

DESIGN AND LAY OUT OF ABATTOIR & GUIDELINES FOR MODERNISATION OF SLAUGHTER HOUSES

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Abattoir is a modern facility intended for humane slaughter and dressing of food animals, encompassing processing and preservation of wholesome meat, utilisation of by-products, hygienic disposal and treatment of solid and liquid waste. In many of the developing countries, modern scientific infrastructure facilities for wholesome meat production are scarce. Even in slaughter houses owned by local bodies, veterinary meat inspection is not enforced and as a result of which contaminated and diseased tissues are being sold to public. The incidence of food borne infections and intoxications is showing an upward trend. Highly valuable by-products are either wasted or under-utilised because of lack of facilities. The discharge of highly putrescent slaughter wastes without any treatment aggravates environmental pollution.

A well designed and constructed structure is essential for the production of healthy, wholesome and clean meat, which is safe for consumption. Meat derived from a healthy animal is safe and free from contaminants. However, the process of slaughter adds the risk of contamination to meat. Prevention thereof, is determined by the layout, flow pattern and management of the abattoir.

A modern abattoir should serve the following objectives:

1. Humane slaughter of healthy food animals
2. Hygienic production and processing of meat
3. Effective separation of clean and dirty slaughter operations
4. Ensuring the safety and wholesomeness of the products through veterinary meat inspection
5. Utilisation of edible and inedible by-products
6. Ensure environmental safety through treatment and disposal of solid wastes and effluents.

Criteria for site selection

In most of the developing countries, communities prefer fresh meat, which will be consumed within 6 - 8 hours of its production. It is, therefore, preferable to establish abattoirs near to the meat markets in order to minimise costs and time on transportation of the carcasses. The choice and preferences of the community are major factors in determining whether a single or multi-species abattoir is to be established. In many countries it is a common practice to drive the animals on hooves for long

distances before they reach abattoirs. Such practice is not only uneconomical and detrimental to the health of the animals but also affects the quality of the meat adversely. Therefore, it will be advantageous to include refrigeration facilities for storing the meat and to establish the abattoir near the livestock markets. It is more economical to transport the meat rather than the live animals and to locate the abattoir away from urban proximity where the land cost will be much cheaper. In general, certain other aspects also need to be considered while selecting the site for an abattoir.

Site should preferably be away from urban dwelling to avoid complaints about smell and noise.

1. No source of contamination should occur in the environment in which the abattoir is established.

Eg: paint factory, foundry, sewage farm, river or residential area.

2. Should be away from airfields to prevent possible bird strikes and damage to aircrafts.
3. Should have proximity to livestock markets to ensure availability of animals for slaughter and to reduce expenses on transportation.
4. Must be large enough to accommodate the abattoir and allied activities to be correctly situated and oriented and for future expansions.
5. Lairage must not be situated on higher ground than the abattoir, nor must they be closer than six metres.
6. Adequate supply of potable water should be ensured.
7. A reliable source of power, preferably three phase, is essential.
8. Consider any religious taboos or sentiments in the locality against the slaughter of any species of animals.
9. Consumer preferences for meat to determine whether single or multi-species abattoir is to be established.
10. Separate slaughter halls, hanging rails and storage facilities may be considered for slaughter of different species of animals.
11. Accessibility to transport communication.
12. Availability of labour force near the abattoir.

13. A level area with a gentle slope may be preferred than very steep area.
14. The subsoil should be firm and suitable for construction of the abattoir.

General guidelines for the design of abattoir

The components of the abattoir have to be planned on the basis of local requirements and the type of abattoir to be established. A small-scale abattoir intended for use of a small community/village/panchayat has to be simple, cost effective, hygienic and easy to manage. As far as possible, locally available materials should be used for the construction. Though it may not be necessary to have chill rooms and freezers for such abattoirs, it is essential that all provisions should be included to achieve the best possible standard of hygiene and meat inspection.

