GENERAL FINDINGS (1)

• Many slaughterhouses are now located in densely populated urban areas, due to the expansion of cities and towns.
• Road access and transportation is often difficult.
• Municipal slaughterhouses:
  - often old and in poor condition
  - extremely poor process control
  - provide products to a wide range of domestic market outlets.
• In contrast, private slaughterhouses:
  - typically operate modern slaughter-lines
  - good process control
  - focussed on meeting the demands of niche markets (export, supermarket, or processed meat sectors)
GENERAL FINDINGS (4)

- Advice and information provided by government officials (central and local) is often questionable, because:
  - They spend very little time actually observing slaughtering operations and practices.
  - In many countries those accompanying us were learning as much as the Study Team.
  - There is poor understanding of the process and business complexity of the sector.
  - The focus tends to be on veterinary and financial issues rather than public health.
- Whilst the control of the formal sector is often debated, the extensive informal sector continues uncontrolled with potentially significant health risks.

INFRASTRUCTURE (1)

- Access roads are poor and congested resulting in considerable transport difficulties.
- Municipal slaughterhouse infrastructure is old and obsolete:
  - Lack of loading and unloading facilities.
  - Old and poorly maintained buildings.
  - No hygienic envelope (open-air processing).
  - Availability of water and electricity is poor.
  - Lack of hot water for process and hygiene purposes.
  - Lighting is very poor (night-time processing is common).
  - Whilst some floor and wall surfaces are adequate, they fail hygienically due to poor maintenance.
  - Equipment that comes into contact with edible product is unhygienic.
  - Design and layout of the facilities prevent effective upgrading.
INFRASTRUCTURE (2)

Poorly maintained buildings and no hygienic envelope.

INFRASTRUCTURE (3)

Very poor lighting during night-time slaughter operations.
Presentation 2 – Conditions at Slaughterhouses

INFRASTRUCTURE (4)

Slaughter and processing areas can be highly congested.

Batch processing at municipal slaughterhouse.

INFRASTRUCTURE (5)

Poultry slaughter and processing.
INFRASTRUCTURE (6)

Poor delivery and dispatch conditions.

OBSERVATIONS – PROCESS CONTROL (1)

- Municipal Slaughterhouses generally lack the ability to implement basic process control.
- Post mortem and hygiene procedures allow cross-contamination due to:
  - The large number of businesses and workers involved in the slaughter and fifth quarter processes.
  - Parallel rather than serial processing meaning many carcasses and fifth quarter products are simultaneously at the same stage of processing.
  - Many processes carried out on the floor.
  - Many products are dragged across the floor from one point to another for further processing.
- It is also difficult to recover waste products efficiently.
OBSESSIONS – PROCESS CONTROL (2)

• Larger slaughterhouses have poorer process control:
  - The volumes of animals being processed in a short period of time.
  - A very high number of functional businesses and people involved in owning, slaughtering (flaying etc), offal recovery & processing, transport and service provision.
  - Low ratio of municipal officials and veterinarians to animals processed.

• Smaller slaughterhouses have superior process control:
  - A higher ratio of municipal officials and veterinarians to animals processed.
  - The lower number of functional businesses and people involved.

OBSESSIONS – PROCESS CONTROL (3)

Cross contamination issues at a slaughterhouse.

Example of the difficulties of implementing good process control.
ANIMAL WELFARE (1)

- Municipal Slaughterhouses lack many basic animal welfare practices and:
  - Slaughter of pregnant and sick animals occurs.
  - Walk and slaughter animals in areas where carcasses are being disassembled.
  - Stunning is generally not practiced (all species).
  - Pithing was observed in some countries (worker safety).
  - Slaughter process often involves stressful animal handling practices (dragging, toppling and live sticking while fully conscious).

ANIMAL WELFARE (2)

Weak animals waiting for slaughter.

Animals waiting amidst the slaughter operations.
HYGIENE AND SANITATION (1)

- Municipal Slaughterhouses lack basic facilities including:
  - Sanitary amenities for staff and employees
  - Clean protective clothing for workers
  - Adequate lighting
  - Provision of hot water, cleaning and disinfection equipment and consumables
  - Facilities to keep edible material off the floor (particularly offal)
  - Facilities for collection transport and disposal of pathological waste

HYGIENE AND SANITATION (2)

- Human waste on banks of drainage channel adjacent to slaughterhouse
- Poor hygienic conditions at poultry slaughter
HYGIENE AND SANITATION (3)

Lack of protective clothing and footwear.

