MEAT SAFETY ACT 2000 (ACT 40 OF 2000)
POULTRY REGULATIONS 2006 (R153 OF 24/2/2006)

POULTRY MANUAL

ABATTOIR LAYOUT AND CONSTRUCTION
1. ABATTOIR LAYOUT AND CONSTRUCTION

1.1 INTRODUCTION

An abattoir is a food factory and its primary aim is to produce a healthy, wholesome and clean product, which is safe for human consumption.

A well-designed and constructed structure is needed to systematically “break” down the bird that is slaughtered. The further the process progresses, the greater the risk of contaminating the product. Prevention thereof is determined by the layout and the flow patterns, which the product follows.

**Hygiene is the prevention of contamination of the product.**

Each function in the slaughter process has a fixed status in terms of “Clean” or “Dirty”. In choosing the premises, this important aspect must be taken into consideration. “Clean” and “dirty” areas are separated by distance, physical barriers and in certain cases by time.

1.2 LAYOUT

The layout of the premises and building must be designed so that the production process moves in one direction without any crossflow of products which may adversely affect the hygiene of the product. Live birds are received at the “dirty” end of the abattoir and meat is out loaded from the clean side of the abattoir.

The flow is from “dirty” to “clean”:

**“Dirty” area**

- Live receiving area.
- Vehicle washbay.
- Shaded holding facilities.
- Ante-mortem veterinary inspection area.
- Emergency facilities for injured birds.
- Post-mortem facilities for dead on arrival birds.
- Hanging area
- Stunning area
- Bleeding area.
- Scalding
- De-feathering area.
- First carcass inspection point
- Room/area for the handling of heads, feet and intestines.
- Areas/rooms where inedible products are handled e.g. feathers.
- Areas where condemned products are handled.
- Cloakrooms, toilets, showers, washing facilities and dining room for “dirty” workers.
- Storerooms.
- Effluent pre-purification plant and holding tanks.
- Disposal facilities for solid waste such as gizzard and intestinal contents.

**“Clean” area**

- Evisceration area.
- Meat inspection area.
- Detain area for suspect carcasses and material.
- Recovery area for the washing and chilling of recovered portions.
- Chiller facilities: Spin chillers, Air chillers, Walk-in chiller for smaller establishments or chest freezer for the very small
- Portioning and packing areas
- Freezing facilities including Gyro and blast freezers for “IQF”
- Palletising area
• Cold storage
• Dispatch facilities.
• Area for the handling of returns if applicable
• Washing bay for meat trucks.
• Office accommodation and ablution facilities for meat inspectors.
• Offices for management.
• Laundry facilities.
• Laboratories.
• Cloakrooms, toilets, showers, wash facilities and dining rooms where to only workers in the clean area has access.
• Store rooms.

1.3 CLEAN AND DIRTY PRODUCTS

Clean products:

All dressed carcasses, portions and meat passed by the meat inspector is regarded as clean. This includes red offal i.e. gizzards, hearts, livers, spleen and necks.

Dirty products:

a) Rough edible offal: intestines, heads and feet, although passed by the meat inspector are regarded as dirty products.
b) Inedible products like feathers are easily identified as not suited for human consumption.
c) Condemned products are those carcasses and portions of meat condemned by the meat inspector/veterinarian which poses a possible health threat and include all the pieces of debris collected during continuous cleaning. Blood is also considered to be a condemned product. Such material must be held under secure conditions until disposed of in accordance with legislation.

1.4 PLANNING

Anyone intending to build an abattoir must pay attention to the following during the preliminary viability study:

(i) Contact the provincial directorate of Veterinary Services.

(ii) Obtain approval in writing for the project from the local authority in whose area the abattoir is to be build. This might be any one of the following:

(a) Municipality Health Department
(b) Department of Environmental Affairs and Tourism
(c) Department of Water Affairs and Forestry
(d) Department of Agriculture Veterinary Services

(iii) Make sure whether the site has the necessary zoning for abattoir use.

