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Acknowledgement:

The Peoples Movement for Good Governance (PMGG) is much thankful to all those who contributed in many ways towards the development and compilation of this report. It would not have been possible to produce this comprehensive report without their sincere and concerned support.

Engineer M M Falulul Haq who is a Shoora Council Member of the PMGG by taking a personal interest did an in-depth study of the problem, made site visits and contributed immensely in developing this preliminary report towards finding a permanent solution. We are greatly indebted to him for efforts.

Dr I L M Rifas (MBBS, M.Sc) another Shoora Council Member has continuously involved himself in finding a solution for this nagging issue affecting the health and environment of the people had pledged to set up a scientifically modern slaughterhouse facility within six months if the PMGG won the March 2011 Kattankudy Urban Council. Alternatively, all he wanted was cooperation and permission by the present Urban Council administration. We express our profound thanks for his interest and concern.

We should be failing in our duty if we do not thank Engineer Mr M M Abdul Rahuman who during his private visit to the United Kingdom recently contributed much towards the study which is being presented and initiated fund generation channels there. Last but not least, we are grateful to many others who were directly and indirectly supported voluntarily and involuntarily in the preparation of this preliminary feasibility report.
Introduction:

Kattankudy which is just approximately 4 square kilometers along the eastern marine coast is chock-a-block with a staggering population of over fifty five thousand people for its compact area. The Urban Council is the elected local body for the city’s administration and maintenance. The UC operates an archaic slaughterhouse for serving Halal cattle and goat meat.

The location where the present Slaughterhouse is situated is a residential area. Due to this reason the residents who experience the extreme inconveniences have voiced against it for years. With no solution in sight, they have made it a legal issue, justifiably, too. Unarguably, the methods of operation and maintenance of this archaic facility is causing innumerable problems to the residents in the surrounding.

In the justifiable circumstances, setting up of a new ultra-modern abattoir to supplant the present one has become a high priority and challenge to the city’s Urban Council. The past and present administrations of the council were either negligent to the serious impacts of that ancient facility and the outcry of the area residents or did not have the will and competency in resolving the issue in the interest of the city’s health in general and the people who are being affected in particular.

It is at this critical and crucial juncture, the PMGG have taken it up as challenge with high priority to provide a feasible and sustainable solution to the problem. The in-house qualified professionals of the movement are already working tirelessly in completing preliminary studies (this report is one such effort). The PMGG are confident of getting technical assistance and financial support from the experienced engineering firms in this line and donor agencies respectively towards its implementation.

PMGG have been asking for the due permission to implement this project from the present ruling body for a long time. With no signal received the PMGG have now decided to bring this issue to the attention of the civil organizations and to the public. The PMGG have been forced to embark on this exercise to get them (civil organizations and the public) to apply pressure on the present ruling body to find a total, feasible and sustainable solution for the long nagging slaughterhouse problem.
Scope:

This report is intended to provide an overview of a possible solution for the replacement of the existing slaughterhouse of Kattankudy Urban Council. This report lists the environmental implications of the present case, summarizes the criteria for the waste management and recommends the waste water treatment solution. The final design of the reactor and other facilities is out of the scope of this report and should be done at the design and implementation stage.

Background:

Slaughterhouse of Kattankudy (will be referred as the slaughter house hereafter) was built decades ago along the banks of the then Sinnath Thona (lead a way) in approximately 1560sq.m (61.7 perch) area of land. The area was then selected for reasons of easy waste water disposal into the Thona which was then an unpopulated surrounding. The slaughterhouse is now surrounded by thick population and the area has become one of the active and fast growing commercial places in the town of Kattankudy.

Only cattle and goats are slaughtered here using halal method of slaughter. The meat thus produced is sold in stalls throughout the town and the satellite villages.

