person may keep any animal, dog or cat on the premises of a sterilisation installation, or allow it to stay there. All possible steps must be taken to keep the premises of a sterilisation installation free from flies, rodents and other vermin e.g. fly screens on windows/entrances etc.			

Activity / Issues	Action required	Responsible Party	Frequency of Monitoring	Abattoir Rank
Sterilising plants	The "dirty" area must meet the following requirements: (i) the entire area must be roofed over and surrounded by walls and must have a continuous floor which drains into the sewage system appropriately; (ii) the entrance to any drain must be provided with a grid to prevent the entry of any solids. The drainage systems must also be provided with equipment to prevent the escape of offensive smells; (iii) any openings in the abattoir walls, which are on the same level as the floor must be provided with steps so that waste water and effluent cannot escape from the floor into other areas of the sterilizing facility other than into the drainage system; (iv) the finish of the structure of the sterilisation plant must be comparable with that of a modern abattoir; (v) hand-washing facilities in the "dirty" area must be provided with hot and cold running water, soap, disinfectant and disposable paper towels; and (vi) footbaths with disinfectant must be provided at all entrances and exits for the disinfections of boots.			
	The floors, walls and equipment of a "dirty" area must be cleaned with hot water and disinfected with a suitable disinfectant every day after the work is completed. Persons who work in the "dirty" area must: (a) be provided with and, must wear distinctive marked overalls and rubber boots; (b) disinfect their hands and boots before leaving the "dirty" area; and (c) remove their dirty protective clothing and boots and wash themselves thoroughly with soap and water before leaving the premises. Thus, suitable facilities to enable them to do this must be provided. No person who works in or enters the "dirty" area may enter the clean area or any section of the abattoir for edible products.	Manager, employees	Continuous	

Activity / Issues	Action required	Responsible Party	Frequency of Monitoring	Abattoir Rank
Sterilising plants	Premises of a sterilizing plant must be fenced and secured so as to prevent the entry of unauthorized persons, vehicles and animals, and must include: • unclean areas, comprising the rooms in which material is received, stored or prepared for sterilizing as well as the entrance to the sterilizing apparatus; • clean areas, comprising the rooms in which the sterilized material is dried, milled or otherwise prepared, packed, stored or dispatched; and • A solid wall to separate the unclean and clean areas, and there may be no direct contact between these areas.			
	No person may sell the products of a sterilizing plant unless they conform with the specifications set by the Registrar in terms of the Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947). Any material produced by processing or treatment under the provisions of this Part and intended for animal consumption or as a fertilizer must be subjected to such examination and tests as the said Registrar may specify.	Manager, employees	Continuously	
Atmospheric Pollution	The building housing the rendering works must be vented to the atmosphere via a discrete stack to allow retrofitting of odour control equipment. The stack must be at least 3 m above the building roof ridge, have an efflux velocity not less than 15 m/s, and be fitted with emission sampling provisions.	Manager	Once-off	
	The most common odour abatement methods used are condensation and condensate subcooling, followed by incineration of the non-condensable by-products. Alternative odour abatement methods must be investigated e.g. biofilters, chemical scrubbers, multi-stage acid and alkali scrubbing followed by chlorination and incineration in boilers. Note that incineration requires a registration certificate issued by the Chief Air Pollution Control Officer **(DEA)** under Section 9 of the Atmospheric Pollution Prevention Act of 1965.	Manager	Continuous	

Activity / Issues	Action required	Responsible Party	Frequency of Monitoring	Abattoir Rank
Atmospheric Pollution	Odour control equipment must be fitted with monitoring equipment with recorders for the monitoring of key parameters. Good housekeeping and rapid processing is essential to stop odours developing. Dropped material or spilt tallow must not be left to develop odours. Batch cookers must be used over continuous cookers as they produce lower emissions which reduce the odour. Bins for holding raw material and rendering products need to be shrouded or covered, and grinding, processing and conveying equipment must be completely enclosed. Skin curing areas must be connected to the odour control systems Storage bins may need to be designed so that they can be cleaned with high pressure hot and/or cold water at least once a day. A procedure for monitoring odour as well as investigating and resolving complaints must be implemented. All processed meats that have become tainted or putrid and not removed for rendering within the day of slaughtering must be stored in enclosed containers and frozen as per the regulation standard until they are removed from the premises. All boilers, steam raising plant and afterburners must use clean fuels free of heavy metals and toxic wastes. All conveyors and pipe runs for waste animal matter transfer operations are capable of being dismantled for effective cleaning. Offal and waste animal matter must be received in a fully enclosed building.	Manager, employees	Continuous, daily and once-off	
	Subject to compliance with Section 20 of the Environment Conservation Act of 1989 and Section 9 of the Atmospheric Pollution Prevention Act of 1965, condemned material must be disposed of by: • Total incineration; • Denaturing and burial at a registered secure site, approved by the provincial executive officer and local government, by slashing and then spraying with, or immersion in, an obnoxious colorant approved for the purpose; and burial and immediate covering to a depth of at least 2 m but filled to 1.6 m and not less than 100 m from the abattoir, providing such material may not deleteriously affect the hygiene of the abattoir; or • Processing at a registered sterilizing plant.			

STORAGE & TRANSPORT OF WASTE

Activity / Issues	Action required	Responsible Party	Frequency of Monitoring	Abattoir Rank
Abattoir Condemned Material Transportation	A vehicle used to transport condemned material must meet the following requirements: (i) the freight section must be completely covered and be capable of being locked and sealed; (ii) the inside lining must be watertight and made of smooth metal; (iii) the floor must form a unit with the bottom of the sides and the door must be made in such a way that the leakage of fluids from the freight section is prevented; and (iv) the floor must be provided with an outlet pipe at its lowest point, which can be tightly closed with a screw valve. The freight space of a vehicle, which has transported condemned material, must be effectively cleaned and disinfected at the end of each day's work in a place specially equipped for the purpose.	Manager	Daily	
	Abattoir must transport their waste to a rendering facility for destruction where this is financially feasible. An emergency plan for accidental spillage in transit must be provided by the abattoir. The “Duty of Care” principle applies.			
	All trailers/tankers must be licensed and kept roadworthy at all times to minimise the risk of spillage while in transit as per the Hazardous Substances Act, 1973 (15 of 1973).		Yearly	
Other Abattoir Waste Transportation	A vehicle used for the transport of condemned material may not be used for any other purpose, but after cleaning and disinfection the vehicle may be used for the transport of inedible material. A vehicle may only be used for the transport of condemned material if the: • load space is lockable, theft proof and sealable; • internal surface is leak proof and constructed of durable material; and • floor is provided at its lowest point with a drain pipe capable of being securely closed by a screw valve. The load space of a vehicle used for transporting material to a sterilizing plant must be cleaned and disinfected to the satisfaction of a registered inspector at the end of each delivery under seal/Red cross permit at a place specifically constructed for the purpose.	Manager	Continuously	

Storage Areas	Separate rooms must be provided for: • Handling and holding of hides, skins, feathers, hair and inedible material prior to removal; • Handling and holding of skin-on heads and feet; and • A room where paunches and intestines are emptied, washed and kept.			
	An abattoir must have a facility where livestock transport vehicles can be sanitized after off loading.			

ANIMAL FEEDS & SOAPS

Activity / Issues	Action required	Responsible Party	Frequency of Monitoring	Abattoir Rank
Manufacturing of animal feeds and soaps	During the manufacturing process of animal feeds. All raw materials must be reduced to a particle size of less than 50 mm. All animal waste products must be exposed to saturated steam at a pressure of at least 300kPa in a digester tank. Once the air is expelled by the steam, it must be kept at that pressure for an uninterrupted period of at least two hours in a digester tank for sterilization. The digester must not be loaded with more than 4 metric tons of animal material. Temperatures must be >133°C for a period exceeding 20 minutes at least. Animal feeds must be registered with the Department of Agriculture in terms of the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act 36 of 1947.	Manager	Continuously	
	During the manufacturing process of soap, the waste must be sterilised by exposure to heat for at least 20 minutes at a temperature of at least 133ºC.			
	The animal feed must be handled after sterilisation in such a way that it remains free from contamination from other non-sterile sources as the animal feed must be free from pathogenic organisms including *Bacillus anthracis* and gangrene (clostridium) bacteria, and must not contain putrefactive or other organisms/micro organisms which might affect the health of animals.			
	Animal feed must be sold in containers which are clean and undamaged and have been sealed in a manner suitable to the containers and contents. The packaging requirements imposed by Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act 36 of 1947 must be observed.			
	Apart from the terms of the Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act 36 of 1947), the sterilisation units must also satisfy the terms of the Meat Safety Act, 2000 (Act No. 40 of 2000).			

Table 4: Hygiene Management Program and Evaluation Systems

(Source:http://www.nda.agric.za/vetweb/Food/Safety/Reg_2000/New2000/DRAFT/REGS/PDF/2004/01/23/05/CROCODILES/2004/01/24/02.GRADING/CROC.pdf)

Activity/ Issue associated with the Hygiene Management System (HMS) which must be provided for	Action required	Responsible Party
HMS	(a) provide the provincial executive officer with a documented Hygiene Management System (HMS) containing detailed information on control measures or programs required to monitor identified control points, including the methods of monitoring or checking these control points, for approval; (b) provide relevant records of observations, checks, measurements or results; (c) provide sampling programs for laboratory analyses, as well as names of laboratories to do the required analyses; (d) provide written accounts of decisions relating to corrective actions when taken; and (e) assess the hygiene status of the abattoir by means of the Hygiene Assessment System (HAS) and provide results to the provincial executive officer for verification as frequently as he or she may require.	Abattoir owner/manager
Document management system	The document management system must provide for:- (a) the retrieval of documents relating to an identified slaughter batch; (b) the recording of each slaughter batch containing information regarding date of harvesting, mass, quantities, identification and destination for carcasses as well as cut meat; and (c) a documented product recall procedure approved by the provincial executive officer.	Abattoir owner/manager
Schematic plan of abattoir	A schematic plan of the abattoir must be available and must indicate:- (i) all the different areas on each level; (ii) all the different rooms in each area identified, indicating the process or operation including the capacities or rates of operation that take place in such rooms; (iii) the flow of the product; (iv) ancillary structures on the premises;	Abattoir owner/manager

	(v) the required temperature as well as the capacity of each room where temperature is controlled; (vi) the different ablution facilities for workers in clean and dirty areas as well as the personnel entrances to the different areas; (vii) all entrances to rooms, areas and building; and (viii) boundaries, indicating entrances and exits to and from premises.	
Flow diagram of slaughter process	A flow diagram of the process must indicate:- (a) all steps involved in the process, including delays during or between steps, from harvesting, receiving of the animals to placing of the end product on the market; and (b) details and technical data including equipment layout and characteristics, sequence of all steps, technical parameters of operations, flow of products, segregation of clean and dirty areas, hygienic environment of the abattoir, personnel routes and hygienic practices, product storage and distribution procedures.	Abattoir owner/manager
Potential hazards	The owner must prepare a list of all potential biological, chemical or physical hazards that may occur at each step of the process, including:- (a) unacceptable contamination or recontamination of a biological, chemical or physical nature; (b) unacceptable survival or multiplication of pathogenic micro-organisms; and (c) unacceptable production or persistence of toxins or other undesirable products of microbial metabolism.	Abattoir owner/manager
Prevention of hazards	The owner must prepare written hygiene control programs (HCP) for approval by **GDARD**, to prevent, eliminate or reduce hazards to:- (a) ensure that control programs for each hazard is implemented; (b) establish critical limits for control points; (c) establish a monitoring or checking system for each control point; and (d) prepare written corrective actions that must be taken without hesitation when a deviation is observed and such corrective action must specify – (i) the persons responsible to implement the corrective action; (ii) the means and action required for each hazard; (iii) the action to be taken with regard to the meat having been processed during the period when the process was out of control; and (iv) that written record of measures taken must be kept.	Abattoir owner/manager

Hygiene control programs (HCP)	The owner of an abattoir must implement:- (a) a HCP for ante-mortem inspection, including control measures to:- (i) ensure that all animals (especially those) which for some reason or other cannot be processed into safe meat are identified and handled humanely and appropriately; (ii) identify animals with diseases and conditions of which symptoms may not be visible during post-mortem meat inspections; (iii) identify animals with highly contagious diseases or diseases controlled under the Animal Health Act, 2002 (Act No.7 of 2002); (iv) identify animals that pose a high contamination risk, and such as those with septic conditions or those that are excessively soiled; and (v) ensure that injured animals in obvious pain are sent through for emergency slaughter. (b) a HCP for slaughter and dressing, including:- (i) control measures (CM) to ensure that no contamination of meat and edible products occur from:- • the slaughter surface; • wind and dust; • the contents of any hollow organs; • persons working with edible products; or • contact with unclean objects; (ii) slaughter and dressing procedures which must limit any contamination to the absolute minimum; (iii) training of all workers in correct slaughter techniques including principles of hygiene practices which must be monitored; and (iv) a programme for the daily checking of carcasses for soiling to provide for regular checking of a representative sample of carcasses throughout the day on a random basis and to determine the levels of contamination of carcasses. (c) a HCP for meat inspection, in terms of which the supervisory registered meat inspector (SMI) assisted by the registered veterinarian must monitor meat inspection by means of implementation of written control measures to ensure:- (i) that meat inspection is done according to the regulations; (ii) the competency of the meat inspectors and meat examiners; (iii) the personal hygiene of the meat inspectors and meat examiners;	Abattoir owner/manager

Hygiene control programs (HCP)	(iv) that organs are correlated to the carcasses of origin until inspection is done; (v) the security of detained carcasses and organs; (vi) the security of provisionally passed carcasses and organs; (vii) the security of the stamp of approval; (viii)the security of condemned material; and (ix) the implementation of standard operational procedures (SOP's) for:- • emergency slaughter; • preferential slaughter; • provisional slaughter; • dirty animals; and • dropped meat. (d) a HCP for personal hygiene of workers in terms of which:- (i) a general code of conduct, approved by a registered inspector, for personnel and in particular for workers who come into direct contact with meat and edible products, must be available; (ii) a training program, as well as registers of attendance, for all personnel to apply the principles of the code of conduct referred to in subparagraph (i) must be available; and (iii) records of surveillance and supervision including records of disciplinary action in cases of repetitive misconduct or non-compliance must be available. (e) a HCP for medical fitness of workers in terms of which:- (i) records of initial medical certification that workers are fit to work with meat and edible products, prior to employment, must be available; and (ii) records of daily fitness checks, including corrective actions applied in cases of illness and injury, must be available. (f) a HCP for sterilizer temperatures and maintenance of sterilizers in terms of which control measures to ensure the continuous availability and accessibility of sterilizers in good working order at temperatures of 82 °C, including registers for daily checks indicating frequency of checks as well as corrective action procedures in cases of non-compliance, must be available. (g) a HCP for the availability of liquid soap and soap dispensers, toilet paper, and disposable towels, in terms of which control measures to ensure the continuous availability and accessibility of liquid soap and soap dispensers for hand-washing purposes, toilet paper and disposable towels at pre-identified points must be available.	Abattoir owner/manager

Hygiene control programs (HCP)	(h) a HCP for sanitation and continuous cleaning including a cleaning schedule providing:- (i) a list of all the areas to be cleaned; (ii) a list of all the rooms that have to be cleaned within every area; (iii) the name of the person responsible for the cleaning of each area, section or room; (iv) for each room within a particular area, a detailed description of the cleaning of each structure, including:- • the frequency of cleaning; • step by step methods of cleaning; • data of the chemicals which are used, such as registration data, safeness, dilutions, application prescriptions; • the correct application of the detergents such as dilution, temperatures and contact times; • the rinsing off of applied chemicals; and • the results to be obtained as an objective of the cleaning programme. (v) an addendum for each room in which the cleaning of each structure must be described in detail including aspects such as method, frequency and target results; (vi) for the training of cleaning teams in the execution of these programs; (vii) for control over the storage of detergents to prevent contamination of edible products; (viii) a detailed description for continuous cleaning on the processing line during processing, which must include:- • a list of all the actions in this program including the cleaning of moving equipment and crates; and • a step by step description of each action. (ix) for these programs to be approved by a registered inspector; and (x) for laboratory checks as control of affectivity of the cleaning programs to be instituted and documented. (i) a HCP for availability and quality of water in terms of which:- (i) the owner of the abattoir must account for the source of water supply and the status of such water; (ii) the owner must be able to demonstrate the water distribution system within the abattoir and provide an updated schematic plan of the water distribution on the premises; (iii) a sampling program must be followed to ensure that all outlets, including water hoses are checked on a repeated consistent basis within an allotted period of time, and the sampling procedure must be	Abattoir owner/manager