1.5 FACTORS TO BE CONSIDERED WHEN CHOOSING A SITE

The choice of a suitable site for an abattoir is most important. The factors listed below must therefore be taken into account when selecting a premises:

1.5.1. Environment

Meat is a foodstuff and must be protected against contamination. No source of contamination should occur in the immediate vicinity where the abattoir is to be build: examples are paint factories, foundries or a sewage farm. Abattoirs are classified as light industries, and have no place in or near a residential area. Because water pollution does occur, the abattoir should be a reasonable distance away from any river. Prevailing winds are also important; eg. it is undesirable to build the abattoir down wind to a large broiler house system.
1.5.2. **GEOLOGICAL STRUCTURE AND FEATURES**

Drainage is affected by the nature of the soil – (sandy or loam), by the water table and the natural slope of the surface.

1.5.3. **SITE DIMENSIONS**

The site must be large enough to allow the abattoir and associated activities to be placed correctly on the site. Provide also for future extensions.

1.5.4. **SERVICES**

*Water*: A adequate supply of potable water must be available. Consideration should also be given to the storage and treatment of water should this be necessary.

*Effluent disposal*: An effective system for the disposal of effluent where necessary or partial purification, must be provided.

*Electricity*: There must be a reliable source of power for heating water as well as to provide for the partial or total mechanisation of the abattoir.

*Transport*: There must be sufficient facilities for the reception of poultry as well as for the removal of products.

*Labour*: The proximity of a labour pool or reasonable access to public transport is also important.

1.5.5. **GENERAL CONSIDERATIONS**

Distance from the production area to the market.

The tendency is to slaughter in the production area and to transport the meat rather than the live poultry. This prevents possible losses through birds dying while transported.

1.6 **ABATTOIR DESIGN AS INFLUENCED BY CONSIDERATIONS OF HYGIENE**

1.6.1. **SITUATION AND ORIENTATION OF FACILITIES**

(i) Refer to the notes on factors to be considered when choosing premises.

(ii) The perimeter must be demarcated by means of a fence with lockable gates in order to control the unauthorised entry of vehicles, persons and animals, thus limiting the spread of infection and contamination.

(iii) The layout of the site should be such that a linear flow pattern can be maintained with live bird reception on one side and the removal of products on the other.

(iv) "Clean" and "dirty" areas must be separated according to their functions as discussed previously.

(v) Factors affecting the situation of an abattoir and allied operations on a site are briefly:

(a) **Prevailing winds**: These must blow from the "clean" side (product dispatch) to the "dirty" side (live bird reception).

(b) **Natural slope**: Rainwater and runoff from the dirty area must not flow into the abattoir during heavy rains, nor must they flow from the dirty to the clean side of the premises. Tanks for the collection of effluent and pre-purification plants must be situated at the lowest point of the site, on the dirty side.
(c) **Water supply:** There is often a need for storage tanks, chlorination tanks and pressure tanks. These must be on the clean side, preferably at the highest point.

(d) **Access roads and staff separation:** If this is required for the relevant grade, the "clean" and "dirty" areas of the premises must be physically separated. Vehicles which offload live birds and loads dirty products are restricted to the "dirty" area and do not go into areas where meat vehicles and staff who handle meat are to be found.

(vi) Surfaces on the site must be paved or grassed. Traffic areas in the case of E Grade abattoirs must at least have a gravel surface to keep them dust and mud free. The traffic zones of larger abattoirs must have a permanent surface. The planting of grass and shrubs creates a pleasant environment and gives the impression that the premises are well managed and cared for.

From the point of view of industrial psychology it has been found that the more attractively a site is maintained, the easier it is for the workers to accept and adjust to the high standards of hygiene expected of them; they are also more likely to do so.

(vii) All paved areas must have a slight slope and must be drained, effective provision must be made for stormwater drainage.