FIGURE: 01 PRESENT SLAUGHTERHOUSE LOCATION (Courtesy: Google Earth®)
Worrying Issues

The slaughterhouse is comprised of an animal retention shed, a water well and slaughtering area. The wastes off the slaughtered animals are collected and transported to a dumping site while the untreated wastewater is drained into a pit. This practice has created serious environmental issues. As can be deduced, the slaughterhouse matter has become the top-priority issue for the Urban Council of Kattankudy.

![Figure: Kattankudy Slaughterhouse](image)

**FIGURE: 02 KATTANKUDY SLAUGHTER HOUSE (Courtesy: pmgg.org)**

The identified issues.

- The people living permanently in the vicinity experience unbearable and incessant stench emanated from the slaughterhouse as a result of decomposing raw blood mixed with the drained water.
- Groundwater in the vicinity is contaminated by the untreated waste streams.
- The hygienic quality of the meat produced is doubtable as the same groundwater is used throughout the cleaning activities of slaughtering process.
- The area residents, especially children contract different kinds of diseases due to high pollution.
- The slaughterhouse is located in a floods-prone area which gets flooded during rainy seasons. This situation makes the life of the residents even more difficult.
and unendurable with aggravated health hazards to the hygiene and environment during the seasons.

- The court, in a verdict to the case filed by the impacted residents against the Kattankudy Urban Council, has ordered the permanent shutdown of the abattoir from August 2011.

![Present Facilities](Courtesy: pmgg.org)

**FIGURE: 03 PRESENT FACILITIES**

**Present information and Data**

The slaughterhouse supplies fresh Halal meat and offal to a population of more than 50,000 people. Its volume of activity therefore is very high with constantly increasing demand.

**Table: 1 Slaughtering Animal Data**

<table>
<thead>
<tr>
<th>DAYS</th>
<th>Cattles/day</th>
<th>Goat/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekdays</td>
<td>20-30</td>
<td>5</td>
</tr>
<tr>
<td>Fridays</td>
<td>40-50</td>
<td>15</td>
</tr>
<tr>
<td>Special Holidays</td>
<td>50&lt;</td>
<td>15&lt;</td>
</tr>
</tbody>
</table>
Present routines exercised

Animals earmarked for slaughter are, by law, required to be brought to the retention shed (stockyard) a day before for inspection by the Physical Health Inspector. Due to this reason, a huge amount of dung and feed leftovers need to be removed on a daily basis.

FIGURE: 04 RETENTION SHED (STOCK YARD)

FIGURE: 05 INTESTINAL AND OTHER SOLID WASTE DUMPING AREAS

Post-slaughter wastes consist of raw blood, hair, bone cuts, flesh and wash waters. These
wastes collect while and post slaughtering of day’s requirement. The waste thus accumulated is considered to be one of the strongest forms of organic waste. The contaminated water used to clean the slaughtering floor is drained untreated straight into a pit.

![Image of waste bones disposal area](image6.png)

**FIGURE: 06 WASTE BONES DISPOSAL AREA**

![Image of routine waste dumping activities](image7.png)

**FIGURE: 07 ROUTINE WASTE DUMPING ACTIVITIES**

The hides of the animals are taken away by the butchers themselves along with the carcass
for sale to tanneries while the bones are transported to a remote area near the southern beach of Kattankudy for drying.

Slaughterhouse waste analysis

The slaughterhouse wastes are intermittent in flow, have high BOD, high suspended solids, are odorous and create heavy sludge deposits when discharged into the water bodies. The volume and quality characteristics of the waste water vary from one plant to another and from one season to another, depending on the number and type of animals slaughtered and housekeeping practices followed [Patwardhan, AD 2008].