Hygiene control programs (HCP)	described; and (iv) the owner is responsible to ensure that water used in the abattoir is potable and that records of microbiological and chemical water test results are available. (j) a HCP for vermin control in terms of which the owner of the abattoir must provide a written control program for each vermin type for approval by **GDARD** and such program must include:- (i) schematic drawings indicating the position of bait stations; (ii) a poison register, including specifications for the use of different poisons; and (iii) training programs for persons working with poisons. (k) a HCP for waste disposal, including condemned material, in terms of which:- (i) the owner of the abattoir must provide a written control program for the removal of each different category of waste material including general refuse removal for approval by **GDARD** and (ii) security arrangements to prevent condemned material from entering the food chain must be described. (l) a HCP for in contact wrapping and packing materials in terms of which:- (i) the owner of the abattoir must provide a written control program addressing the suitability as well as the storage and handling of all in contact wrapping and packing material; (ii) control measures to prevent contamination in store rooms must be provided; and (iii) control measures to prevent contamination of wrapping materials must be provided. (m) a HCP for maintenance, providing for the owner of the abattoir to provide a document addressing the routine maintenance of all equipment and structures; and (n) a HCP for thermo control in terms of which:- (i) a map must be provided that indicates the layout of all the chillers, freezers and processing rooms where temperature control of the rooms is required including:- • each temperature controlled room or area; • the number of the room or area; • the temperature requirement of each room; and • the throughput of each room; (ii) each room must be equipped with a recording thermograph, or equivalent means of monitoring and recording must be used, that indicates the temperature measurements in the room on a continuous basis; (iii) the graphs or data must provide the actual time and temperature as well as the correct date;	

Hygiene control programs (HCP)	(iv) annual calibration and certification to this effect must be available; (v) records in respect of regular testing of digital thermographs and meters against a certified fluid in glass thermometer, done by the owner, must be available; (vi) placing of the thermo-sensors within rooms must be representative of the temperature in the room; (vii) if a centralized computer system is used for this purpose all the relevant temperatures must be recorded on an ongoing basis at least every 30 minutes; (viii) the temperature status of every room must be checked at least every 12 hours by the owner to ensure maintenance of temperatures and all deviations must be accounted for; (ix) checks by the owner must be recorded on the temperature control records; (x) any deviations from the required temperature must receive immediate corrective attention; (xi) the hygiene manager must be notified immediately in every case where a temperature breakdown has occurred; (xii) records must be available for inspection by the national executive officer or provincial executive officer; and (xiii) the hygiene manager must indicate daily control checks by way of signature on the records.	

Table 1: Incident and Environmental Log

ENVIRONMENTAL INCIDENT LOG				
Date	**Env. Condition**	**Comments** *(Include any possible explanations for current condition and possible responsible parties. Include photographs, records etc. if available)*	**Corrective Action Taken** (*Give details and attach documentation as far as possible)*	**Signature**

Table 6

COMPLAINTS RECORD SHEET	File Ref: Page ____ of ____	DATE: _____
COMPLAINT RAISED BY:		
CAPACITY OF COMPLAINANT:		
COMPLAINT RECORDED BY:		
COMPLAINT:		
PROPOSED REMEDIAL ACTION:		
ECO: _____ Date: _____		
NOTES BY ECO:		
ECO: _____ Date: _____	Site Manager: _____ Date: _____	

APPENDIX A

AWMFG Project Note

Noise Report

In order to investigate the situation actually existing at operating abattoirs, noise measurements were made at three previously identified large abattoirs close to Johannesburg. In order to have as wide a range of data as possible, a chicken, pig, and cattle abattoir were included.

Initial investigations around the perimeter of the plants revealed that there were three primary sources of noise from within the sites, and these were measured where possible according to current SANS requirements. In order of importance, these were:

1. Unattenuated ventilation fans
2. Boilers and other process plant
3. Noise from animals in open stockyards

Apart from the last of these, the noise sources are typical of any processing plant that would be found in an industrially zoned area, and therefore not specific to abattoirs. All were in industrial areas and directly adjacent to main roads, highways, or railways, which in themselves are sources of high noise levels.

MEASURED NOISE LEVELS

Ventilation Fans
Abattoir 1

Measurement position 15m from the property line and 30m from the façade containing the ventilation fans.
Noise level at 30m – 59.5dB(A)

Abattoir 1 – View of ventilation fans from measurement position

Abattoir 2

Measurement position 20m from the property line and 30m from the façade containing the ventilation fans.
Noise level at 30m – 72.7dB(A)

Abattoir 2 – View of ventilation fans and measurement position

Boilers and other process plant

Abattoir 1

Measurement position at the property line, 30m from boiler house façade.
Noise levels were recorded for periods of 10minutes at this position for a number of different situations of noise generation within the site.

No stock intake: 58.8dB(A)

No stock intake, steam plant operates for 30% of time:	59.4dB(A)
No stock intake, voices & material handling in building:	59.1dB(A)
Stock intake for 20% of time, cattle moving, shouting:	62.6dB(A)

Abattoir 1 – View of boiler house across lead-in passage from stockyard to plant

Note: The noise produced at the boundary by the process plant is quite consistant, whether or not different equipment is functioning, and rises by only 4dB during times when stock is being taken in.

Abattoir 3

Measurement position 10m from the boiler house facade.

Noise level predicted at 30m – 60.8dB(A)

Abattoir 3 -View of boiler house

6. Conclusions and recommendations

The noisiest equipment from the viewpoint of environmental noise is clearly identified as ventilation fans. These were unattenuated units in all cases and operate continuously when the plant is in operation, and are therefore not only the loudest noise source but also the one which contributes most to the equivalent noise level, on which environmental noise standards are based. Other noise sources are generally lower in level and short in duration and therefore do not contribute significantly to this equivalent noise level. This is a similar situation to any other industrial plant, and there are generally no abattoir-specific noise sources of particular significance.

Noise values at the site boundary of a typical abattoir are not likely to be significantly different from those recorded above. This is well within the limits for an industrial area during the day (70dB(A)), except where the ventilation fans are concerned, but only marginally at night (60dB(A)). In the design of new or the upgrading of older abattoirs, the ventilation fans should be placed and attenuated to take into account their pre-eminent position as the primary environmental noise source on the plant. This is particularly important in plants designed to be operated at night.

The noise requirements appropriate to the property boundary in industrial districts are stated in section f) of table 1 on the next page.

Type of district	Equivalent continuous rating level ($L_{Req.T}$) for noise dB(A)					
	Outdoors			Indoors, with open windows		
	Day-night $L_{R,dn}$ [1)]	Day-time $L_{Req,d}$ [2)]	Night-time $L_{Req,n}$ [2)]	Day-night $L_{R,dn}$ [1)]	Day-time $L_{Req,d}$ [2)]	Night-time $L_{Req,n}$ [2)]
RESIDENTIAL DISTRICTS a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
NON RESIDENTIAL DISTRICTS d) Urban districts with some workshops, with business premises, and with main roads	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

Table 1: Acceptable rating levels for noise in districts – Table 5 of SANS 10103:2003

The noise specifications for abattoirs should be strictly in line with the South African National Standards and regulations for other industries, including the two periods of the day, Daytime (06:00-22:00) and Night-time (22:00-06:00), and a minimum noise measurement duration of 10 minutes, defined by SANS 10103 for Environmental Noise.

APPENDIX B

Odour Impact Assessment

1. When is an odour impact assessment required?

To provide a baseline for EIA Application:

An odour impact assessment will be required if:

- The application is required for a new abattoir or an extension to an existing abattoir;
- There is a history of odour problems; and/or
- Odour is detectable beyond the boundary or at sensitive receptors.

For comparing different abatement options:

- A methodology to compare different proposed abatement options (which may be to abate odour, or for a wider purpose) in terms of their total environmental impact, i.e. looking at issues such as energy use, wastes generated, water or other raw material usage, costs etc.
- The screening out of insignificant sources at the abattoir that may pose a risk to sensitive receptors and therefore the establishment of significant on-site point sources.

Other reasons for undertaking an assessment:

In addition to providing a baseline relating to the odour impact, an assessment may also be undertaken for:

- predicting the impact of a new plant, or an extension/modification of existing plant
- investigating complaints comparing the effect of different operational changes, or
- looking at long term trends

2. What sorts of "tools" are available?

Several methodologies, or "tools", are available for assessing the environmental impact of odorous releases. These range in complexity from simple (and imprecise) to detailed (with a corresponding increase in accuracy). It may be appropriate to undertake a simple assessment as a screening exercise or scoping study to identify and/or prioritise sources before carrying out more detailed work. In some cases where risk is low a simple screening assessment may be sufficient on its own, for example, in rural or low throughput abattoirs.

Odour impact assessment tools can be broadly classified into two types:

(i) Those that estimate the "footprint" of effect of the activity by mathematical modelling of actual or estimated/predicted emissions:

(ii)

- simple "indicative" models, e.g. dmax or Schauberger & Piringer (for livestock)
- complex mathematical atmospheric dispersion models

(iii) Those that use information collected at the receptor(s), based on the opinions and judgement of those ex posed, to estimate the extent of the footprint.

(a) Assessment of community response:

- complaint histories (based on past and present experiences)

- attitude surveys (based on past exposures)
- population panels or odour diaries (on-going assessment of the current situation)

(b) Assessing the extent and magnitude of the exposure in the community:

- field judges/panels

There is also a third form of assessment which relates to the process or activity rather than to impact on receptors – this is to undertake a thorough review of materials used and generated, products, wastes and release points.

2.1. Selecting the appropriate methodology for assessing odour impact

Selection of an appropriate assessment methodology is not always straightforward. Considerations will need to include:

- Why is the work being undertaken?
- Have assessments been carried out previously? (there may be a need to follow a previous methodology)
- How much detail is required (and what is the cost of obtaining it?
- Is the risk of causing annoyance high or low? (more detail will be required if the risk is high, if it is very low an assessment may not be required)

Also the type of source, and ease of obtaining emissions data, should be considered:

- Can emissions be measured or predicted?
- Can information be obtained from those exposed to the odour?

An indication of what might be suitable for the purpose of providing an impact assessment for application purposes can be gained from the type of operation/or the size of the operation. The table also indicates in broad terms how the level of risk can be addressed in the choice of methodology. The previous history will also have some bearing on this.

Undertaking an assessment and interpreting the output

Figures 1, 2 and 3 on the following pages outline the process of undertaking an odour impact assessment and the potential outcomes for activities or operations where:

(i) (Fig 1 and 2) the odour emission rate can be measured, estimated or predicted. This applies to source type 1 (where assessment is required), source types 2 and 3, source types 5/6.
(ii) (Fig 3) the odour emission rate cannot be measured estimated or predicted.

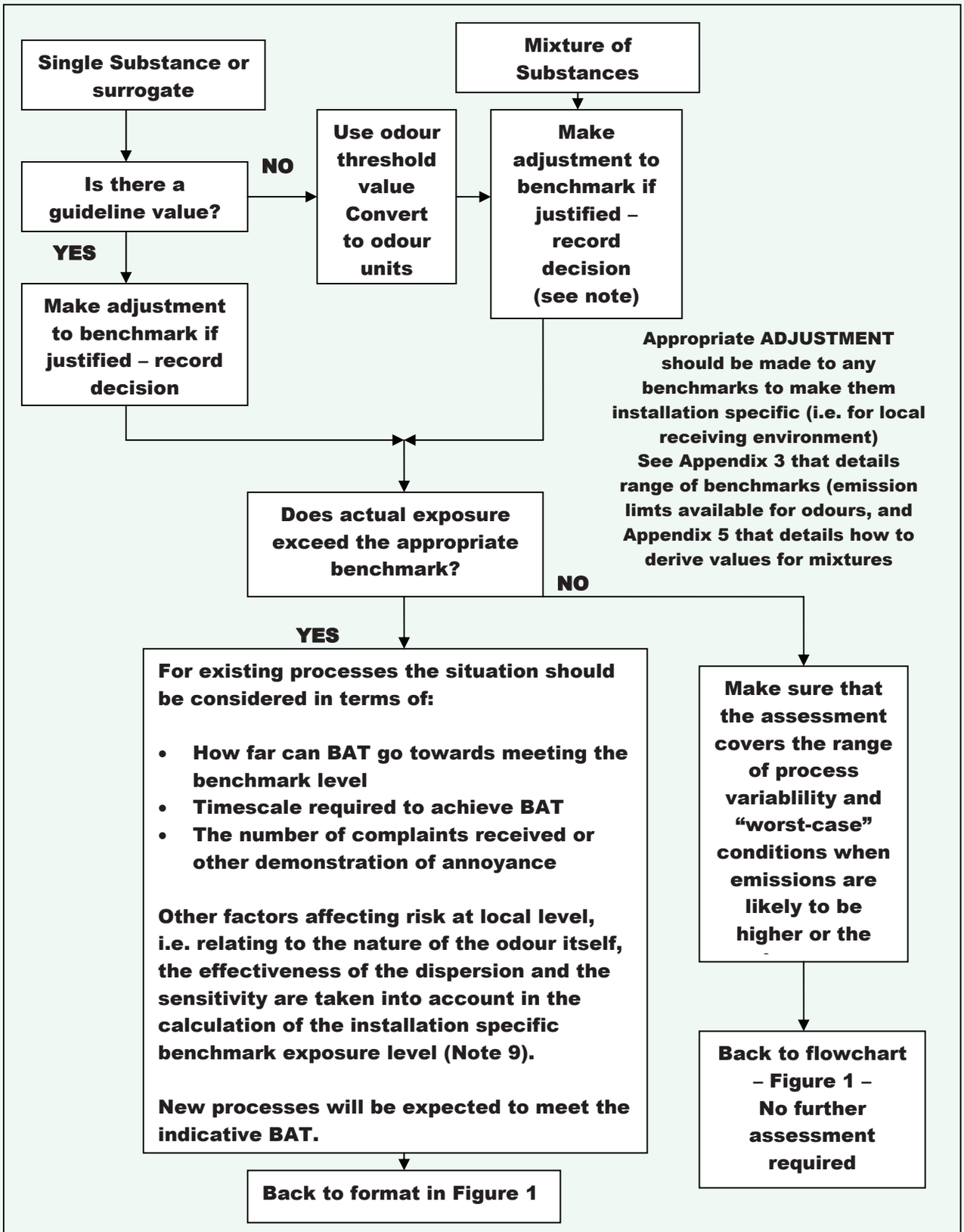


Figure 2 – Continued from Fig 1 – detail impact assessment – is exposure acceptable

Notes to be read for Figure 1 and Figure 2:

Note 1 This includes consideration of "worst case", e.g. no problem during the winter but complaints in the summer, or, only when the wind blows from the NE, or if complaints have been received ….this indicates the need for a "yes" response.

Note 2 Insignificant in terms of contributing to the overall impact at sensitive receptors (under all operating conditions).

Note 3 Where sources are completely different in terms of their odour characteristics it is often better to consider them separately in terms of impact on receptors. The combined impact may, or may not, be additive from a perceptual point of view. It may take a visit to the area, or evaluation of complaints to decide upon the best approach to take. It may be obvious where one odour is clearly stronger or more offensive, or exposure to one particular odour is more frequent than another.

Note 4 The higher the risk, the more detail is required. However, it may be appropriate to carry our a simple scoping study first in order to ascertain the degree of risk in very general terms (i.e. in terms of whether complaints are likely) or to identify the priorities for more detailed work.

Note 5 See Appendix 4 for guidance on modelling and odour release. Model multiple sources together using an appropriate model. A common sense approach will need to be taken where sources are spread across a large installation in which case it may be appropriate to consider individual or groups of sources in terms of the specific receptors that may be affected. Also, on a large installation consider if different sources affect different receptors and also the effect of wind direction.

Note 6 Relate model output to complaint history or compliance with conditions relating to subjective assessment. The consideration should include "worst case". Consider what is actually achievable with BAT.