Recovery of material from drain.

FIFTH QUARTER PROCESSING (1)

- In developing countries, almost all animal tissue and bone are recovered for edible purposes.
- Some of these products are more valuable per unit than the carcass.
- Hides and skins are all recovered.
- In many, blood is often edible or recovered for animal protein meal.
- Supports many micro-businesses and employs a large number of local people.
- Health and sanitation practices are non-existent or very rudimentary, posing greater hazards than carcass products.
<table>
<thead>
<tr>
<th>LOCATION</th>
<th>WASTES</th>
<th>DESTINATION IN DEVELOPING COUNTRIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livestock Holding Area</td>
<td>Bedding &amp; Straw, Truck waste, Deadstock</td>
<td>Formal and informal landfill, Composting.</td>
</tr>
<tr>
<td>Stunning &amp; Bleeding</td>
<td>Blood</td>
<td>Collected as edible or Processed into Protein meal, or Discharged in wastewater</td>
</tr>
<tr>
<td>Dressing</td>
<td>Heads, Hooves, Feet, Hide, Feathers</td>
<td>Recovered as edible products</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Recovered for further processing into leather, protein meal, etc</td>
</tr>
<tr>
<td></td>
<td>Horns, Pig Hair</td>
<td>Often disposed to landfill</td>
</tr>
<tr>
<td>Evisceration, Splitting &amp; Trimming</td>
<td>Trimmings &amp; Fat</td>
<td>Recovered as edible products</td>
</tr>
<tr>
<td>Inspection</td>
<td>Pathological material</td>
<td>Little produced in most countries. Goes to landfill, compost, incineration</td>
</tr>
<tr>
<td>Edible Offal Processing</td>
<td>Trimmings</td>
<td>Recovered as edible products</td>
</tr>
<tr>
<td>Intestinal Offal processing</td>
<td>Trimmings, Stomach &amp; Intestinal Contents</td>
<td>Recovered as edible products</td>
</tr>
<tr>
<td>Wastewater</td>
<td>Contamination with blood, body fluids and intestinal contents</td>
<td>Mostly discharged direct to surface water without any treatment (even screening), occasionally to the Municipal sewer.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ITEM</th>
<th>HIGH-INCOME COUNTRY</th>
<th>DEVELOPING COUNTRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood</td>
<td>Converted into an animal feed protein. Small quantity used for the production of edible blood protein fractions</td>
<td>Collected and coagulated for direct human consumption. In Muslim countries blood is haram and there are several interpretations as to acceptable uses.</td>
</tr>
<tr>
<td>Slaughter-floor bone-in items (heads, hooves/feet, etc)</td>
<td>Converted into animal feed protein and tallow in rendering systems</td>
<td>All these products are considered valuable contributors of protein and fat for human consumption.</td>
</tr>
<tr>
<td>Offal items such as lung, spleen, etc</td>
<td>Used as petfood both in wet (canned) form and as dry products (after rendering into a protein meal).</td>
<td>All of these products are considered edible.</td>
</tr>
<tr>
<td>Stomach and intestines</td>
<td>A number of items are recovered as edible generally for export markets. Difficult to handle and low return products are directed to rendering raw material.</td>
<td>All considered as edible after appropriate flushing and washing</td>
</tr>
<tr>
<td>Tissue and trimming</td>
<td>All directed to rendering.</td>
<td>All considered to be edible</td>
</tr>
<tr>
<td>Fat &amp; Bone</td>
<td>No value as direct edible items so all product directed to rendering raw material. About 20% carcase weight is bone and 10-15% fat (cattle).</td>
<td>Fat is seen as a valuable dietary contribution in generally low energy dietary intakes. Bone provides a valuable raw material for the provision of soup stocks (mixed with noodles, rice and in wet cooked dishes) as a contribution to dietary intakes.</td>
</tr>
</tbody>
</table>
FIFTH QUARTER PROCESSING (4)

Approximate Rendering - Raw Material Volumes

<table>
<thead>
<tr>
<th>HIGH INCOME COUNTRY</th>
<th>DEVELOPING COUNTRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Cattle - 75-100kg/head</td>
<td>• Sheep/ Goats - 0-1kg/head</td>
</tr>
<tr>
<td>• Sheep/ Goats - 4-8kg/head</td>
<td>• Cattle - 0-5kg/head</td>
</tr>
<tr>
<td>• Pigs - 2-10kg/head</td>
<td>• Pigs - 0-1kg/head</td>
</tr>
<tr>
<td>• Poultry - 0.2-0.5kg/head</td>
<td>• Poultry - 0-.2kg/head</td>
</tr>
</tbody>
</table>

• Low volumes involved in developing countries
• Waste reduction Interventions must be appropriate to the volumes of waste produced.

