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Lecture title: Meat plant construction and operation

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Summary: The local authority owns the buildings and also responsible for certain essential services such as sanitation ,feeding of animals in the lairage , provision of meat inspection service

Meat plant construction and operation

In most countries abattoirs are either privately owned or provided by the local authority

The local authority owns the buildings and also responsible for certain essential services such as sanitation ,feeding of animals in the lairage , provision of meat inspection service

In some instances the slaughtering is carried out by contractors staff and in others by municipal employees , a situation which gives greater control over the quality of the employees and their methods.

Construction, layout and equipment must all be geared to promote efficient and hygienic operations

The first step in planning an abattoir is to ascertain the:

- ultimate maximum daily kill of each class of animal - proposed disposal
- treatment of the edible and inedible by products.

The actual system of operation must also be determined ,bearing in mined local conditions .it may comprise a complete meat plant including full processing facilities on one or more floors or an abattoir adapted only for slaughter and dressing.

Sits:

A suitable site for an abattoir should have the following main facilities: 1-water and electricity supply (10000 L/ton dressed carcasse weight daily).

2-mains sewerage.

3-contiguity with uncongested road and rail systems.

4-proximity with public transport.

5- proximity to supply of varied labour.

6 freedom from pollution from other industries, odours, dust ,smoke ,ash.

7- ability to separate clean and dirty area.

8-freedom from local housing and other development to avoid complaints about noise and smell

9-good availability of stock nearby.
10-ground suitable for good foundations ,including piling and freedom From flooding.
11-sufficient size for possible future expansion.

In general ,urban sites should be avoided ,rural and nominated industrial sites are preferred.

In order to evaluate the efficiency of the slaughterhouse must consider the following:
• Product flow
• Safety of workers
• Food safety / cross-contamination
• Movement of supplies or waste
• Supervision

Water :

Mains water supply usually provides an ample supply of potable water.
Hot and cold water are necessary ,the hot from a central heating system ,at not less than 82˚C.
On-site water storage tanks holding at least one day consumption are usual .
272 L/day/bovine , 45 L/day/sheep

Electricity:

Industrial three –phase electricity should be supplied and a stand – by generator installed

Area size:

Careful consideration must be given to the size of the site ,with allowance for various building and traffic circulation .

Completely separate routes for stock and meat vehicles must be provided ,approach roads should be at least 6.10 m wide.

- Small abattoir (up to 30000 unit/year) 1-2 acre
- Medium abattoir (50000 unit/year) 2-4 acre
- Large meat plant handling over 100000 unit annually need 4-6 acre

Acre = 4000 m2

Overall layout:

There must be adequate partition between the clean and polluted section ,with completely separate entrances and exits for traffic involved .
Lairage accommodation should be sited away from main roads

The direction of prevailing winds should be taken into account in the siting of any inedible by-products department in relation to fresh meat areas.

It is recommended that inedible rendering is restricted to large factories located outside the meat plant ,and that all material is conveyed to them under approved security conditions

Lighting:

Adequate natural or artificial lighting must be provided throughout the meat plant , The type of lighting must not distort colors.

It is recommended that overall intensity should not be less than :

- 540 lux (50 foot – candles) at all inspection points
- 220 lux (20 foot – candles) in work rooms
- 110 lux (10 foot – candles) in other areas

Ventilation:

Adequate ventilation must be provided to prevent excessive heat ,steam and condensation

Ventilation prevent the accumulation of odours ,dust etc., but it should not cause draughts and lead problems to staff.

Opening ventilators and windows should be screened and internal window sills sloped

Floor and wall finishes :

All part of meat plant must be easily cleaned .this means that all floors and walls should be non – toxic and non – absorbent ,the floor also non-slip.

The floors of slaughterhouse should have gradients of 50 mm in 3 m and be coved at wall junctions.

It is generally recommended that walls should be faced with a smooth ,hard , impervious material up to a height of not less than 3 m from the floor.

Equipment design:

The design and location of equipment should be such as to allow for ease and efficiency of cleaning and disinfection

Pest control :

The ingress of birds ,rats ,mice and insects such as flies and cockroaches can cause serious problem ,in addition to dirt ,they carry food poisoning organisms ,even those responsible for zoonoses.

An effective final means of birds control is the use of narcotic baits (alphachloroalose and pentobarbitone sodium baited on wheat with a sticker oil . e.g. risella oil) .

Control is effected by ensuring cleanliness , absence of food scraps and the use of specialist pest control firms .

plant location and design are important factors in prevention of fly infestation e.g. the manure bay must be sited away from meat areas

Building :

There are various form of abattoir design ,but the following are considered necessary in a modern meat plant dealing with a throughput in excess of 100000 units/year:

1- Lairage :

Lairage space sufficient for three days supply of cattle and two days supply of sheep . it provided by roof to protect animal and staff particularly during identification ,handling and sorting of stock ,off-loading dock should about 1.2 m high to permit careful off-loading .

The pen size for cattle (loose) 2.3 – 2.8 m2 and 3.3 m2 for tied cattle ,for sheep and calves 0.7 m2 ,also provide by water and feed (forage) and well ventilated .

Ante mortem care of the food animals

1- Resting :

It is necessary to rest animal before slaughter, an inadequate rest period may reduce the keeping quality of the meat due to incomplete development of acidity of the muscles and the early invasion of the system by **putrefactive bacteria** from the intestinal tract .

These bacteria are the essential cause of bone taint in cattle . The meat animals slaughtered while exhausted appear dark in color due to incomplete bleeding .

A period of 12-24 hours with a maximum of 36 hours detention and rest in a lairage is therefore essential before slaughter.

Cattle that subjected to stress for short period may recover rapidly , and those subjected for a long period may take several days to regain physiological normality .

In general it has been found that rest before slaughter is essential for the production of meat of good keeping quality

2- Watering:

Animals should receive ample of drinking water during their detention as this serves to lower the bacterial load in the intestine and facilities removal of the hide during dressing

3-Fasting :

Beside the need for physiological normality in animals before slaughter ,there is also a duty to insure that they are not slaughtered with full stomach.

These requirements serve to prevent carcass contamination . remembering that the fasting period begins at the animal leaves the farm .Don't fasting for long period ,may be cause *loss of the body weight* , Moreover it has been recorded that the fasted animals bled better, easier to dress and have brighter color .

1- **Slaughter hall :**

The transference of animals from Lairage to slaughter hall is easy if the abattoir is well designed .

Many abattoir spray the cattle from above as they move along race connecting the mustering pen and stunning pen and by horizontally directed water sprays fitted on both sides of race to clean the bellies ,legs and feet.

The size and type of slaughter hall for cattle depended on which of slaughtering system is adopted ,but in all cases it should be an open hall with good floor space and well ventilated and lighted .there are two area in slaughter hall ,stunning area and bleeding area

Stunning prior to bleeding:

Most countries have legislation requiring that animals are rendered unconscious (stunned) by a humane method prior to bleeding.

Exceptions are made for religions which require that ritual slaughter without prior stunning is practised, provided the slaughter method is humane.

Stunning also makes sticking (throat-slitting) less hazardous for the operator. The animal must be unconscious long enough for sticking to be carried out, and for brain death to result from the lack of blood supply.