Note 7 Compliance with odour exposure acceptability criteria and other odour benchmarks can rarely if ever be determined by taking measurements at the receptor. For regulatory purposes an appropriate benchmark will need to be interpolated to give an emission at source – which can be measured or calculated for compliance purposes. The emission concentration which is acceptable for the purpose of preventing or minimising pollution in the form of offence to the sense of smell must then be compared with any relevant limits for specific compounds.

(i) devised for the purpose of maintaining air quality or
(ii) avoiding harm to health.

Because many substances have a low odour threshold, in the majority of cases the restrictions imposed to avoid odour annoyance will be more stringent than those described above.

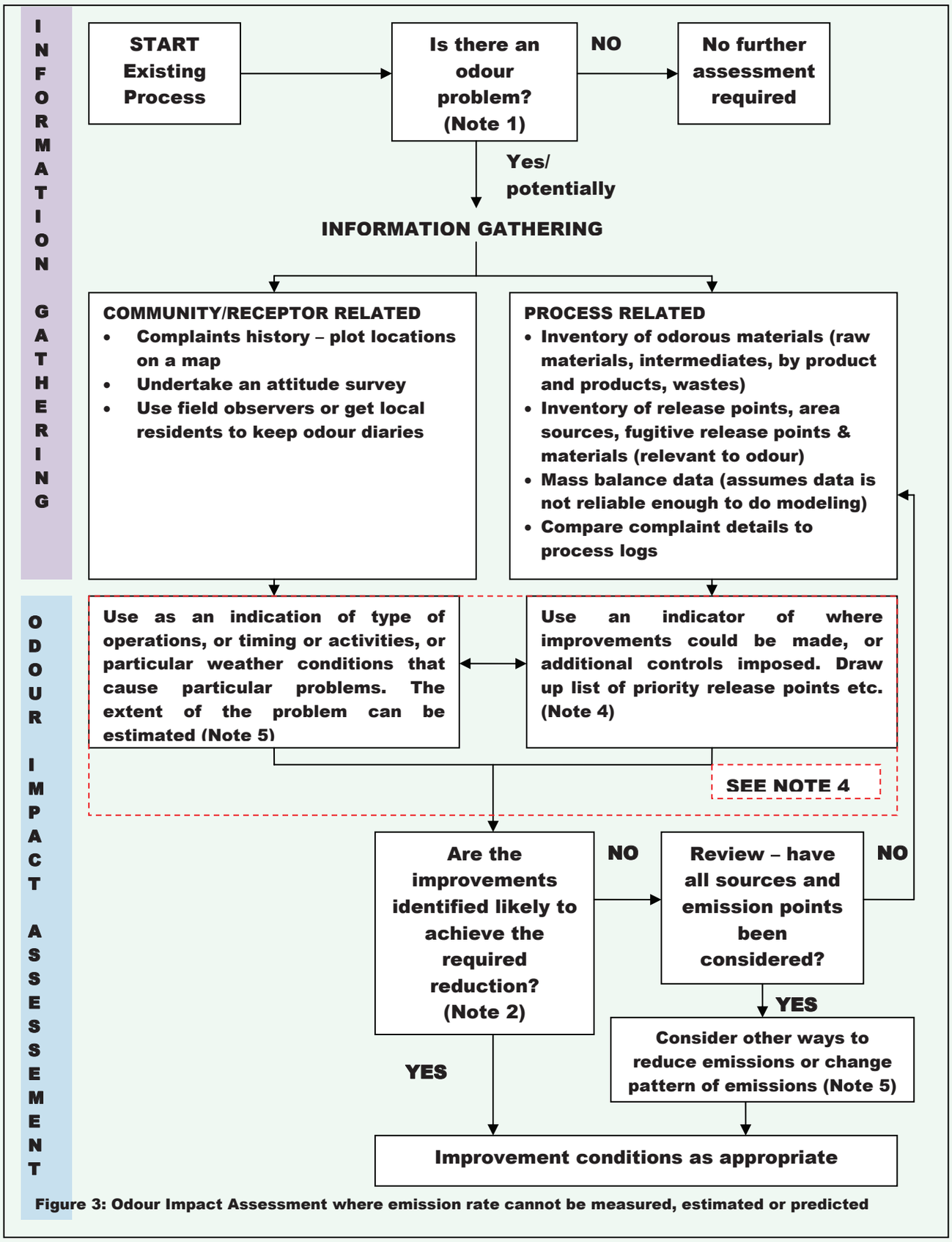


Figure 3: Odour Impact Assessment where emission rate cannot be measured, estimated or predicted

Notes to be read with Figure 3:

Note 1 This includes consideration of "worst case", e.g. no problem during the winter but complaints in the summer, or, only when the wind blows from the NE, or if complaints have been received this indicates the need for a "yes" response.

Note 2 Appendix 3 for guidance on what exposure is acceptable – Exposure Guidance – Emission Limits for odours.

Note 3 Where impact cannot be measured in numerical terms, it has to be assessed in terms of the way in which exposed receptors respond, or alternatively based upon the views of an experienced observer (the regulatory officer), i.e. a qualitative assessment rather than quantitative. Information relating to response can be used as an indicator of how much exposure needs to be reduced by – i.e. a target for reduction.

The degree of exposure can be estimated by considering factors such as: (see Appendix 1 – Attributes and quantification of odour releases and

Appendix 2 - Factors Affection Response/human response

- Is odour present or not?
- How strong is it?
- How often is it present/pattern of exposure?
- How "offensive" is it?
- How many complaints have been received?
- Do these relate to identifiable incidents or activities, or are they well distributed over time?

The aim, in applying BAT, should be to reduce odour exposure to the point where there is use for annoyance". This may not mean "no odour".

Use exposure as an indicator of where improvements could be made, or additional controls imposed.

The consideration of exposure patterns may identify specific operations or materials which need to be better controlled or restricted in some way in order to achieve the desired reductions. Evaluation of the operation/ process should give an insight into how reductions can be achieved. Sources should be prioritised as far as possible in terms of their contribution to the overall exposure and measures to reduce can be tackled in this order.

Note 4 Improvements should be tackled on the basis of the list of priorities drawn up. Reassessment and review should be undertaken as successive improvements are made.

Note 5 Evaluation of the community response (e.g. odour diaries, complaints or surveys), or the outcome of subjective testing can give an indication of the degree of reduction needed and to prioritise the order in which specific issues are tackled.

Consider:

- How strong is the odour?
- Is it constant in strength or fluctuating?
- Does it form a constant background or is there any pattern to the exposure?
- Does it smell the smell the same all the time, or does it change?
- Over what area is the effect felt?

It may be possible to match particular aspects of the exposure to specific events, operating parameters or weather conditions.

Examples of ways to reduce odour include:

- reducing throughput when adverse wind direction is likely to cause annoyance at sensitive receptors;
- restricting particular operations at weekends or public holidays

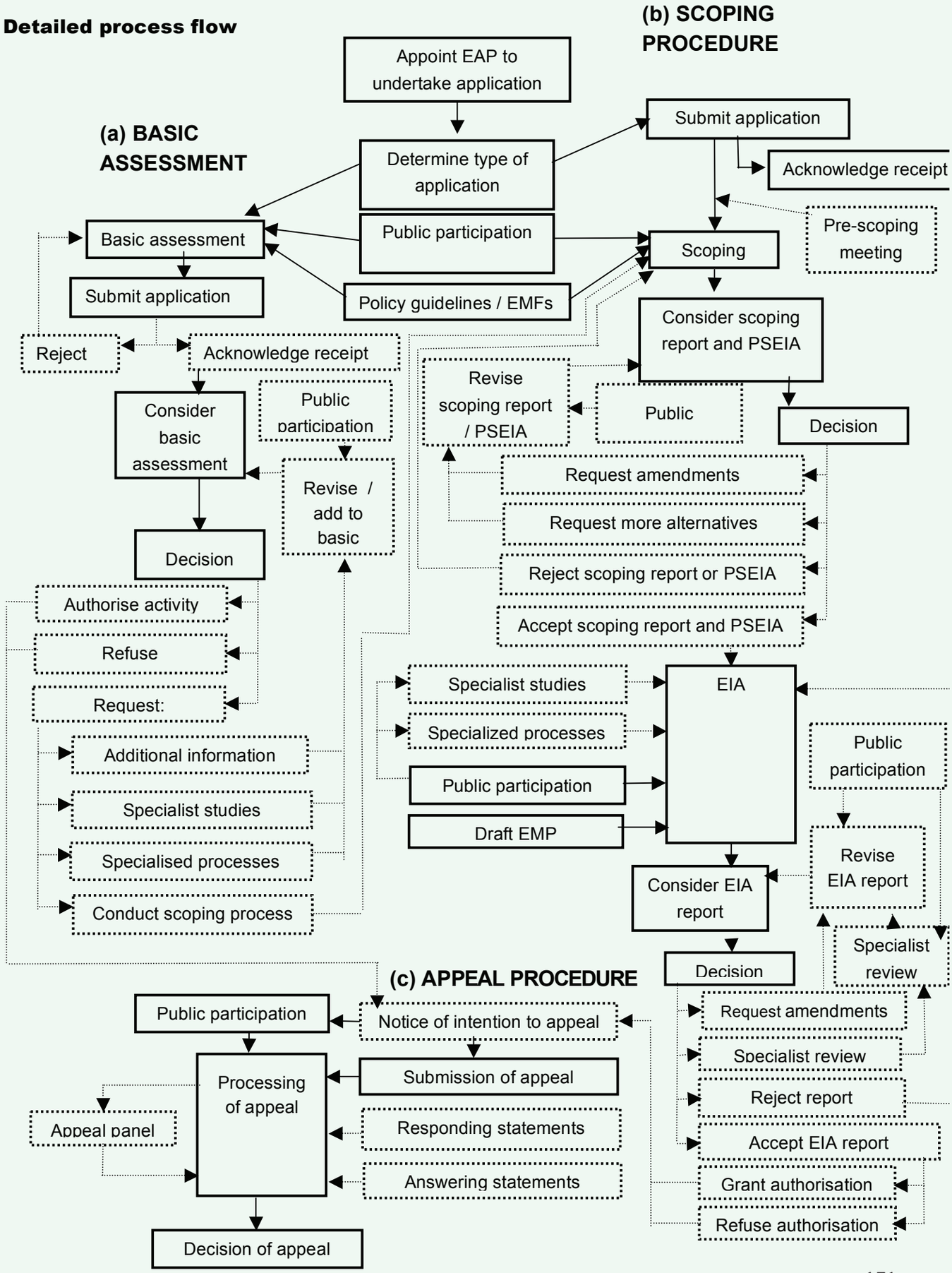
APPENDIX C
Authorisation

The EIA regulations promulgated in 2006, under section 24(5) of the NEMA and published in GNR No 385, 386 and 387, 2006 requires that an EIA procedure be undertaken for activities that would require the disposal, and treatment of waste.

Authorities to be consulted, include inter alia:

- Local Authority (Municipalities) – inter alia health inspector
- GDARD Veterinary Services
- DWEA (regarding sewerage systems and water supply)

Detailed process flow



APPENDIX D 1

AIR QUALITY AND AIR EMISSION CONTROL

1. INTRODUCTION

1.1 Aim of this Document

The aim of this document is to describe the airborne waste emissions from abattoirs, their impacts and air emission controls. This document serves to inform the Environmental Impact Assessment (EIA) Application Process and Environmental Performance Application Guidelines conducted by the Gauteng Department of Agriculture and Rural Development (GDARD).

1.2 Legislative Requirements related to Airborne Waste Emissions from Abattoirs

Abattoirs are registered in terms of the Meat Safety Act, Act No. 40 of 2000.

National Environmental Management Act, Act 39 of 2004

1.3 Definition of Abattoirs

An abattoir industry may be defined as any facility which is responsible for the conversion of animals to meat via a slaughtering process. This includes livestock, poultry and special classes of animals, e.g. crocodiles.

The grading of abattoirs is based on the throughput units. Throughput units are the amount of animals which can be processed in a specified time, in addition to structural requirements.

A unit in relation to a quantity standard for determining throughput for red meat means:

- 1 Bovine (cattle)
- 1 Horse
- 5 Pigs
- 6 Sheep

1.4 Classification and Grading of Abattoirs

Rural Red Meat Abattoir

A **rural** red meat abattoir may not exceed a throughput of two units per day.

Low Throughput Read Meat Abattoir

A **low** throughput red meat abattoir must have a maximum throughput of 20 units per day, but if only one species is slaughtered per day, the maximum throughput is:

- cattle, horses or sausage pigs larger than 90 kg – 20 units;
- (ii) sheep or goats – 40 units; or
- (iii) pigs – 30 units;

High Throughput Abattoir

A **high** throughput red meat abattoir must have a maximum throughput which the provincial executive officer may determine on grounds of the capacity of the lairages, hourly throughput potential relative to available equipment and facilities including hanging space, chiller capacity as well as rough offal handling and chilling capacity.

1.5 Abattoir Activities

The major activities undertaken at an abattoir are:

- Receiving and holding areas for livestock prior to slaughter;
- Retention area (12 – 24 hours) for livestock prior to slaughter;
- Stunning of animals;
- Bleeding of animals;
- Skinning of animals;
- Splitting washing and dressing of carcasses;
- Handling, storage and transport of carcasses and meat;
- Collection of residue arising from slaughter of animals;

- Sterilisation and Stabilisation;
- Cooking and rendering processes;
- Burning of waste and recovery of fats and oils.

1.6 Airborne Wastes associated with abattoir activities

Abattoirs may release contaminants into the atmosphere. These include odorous substances, as well as chlorofluorohydrocarbons (CFC) and ammonia:

- Chlorofluorohydrocarbons (CFCs) may be used in refrigeration and freezer plants. CFCs are ozonedepleting gases and their production and use is subject to national and international regulation.
- Odour is also a major problem associated with abattoirs. The main source of odour are:
- Animal Excreta – urine and manure
- Animal Waste – skins, hides, hooves, reject carcasses, stomach contents
- Animal byproduct Rendering Process emissions
- Untreated effluent
- Ammonia based refrigeration plants.
- Particulate matter (dust) may arise from combustion plants and unpaved areas.
- Other gaseous emissions such as nitrous oxides and sulphurous oxides may arise from combustion plants, such as boilers and incinerators.

Odour control may be a significant issue, particularly when abattoirs are located close to sensitive receptors such as residential areas.

Potential sources of odours in abattoir operations are:

- Livestock transport vehicles
- Animal holding pens (Lairages)
- Slaughter houses
- Holding areas for reject carcasses
- Product storage and handling areas
- Materials drying areas

- Skin handling
- Skin sheds
- Cooking and rendering process
- Waste effluent treatment plants

Dust

- Unpaved Roads
- Lairages or holding pens

Fuel burning emissions

- Coal or gas fired boilers for steam production
- Incinerators used for the burning of diseased animals, sludge, packaging or unuable skin

Greenhouse Gases and Ozone-depleting Gases

The amount of fuel utilised should be minimised by heat conservation and re-use to limit the emission of greenhouse gases.

Fuel burning appliances should have appropriate air pollution control systems installed to minimise greenhouse gas emissions.

Ozone depleting gases used in refrigeration units should be replaced in existing abattoirs and new abattoirs should install refrigeration units that do not utilise ozone depleting gases.

An Example of a conceptual framework is given in **Appendix 8 - Figure 1: Conceptual Framework of Airborne Emissions from Red Meat Abattoir**

2. ENVIRONMENTAL IMPACT ASSESSMENT APPLICATION PROCESS AND PERFORMANCE EVALUATION (COMPLIANCE)

2.1 Odour

This section describes odour-specific aspects of the environmental impact assessment process and outlines the tools that are available. Therefore this section serves as guidance for:

- The circumstances under which an odour impact assessment would be required;
- The type of methodologies that are available;
- The process of selecting the right methodology for a particular situation;
- The considerations that need to be addressed during the process of planning and undertaking the assessment;
- The process of comparing the result with an environmental benchmark or other indicators of acceptability.

2.1.1 When is an odour impact assessment required?

To provide a baseline for EIA Application:

An odour impact assessment will be required if:

- The application is required for a new abattoir or an extension to an existing abattoir,
- There is a history of ordour problems and/ or
- Ordour is detectable beyond the boundary or at sensitive receptors

For comparing different abatement options

- A methodology to compare different proposed abatement options (which may be to abate odour, or for a wider purpose) in terms of their total environmental impact, i.e. looking at issues such as energy use, wastes generated, water or other raw material usage, costs etc.
- The screening out of insignificant souces at the abattoir that may pose a risk to sensitive receptors and therefore the establishment of significant on-site point sources.