(viii) Vehicle parking areas where birds are offloaded or meat is loaded must have kerbstones and must be drained so that they can be cleaned every day. Dirt which is washed-out into grass is impossible to remove.

(ix) Walkways for staff between the ablution block and the processing plant should be roofed over, not just to protect workers but also to prevent them from entering the working areas with wet clothing.

(x) Specific areas such as collection points for feathers and gizzard contents must be paved, drained and provided with kerbstones in order to prevent contamination of adjacent areas and to allow for regular cleaning.

### 1.6.2 ABATTOIR WORK AREAS

In designing the abattoir it is important to refer once again to the principle of a linear flow pattern.

Ongoing attempts must be made to prevent the contamination of meat by organisms and other contaminants while it moves "forward" in the process of transforming a living bird into meat for human consumption.

This aim can be facilitated by correct internal abattoir design. The layout must eliminate crossflow patterns of people and products.

Here are a few general guidelines:

(i) During processing, product flow must be from dirtier to cleaner areas, zones or rooms. These products must not come into contact with the floor or walls, or even with equipment and must remain within the building until dispatched.

(ii) Drainage must be from clean to dirty, preferably in a concave drainage channel.

(iii) The airflow must be from clean to dirty.

(iv) Product flow lines must not intersect or cross

(v) Back tracking must be avoided.
(vi) Products derived from slaughtering and processing must be removed from the slaughtering area as quickly as possible.

(vii) “Warm” and “cold” working areas must be distinguished.

(viii) Staff must take the shortest routes when moving to their work stations.

(ix) Hand wash basins must be readily accessible to all workers, at a distance not exceeding three metres from any work station where products are handled. Hand washbasins must be available at raised platforms. Where manual equipment is in use, sterilisers must be provided in combination with the hand basins. Taps must be foot or knee operated.

1.6.3 FACILITIES FOR STAFF

(i) Cloakroom facilities, toilets, showers and canteen facilities sufficient for the number of workers on the premises must be provided in terms of the Occupational Health and Safety Act 1993.

(ii) From High Throughput grade abattoirs physical separation is required for the various categories of workers.

(iii) In smaller abattoirs where separate facilities for “clean” and “dirty” workers are not required, the facilities must be situated on the cleaner side of the premises. Where separate facilities are required, they must obviously be situated in the “clean” and the “dirty” areas respectively.

(iv) Staff facilities can be in a free standing building connected to the abattoir by means of a covered walkway. Alternatively they may form part of the main structure. In this case a ventilated lobby must be provided between the slaughtering area and the facilities.

(v) Staff facilities must be planned so that total separation is achieved between cloakroom/shower and toilet/urinal areas. Hand basins or wash troughs with taps controlled not by hand but preferably with the foot or knee must be provided at the exit to the facilities. Numbers will depend on the number of workers.

(vi) With the exception of the smaller abattoirs there must also be facilities for inspection staff. If these staff also perform management functions, only one set of facilities need be provided for management and inspection staff.

(vii) The person in charge should have an office.

(viii) A storeroom for overalls, equipment and clean manual implements normally required for the work must be provided.

(ix) Cleaning agents, soap and chemicals must be stored separately.

(x) The basket system as used at swimming baths is highly recommended as an alternative to the usual lockers, as it allows for greater freedom of movement in the change area as well as for easier cleaning. Stricter control can also be exercised over the contents of the baskets, e.g. food, empty bottles and so on which might be stored together with the overalls.

2. REQUIREMENTS FOR THE REGISTRATION OF POULTRY ABATTOIRS

[Section 11. (1)(a)]

All abattoirs have statutory grading requirements. The higher the grade of the abattoir, the higher the requirements, because a higher throughput increases the risk of contamination.