1. Stockyard Component

<table>
<thead>
<tr>
<th>Animal</th>
<th>Kg/head</th>
<th>Quantity of Solid Wastes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Kg/TLWK</td>
</tr>
<tr>
<td>Cattle</td>
<td>83</td>
<td>275</td>
</tr>
<tr>
<td>Goat</td>
<td>2.5</td>
<td>170</td>
</tr>
</tbody>
</table>

Note: TLWK = Tonne of Live Weight Killed

2. Slaughtering Floor Components

<table>
<thead>
<tr>
<th>Flow m3/day</th>
<th>Suspended Solids</th>
<th>pH</th>
<th>BOD</th>
<th>Grease</th>
<th>Settled BOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>900</td>
<td>700-1000</td>
<td>7-8</td>
<td>2000</td>
<td>-</td>
<td>1200</td>
</tr>
<tr>
<td>720</td>
<td>900-2000</td>
<td>7.5-10</td>
<td>1900</td>
<td>-</td>
<td>1400</td>
</tr>
<tr>
<td>950</td>
<td>1000-3100</td>
<td>7-9.5</td>
<td>1900</td>
<td>-</td>
<td>1400</td>
</tr>
<tr>
<td>-</td>
<td>1500-2000</td>
<td>6.7-7.4</td>
<td>1600</td>
<td>1200</td>
<td>1000</td>
</tr>
</tbody>
</table>

Note: All values except flow and pH are in mg/l.
3. Skinning and Rendering byproducts

The skinning and rendering byproducts that are needed to be recycled are as follows. (Quantity indications are not given)

- Intestinal wastes
- Bones
- Skins
- Horns

Slaughterhouse and waste management

The slaughterhouse management is of great importance for many reasons. Food processing industry is to be strictly monitored for ethical practices, especially the slaughtering of animals for food. Slaughterhouse can be a threat to the environment if it is mishandled. Major areas of slaughterhouse management can be listed as follows.

- Slaughtering Animal welfare
- Slaughter Animal’s health assurances
- Ethical labor management
- Slaughter product hygiene
- Slaughterhouse hygienization
- Recovery of valuable products
- Recovery of energy
- Purification of wastewater
- Efficient and cost effective industrial practices
- Business development through best practices

Wastewater treatment criteria

The treatment of wastewater is to assure the protection of environment. The wastewater from any industry should be treated before discharged to any source. There is a cost incurred in the treatment of wastewater. The extension of treatment of wastewater, therefore, can be determined only by the source where it is going to be discharged into. For example, the
treatment requirement will be higher if the effluent is discharged to *inland surface water (ISW)* compared to *marine coastal areas (MCA)*. Therefore the design of treatment facility highly depends on the source where the treated wastewater is discharged.

As per the treatment requirement by the Central Environmental Authority, the criteria of effluent will be as follows.

### Table: 4 Tolerance Limit of Industrial Waste Discharge

<table>
<thead>
<tr>
<th>Item No:</th>
<th>Parameter</th>
<th>Unit type of limit</th>
<th>Unit, type of limit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Discharged into ISW</td>
</tr>
<tr>
<td>01</td>
<td>Total suspended solids</td>
<td>Mg/l, max</td>
<td>50</td>
</tr>
<tr>
<td>02</td>
<td>Particle size of the Total suspended solids</td>
<td>µm, less than</td>
<td>850</td>
</tr>
<tr>
<td>03</td>
<td>pH at ambient temperature</td>
<td>-</td>
<td>6.0-8.0</td>
</tr>
<tr>
<td>04</td>
<td>Biochemical oxygen demand</td>
<td>Mg/l, max</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>(BOD5 in five days at 20°C or BOD3 in three days at 27°C)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>08</td>
<td>Chemical oxygen demand (COD)</td>
<td>Mg/l, max</td>
<td>30</td>
</tr>
</tbody>
</table>

It is said that the all efforts should be made to remove unpleasant odour and color as far as practicable.

**Note:** The above table is only an abstract of the large amount of data given in this regard.

**Source:** Gazzette of Democratic Social Republic of Sri Lanka - 01.02.2008

**Waste Management Recommendation**

There are number of waste produced from a slaughterhouse as discussed earlier, namely, wastewater, blood, bones, skins etc. The waste management recommendation is to convert these byproducts either into valuable products or remove the hazardous components from them before disposing to the environment.