Other reasons for undertaking assessment:

In addition to providing a baseline relating to the odour impact, an assessment may also be undertaken for:

- predicting the impact of a new plant, or an extension/modification of existing plant
- investigating complaints comparing the effect of different operational changes or
- looking at long term trends.

2.1.2 What sorts of "tools"" are available?

Several methodologies, or "tools", are available for asssessing the environmental impact of odorous releases. These range in complexity from simple (and imprecise) to detailed (with corresponding increase in accuracy). it may be appropriate to to undertake a simple assessment a screening exercise or scoping study to identify and /or prioritise sources before carrying out more detailed work. In some cases where risk is low, a sample screening assessment may be sufficient on its own, for example, in rural or low throughput abattoirs.

Odour impact assessment tools can be broadly classified into two types:

(i) Those that estimate the "footprint" of effect of the activity by mathematical modelling of actual/predicted emissions:

- simple "indicative" models, e.g. dmax or Schauberger & Piringer (for livestock)
- complex mathematical atmospheric dispersion models.

(ii) Those that use information collected at the receptor(s), based on the opinions and judgement of those exposed, to estimate the of the footprint

(a) Assessment of community response:

- complaint histories (base on past and present experiences)
- attitude surveys (based on past exposures)
- population panels or odour diaries (on-going assessment of the current situation).

(b) Assessing the extent and magnitude of the exposure in the community:

- field judges/panels.

There is also a third form of assessment which relates to the process or activity rather than to impact on receptors - this is to undertake thorough review of materials used and generated, products and wastes and release points.

2.1.3 Selecting the appropriate methodology for assessing odour impact

Selection of an appropriate assessment methodology is not always straightforward.
Considerations include:

- why is the work being undertaken?
- have assessments been carried out previously? (there may be a need to follow a previous methodology)
- how much detail is required (and what is the cost of obtaining it?)
- is the risk of causing annoyance high or low? (more detail will be required if the risk is high, if it is very low, an assess may not be required).

Also the type of source, and ease of obtaining emission data, should be considered:

- can emissions be measured or predicted?
- can information be obtained from the exposed odour?

An indication of what might be suitable for the purpose of providing an impact assessment for application purposes can be gained from the type of operation/or the size of the operation. The table also indicates in in broad terms how the level of risk can be addressed in the choice of methodology. The previous history will also have some bearing on this.

Undertaking an assessment and interpreting the output

Figures 1, 2,3 on the following pages outline the process of undertaking an odour impact assessment and the potential outcomes for activities or operations where:

(i) (Fig 1 and 2) the odour emission rate can be measured estimated or predicted. This applies to source type 1 (where assessment is required), source types 2 and 3, source types 5/6.

(ii) (Fig 3) the odour emission rate **cannot** be measured, estimated or predicted.

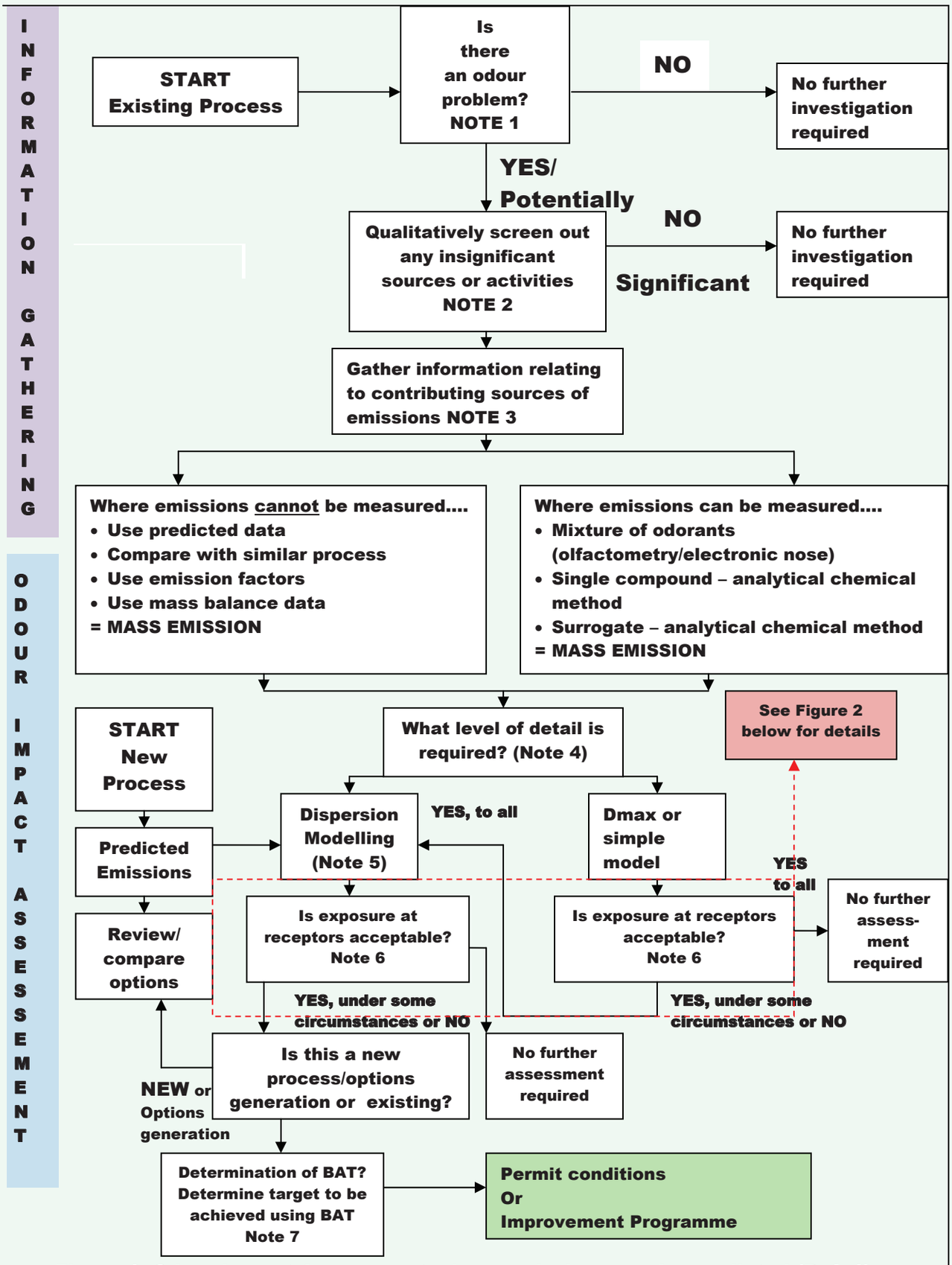


Figure 1: Odour Impact Assessment where emissions can be predicted (Ref: 1)

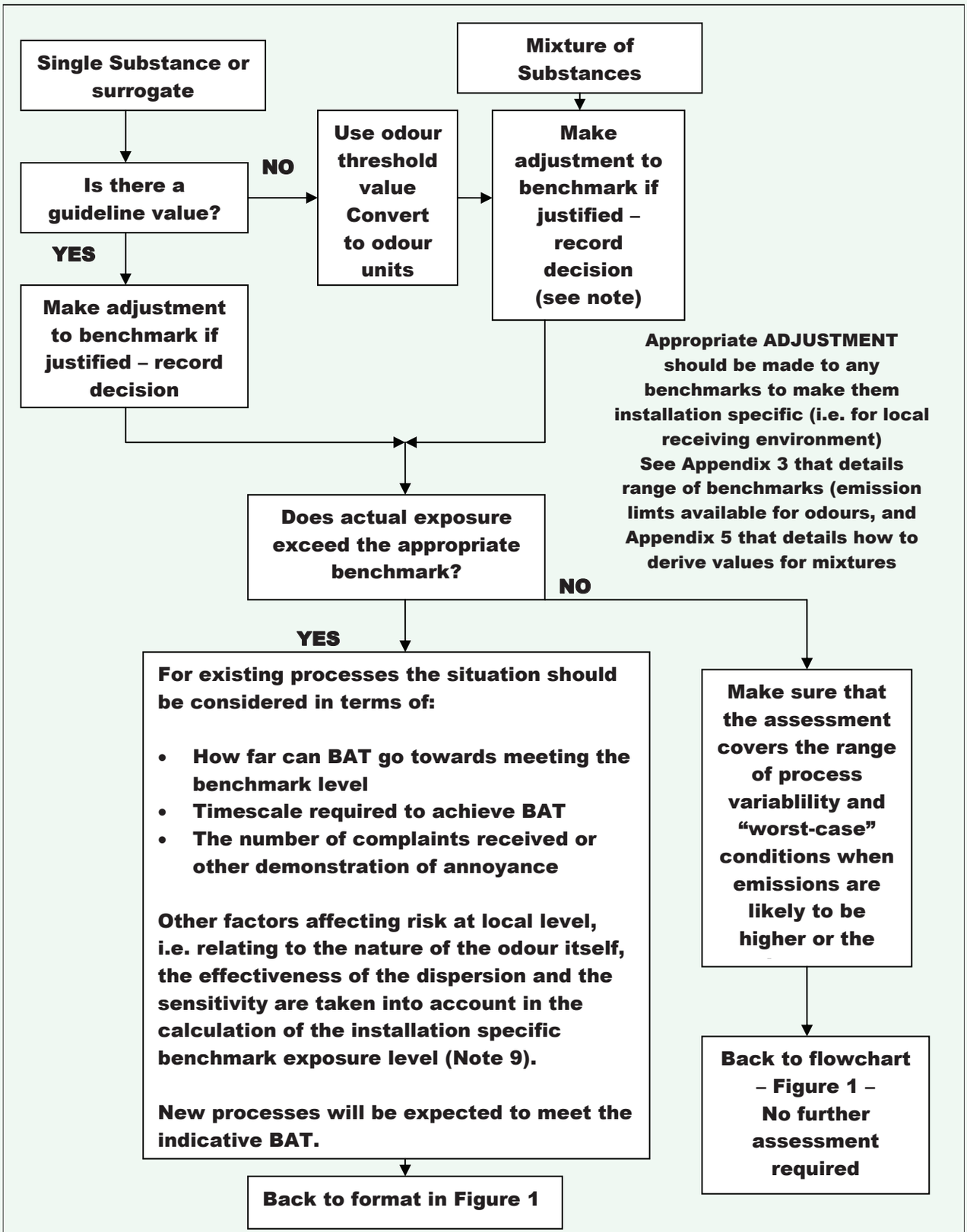


Figure 2 – Continued from Fig 1 – detail impact assessment – is exposure acceptable

Notes to be read with Figure 3:

Note 1 This includes considerations of "worst case", e.g. no problem during the winter but complaints in the summer, or only when the wind blows from the NE, or if complaints have been received this indicates the need for a "yes" response.

Note 2 Insignificant in terms of contributing to the overall impact at sensitive receptors (under all operating conditions).

Note 3 Where sources are completely different in terms of their odour characteristics it is often better to consider them separately in terms of impact on receptors. The combined impact may, or may not, be additive from a perceptual point of view. It may take a visit to the area, or evaluation of complaints to decide upon the best approach to take. It may be obvious where one odour is clearly stronger or more offensive, or exposure to one particular odour is more frequent than another.

Note 4 The higher the risk, the more detail is required. However, it may be appropriate to carry our a simple scoping study first in order to ascertain the degree of risk in very general terms (i.e. in terms of whether complaints are likely) or to identify the priorities for more detailed work.

Note 5 See Appendix 4 for guidance on modelling and odour release. Model multiple sources together using an appropriate model. A common sense approach will need to be taken where sources are spread across a large installation in which case it may be appropriate to consider individual or groups of sources in terms of the specific receptors that may be affected. Also, on a large installation consider if different sources affect different receptors and also the effect of wind direction.

Note 6 Relate model output to complaint history or compliance with conditions relating to subjective assessment. The consideration should include "worst case". Consider what is actually achievable with BAT.

Note 7 Compliance with odour exposure acceptability criteria and other odour benchmarks can rarely if ever be determined by taking measurements at the receptor. For regulatory purposes an appropriate benchmark will need to be interpolated to give an emission at source – which can be measured or calculated for compliance purposes.

The emission concentration which is acceptable for the purpose of preventing or minimising pollution in the form of offence to the sense of smell must then be compared with any relevant limits for specific compounds:

(i) devised for the purpose of maintaining air quality or

(ii) avoiding harm to health. Because many substances have a low odour threshold, in the majority of cases the restrictions imposed to avoid odour annoyance will be more stringent than those described above.

Notes to be read with Figure 3:

Note 1 This includes consideration of "worst case", e.g. no problem during the winter but complaints in the summer, or, only when the wind blows from the NE, or if complaints have been received ….this indicates the need for a "yes" response.

Note 2 Appendix 3 for guidance on what exposure is acceptable – Exposure Guidance – Emission Limits for odours.

Note 3 Where the impact cannot be measured in numerical terms, it has to be assessed in terms of the way in which exposed receptors respond, or alternatively based upon the views of an experienced observer (the regulatory officer), i.e. a qualitative assessment than quantitative.

Information relation to response can be used an indicator of how much exposure needs to be reduced by - i.e. a target for reduction.

The degree of exposure can be estimated by considering factors such as:
(See Appendix 1 - Attributes and qualification of odour releases and Appendix 2 - Factors affecting response)

- Is odour present or not?
- How strong is it?
- How often is it present/pattern of exposure?
- How "offensive" is it?
- How many complaints have been received?
- Do these relate to identifiable incidents or activities or are they well distributed over time?

The main aim in applying BAT, should be to reduce odour exposure to the point where there is use for annoyance. This may mean "no odour"".

Use exposure as an indicator or where improvements could be made, or additional controls imposed.

The consideration of exposure patterns may identify specific operations or materials which need to be better controlled or restricted in some way in order to achieve the desiredreductions. Evaluation of the operation/process should give an insight into how reductions can be achieved. Sources should prioritise as far as possible in terms of their contribution to the overall exposure and measures to reduce can be tackled in this order.

Note 4 Improvements should be tackled on the basis of the list of priorities drawn up. Reassessment and review should be undertaken as successive improvements are made.

1. **Estimate both the long term and short term Process Contributions (PC) (note 1) of all substances released to air**, using the following simplified calculation method. Data may be entered into the H1 software tool, which performs the calculations. **Note: If you already have detailed dispersion modelling data available that is valid for the activities in the assessment, then the process contribution derived from modelling should be used instead of the method below.** The Operator should identify where this is the case by inputting the modelled data into the software as prompted.

   Where detailed modelled data is not available, estimate the process contribution using the formula below:

   $$PC_{air} = DF \times RR$$

   where:

   PC = process contribution (µg/m3)

   RR = release rate of substance in g/s, (see inventory of emissions in module 2).

   DF = dispersion factor, expressed as the maximum average ground level concentration per unit mass release rate (µg/m^3/g/s), based on annual average for long term releases and hourly average for short term releases (note 2). A table of dispersion factors is provided below.

Effective height of release (see Module 2) (m)	Dispersion Factor (µg/m^3/g/s)	
	long term: maximum annual average	short term: maximum hourly average
0	148	3900
10	32	580
20	4.6	161
30	1.7	77
50	0.52	31
70	0.24	16
100	0.11	8.6
150	0.048	4.0
200	0.023	2.3

Notes

Different process options may lead to variations on the pattern of releases. For example, a process operated intermittently may give lower annual concentrations compared to one run continuously but an increased frequency of short-term peaks may be the result. Furthermore, although the long-term average concentration may have been rendered acceptable by generally good dispersion there may, on occasions, be unacceptable short term peaks.

Environmental benchmarks for both long-term and short-term effects in the receiving environment are available. Long-term effects may relate to those substances that are released continuously, frequently or over relatively long time periods. Short-term effects may relate to peak concentrations, intermittent or periodic emissions that occur over short time periods. Both long term and short term effects of releases should be considered in the assessment, according to the pattern of releases from the activities. It is also important, particularly with short term concentrations, that they are calculated on the same basis as corresponding environmental benchmarks e.g. over the same averaging period or percentile exceedence environmental impacts is proposed as 1% of the relevant benchmark.

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environmental impacts is proposed as 1% of the relevant benchmark.