The throughput determines the basis for the grade of the abattoir. It is regulated as follows:

- Rural Throughput - 50 poultry per day
- Low Throughput - 2000 maximum poultry per day
- High Throughput - More than 2000 poultry per day

A. Throughput and other requirements for grades
2.1 Requirements for rural poultry abattoirs

Considering the requirements set out in Part II B (1) for an abattoir to be graded as a rural poultry abattoir –

(a) the throughput may not exceed fifty units per day;
(b) the premises must be fenced and provided with a gate to control access of people and animals;
(c) a roofed offloading and holding area for live birds must be provided;
(d) it must consist of at least one room, equipped with a dressing rail, in which all the functions regarding the slaughtering and dressing of poultry can be performed hygienically;
(e) if windows are not glazed fly screens must be provided;
(f) doors must be provided –
   (i) where birds enter the abattoir;
   (ii) where carcasses and offal are dispatched; and
   (iii) above mentioned may be the same door if the process is separated by time;
(g) the abattoir must be provided with conveniently placed boot wash and hand wash facilities;
(h) a sterilizer adjacent to a hand wash-basins must be provided;
(i) toilet and hand wash facilities must be provided;
(j) facilities to store items needed in the daily slaughter process must be provided;
(k) the design of the abattoir must allow for future upgrading of the facility; and
(l) chilling facilities to accommodate at least the daily throughput must be provided and the proximity of these facilities must be such as not to compromise hygiene standards and be acceptable to the provincial executive officer.

2.2 Requirements for low throughput poultry abattoirs

Considering the requirements set out in Part II B(1) and (2), for an abattoir to be graded as a low throughput poultry abattoir –

(a) a maximum throughput of two thousand units per day may not be exceeded, provided that the provincial executive officer may determine a lower maximum throughput for an abattoir on grounds of the hourly throughput potential relative to available equipment and facilities as well as chilling capacity;
(b) premises must be fenced and provided with a gate to control access of people and animals;
(c) roofed facilities for offloading and holding of live birds must be provided;
(d) a facility where poultry transport trucks must be sanitized after offloading must be provided;
(e) an equipped room must be available, but if throughput exceeds 100 units per day separate rooms inter-connected by means of hatches only must be available, where –
   (i) poultry is stunned, bled, scalded, defeathered, heads and feet are removed, rough offal is dispatched and meat inspection is done;
   (ii) carcasses are eviscerated, washed, meat inspection is done and where separate facilities must be provided for further inspection and recovery;
   (iii) carcasses are portioned, packed and chilled and meat and red offal are dispatched provided that where the daily throughput is less than 300 birds, this function may be done in the room mentioned in (ii) and where the throughput exceeds 500 birds the air temperature of this room may not exceed 12°C;
   (iv) rough offal is handled, provided that this may be done in a separate area in (ii);
(f) facilities must be provided where feathers and inedible products can be kept under hygienic conditions prior to removal from the abattoir, unless it is removed on a continuous basis;
(g) separate chillers and freezers must be provided for the daily throughput of –
   (i) carcasses, red offal; and
   (ii) washed rough offal;
a personnel entrance to the clean areas of the abattoir must be provided and must be
designed as an ante-chamber for cleaning purposes and must be provided with hand
wash-basins, soap dispensers, hand drying facilities, a boot wash, apron wash, hooks for
aprons and a refuse container and at the discretion of the provincial executive officer,
personnel entrances to other areas of the abattoir need not be provided with an ante-
chamber but must be provided with conveniently placed boot wash and hand wash
facilities at the entrance to such areas;

(i) change room, shower, toilet as well as hand wash-facilities must be provided on the
premises for persons working at the abattoir;

(j) dining facilities must be provided with tables and chairs and must be situated so that
personnel do not sit or lie on the ground or soil their protective clothing during rest
periods;

(k) a storage facility or room for items needed in the daily slaughter process must be
provided;

(l) if an office is required by the owner, a separate room must be provided;

(m) rooms or facilities must be provided for –

(i) storage of cleaning equipment and materials;

(ii) cleaning and sterilization of fixed and movable equipment; and

(iii) sterilization of product crates and storage thereof; and

2.3 Requirements for high throughput poultry abattoirs

Considering the requirements set out in Part II B (1) and (2) for an abattoir to be graded as a high
throughput poultry abattoir –