The pre-slaughter care of animals is of paramount importance in improving the keeping quality of meat. Transportation of the animals should be carried out in comfortable trucks as far as possible. However, if the animals are available near the abattoir, it may well be brought on hooves. A comfortable lairage facility for providing rest to the animals and for the conduct of ante-mortem inspection is an essential component of all types of abattoirs. While designing the abattoir, facilities for humane slaughter by stunning should be included. In certain areas, there will be objections to the use of stunning. This objection is mainly based on the apprehension that the animal dies as a result of stunning. It is worthwhile to educate the public on the advantageous of stunning in making the animal unconscious before bleeding and in easy control of the animal. Facilities for hauling up the animal for effective bleeding and to raise the carcass on overhead rails for dressing may be provided by manual/electric hoists depending upon the number of kill. Boning and processing facilities are to be included only in places where such activities are planned in the abattoir. It is essential that the processing area be clearly separated from the killing floor.

The areas of dirty and clean areas of operation should be clearly demarcated and separate group of workers should be employed in such areas to prevent possible contamination. Facilities like wash basins, sterilizers, changing rooms, toilets and other amenities to ensure high standards of hygiene should invariably be provided.

Utilisation of edible and inedible by-products is a key factor in determining the cost effectiveness of the meat industry. It not only enhances the revenue but also helps in recovering and salvaging valuable animal protein and in prevention of environmental pollution. Effluent treatment should be an integral part component of the abattoir.

Since the safety and quality of meat can only be assured by effective veterinary meat inspection, the design should include all facilities for ante and post-mortem inspection. Veterinary

meat inspection should be made mandatory in all abattoirs wherever this is not included in the regulations. Meat inspection authority is veterinarian in all developed countries.

It is essential to ascertain the number of animals to be slaughtered, species, number of working days, working hours, marketing facilities and anticipated meat requirement of the community before finalising the design of the abattoir.

Abattoir work areas

In designing an abattoir, the principle of linear flow pattern is of utmost importance to prevent contamination of carcasses and meat. The layout must eliminate cross flow patterns of people and products.

1. 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.
2. Drainage must be from clean to dirty area.
3. The airflow must be from clean to dirty.
4. Product flow lines must not intersect or cross.
5. Backtracking must be avoided.
6. Products derived from slaughtering and dressing must be removed from the slaughter area as quickly as possible. Heads and skins must be removed immediately after dressing without coming in contact with clean areas.
7. Staff must take the shortest routes when moving to their work areas.
8. Hand wash basins must be readily accessible to all workers at a distance not exceeding three metres from any workstation.

Components of an abattoir

Lairage

Lairage is an area for providing rest to the animals arriving for slaughter. Bruises and injuries occur generally during unloading of animals at the lairage. In order to prevent such injuries, it is essential to provide non-slippery unloading platform or ramp having an easy gradient. An understanding of the behavioural patterns of livestock is essential in designing the lairage. Animals generally show reluctance to climb down rather than an ascending ramp. They prefer to follow one another and show reluctance to move from light to darkness.

The lairage should be large enough to hold two days kill of livestock. The detention of animals in lairage should, under no circumstances, exceed 72 hours because lengthy detention will adversely affect the health of the animals and the quality of meat. It will also result in migration of the intestinal flora to other tissues and development of disease because of the lowered resistance.