Environmental impacts is proposed as 1% of the relevant benchmark. This is based on
judgement of the level at which it is unlikely that an emission will make a significant contribution to background concentration of a substance that dominates, rather than the long-term process contribution. As the proposed 1% criterion is two orders of magnitude below the benchmark that represents maximum acceptable concentration for the protection of the environment, a substantial safety factor is built in. Even if the existing ambient quality meant that a benchmark was already at risk due to releases from other sources, a contribution from the process of less that 1% (which is in itself likely to be an overestimate) would be only a small proportion of the total.

environmental impacts is proposed as 20% of the relevant short-term benchmark. Here, the assumption is that for short term releases, differences in spatial and temporal conditions mean that the process contributions themselves are more likely to dominate and not the ambient environmental concentrations. If a maximum error factor of 10 is assumed for the estimation of short-term contributions, it suggested that those emissions below 100% of the short term benchmark are unlikely to lead to breaches of a short-term benchmark.

A clear audit trail for the decisions made should be provided. This is done, most easily, by providing a supplementary document that refers to the environmental impact and cost information.

NOTES:

1. The choice of installation-specific Best Available Techniques involves a consideration of economic and environmental information. The Operator should summarise the impacts of each option against a range of environmental considerations, in order to judge relative performance and identify which option represents lowest impact on the environment as a whole.

   Once the options have been ranked according to environmental performance, the option that results in the lowest impact on the environment as a whole will usually be BAT, unless economic considerations mean that it is unavailable. The principal consideration in determining whether an option represents BAT is that the costs of its implementation should not be disproportionate to the environmental benefit it realises. Thus it may not be reasonable to implement an option of significantly higher cost which achieves only a marginal environmental improvement compared with another option.

2. An objective judgement needs to be taken to balancing costs and advantages when assessing what is BAT. There are several ways this judgement may be carried out, depending on the complexity of the situation. For example, in some situations, the environmental benefits of different options may be based on the control of a single or dominant pollutant. This provides a common cost/benefit factor that can be used for comparison of options, such as "cost of preventing emission of 1 tonne of pollutant". However, there are other situations where the benefits are more complex eg involve different pollutants or media. In these cases the Operator may need to apply further expert judgement to identify the more important environmental risks and the value of their control.

3. Throughout the assessment, uncertainties about many of the assumptions made could influence the results of the assessment. This does not necessarily invalidate the methodology used to undertake the assessment, but highlights the importance of sensitivity analysis as a technique to explore the influence of these uncertainties. Sensitivity analysis involves varying the values of parameters used on the assessment within reasonably expected bounds and analysing how alternative assumptions could change the results of the assessment. Such a technique might need to be used at various stages of the assessment, including, for example, the identification of significant releases, where assumptions about the amount of substances released could be important, as well as the assessment of the environmental and economic effects of the various options, to test the robustness of the results to possible alternative assumptions.

4. Benchmarks, particularly those for statutory air quality guidelines, are often expressed on different time bases.

Conversion factors for different averaging times are provided below:

From ⇩ To ⇨	15 minutes	1 hour	8 hours	24 hours
1 hour	1.34	1	0.7	0.59

3. CONSIDERATION FOR BEST AVAILABLE TECHNIQUES (BAT)

Types of technologies available have been outlined in AWMF draft 1 Part 1.

Identify the Option which Represents BAT

1. Identify the option that represents BAT for the activity or installation, by making a comparative assessment of environmental advantages and costs between options.

Guidelines are provided in the notes below. (note 1)

2. Provide a brief summary to support this decision, which should include:
- decisions made at earlier stages within this methodology;
- the methods used to compare costs and benefits; (note 2)
- the sensitivity of the decision to any uncertainties in data or assumptions. (note 3)

A clear audit trail for the decisions made should be provided. This is done, most easily, by providing a supplementary document that refers to the environmental impact and cost information.

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Availability of Capital

If an option is judged to represent BAT, it should be implemented within a reasonable timescale. This may depend on the availability of investment capital to the Operator and the amount required. Where there is more than one environmental protection project requiring investment, and capital is limited, the Operator should agree a priority for implementation of the techniques with the Regulator. Priority should usually be given to those projects yielding the greatest environmental benefits.

Considerations to be made for BAT:

1. the use of low waste technology.
2. the use of less hazardous substances.
3. the furthering of recovery and recycling of substances generated and used in the process and of waste, where appropriate.
4. comparable processes, facilities or methods of operation which have been tried with success on an industrial scale.
5. technological advances and changes in scientific knowledge and understanding.
6. the nature, effects and volume of the emissions concerned.
7. the commissioning dates for new or existing installations or mobile plant.
8. the length of time needed to introduce the best available technique.
9. the consumption and nature of raw materials (including water) used in the process and the energy efficiency of the process.
10. the need to prevent or reduce to a minimum the overall impact of the emissions on the environment and the risks to it.
11. the need to prevent accidents and to minimise the consequences for the environment.
12. the information published by the Commission (e.g. BREF documents) or by international organizations.

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APPENDIX D 2 - Factors affecting human response

The aim of this Appendix is to describe:

- the terms used to describe an adverse response
- the chain of events which lead from a release of odour to annoyance
- the reasons for variation in response between individuals – why some are more sensitive than others, and
- how much odour is annoying – and how much is acceptable.

This is compiled from the best information that has been made available at the time of writing. It is acknowledged that more research on the response to odours would be desirable and this text will be reviewed should additional relevant data become available.

The characteristics of individuals which affect their response to odours

The sensitivity of the general population, and of individuals, to odours
Olfactory acuity (the ability to smell a certain odour) in the population follows a lognormal distribution. Two percent are predictably hypersensitive and 2 percent are insensitive. The insensitive range includes those who are unable to smell at all (anosmic) and those who are partially unable to smell (hyposmic). A person may be relatively insensitive to one smell and abnormally sensitive to another.

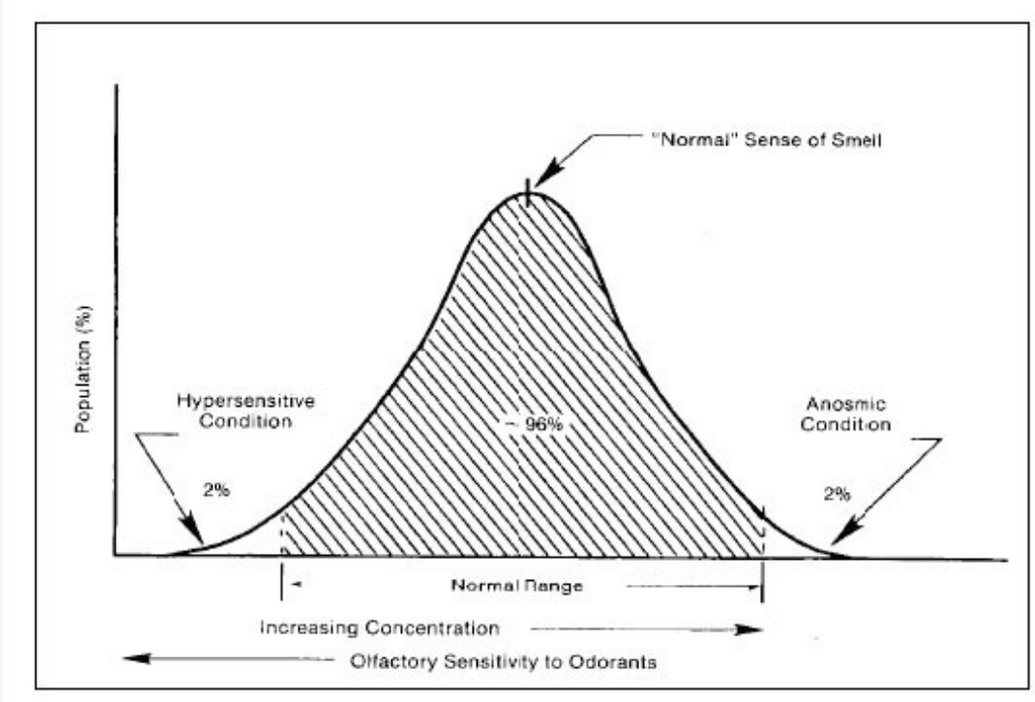


Figure 1: Diagram representing a frequency distribution of olfactory sensitivity
The non-specified values on the horizontal axis (e.g. ppb n-butanol at detection threshold) are typically expressed in log values (after log transformation).

Variation between individuals

There are a number of factors which affect the variation in response to odours between individuals. These can be broadly described as:

(i) physical, and
(ii) psychosocial

Physical

The ability to detect odours varies with age; increasing age correlates with decreasing ability. Women tend to show a slightly heightened sensitivity compared with men at any given age. Smoking habits can affect olfactory sensitivity, with smokers being less sensitive than non-smokers.

Psychosocial

Once a person detects an odour there are a number of factors which may affect the way in which he/she responds. These include the history of previous exposure, current state of health and perception of risks to health from emissions, economic dependence on the source, expectations, coping strategies, residential satisfaction and personality.

The following theories have been tested and confirmed by various researchers

- Individuals with health complaints have a higher probability of experiencing annoyance than others at the same exposure level, (the link is the occurrence of annoyance, not a link between exposure to odour and prevalence of health complaints).
- Individuals who are anxious that odour is related to a health risk have a higher probability of experiencing odour-induced annoyance than those who are not anxious.
- Where an individual has a history of exposure and odour related annoyance it may lead to a long term heightened annoyance sensitivity, even a number of years after the high exposure has been abated.

Individuals with increased tolerance

There are three main divisions of individuals who can have an increased tolerance to particular odours (excluding those who have a decreased ability to detect odours).

(i) Those who have a vested interest, i.e. individuals with an economic interest in the activity associated with the source of odour are less likely to experience annoyance than others and can tolerate a higher dose before they become annoyed.
(ii) Those who are accustomed to it – a higher dose can be tolerated better than by someone who is not accustomed to it, but not as much as those with a vested interest.
(iii) Those who either do not perceive the odour as a result of attention to other, more important, life matters or those who automatically develop a coping strategy.

Hypersensitive individuals

The most sensitive section of the population will be able to detect some odours at a concentration that lies below the threshold of detection for the majority of the population. Within this, further sub-sets can be identified:

(i) Those who have an acute awareness of an odour exposure situation: there is a difference between the level of odorant that can be detected and the level which will be detected, i.e. where the attention of the subject is focussed upon the sole objective of detecting odour as compared to someone who is distracted by other matters.

(ii) Those who have a medical condition which can produce a degree of hypersensitivity.
In addition to the increased likelihood of annoyance in those with health problems, some medical conditions may increase sensitivity to odours in some individuals.

How much odour is annoying - and what is "acceptable"?

Complaints can serve as good indicators of an operational malfunction and the effectiveness of on-going control, but cannot provide a reliable estimation of the state of annoyance of a community. They are ungraded, all-or-nothing, responses and are not suitable for measuring small amounts of annoyance in a sensitive way. They only occur when a certain threshold of dissatisfaction has been exceeded.
Guideline values published by the World Health Organisation (see Appendix 3) indicate "acceptable" benchmark exposure levels, which are based on avoidance of annoyance, for a handful of single odorous substances, but equivalent benchmarks do not exist for mixtures of substances. Appendix 7 sets out a method for determining values for an acceptable ground level concentration for odorous mixtures which are tailored to particular installations.

Dose-effect studies

The only realistic way of estimating the actual level of annoyance in a particular community resulting from exposure is by carrying out dose-effect studies locally. Such a study links the exposure (determined by mathematical modelling of emissions from the installation) to the level of annoyance (which is determined by a standardised questionnaire that disguises the purpose of the survey). Alternatively the response can be based on complaint records but this is less accurate.

A number of these studies have been undertaken in Europe for different industry/process types using a common methodology and the information has been extrapolated for application to other populations with due regard for any particular local factors. Such studies are fairly limited at present.

Exposure is usually quantified in terms of a frequency of occurrence over a year of hourly average concentrations above a certain limit odour concentration; e.g. 2 odour units per cubic metre (ouE/m3) as a 98-percentile of hourly averages of odour concentration for a year: C98 = 2 ouE/m3. This is calculated from an estimated or measured odour emission from the source, and local meteorological ("worst case" is usually considered) and terrain input data, using an atmospheric dispersion model.
In this document "no reasonable cause for annoyance" describes a point where the majority of the exposed population (90%) report that they are not annoyed, i.e. they find exposure at that level is acceptable. The 10% "annoyed" point is reckoned to be a lower limit of detection for the assessment methodology, i.e. the point at which we can show with good statistical confidence that the result is "real" and does not arise from the methodology used in the survey. Beyond this point, according to our current understanding, it is considered likely that there may be reasonable cause for annoyance. Work is on-going to further expand our understanding.

Does the level of acceptability vary according to the offensiveness of the odour?
The dose-effect studies have shown that the more offensive the odour, the lower the acceptable

exposure level. There are no clear cut-off points for categorising the degree of offensiveness but, (see Appendix 1), it is possible to obtain a reasonably consistent ranking of relative offensiveness across a sample population and between populations. Further work is being undertaken to support this.

Determination of installation-specific acceptability

Using the outcomes from the dose-effect studies, a series of indicative odour exposure "acceptability" criteria for mixed odours have been derived for different types of industrial odours based on their relative offensiveness. These relate to modelled ground level concentrations at sensitive receptors and represent our best understanding of a level of exposure which is reported as being acceptable by a high proportion of those exposed. This information is as close as we can get with the current level of understanding to determining a numerical value which represents "no reasonable cause for annoyance".

IPPC requires that installation-specific factors be considered in determining appropriate Permit conditions. The appropriate indicative odour exposure criterion will therefore need to be adjusted for the local environment as described in Appendix 7. The resulting installation-specific odour exposure acceptability criterion can be used as a basis (benchmark) for determining the appropriate maximum odour emission rate that equates to "no reasonable cause for annoyance" and the Operator should go as far as possible towards achieving this by the application of BAT. The indicative odour exposure acceptability criteria and a simplified methodology for determining an installation-specific criterion are given in Appendix 7.

Should the size of the exposed population be taken into account?

The balance of cost and benefits will shift towards the expectation that the cost of odour control will be greater where the environment is more sensitive, for example where the exposed population is large. A larger population is likely to contain a greater number of hypersensitive individuals. Conversely, where an odorous release is remote from any population the balance of costs and benefits might be expected to tip towards the expectation of lower expenditure when compared to the previous example. However, the possibility of future development closer to the installation should be always be considered and, should this occur, then BAT may be adjusted accordingly. It should be remembered that a sensitive receptor can also be a park or a footpath.
The indicative odour exposure acceptability criteria given in Appendix 7 are based upon dose response studies and what we currently understand to be a "lower limit of detection" in terms of the percentage exposed individuals reporting annoyance. Normally no adjustment would be required for population size as it is already taken into account but it might be appropriate to make an adjustment where the "footprint" of effect is large and a large number of people are affected.

APPENDIX D 3 - Emission limit values and exposure benchmarks for odour

Use of benchmarks

There may be a need to use exposure benchmarks for planning/predictive purposes.

1. The impact of a proposed installation, extension to an existing installation, or in stack height calculation for effective dispersion or residual odours – will the proposed installation or extension lead to a situation of "no pollution" at receptors?

2. As an indicator of the degree of efficiency required of proposed abatement equipment (how much improvement is needed to produce "no pollution").

And possibly, if the need can be justified.

1. To consider the likelihood of complaints being made in a given exposure situation, much as BS4142 is used for determining the likelihood of noise complaints, or to retrospectively evaluate the local exposure situation (on a long term basis) if complaints have been received.

2. In the case of existing plant, the appropriate benchmark can be used to determine the installation-specific maximum mass emission which should avoid "odour pollution" (ie taking local topography and meteorology into account). It is envisaged that this test need normally only be undertaken once at application if justified; any further work would be periodic stack monitoring against that mass emission (if process-based information cannot provide the necessary data).

What are benchmarks?

Odour exposure benchmarks are numerical values which represent an "acceptable" level of exposure which, for the purpose of this guidance, equate to "no pollution" in terms of offence to the sense of smell. It should be noted that exposure benchmarks are predicted ground level concentrations which are calculated by mathematical modelling of measured emissions. They cannot be measured at ground level and are, in any case generally averaged over long time periods (a year in the case of odour). They cannot be applied when it is not possible to meaningfully measure emissions at source, for example if there are many fugitive emission points. This Appendix, together with Appendix 7, describes benchmarks for odorous emissions, i.e. levels of odour exposure which are deemed "acceptable" and which should not lead to reasonable cause for annoyance.