(a) it must have a maximum throughput which the provincial executive officer may determine
on grounds of the hourly throughput potential relating to available equipment and facilities
as well as chiller capacity;

(b) the premises must be fenced to control access of people and animals and
providing separate gates for clean and dirty functions;

(c) the abattoir and premises must be designed to separate dirty and clean areas and
functions;

(d) roofed facilities for off-loading and holding live birds must be provided;

(e) a facility where poultry transport trucks must be sanitised after offloading must be
provided;

(f) rooms with clean functions and those with dirty functions may only be interconnected by
means of hatches and/or chutes;

(g) the stunning and bleeding area must be physically separated from any other work areas;

(h) separate rooms, where applicable, inter-connected by means of hatches only, must be
provided where –

(i) poultry is scalded, defeathered, heads and feet are removed and meat inspection
is done;

(ii) feathers are collected, placed in containers and kept till removal;

(iii) dry de-feathering and down recovery is performed if so required;

(iv) wax is recovered and stored if so required;

(v) carcasses are eviscerated, red offal is cleaned and meat inspection is done;

(vi) rough offal is handled, washed, packed, chilled and loaded;

(vii) carcasses are detained for further inspection and recovery, where no separate
and approved areas exist in (v) to carry out such functions;

(viii) condemned carcasses and material are kept before removal from the abattoir,
provided that if the condemned material is removed on a continuous basis during
production or a separate dedicated chiller is available for condemned material,
such a room is not required;

(ix) separate hand wash, boot wash and apron wash facilities directly connected to
the condemnation area, must be provided for persons who handle condemned
products referred to in subparagraph (viii);

(x) carcasses are portioned, cut and meat, including red offal, is wrapped;

(xi) in-contact wrapping material, for daily use, is stored;

(xii) wrapped meat is packed;
(xiii) packing material (cartons), for daily use, is stored;
(xiv) cleaning equipment for the daily operation of the abattoir is stored; and
(xv) meat and red offal are sorted and dispatched and the air temperature in this area must not be more than 12°C when meat is handled and dispatched and the dispatching doors must be such that the doors of the vehicles will only be opened after docking;

(i) separate chillers must be provided, for the daily throughput, for –
   (i) chilled or frozen carcasses and poultry meat products as well as red offal; and
   (ii) chilled or frozen rough offal if required;

(j) a personnel entrance to the clean areas of the abattoir must be provided and must be designed as an ante-chamber for cleaning purposes and must be provided with hand wash-basins, soap dispensers, hand drying facilities, a boot wash, apron wash, hooks for aprons and a refuse container and at the discretion of the provincial executive officer, personnel entrances to other areas of the abattoir need not be provided with an ante-chamber but must be provided with conveniently placed boot wash and hand wash facilities at the entrance to such areas;

(k) change room, shower, toilet as well as hand wash facilities must be provided on the premises for persons working at the abattoir and separate facilities must be provided for clean and dirty areas;

(l) dining facilities must be provided separately, for clean and dirty areas, with tables and chairs or benches and must be situated so that personnel do not sit or lie on the ground or soil their protective clothing during rest periods;

(m) office accommodation and ablution facilities must be available for meat inspection personnel;

(n) a store room must be provided for items needed in the daily slaughter process;

(o) office facilities must be separate from bleeding and dressing areas;

(p) suitably equipped rooms and facilities must be provided for sterilization of movable equipment;

(q) a room or rooms for bulk storage of cleaning equipment and chemicals must be provided;

(r) separate bulk storage facilities must be provided for wrapping material and packing material, if both materials are kept;

(s) a storage room for cleaned crates must be provided adjacent to a crate receiving and cleaning facility and directly interconnected to the rooms and areas where needed;

(t) a facility where meat transport trucks must be sanitized must be provided; and

(u) access to a laboratory must be possible.