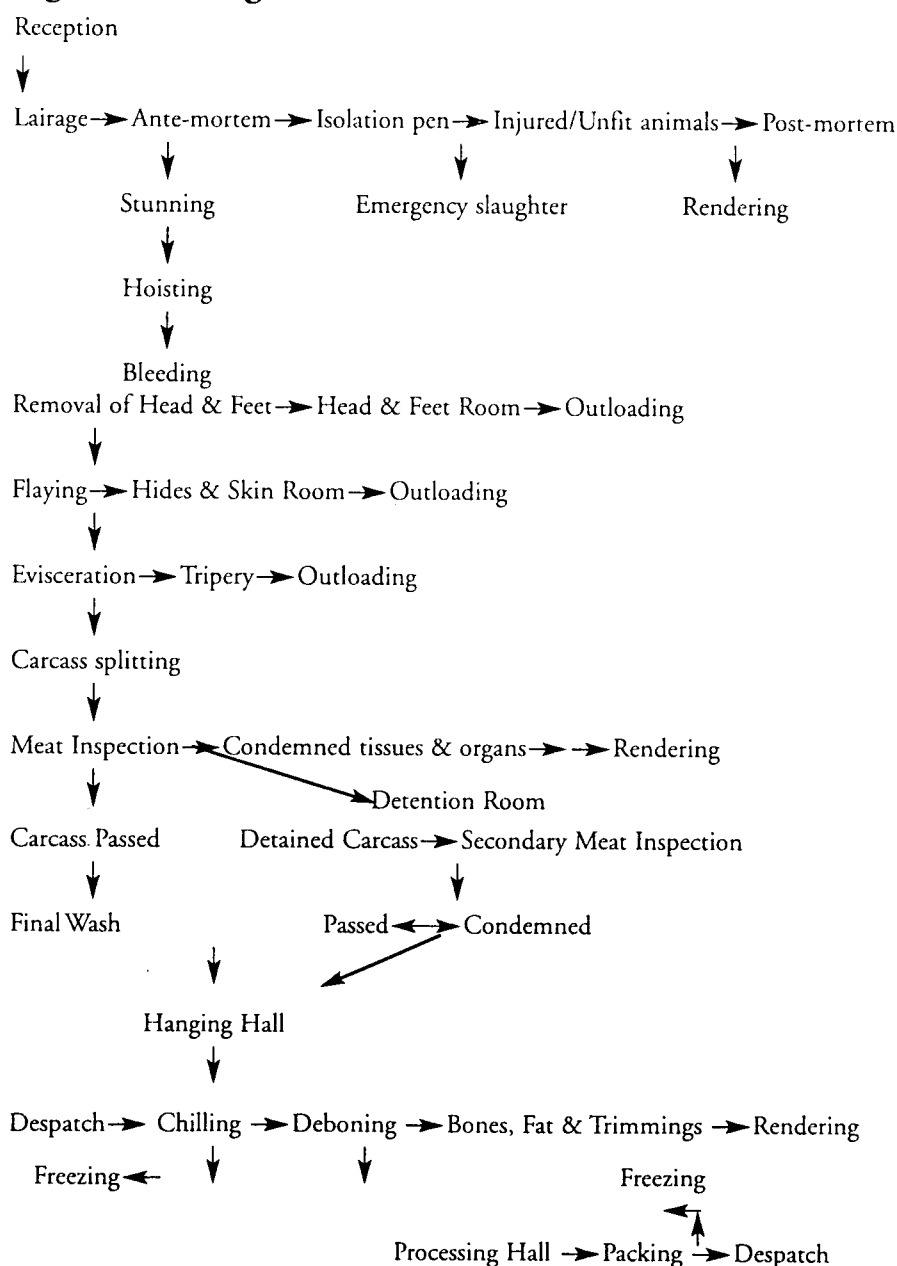
The design of the lairage should be simple. As far as possible inexpensive locally available materials should be used for its

construction. The floor of the lairage should be hard, impervious, non-slippery and should slope towards a drain. The roofing should protect the animals from direct solar radiation and rain. Galvanized iron sheets/light roofing materials/aluminium sheet/thatch may be used as roofing materials at such heights that will permit maximum air movement and ventilation. The side walls may be constructed with either laterite or bricks to a height of 1.5 metre. In areas where timber is available at low cost, timber slats may be used instead of bricks for side protection. Water troughs should be provided in all pens and drinking water should be made available

at all times. Feeding of the lairaged animals is required only when the detention period is longer than 18-24 hours. The lairage space required may be calculated at the rate of 1.75 sq. metre per cattle, 0.35 sq. m per pig and 0.25 sq. m per sheep/goat. It is preferable to provide loose pens for all species of animals in the lairage. However, tie up facilities may be provided for aggressive and horned cattle. The livestock races leading to the slaughter house should not permit turning of the animals.