What benchmark values are there for odour?

Benchmarks for odour are derived from several sources:

- World Health Organisation guideline values (as a ground level concentration) which aim to prevent annoyance resulting from exposure to single odorous compounds
- indicative benchmarks for exposure to mixtures of odorous substances which are based on acceptability (odour exposure acceptability criteria)
- it is also possible to calculate a multiple of a published odour threshold value (for a single substance) which is equivalent to the "acceptability" level.

Ground level concentrations or criteria based on acceptability should not be applied directly as Permit or EIA conditions. Determining compliance with them in this form is not possible, making them meaningless as conditions.

Where point sources are present, the emission equivalent to the acceptable ground level concentration can be calculated and these emission limit values can be used as Permit or EIA conditions where appropriate. The emission limit values imposed in any particular case will depend upon the installation-specific circumstances and what is achievable through the application of BAT. For area sources where the emission rate is difficult (or meaningless) to measure, emphasis should be on the Odour Management Plan (Appendix 3) and general good practice.

APPENDIX D4 - Modelling of odorous releases

This Appendix is NOT intended to be a guide to dispersion modelling. It is a necessarily brief outline of some of the main issues relating to the modelling of odorous releases. Expert opinion should be sought where there is doubt.

The role of dispersion modelling

Where the odour emission rate from a source is known by measurement or can be estimated, the odour concentration in the vicinity can be predicted by means of dispersion modelling. The model attempts to describe the effects of atmospheric turbulence on the emission(s) as they undergo dilution and dispersion in the surrounding environment. Concentration is one of the factors that determine the impact of a given odour on sensitive receptors (see Appendix 1).

The output from the modelling process is compared with an odour exposure (acceptability) criterion (in odour units) or a guideline value for avoiding annoyance (in ppb or g/m3). These are statistical means of linking the mass odour emission from a process to the impact as a ground level concentration, in terms of probability of occurrence, taking frequency of occurrence into account. It is sometimes necessary to evaluate impact above ground level, such as in high rise buildings and expert advice should be sought where necessary.

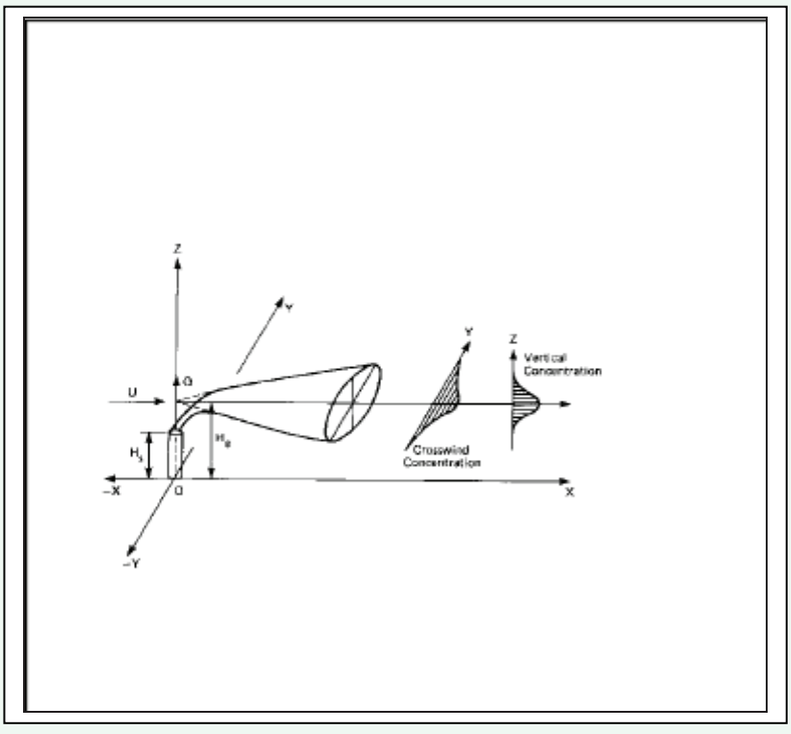


Figure 1: Dispersion modelling

An example of an odour exposure criterion might be: 3 ouE/ m3 as a 98th percentile of a year of hourly means to visualise the extent of odour impact it is useful to produce contour plots showing odour concentrations around the source or highlighting where concentrations exceed the appropriate guideline value or odour exposure criterion **(Appendix 3).**

Dispersion models

A range of different models have been used for modelling the impact of odorous releases. Such models have a number of common features but there are differences in the way that data is dealt with between the older gaussian models and the new generation models such as AERMOD and ADMS. In particular there are differences in the representation of the behaviour of the atmosphere, ie a move from Pasquill Gifford stability categories to Monin Obhukov, and the calculation (or input) of upper air
parameters.

Modelling of odorous releases is a developing field when compared to modelling of other pollutants, and there are a number of areas which need further validation, such as peak to mean ratios and appropriate averaging times. This document proposes a "recommended" approach to odour modelling for the following reasons:
• to bring about a degree of consistency and to allow comparison between different
installations and sectors
• the relationship between odour exposure and annoyance has been established in a
number of epidemiological studies, upon which the indicative exposure values (benchmarks) for acceptability given in **Appendix 7** are based. A particular modelling approach has been used in all of these studies. For the purpose of consistent approach in applying the indicative values given in this document the same relationships need to be maintained, hence the objective should be to use the same parameters that were used to establish the dose-effect relationships in the underlying studies.

The indicative benchmarks given in **Appendix 7** have been derived using older generation models. If using newer models to compare the actual performance against the benchmark, it is possible that the installation-specific results may show a numerically higher result than would have been the case with use of an older generation model. If the predictions from the use of a new generation model are likely to exceed the benchmark and there is an actual or potential odour problem, then the Agency will reassess the situation as appropriate. This is seen as an interim situation whilst further work is undertaken to compare the different approaches. It is expected that revisions of this document will refine the approach if better information becomes available. In some circumstances there may be a valid reason for taking a different approach to that suggested here. In such cases, the methodology used should be described and justification given.

For the purpose of predicting odour impact within the scope of this document, models and input data with the following characteristics are preferred:

- gaussian plume and new generation models – such as ISCST3, ISC Prime, Aermod, Aermod Prime and ADMS

- to represent conditions for an "average year" hourly meteorological data for a period of at least three, preferably five years should be used

- one-hour average concentrations should be calculated for all hours in the meteorological data-set

- exposure to be expressed as the concentration corresponding with the 98th percentile of the distribution of hourly values

- to incorporate critical receptors as discrete receptors

- the ability to account for the effects of buildings and topography on the plumes frompoint sources.

This is covered in more detail in Table 1 on the next page.

Table 1: Dispersion modelling – recommended parameters

Dispersion modelling for odour impact assessment – recommended parameters (where different from modelling of no-odorous substances)	
Emission parameters	
Quality of source emission data	Use the relevant Standards where available for taking samples. Analyse or quantify samples according to the relevant standards.
Choice of sampling times (relative to process operations)	In most cases it will be appropriate to consider the impact of the worst case emissions scenario (e.g. maximum production level, most odorous materials used, where odour varies with season use highest odour levels). The appropriate justifications should be given.
Other specific considerations relating to emissions:	Where releases are of less than 1-hour duration it is possible to model as a "puff" release. Plume rise - as for other gaseous emissions. In the case of flares, estimate the buoyancy flux of the flare from the heat content of the combustible components and their efficiency of combustion. In order to get a value for mass release of odour from the flare the odour input to the flare and the destruction efficiency must be used.
Model input parameters	
Meteorological parameters	Where odour emissions are continuous or the fluctuations are predictable, modelling can be carried out using sequential hourly meteorological datasets or for particular lines of meteorological data coinciding with odour complaints. When emissions occur less predictably modelling can be carried out for set combinations of wind speed and atmospheric stability with appropriate wind directions. Historically, Pasquill-Gifford stability classes have been used but in new generation models representative values of MO length and boundary layer height should be used to define unstable, stable and neutral conditions. The meteorological data should be representative of the area in which the installation is situated. It should be noted that the closest meteorological station is not necessarily the most representative. Where complaints are frequent it is useful to collect on-site wind direction and speed data, as this allows better correlation of complaints with potential odour sources. If modelling is to be undertaken, information on cloud cover or net solar radiation is also needed.
Terrain	Terrain with gradients of more than 1:10 can have a significant impact on ground level concentration of odour. In such cases dispersion calculations should incorporate these features.
Grid resolution	Grid resolution can also have a significant impact on predicted maximum odorant ground level concentration, although care should be taken in over-interpretation of data from fine grid resolutions.
Critical / sensitive Receptors	Critical receptors should be identified as discrete receptors in the dispersion model. Critical receptors may include housing, offices, parkland, recreational areas and retail areas.
Buildings (wake)	A structure produces an area of wake effect influence that extends out to a distance of five times L directly downwind from the trailing edge of the structure, where L is the lesser of the building height or the projected building width. If the stack is within this area of influence its effects should be accounted for within the dispersion model.
Model output parameters	
Averaging time	For the reasons given above, an averaging time of one hour should normally be used. A typical feature of exposure to odorous emissions is the very rapid human response which occurs when exposed to fluctuations in emissions; this can take place within a matter of 2 or 3 seconds unlike other non-odorous pollutants where response may be delayed by months or years (i.e. health effects). Short averaging times, down to a duration of one second, have been used to try and reflect this rapid response. However a standardised approach based on a shorter duration has not yet been validated.
Percentiles	A range of different percentiles have been used in the setting of air quality and odour exposure acceptability criteria. This guidance recommends use of the 98th percentile of a year of hourly means for comparative purposes, as stated on the previous page.
Reporting	
Justification of Procedure	The type of modelling procedure chosen should be described and justified in relation to the objectives. Reasons for factors having been included or excluded should be considered within the text. This commonly would include terrain effects, influences of buildings meteorology and source behaviour.
Presentation of Results	Presentation would commonly include quantitatively labelled graphical summaries (such as a suitable map overlaid with concentration contour plots).
Audibility	Dispersion modelling should be fully auditable. All data sources should be referenced. Commonly input files to the dispersion model are included as an appendix.

APPENDIX D 5 - Template for an Odour Management Plan

What is an Odour Management Plan?

An odour management plan is a working document for managing odour issues on the installation.

Whilst an odour management plan could be used to cover all aspects of odour management on an installation, in most cases it is likely to contain a description of foreseeable events which may lead to an increased odour impact at sensitive receptors and which are outside the control of the Operator, and for which it is agreed that it is not BAT to provide backup or alternative. It will also contain a description of the actions which will be taken in each case to minimise the impact.

The nature of those events and the subsequent actions should be agreed with the Agency at the time of drawing up the document. A means of recording the failure and demonstrating that the appropriate actions were indeed taken must be put in place by the Operator. It should be stressed that such events would be infrequent; if they occur regularly then BAT needs to be re-evaluated in the light of the degree of environmental impact.

In order to prepare the plan, the operator will need to consider:

- the activity which produces the odour and the point(s) of odour release (both intentional and unintentional)
- possible process or control failures or abnormal situations which could lead to an increased level of exposure
- the potential outcome of each failure scenario in respect of the likely odour impact on local sensitive receptors
- the actions which are to be taken to mitigate the effect of the odour release, and details of the persons responsible for the actions on the installation.

What should be included?

There are four main types of failure which may lead to an increase in emissions of offensive odour. These are:

- those which have potential to affect the process and the generation of odour
- those which affect the ability to abate/reduce odour
- those which affect the ability to contain odour (where releases are not normally permitted)
- those affecting dispersion between the source and sensitive receptors (for permitted release points such as vents, stacks or permitted open (area) sources.

Within all of these general headings there are causative factors which the operator could take actions to prevent and there may also be potential failure scenarios which are outside of his control and for which it as been agreed that it is not BAT to provide back-up or mitigation. For example it may not be BAT to provide a stand-by generator against the possibility of very infrequent power supply interruptions. It is the latter that will be of particular interest to the Regulator. Examples of the issues which might need to be considered under the above headings are given in the table below.

Nature/cause of failure	*Examples of issues to consider*
Those which have potential to affect the process and the generation of odour	Examples of factors which the Operator should normally have made arrangements for are: • materials input (seasonal variation in weather may affect odour of materials), particularly if putrescible • process parameters (changes in temperature/pressures) • rate of throughput or increased hours of operation • anaerobic conditions develop
Those which affect the ability to abate/reduce odour	Examples of factors which might be considered to be outside of Operator's control and best dealt with by management actions: • power failure (if accepted to be BAT not to provide backup) • external failure of other utilities, e.g. water supply. (Where the Operator has signed up to an interruptible utility supply, there may be some debate as to whether an interruption is outside of the Operator's control). • start up/shut down (depending on frequency of occurrence and the nature of the process).
	Examples of factors which the Operator should normally have made arrangements for are: • breakdown of abatement kit/pumps • poor performance of biofiltration or poisoning • saturation of a carbon filter bed and subsequent breakthrough of odorants • below optimum temperature of incinerator/boiler etc • saturation of scrubber liquor
Those which affect the ability to contain odour (where releases are not normally permitted)	Examples of factors which might be considered to be outside of the Operator's control and best dealt with by management actions: • power failure (if accepted to be BAT not to provide backup)
	Examples of factors which the Operator should normally have made arrangements for are: • failure of automatic doors, i.e. in open position • failure in procedures to maintain containment (human error)
Those affecting dispersion between the source and sensitive receptors (for permitted release points such as vents, stacks or permitted open (area) sources):	Examples of factors which might be considered to be outside of the Operator's control and best dealt with by management actions: • short term weather patterns which fall outside of the normal conditions for that area (ie highly unusual, not just the normal meteorological pattern - for example inversions and other conditions unfavourable to dispersion should have been considered in designing the process).
	Examples of factors which the Operator should normally have made arrangements for are: • weather – wind direction, temperature, inversion conditions if these are normal variants of local weather • loss of plume buoyancy/temperature *Note: the above are design issues to a large extent – the process should be designed to prevent/reduce odour to the required level (a level of acceptability) which takes the range of meteorological conditions into account.*

The specific arrangements for dealing with accidents will have been dealt with separately within the application. These can be cross-referenced where appropriate.

This is a suggested outline only and can be amended, as appropriate, to reflect different situations.

Where does odour occur and how is it generated?	Identify the release points.	Identify possible failures or abnormal situations. Nature/cause of failure	Potential outcome if failure occurs	What measures have been put into place to prevent or reduce the risk of this failure?	What actions are taken And who is responsible?
Describe the activity or process in which odorous materials are used or generated.	For each activity or process described in the previous column, list the intentional release points, e.g. vents, chimneys, exhausts, and the fugitive release points.	For each source – identify particular difficulties which affect odour generation, abatement, containment or transport/ dispersion in the atmosphere. *See Table A7.1 for examples*	Identify the local receptors who are likely to be affected and the nature or degree of the impact.		What actions are taken? Describe the measures that have been put into place to reduce the impact should a failure occur. These actions need to be agreed with the Regulator. Such actions may be as minor as closing doors or more significant – slowing production or shutting down under adverse conditions. Who (post) is responsible for authorising the actions described?

The following table contains a number of fictitious examples. In the case of failures outside of the control of the Operator, for any one installation, very few "incidents" per year are to be expected. If more are likely, then BAT should be reviewed and the odour emission potential reduced. Where failures are preventable, there should be no failures.

Where does odour occur and how is it generated?	Identify the release points.	Identify possible failures or abnormal situations. Nature/cause of failure	Potential outcome if failure occurs	What measures have been put into place to prevent or reduce the risk of this failure?	What actions are taken And who is responsible?
		Failure of scrubber liquor pumps due to power failure	Scrubber failure. Release of unabated off-gas to atmosphere. (50,000 odour units/m³). Local residents may experience odour annoyance. Duration - until pumps re-started or process shutdown.	(This assumes it is not BAT to provide a back-up generator)	Instigate process shutdown procedure (30 mins) Advise regulator by telephone immediately (phone no:….) Duty manager
		Failure of self-closing (roller) doors – mechanical failure or power failure	escape of odour from main storage area. May cause odour to be detected at nearby houses – raw material odour infrequently. Duration….(until action taken to correct)	Manual operation possible. Monthly inspection of door operation	Manually close doors. Inform Chargehand Storage area operators
		Inversion conditions may cause odour annoyance at New Village	Complaints likely to be received from New Village. Occurrence: very infrequent – once or twice a year	Weather station located on site with logging facility. Daily weather forecast received from Met office.	Finish current batch but reduce temperature if possible. Hold further batches of Product X. Product Y can be run on reduced temperature. Duty manager

APPENDIX D6 - Tabulated information

Odour descriptors

Descriptors can help to establish the source of an odour and it is useful, when recording information from a complainant, to seek their description of the odour.