**Stockyard Sanitation:** The stockyard produces two components namely solid waste and wastewater. We recommend that the stockyard waste and manures should be collected separately. This can be sold in quantities to farmers or retailers as an organic fertilizer which has a high demand. The wastewater from sanitation of the yard can be coupled with other toilet wastewater from the slaughterhouse and can be...
sent to the septic tank in the facility.

![Image](image.jpg)

**FIGURE: 08 PREENT STOCKYARD (Courtesy: pmgg.org)**

**Blood:** The blood should be collected in concentrate in the slaughtering step. This will be dried by a dryer and can be sold as a valuable byproduct. The dried blood is used as a raw material for poultry feed industry etc.

**Skins:** Skins are collected at the skinning and evisceration plant. Skins can be dried and further treated for sale as a raw material for other industries.

**Bones:** Bones are collected at the rendering plant. They have to be cleaned and dried using a drier. The dried bones are another valuable raw material for some other industries. (Refer Figure No: 06)

**Other solid wastes:** there are other forms of organic solid wastes collected from evisceration and rendering stages (Refer Figure No: 05). These wastes can be minced and/ boiled to transform into feed.

**Wastewater treatment and discharge**

The most challenging and still manageable waste of a slaughterhouse is the wastewater which is produced mainly by washing operation of slaughtering floor, packing and rendering plant. This water consists of solid and liquid forms of materials which contribute to the contamination. These constituents will decompose due to the actions of living microorganisms over the time and will generate strong unpleasant odour. The microorganisms find their food and make a population growth. This action
An artificial water treatment process may consist of physical, chemical and biological processes to accelerate the results.

**Screening**: This action is to remove solid hard particles from the wastewater. Hair and born cuts can be removed in this stage and only the liquid is released through as upstream. This is an immediate process which requires no additional time. To accomplish this task, a **Hydrasieve** can be installed in the first step of treatment. This screening equipment will remove the ‘**BOD (5-20%) and Total Suspended Solids (TSS) by 5-30%**.’ [Mike Lawrence, 2007].

**Flow Equalization**: This done by mixing and adding water to the influent if required to homogenize the wastewater so that a uniform content and flow is assured.

**Anaerobic Digestion**: Further treatment of slaughterhouse wastewater is to be carried out by a biological process called anaerobic digestion. The microorganisms in the wastewater are allowed to act without oxygen. This is a sensible process and biogas (Methane) is produced as a byproduct.

*Under the described circumstances the stable operation of a biogas plant using only slaughterhouse waste as substrate is feasible.* Strong attention should be paid to the odour emissions caused by the operation of the biogas plant and by the land application of the digestate. The anaerobic monodigestion of high nitrogen-containing animal byproducts like slaughterhouse waste causes a very weak equilibrium in the process. Small mistakes may easily cause process failure. Proper training of the plant operator and careful process control (e.g., through the measurement of volatile fatty acids, ammonia content, and pH) is absolutely necessary in order to ensure long time digestion operation. [R.Kirchmayr 2007]

**Anaerobic Sequencing Batch Reactor (ASBR)**: This is compact in size and has a Hydraulic Retention Time of (HRT) 6 to 24 hours. An anaerobic sequencing batch reactor (Figure 10), or ASBR digester, is a variation on an intermittently mixed digester. Methane forming microorganisms are kept in the digester by settling solids and decanting liquid. An ASBR operates in a cycle of four phases (Figure 09).
FIGURE: 09 PHASE DIAGRAM OF ASBR (Courtesy: extension.org)

The digester is fed during the fill stage, manure and microbes are mixed during the react phase, solids are settled during the settle stage, and effluent is drawn off during the decant stage. The cycle is repeated up to four times a day for nearly constant gas production. Liquid retention times can be as short as five days. Although ASBR digesters work well with manure in a wide range of solids concentrations, they are particularly well suited for very dilute manures (< 1 percent TS), and if filled with active microbes during start-up, can even produce biogas with completely soluble organic liquids. Sludge must be removed from the ASBR digester periodically. Concentrated nutrients are harvested during sludge removal.[extensions.org, 2011]
Modern Facility Requirement:

The aim of this proposal report is to provide a complete solution for the existing slaughterhouse as mentioned above. Therefore we recommend that the following facilities should be available on-site.