3. REQUIREMENTS FOR EXPORT ABATTOIRS

An abattoir from which meat or animal products are exported shall at least comply with the requirements for a High Throughput abattoir, as well as any additional requirements as determined by the appropriate authority in the country to which such meat or animal products are to be exported.

4. EXCEEDING THE THROUGHPUT

The Provincial Executive Officer (Senior Manager Veterinary Services) may on application grant written authority that the throughput of an abattoir may exceed the maximum determined in this notice:

The following criteria should be considered when assessing an application for a higher throughput:

Available working space, cold storage, water supply, capacity of sewer system etc.
Proven managerial ability
Ability of applicant to maintain hygiene standards at the abattoir concerned
Effectivity of meat inspection and the correct method of disposing of condemned and inedible material.
6. WATER

6.1. Use of water in the abattoir

INTRODUCTION

The estimated average water consumption of an A grade poultry abattoir can be roughly analysed as follows:

<table>
<thead>
<tr>
<th>DIRTY SIDE</th>
<th>RECEIVING KILLING</th>
<th>SCALDING DEFEATHERING</th>
<th>42%</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLEAN SIDE:</td>
<td>EVISCERATION CHILLING</td>
<td>PORTIONING PACKING</td>
<td>35%</td>
</tr>
<tr>
<td>RENDERING</td>
<td>6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BOILERS</td>
<td>8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABLUTION, LAUNDRY ETC.</td>
<td>7%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VACUUM PUMPS FOR TRANSPORTING PRODUCT</td>
<td>2%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The volume of waste water from abattoirs is 80-85% of the water intake. This waste water typically contains the following contaminated waste materials: blood, bits of meat, fat, gizzard contents and feathers. Each of these waste materials contributes to a high organic load as well as to a considerable amount of suspended material in the waste water.

The management and treatment of waste water is a specialised subject and will not be dealt with here.

6.2. LEGAL ASPECTS REGARDING THE USE OF WATER IN ABATTOIRS

Three Acts in particular have relevance to the application of water in an abattoir:

The Abattoir Hygiene Act 1992 (Act 121 of 1992) and the Standing Regulations in terms of this Act

A water supply of at least 15 litres per poultry slaughter unit must be available 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:

(a) there are no coliform organisms present;

(b) it contains no more than 100 viable microorganisms per millilitre.

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 which the Director: Veterinary Public Health may lay down from time to time.


This Act and its Amendment regulate the use of water for industrial purposes, and abattoir owners are advised to obtain a copy of this Act and to study it carefully, especially the Amendment.

Bye-laws issued by local authorities

Abattoir owners must familiarise themselves with the bye-laws issued by the relevant local authority.

6.3. GUIDELINES FOR THE TESTING OF WATER

The following guidelines have been laid down by the Director: Veterinary Public Health in respect of bacteriological and chemical tests on water used in abattoirs.

High Throughput poultry abattoirs

(a) Bacteriological testing every month.

(b) Chemical testing every six months.

Low Throughput poultry abattoirs

(a) Bacteriological testing once a year.

(b) Chemical testing once a year, except where water comes from a borehole in which case it must be tested twice a year, in the wet and the dry season.

The aim of regular water testing is to ensure that water used in abattoirs complies with the requirements laid down in Regulation 2 of Part III of the Standing Regulations.

Rural Throughput poultry abattoirs

Potable water should be used in these abattoirs

User code, SANS 241 - 1984 "Specifications for water for domestic use" is a guideline

(a) Physical requirements:

   Colour - The colour must not exceed the following:

   Recommended limit : 20mg/l platinum
   Maximum permissible limit: Not specified

   Smell and taste - The smell and taste must not be objectionable.

(b) Chemical requirements:

   The pH-value must be within the following limits:

   Recommended limit : 6,0 min. 9,0 max.
Permissible limit:: 5,5 min. 9,5 max.