It should be noted that some commercial substances have odour characteristics which are very different to the pure form - for example, carbon disulphide (CS2) has an ethereal (fruity) odour that is far more “pleasant” than the commercial grade which has a “rotten cabbage” smell resulting from the presence of impurities (mercaptans).

Table 1: Odour descriptors for commonly encountered compounds. See next page.

Table 1: Odour descriptions for commonly encountered compounds

ubstance	Odour	Substance	Odour
10	Apple, stimulant	Dimethyl sulphide	Rotten vegetable
Acetic acid	Sour vinegar	Diphenylamine	Floral
Acetone	Chemical/sweetish/solvent	Diphenyl sulphide	Burnt rubber
Acetonitrile	Ethereal	Ethanol	Pleasant, sweet
Acrylaldehyde	Burning fat	Ethyl acetate	Fragrant
Acrolein	Burnt sweet, pungent	Ethyl acrylate	Hot plastic, earthy
Acrylonitrile	Onion, garlic, pungent	Ethylbenzene	Aromatic
Aldehydes C9	Floral, waxy	Ethyl mercaptan	Garlic/onion, sewer, decayed cabbage, earthy
Aldehydes C10	Orange peel	Formaldehyde	Disinfectant, hay, straw-lie, pungent
Allyl alcohol	Pungent, mustard like	Furfuryl alcohol	Ethereal
Allyl chloride	Garlic, onion pungent	n-Hexane	Solvent
Amines	Fishy, pungent	Hydrogen sulphide	Rotten eggs
Ammonia	Sharp, pungent odour	Indole	Excreta
Aniline	Pungent	Iodoform	Antiseptic
Benzene	Solvent	Methanol	Medicinal, sweet
Benzaldehyde	Bitter almonds	Methly ethyl ketone	Sweet
Benzyl acetate	Floral (jasmine), fruity	Methyl isobutyl ketone	Sweet
Benzyl chloride	Solvent	Methyl mercaptan	Skunk, sewer, rotten cabbage
Bromine	Bleach, pungent	Methyl methacrylate	Pungent, sulphide like
Sec-Butyl acetate	Fruity	Methyl sulphide	Decayed vegetables
Butyric acid	Sweaty, body odour	Naphthalene	Moth balls
Camphor	Medicinal	Nitrobenzene	Bitter almonds
Caprylic acid	Animal like	Phenol	Sweet, tarry odour, carbolic acid
Carbon disulphide	Rotten vegetable	Pinenes	Resinouis, woody, pine like
Chlorine	Irritating, bleach, pungent	Propyl mercaptan	Skunk
Chlorobenzene	Moth balls	Putrescine	Decaying flesh
2-Chloroethanol	Faint, ethereal	Pyridine	Nauseating, burnt
Chloroform	Sweet	Skatole	Excreta, faecal odour
Chlorophenol	Medicinal	Styrene	Penetrating, rubbery, plastic
p-Cresol	Tar-like, pungent	Sulphur dioxide	Pungent, irritating odour
Cyclohexane	Sweetish when pure, pungent when contaminated	Thiocresol	Rancid, skunklike odour
Cyclohexanol	Camphor, ethanol	Toluene	Floral, pungent, mothballs
Cyclohexanone	Acetone-like	Trichloroethylene	Solventy
Diamines	Rotten flesh	Triethylamine	Fishy pungent
1,1 Dichloroethane	Ether-like	Valeric acid	Sweat, body odour, cheese
1,2 Dichloroethylene	Chloroform-like	Vinyl chloride	Faintly sweet
Diethyl ether	Pungent	Xylene	Aromatic sweet
Dimethylacetamide	Amine, burnt, oily		

Knowlton J and Pearce S, “Handbook of Cosmetic Science and Technology”. Leonardos G, Kendall D and Bernard N, “Odour threshold determinations of 53 odorant chemicals” JAPCA Volume 19, No 2, 1969.

References: The Royal Society of Chemistry, “Chemical Safety Data Sheets” Volumes 1 and 5.
Turk, “Atmospheric gases and vapors” Annals New York Academy of Sciences.

Hedonic Scores (1)

This table is continued on the following page.

These scores are also referred to as "Dravnieks" and are derived from laboratory-based experiments. They give an indication of the relative pleasantness or unpleasantness of one odour when compared to another. When considering odours from industrial activities, the descriptors given in the previous table can be used. Alternatively refer to the European odour ranking survey results in Appendix 2.

This table is continued on the following page

Description	Hedonic Score	Description	Hedonic Score	Description	Hedonic Score
Cadaverous (dead animal)	-3.75	Fishy	-1.98	Wet paper	-0.94
Putrid, foul, decayed	-3.74	Musty, earthy, mouldy	-1.94	Medicinal	-0.89
Sewer odour	-3.68	Sooty	-1.69	Chalky	-0.85
Cat urine	-3.64	Cleaning fluid	-1.69	Varnish	-0.85
Faecal (like manure)	-3.36	Kerosene	-1.67	Nail polish remover	-0.81
Sickening vomit	-3.34	Blood, raw meat	-1.64	Paint	-0.75
Urine	-3.34	Chemical	-1.64	Turpentine (pine oil)	-0.73
Rancid	-3.15	Tar	-1.63	Kippery-smoked fish	-0.69
Burnt rubber	-3.01	Disinfectant, carbolic	-1.60	Fresh tobacco smoke	-0.66
Sour milk	-2.91	Ether, anaesthetic	-1.54	Sauerkraut	-0.60
Stale tobacco smoke	-2.83	Burn, smoky	-1.53	Camphor	-0.55
Fermented (rotten fruit)	-2.76	Burnt paper	-1.47	Cardboard	-0.54
Dirty linen	-2.55	Oily, fatty	-1.41	Alcoholic	-0.47
Sweaty	-2.53	Bitter	-1.38	Crushed weeds	-0.21
Ammonia	-2.47	Creosole	-1.35	Garlic, onion	-0.17
Sulphorous	-2.45	Sour, vinegar	-1.26	Rope	-0.16
Sharp, pungent, acid	-2.34	Mothballs	-1.25	Beery	-0.14
Household gas	-2.30	Gasoline, solvent	-1.16	Burnt candle	-0.08
Wet wool, wet dog	-2.28	Animal	-1.13	Yeasty	-0.07
Mouse-like	-2.20	Seminal, sperm like	-1.04	Dry, powdery	-0.07
Burnt milk	-2.19	New rubber	-0.96		
Stale	-2.04	Metallic	-0.94		

Hedonic Scores (2)

Description	Hedonic Score	Description	Hedonic Score	Description	Hedonic Score
Cork	0.19	Crushed grass	1.34	Maple syrup	2.26
Black pepper	0.19	Celery	1.36	Pear	2.26
Musky	0.21	Green pepper	1.39	Caramel	2.32
Raw potato	0.26	Tea leaves	1.40	Coffee	2.33
Eggy (fresh eggs)	0.45	Aromatic	1.41	Meaty (cooked, good)	2.34
Mushroom	0.52	Raisins	1.56	Melon	2.41
Beany	0.54	Cooked vegetables	1.58	Popcorn	2.47
Geranium leaves	0.57	Clove	1.67	Minty, peppermint	2.50
Grainy (as grain)	0.63	Nutty	1.92	Lemon	2.50
Dill	0.87	Coconut	1.93	Fragrant	2.52
Woody, resinous	0.94	Grapefruit	1.95	Fried chicken	2.53
Soapy	0.96	Perfumery	1.96	Cinnamon	2.54
Laurel leaves	0.97	Peanut butter	1.99	Cherry	2.55
Eucalyptus	0.99	Spicy	1.99	Vanilla	2.57
Molasses	1.00	Banana	2.00	Pineapple	2.59
Incense	1.01	Almond	2.01	Apple	2.61
Malty	1.05	Sweet	2.03	Peach	2.67
Caraway	1.06	Buttery, fresh butter	2.04	Violets	2.68
Soupy	1.13	Grape juice	2.07	Fruity, citrus	2.72
Bark, birch bark	1.18	Honey	2.08	Chocolate	2.78
Anise (liquorice)	1.21	Cedarwood	2.11	Floral	2.79
Oak wood, cognac	1.23	Herbal, green, cut grass	2.14	Orange	2.86
Seasoning (for meat)	1.27	Cologne	2.16	Strawberry	2.93
Leather	1.30	Fresh green vegetables	2.19	Rose	3.08
Raw cucumber	1.30	Fruity, other than citrus	2.23	Bakery (fresh bread)	3.53
Hay	1.31	Lavender	2.25		

References

Dravnieks A, Masurat T, Lamm R A, “Hedonics of Odours and Odour Descriptors”: in Journal of the Air Pollution Control Association, July 1984, Vol. 34 No. 7, pp 752-755

Guidance for the Regulation of Odour at Waste Management Facilities under the Waste Management Licensing Regulations, July 2001, Version 2.3

Odour threshold values

The quality of odour detection threshold data can be poor. “Odour measurement and control - an update” (Woodfield and Hall 1994) differentiates between chemicals for which threshold values have been determined by a recognised test method (dynamic dilution olfactometry), and those chemicals where threshold values have not been determined by a recognised test method. The data quality for compounds determined by recognised methods are more likely to approach the “true value”. The table below contains those odour threshold values which have been determined using recognised test methodologies.

Other sources of threshold values

Compilation of odour threshold values in air and water, Central Institute for Nutrition and Food Research, TNO, Netherlands, June 1997. Editors: van Gembert L J; Nettenbrejer A H.

Compilation of odour and taste threshold values data, American Society for Testing and Materials, ASTM Data Series DS 48A. Editor: Fazzalari F A.

The documents listed above contain odour threshold values for a much wider range of substances. The fact that a document is listed does not necessarily mean that the values given are consistent with other documents and it is advisable to cross-check values with more than one source as there can be considerable variation. This list is not exhaustive and other published values exist.

See table on next page

Table under section: Odour threshold values

Compound	mg m^{-3}	ppm	Compound	mg m^{-3}	ppm
Acetic acid	0.043	0.016	2-Hydroxyethyl acetate	0.527	0.114
Acetic anhydride	0.013	0.00029	Light fuel oil	0.053	
Acetone	13.9	4.58	3-Methylbutanol	0.0016	0.0004
Acrylic acid	0.0013	0.0004	2-Methyl-1-butanol	0.16	0.041
Amyl acetate	0.95	0.163	Methyldithiomethane	0.0011	0.00026
iso Amyl acetate	0.022	0.0038	2-Methyl 5 ethyl pyridine	0.032	0.006
Benzene	32.5	8.65	Methyl methacrylate	0.38	0.085
1,3 Butadiene	1.1	0.455	3-Methoxybutyl acetate	0.044	0.007
1-Butanol	0.09	0.03	1-Methoxy-2-propylacetate	0.0075	0.0014
2-Butanol	3.3	1	1-Methoxypropan-2-ol	0.0122	0.003
2-Butanone (MEK)	0.87	0.27	1-Methoxy-2-propylacetate	0.0075	0.0014
Butoxybutane	0.03	0.005	2- Methyl pentaldehyde	0.09	0.02
2-Butoxyethanol	0.0051	0.00097	4-Methyl-2-pentanone (MIBK)	0.54	0.121
2-Butoxyethylacetate	0.045	0.0063	2-Methyl-2-propanol	71	21.46
Butoxypropanol	0.191	0.0324	α-Methyl styrene	0.021	0.003
Butyl acetate	0.047	0.0066	1-Nitropropane	28.2	7.09
2-(2-Butoxyethanocy)ethanol	0.0092	0.0013	1-Octene	0.33	0.066
2,2-butoxyethoxyethyl acetate	0.0092	0.0016	2-Octene	0.5	0.1
Carbon tetrachloride	280	40.73	2-Octyne	0.03	0.006
Carbon sulphide	0.0275	0.0102	2,4 Pentanedione	0.045	0.01
m-Cresol	0.013	0.0003	1-Pentanol	0.02	0.0051
o-Cresol	0.0028	0.0005	Petroleum naptha	0.2	
p-Cresol	0.0029	0.0006	Phenyl ether	0.0021	0.0003
Cyclohexane	315	83.8	2-Picolene	0.014	0.0034
Cyclohexanone	0.083	0.019	Propanal	0.014	0.0054
2-Chloromethane	3.42	0.912	2-Propanol	1.185	0.442
Diesel	0.06		2-Propen-1-ol	1.2	0.47
Dimethyl adipate	7.101	0.913	iso Propylamine	0.158	0.06
Dimethyl glutarate	1.212	0.169	Propylbenzene	0.048	0.009
Dimethyl succinate	0.992	0.152	Propylene-n-butylether	0.206	0.01
1,4-Dioxane	30.6	7.78	Propyl ether	0.024	0.0053
1,3-Dioxolane	56.3	17.02	Styrene	0.16	0.0344
Diphenylmethane	0.41	0.55	1,1,2,2-Tetrachloroethane	1.6	0.21
Ethoxypropanol	0.161	0.035	Toluene	0.644	0.16
Ethoxypropyl acetate	0.0052	0.0008	Trichloroethylene	8	1.36
Ethyl acetate	2.41	0.61	Trimethylamine	0.0026	0.01
Ethyl alcohol	0.28	0.136	Xylene (mixed)	0.078	0.016
2-Ethyl-1-butanol	0.07	0.015	2,3 Xylenol	0.0037	0.0007
2-Ethyl-1-hexanol	0.5	0.086	2,4 Xylenol	0.064	0.0117
2-Ethylhexyl acrylate	0.6	0.073			
2-Furaldehyde	0.25	0.058			
1-Hexanol	0.05	0.011			
Hydrogen sulphide	0.00076	0.0005			

APPENDIX D7 - Installation-specific odour exposure "acceptability" criteria for mixed odours

Overview

This Appendix outlines a number of indicative odour exposure criteria for mixtures of odorants associated with different industry types. These indicative criteria must then be "adjusted" for local the factors on an installation-specific basis. These criteria indicate the exposure that the particular local environment (i.e. number of exposed people) can tolerate without reasonable cause for annoyance. They can be used as:

- an indicator of how much improvement is needed or to size abatement equipment
- for planning purposes to predict the acceptability of the impact of a planned installation or extension to an existing operation
- to calculate a suitable chimney height to provide an acceptable exposure at receptors.

Such criteria cannot be used in this form as Permit conditions but can be used to determine equivalent emission limit values as described in Appendix 5 and shown below in Figure 1. **This methodology is based on best available data.**

The use of odour exposure criteria is only meaningful where the emissions from the installation can be measured or predicted, otherwise there will be no realistic input data for modelling and no means for assessing whether the criterion is being met.