FIFTH QUARTER PROCESSING (2)

Cattle - intestinal tract recovery and processing.

Goat – head and feet preparation.
FIFTH QUARTER PROCESSING (3)

Pig – intestine recovery and processing.

Drying rooms for range of fifth quarter products.

WASTE MANAGEMENT (1)

- Larger slaughterhouses recover almost all non-carcass items for a market purpose.
  - Almost all tissue products are recovered as edible.
  - Blood is collected as edible (Asia) or for processing into a protein feed.
  - Leftover animal tissue is recovered for the production of fat and protein meal (in South America for animal feed-swill).
  - Stomach and intestinal contents are generally wasted (in Asia can be used for fish feeding).

- Smaller slaughterhouses have poorer waste management due to lack of scale:
  - Recovery of blood is not practiced
  - Recovery of edible items is lower
  - Handling of unwanted items and stomach contents is more problematic due to the ability to dispose of smaller quantities in less formal ways.
WASTE MANAGEMENT (2)

Solid Waste:

- There is often observable animal-based solid waste in the vicinity of the slaughterhouses.
- There appears to be several sources:
  - Retention of animals in uncontrolled private properties around the slaughterhouse area.
  - Clandestine animal slaughter within the slaughterhouse precinct.
  - Out of hours slaughter (e.g. emergency slaughter).
  - Limited amount of this waste appears to be sourced from normal hours slaughterhouse operation.
- All of this waste appears to be totally uncontrolled.

WASTE MANAGEMENT (4)

Waste from emergency slaughter.

Emergency and clandestine slaughter waste.
WASTE MANAGEMENT (3)

Liquid Waste:

• Relevant to modern facilities, liquid waste volumes are very low (less than 10%, even when water is readily available).
• There is effectively no treatment of liquid waste from slaughterhouses; not even screening to capture solids.
• Wash-water is the main liquid waste, primarily containing:
  - Contamination from intestinal tract recovery
  - Blood
  - Fifth quarter wash-water
  - General wash-water
• Where blood is recovered, however, organic contamination is much reduced.
• Unwanted solid waste from formal and informal slaughter often finds its way into the municipal drainage system.

WASTE MANAGEMENT (2)

Solid material in liquid wastes from slaughterhouse drain
(examples of where simple screens would be effective)
SIGNIFICANT ISSUES

• Municipalities focused on revenue gain rather than improvement of infrastructure and operations.
• Imposition of extra costs in the formal sector encourages diversion into the informal sector.
• Lack of commitment and resources to deal with the informal sector.
  - While there is often sound regulations in place for the formal sector these are seldom implemented
  - Implementation encourages growth in the informal sector
  - Resources are required to police the informal sector
  - Unless informal is controlled the extra costs of improved slaughter processes can only be carried by improved returns from niche markets (eg supermarket, export, further processing)

WHAT CAN BE DONE? (1)

• Due to poor knowledge of the slaughterhouse sector by Government officials (central & local) it is essential to visit and thoroughly investigate current circumstances in order to plan interventions in the sector.
• Interventions need to include programs to address infrastructure, technical, operational and environmental issues with a view to providing wholesome and safe products in an environmentally acceptable way.
• Programs to build capacity to control the sector (both formal and informal) are likely to be required for any successful intervention.
• These interventions will need to be appropriate to the circumstances.
WHAT CAN BE DONE? (2)
Simple interventions that will make a difference may include:

• **Animal Welfare**
  - Separation of animals awaiting slaughter from the slaughter activities.
  - Improve loading and unloading
  - Tilting ‘knocking box’

• **Hygiene and Sanitation**
  - Provision of sanitary facilities for workers
  - Provision of protective clothing and laundry services
  - Provision of mobile pressurize water cleaning devices
  - Use of sanitisers / disinfectants

• **Process Control**
  - Separation of sticking, dressing, and evisceration areas

WHAT CAN BE DONE? (3)
Simple interventions that will make a difference may include:

• **Blood**
  - Separate collection and handling of blood
  - Blood treatment systems to comply with religious and cultural sensitivities

• **Wastewater**
  - Simple screening of effluent to remove large solids

• **Solid Waste**
  - Simplified degradation systems (e.g. Composting, Digestion, Wet rendering)