The conductivity of water must not exceed the following:

Recommended limit: 70 mS/m

Permissible limit:: 300 mS/m

The macro-determinants (macro-constituents) of water must meet the requirements laid down in column 2 or 3 as applicable.

**TABLE 1 – MACRO-DETERMINANTS**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determinant, mg/l</td>
<td>Recommended limit</td>
<td>Maximum permissible limit</td>
</tr>
<tr>
<td>Total hardness</td>
<td>300 max.</td>
<td>650</td>
</tr>
<tr>
<td>Magnesium</td>
<td>70 max.</td>
<td>100</td>
</tr>
<tr>
<td>Sodium</td>
<td>100 max.</td>
<td>400</td>
</tr>
<tr>
<td>Chloride</td>
<td>250 max.</td>
<td>600</td>
</tr>
<tr>
<td>Sulphate</td>
<td>200 max.</td>
<td>600</td>
</tr>
<tr>
<td>Nitrate + Nitrite</td>
<td>6 max.</td>
<td>10</td>
</tr>
<tr>
<td>Fluoride</td>
<td>1,0 max.</td>
<td>1,5</td>
</tr>
<tr>
<td>Zinc</td>
<td>1,0 max.</td>
<td>5,0</td>
</tr>
</tbody>
</table>

The micro-determinants (micro-components) of the water must meet the requirements laid down in column 2 or 3 as applicable.

**TABLE 2 – MICRO-DETERMINANTS**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determinant, µg/l</td>
<td>Recommended maximum limit</td>
<td>Maximum permissible limit</td>
</tr>
<tr>
<td>Arsenic</td>
<td>100</td>
<td>300</td>
</tr>
<tr>
<td>Cadmium</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Copper</td>
<td>500</td>
<td>1000</td>
</tr>
<tr>
<td>Cyanide</td>
<td>200</td>
<td>300</td>
</tr>
<tr>
<td>Iron</td>
<td>100</td>
<td>1000</td>
</tr>
<tr>
<td>Lead</td>
<td>50</td>
<td>1000</td>
</tr>
<tr>
<td>Manganese</td>
<td>50</td>
<td>1000</td>
</tr>
<tr>
<td>Mercury</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Phenol compounds</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Selenium</td>
<td>20</td>
<td>50</td>
</tr>
</tbody>
</table>
The water must not contain any other substances in concentrations which make it unsuitable for domestic use. If radio-activity is present, it must be within the limits laid down by the International Commission for Radiological Protection.

The abattoir owner must keep meticulous records of the results of bacteriological and chemical tests. All expenses incurred are the responsibility of each individual abattoir owner.

(c) Bacteriological requirements

When tested according to the methods in Column 4 of Table 3, the water must satisfy the requirements in column 2 or 3 as applicable.

TABLE 3 - BACTERIOLOGICAL LIMITS

<table>
<thead>
<tr>
<th>Property</th>
<th>Recommended maximum limit</th>
<th>Maximum permissible limit</th>
<th>Test method subdivision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total count of coliform bacteria per 100 ml</td>
<td>Nil*</td>
<td>5</td>
<td>5,2</td>
</tr>
<tr>
<td>Count of faecal coliform bacteria per 100 ml</td>
<td>Nil</td>
<td>Nil</td>
<td>5,3</td>
</tr>
<tr>
<td>Standard plate count per millilitre</td>
<td>Not specified</td>
<td>Not specified</td>
<td>5,4</td>
</tr>
</tbody>
</table>

* (a) If any coliform bacteria are found in a sample, take a second sample immediately after the tests on the first one have been completed; this sample must be free from coliform bacteria; and

(b) a maximum of 5% of the total number of water samples from a given network tested per year may contain coliform bacteria.

7. Disposal of abattoir effluent

The volume of waste water from abattoirs is 80 – 85% of the water intake. This waste water typically contains the following contaminated waste material: blood, bits of meat, fat, gizzard contents, urine and dung. Each of these waste materials contributes to a high organic load as well as a considerable amount of suspended material in the waste water.