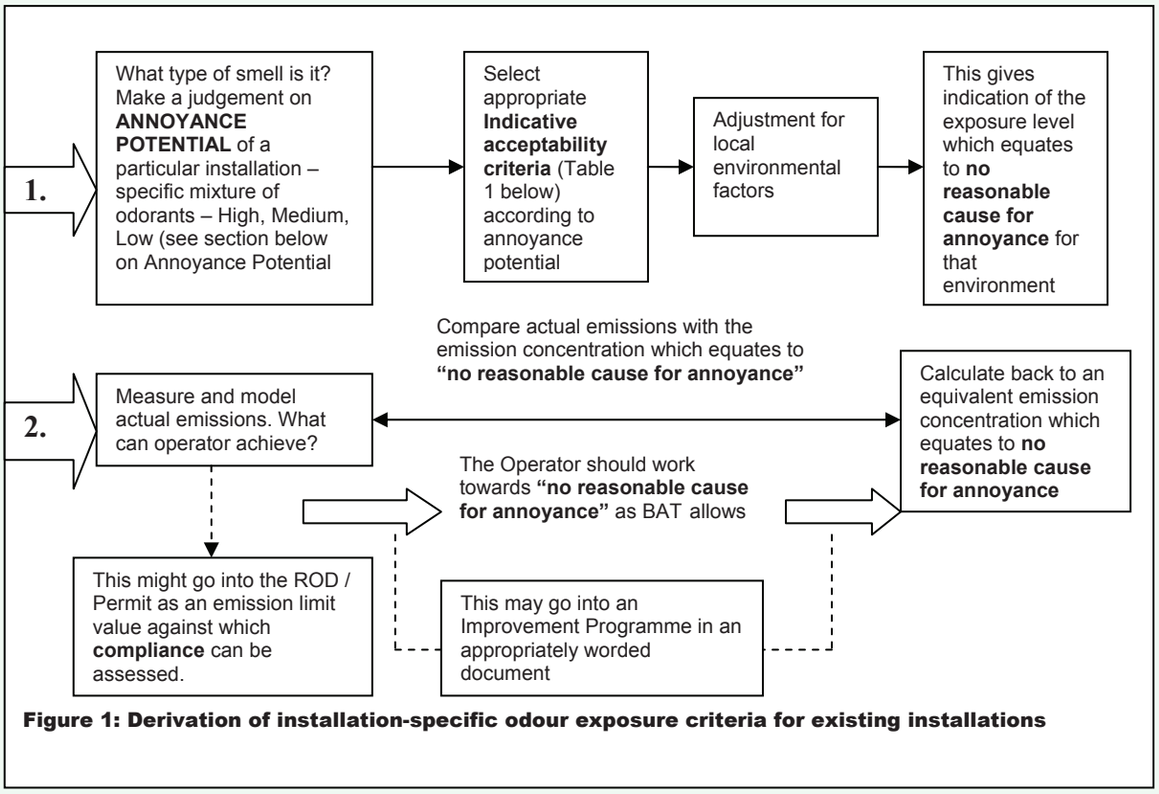


Figure 1: Derivation of installation-specific odour exposure criteria for existing installations

Annoyance potential

Annoyance potential is the likelihood that a specific odorous mixture will give reasonable cause for annoyance in an exposed population.

Not all odours have the same potential to cause annoyance – for example odours arising from putrescible materials, are typically considered to be more "offensive" than odours from a bakery which might be better tolerated. It should be remembered however that **ANY** odour has the potential to cause offence if, for example, the odour is strong and/or exposure is frequent. The list below (Figure 2) is based around a ranking of industrial-type odours which was carried out in the UK recently (as described in Appendix 1). The results are consistent with those from the Netherlands and Germany. A larger UK study is currently underway and the table below will be reviewed in line with any different outcomes.
This ranking gives some indication of **relative** offensiveness. These have then been categorised as "low", "medium" and "high" offensiveness and exposure criteria have been assigned to each category. These categories are indicative only and do not have definite cut-off points in terms of the industry types listed. Although this ranking is based upon the views of a number of people; within this there may be individuals who respond differently, (see Appendix 1 – "Offensiveness")

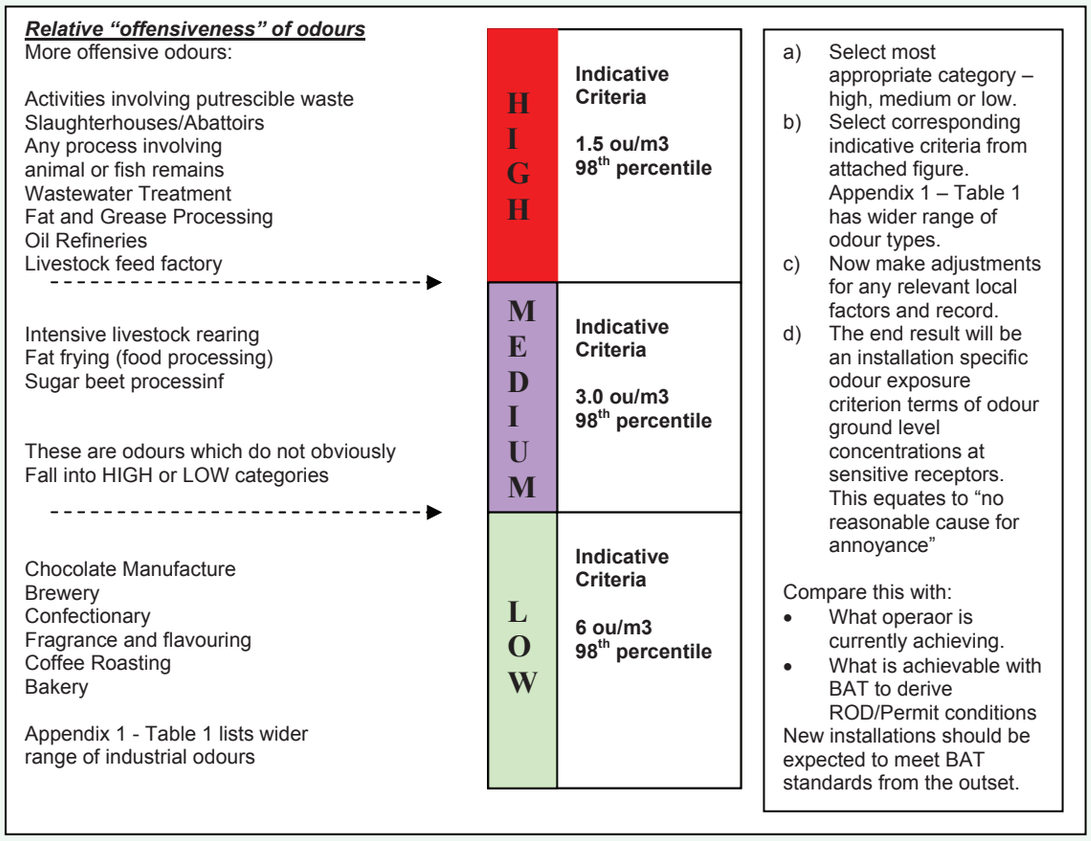


Figure 2: Indicative odour exposure criteria for ground level concentration of mixtures of odorants

The criteria given are based upon: (see Appendix 4)

- 98th percentile
- 1 hour averaging time

Offensiveness of odour - some considerations (see also Appendix 1)

- Odours from some industry types such as chemical manufacture will vary across the sector and the nature of any odorous emission will be dependent upon the types of materials used and products manufactured.

- There may be a difference in the odour described by local residents and the odour as experienced at source. Odours can change in nature over distance (Section 3.1.4).

- For some types of process or activity there will be variation in odour intensity, and possibly character also, depending upon the stage of the cycle (e.g. livestock) or upon season (e.g. landfilling of putrescible wastes).

A list of "hedonic scores" is given in Appendix 6; these scores indicate relative "pleasantness" or "unpleasantness" based upon descriptions of what an odour smells like. These may assist in determining the relative offensiveness of an odour where it is not possible to categorise it in terms of an industry type or process.

Adjustments for local factors

In accordance with the PPC Regulations, installation-specific factors should be taken into account in determining emission limit values. These factors relate to both the technical characteristics of the plant and also local conditions:
When deriving installation-specific benchmarks for odour the following types of environmental factors should be considered:

Local conditions

- Where an odour has generated a high level of complaints over a prolonged period of time, the population may become hypersensitive to that odour. As such, even if the levels of odour were reduced to what would be an acceptable level in other areas may still give rise to justifiable complaints.

- This effect may be more pronounced in densely populated areas where the numbers of hypersensitive individuals would be greater.

There may be other relevant local factors in addition to the above. Local topography does not need to be taken into account in determining a benchmark as such, but it will need to be included in the input to a dispersion model when calculating the equivalent emission at source to meet the benchmark. Technical aspects of the operation will need to be considered in determining BAT, but not in determining the installation-specific odour exposure criterion as the latter only considers the local receiving environment. Where an adjustment is considered to be necessary, the indicative odour exposure criteria given in Figure 2 can be adjusted upwards (ie less stringent) or downwards (more stringent). If the environment is considered to be insensitive the need to apply such criteria at all should be reconsidered.

As an example of an adjustment to reduce the level of exposure, the criteria given in Figure 2 become:
High Criterion: 1.0 ouE m -3 as the 98th percentile of a year of hourly averages (from 1.5ouE)
Medium Criterion: 2.5 ouE m -3 as the 98th percentile of a year of hourly averages (from 3ouE)
Low Criterion: 5.5 ouE m -3 as the 98th percentile of a year of hourly averages (from 6ouE)

The indicative odour exposure criteria are based upon a number of different populations but if an installation-specific criterion does not provide for "no reasonable cause for annoyance", for a specific population then it may need to be re-visited. However the degree to which BAT allows the installation-specific criterion to be met should be taken into account.

Other considerations

A number of other considerations may need to be taken into account.

- Where the receptors are remote from the source it would be unlikely that the Operator would need to go through the full process of calculating an installation-specific odour exposure criterion unless there is some other sensitivity, and the balance of costs and benefits would be expected to be less heavily weighted towards more expenditure when compared to a more sensitive location

- Under some circumstances where more local information is required in determining the level at which acceptability criteria should reasonably be set, it may be appropriate to undertake a survey of annoyance in the community.

- Where many complaints have been received, the calculated odour exposure criterion could be calibrated against a plot of locations of complaints around the source.

Using exposure criteria - what it means in practice for regulation

The odour exposure criteria given in Figure 2 have been derived from dose effect studies and describe ground level concentrations of different odour types which have been reported at interview by those exposed as being "acceptable" in the long term. The following description aims to explain what these criteria actually mean in terms of the odour to which those people interviewed were exposed and what it might mean where these criteria are used for planning or regulatory purposes.

What are odour exposure criteria?
Odour exposure criteria are a statistical means of linking the odour emission from a process to the impact (concentration) at ground level, in terms of probability of occurrence, taking frequency of occurrence into account. They are determined by mathematical dispersion modelling of source emission data and other local data.

They are probability-based and therefore are not absolute "limits"; they are merely indicative of an average concentration that is likely to occur for a specified percentage of the time over a year.

An example of the way an odour exposure criterion is set out might be:

x ouE m-3 as a 98th percentile of a year of hourly means

A 98th percentile value "x" of a year of hourly averaged concentrations means that hourly averaged concentrations will be less than or equal to x for 98% of the year. For 2% of the year, hourly averaged concentrations will be higher than or equal to x.

An odorous emission which is equivalent to the odour exposure criterion at ground level does not, therefore, mean that receptors do not experience odour at all.

Factors affecting response

The average concentration, duration and frequency of exposure (and also the type of odour) are important in determining the likely response of receptors. However the magnitude of the peaks is often the factor determining whether an acceptable situation becomes annoying for those exposed. The magnitude of the peaks may be a feature of the process (i.e. the emissions vary) or it may be related to the height and type of source (point sources can give much greater peak to mean ratios downwind than area sources) or to atmospheric conditions (see Appendix 4 – peak to mean ratios).

Using odour exposure criteria in Record of Decision (ROD) / Permitting

The aim should be to identify a criterion using this Appendix where the average exposure level is not likely to give reasonable cause for annoyance and, in the case of an existing process, the Operator should use BAT to get as close to this as possible. There might be several reasons for excursions proving to be too frequent: (i.e. the average exposure is greater than the atmospheric dispersion modelling predicts, or the peaks are frequent and of high concentration):

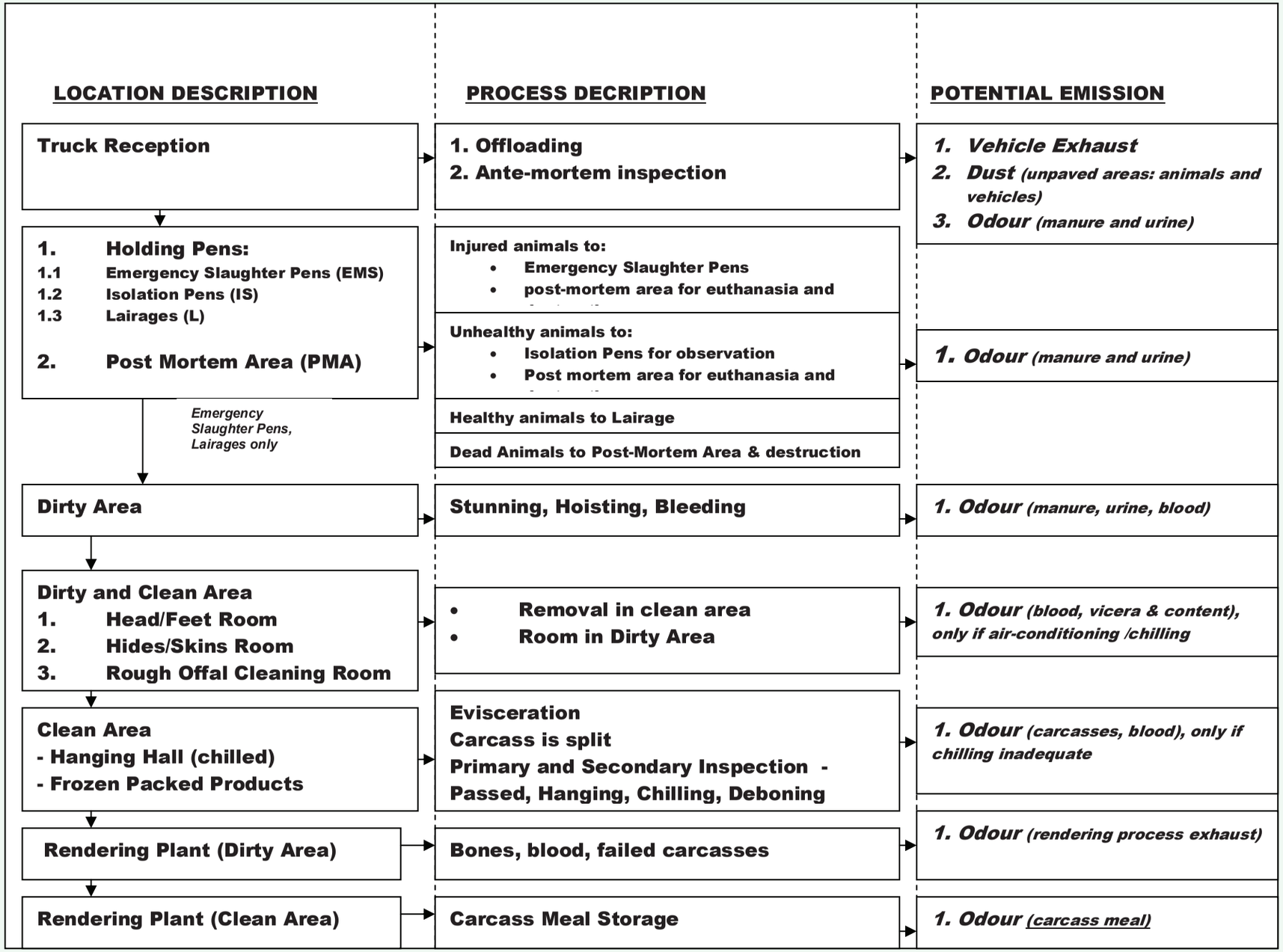
- there might be particularly "difficult" topography which impairs dispersion and brings the plume to ground
- the meteorological data used may not adequately reflect the local situation, for example in a valley subject to inversion conditions, or it may be for a dissimilar area
- the emissions may be very variable and worst case has not been used in the calculations
- there may be fugitive emissions which have not been taken into account.

Other factors, such as the uncertainties in source measurement and in modelling, will also need to be considered in any assessment. Odour exposure criteria cannot be used directly as conditions because compliance is impossible to determine as the measurement of odorants is very rarely possible at such dilute concentrations as are present in ambient air samples and in any case the exposure is averaged over a year.

The emission rate at source is used to calculate the actual ground level concentration. The actual ground level concentration should be compared with the desired ground level concentration which aims to give no reasonable cause for annoyance and the Operator should get as close to this level as possible using BAT. It is however the emission rate which is used as a condition NOT the exposure benchmark itself. Monitoring can then be undertaken to show compliance with the condition.

Continuous monitoring is possible for some odorous substances, but where mixtures are present olfactometry is usually the most suitable means of quantification, unless a suitable surrogate can be identified. Olfactometry is more expensive to undertake than some techniques, hence periodic monitoring – quarterly or half yearly (or according to risk) is usually specified for compliance purposes. A parallel means of ensuring that emissions are fairly constant between compliance checks is to impose a condition relating to a relevant process parameter, i.e. something that can be continuously or frequently checked and which is a surrogate for the emission concentration. This might be pH and circulation rate of scrubber liquor, or flow rate (back pressure) through a carbon bed, for example.

APPENDIX D8 - Figure 1: Conceptual Framework of Airborne Emissions from Red Meat Abattoir



Notes