Components of an Abattoir

Fig.1. Flow diagram of abattoir



The basic components of a slaughter house will comprise of:

Lairage with facilities for tie up and drinking water, drain, Stunning pen / Halal facility for restraining the animals, Facilities for Bleeding and collection of blood,

Hoist (electric or manual) and bleeding rail for raising the animal from the stunning area and for effective bleeding, Stainless steel dehiding cradle for keeping the carcass above the floor level and to remove the hide from legs and ventral area,

Hoist for raising the carcass from the dehiding cradle and to place it on the dressing rail,

Overhead rail system, preferably flat iron bar held on rail hangers with supports of steel beams and columns, beef roller trolleys with bearing and stainless steel hooks,

The overhead rail dressing will provide facilities for dehiding, removal of pluck, evisceration, splitting, meat inspection, washing of the carcass and final despatch. It is important to dress the carcass on the rail in order to effectively separate the unclean and clean operations and for safeguarding the carcass from contamination. Stainless steel offal barrows should be provided to collect the hide, stomach, and intestines and condemned materials and remove them from the slaughter floor to the rooms provided for their treatments. Offal inspection table with facilities for hanging the offals for inspection is necessary for effective veterinary inspection. High pressure washing system will be very useful in washing of the carcasses and for cleaning the floor of the slaughter house.

The slaughter house should also have separate rooms for storing the blood, skin/hide, tripe for cleaning the stomach and intestine, store room, clock room for workers with toilets, and Veterinary Surgeon's room.

The floor should be concrete and additionally coated with epoxy based chemical treatment to ensure hygienic conditions. The walls should be either laid with glazed tiles or epoxy-based coating for joint-free surface. Drains are important component, which should lead to the Effluent treatment plant. The liquid wastes are treated in the ETP. Solid wastes like dung, intestinal content, stomach content etc. could be treated in a biogas unit.

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found out that feeding of milk and sugar to pigs during 72 hours rest, reduced the loss of carcass weight from 7% to 3% and that of live weight from 30% to 8%.

The notion that meat is the flesh obtained from a carcass after slaughter is misplaced. The conversion of the tough locomotor and supporting organ called muscle to the edible and tender meat is the result of a complex process, which involves various endogenous chemicals, enzymes and ions acting in tandem. Pre-slaughter stress and the associated physiological changes often hinders with this delicate system producing inferior quality meat. Also it is imperative that the animals that sacrifice their lives to become the food for mankind should be

Wherever necessary, Rendering plants may be established for effective utilisation of by-products and wastes. In large slaughter houses, the whole slaughter and dressing operations may be done on the rail. The choice of deciding on what type of modernisation is left to the local self-governments depending on their financial competency. Under no circumstances, the responsibility for modernisation should be entrusted to agencies that have no expertise or knowledge about the various components and their specifications. It is unfortunate that such agencies undertake the work and fail miserably in functioning such plants. It will also be essential to train the butchers and the staff for utilising the modern facilities effectively. A functional guarantee should be sought from any agency, which undertake the work on modernisation. The modalities to be observed in modernisation will comprise of appointing an expert as a Consultant for preparing a project report. This has to be done by a resolution of the Council of the Panchayat or Municipality/Corporation. The Consultant should have previous experience in preparing and implementing functional projects and a thorough knowledge on modern slaughter houses and abattoirs. Once the project report is ready, the authorities should hold detailed discussions with the consultant regarding the implementation of the project. Tender schedules and notices should be prepared and published. The work should be awarded to agencies, which have successful previous experience in implementing such projects. The Consultant should have an effective overall supervision of the work. It is seen that many of the Panchayats / Municipalities are spending huge amounts on civil construction especially on RCC roof and beams. In most cases, the roof could be simple truss work. Funds required on providing overhead rail system, equipment and machinery should not be spent on unnecessary civil constructions. The ETP should be very effective, wherever needed, forced oxidation tanks should be provided in addition to anaerobic treatment.

With the rich experience and expertise in this area of specialisation to my credit, I am now providing Consultancy services for preparing project reports and for turnkey implementation of such projects.

treated with the maximum possible care and humaneness. Withstanding all these factors it is a known fact that pre-slaughter care and management of slaughter animals is an area that is often neglected in our country resulting in the production of inferior quality meat. The awareness about its importance is often found lacking among producers, transporters and slaughterers alike. Even though legislations exist regarding transport of animals, it is a common sight to see them openly flaunted in our roads. What is needed is educating the people involved, enactment of new legislations together with strict implementation of existing legislations.