The management and treatment of waste water is a specialised subject and professional advice from consulting engineers is essential.

Most abattoirs including large ones make use of municipal sewerage systems. Where these facilities are not available alternative arrangements must be made in consultation with officers of the Department of Water Affairs. Care must in all cases be taken to avoid contamination of natural streams and water sources.

Removal of as much of the solid waste in the effluent is essential in making further processing
of effluent more manageable. Excessive amounts of solids in effluent may lead to exorbitant
levies by municipalities or the overloading of systems on the abattoir premises.

In a system where solids are removed effectively, the remaining fluid may be disposed of in a
percolation system (French drain) or used to irrigate lands.

It is important that sewerage from toilets are not mixed with abattoir effluent but is channelled
to a septic tank system associated with a French Drain.

7.1. SEPTIC TANK SYSTEMS

Based on a CSIR technical guide K86 of the Institute
for Water Research

A septic tank system usually consists of two main components:

1. the septic tank
2. the final disposal system, that is usually an underground seepage furrow.

Each of these components has specific functions and should be designed accordingly

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
setting to the bottom or collecting at the surface (float). This results in the formation of three distinct
layers:
- 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 liquification of the solids with associated gas
formation – thus reducing the solids volume.

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.

Designing requirements

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

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

Public Health aspects of septic tank systems
In built 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 derived from bore holes, it is usually unwise to make use of a septic tanks system.

**Combined and separate disposal systems**

Two types of disposal systems are in use:

1. A separate system for the ablation facilities (cloakrooms, toilets and kitchens) utilizing a septic tank and a separate or common soil percolation system
2. 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 of the same common soil percolation system

**Designing criteria**

1. **Volume sewerage water**

   Abattoirs require a water supply of at least 15 liters per poultry slaughter unit. The water must be available at an effective pressure and be protected against pollution.

   The estimated average water consumption at an A-grade abattoir can be subdivided into:

<table>
<thead>
<tr>
<th>Description</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiving, killing and de-feathering</td>
<td>42%</td>
</tr>
<tr>
<td>Slaughter and chilling</td>
<td>35%</td>
</tr>
<tr>
<td>Rendering</td>
<td>8%</td>
</tr>
<tr>
<td>Boilers</td>
<td>8%</td>
</tr>
<tr>
<td>Ablution</td>
<td>7%</td>
</tr>
</tbody>
</table>

   The volume of effluent is approximately 80 – 85% of water required.

   Typical abattoir effluent contains blood, pieces of meat, fat and gut. Each of these contributing to a very high organic load.

2. **Septic tanks**

   (a) **Location:**

   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 200 mm over the system.

   (b) **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.

   (c) **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.
(d) Inlet, outlet and inter-compartment arrangements:

Figure 1 indicates the positioning of the above in terms of the water level. To accommodate the scum accumulation, the distance between the waterline and the roof of the tank should at least 20 percent of the water depth.

(e) Access and ventilation:

The different compartments components should be accessible for inspection and maintenance. The location of man holes 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.

(f) 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.

Design and construction of soil percolation system

(a) Location:

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

(b) 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 influences the absorbing ability. The larger and more uniform the particles, the faster the percolation rate. Yellow and reddish-brown soil usually have good absorption quality, whereas a dull-gray (high clay content) has not

(c) 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 layer, covered with impervious strata will require a deep trench, while the permeable topsoil, with permeable sub-soil will call for shallow trenches.

(d) Trench construction:

Trenches should be constructed along the contours. Where two 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 6 mm to 75 mm 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 150 mm 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 m it will become necessary to provide an open jointed distribution pipe.

Figure 2 illustrates a typical percolation trench. The trench should be approximately 4 m in length for every 1000 liters given average absorption of the soil

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 lifetime of the furrows considerably.

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

Fig. 6. Inlet and outlet arrangements.
Fig. 8 Details of trench construction.

CSIR Technical Guide K86