- **Primary Stockyard:** The animals brought to the slaughterhouse for slaughtering will be kept here for certain period of time. This ensures that the animals are examined on-site. There area will be divided into two separate areas for Bovines and Goats.
- **Secondary stockyard:** This will small in size and allocated for the immediate evacuation if either the animal failed in inspection or condemned for other reasons.
- **Slaughtering floor:** This floor is specially designed only for the slaughtering purpose. The blood will be immediately collected for further processing and treatment. The slaughtered animal will be hanged over-head and pushed to the adjacent skinning area.
Skinning and evisceration area: The slaughtered animal is skinned and the intestinal wastes are collected here and these solid wastes are taken for further management. The carcass is pushed to the adjacent rendering area.

Rendering area: This is the last area where the carcass is cut into adequate size and shape for loading and transport. The rendering current practice is not advanced found in other countries where carcass is divided for special packing,
display and business purposes.

![Image](image.jpg)

**FIGURE: 13 A TYPICAL RENDERING FLOOR (Courtesy:nytimes.com)**

- **Wastewater treatment plant:** this is where the wastewater from slaughterhouse is fed and treats for purification. The effluent from this plant will be directly discharged to the sea.
- **Solid or Usable Waste Management Area:** Blood, Bones, Skins, Solid wastes and Manure will be treated or recycled here. This will be equipped with Drier, Bone saw, Cutting facilities, heating facilities etc.
- **Staff labor welfare room:** Working laborers of the slaughterhouse will utilize this room for temporary stay, sanitation etc.
- **Equipment room:** This is where the tools, uniforms and other accessories are kept and maintained.
- **MOH and Urban Council Site office:** The officers from Urban Council and the MOH will utilize this facility for their short stay, documentation, sanitation etc.
- **Security Office Room:** This is used for the security officers' welfare purposes who work round the clock in shifts.
- **Utilities:**
  - **Three phase Electric power supply:** for the operation of Treatment plant, other electric equipment and lighting.
  - **Water supply:** Clean water for drinking, sanitation and cleaning activities. Treated water can be used for trees planted in the slaughterhouse premises.
  - **Water Jet:** Pressurized water jet should be used for the easy cleaning as the blood will clog and stick to the floor. It is also important to use as little water as possible. This will ensure that the size of the water treatment plant will be as smaller as possible. The cost of water treatment will become less.
  - **Firefighting equipment:** It is important to install a heavy duty-fire extinguisher in case of fire.
o **Operational and Training Manuals:** There should be clear guidelines for the smooth operation and maintenance of all the facilities available in the slaughterhouse. The absence of these guidelines may cause serious and expensive damages to facility and harm to the personnel.

o **Surveillance system:** A closed circuit camera surveillance system should be installed wherever appropriate to monitor the facility round the clock. This will eliminate much kind of losses and malpractices. This will also ease the management for Urban Council.

o **Fingerprint log:** a computerized fingerprint sign-in, sign-out system should be installed to monitor the operation of the slaughterhouse even from Urban Council.

o **Communication facility:** Fixed landline telephone and mobile should be available in the facility.

**Site Selection**

The site of present slaughterhouse cannot be used for this purpose as the court has ordered evacuation. Therefore a new site should be selected with many criteria in mind. The size of the land to encapsulate all the facilities mentioned above, neighborhood, where the treated waste water is going to be discharged, is key factors in deciding the location and size.

- **Location:** The Table No: 4 indicate that it is desirable to discharge the wastewater to the sea (Coastal Marine Area). Because of the quality requirement of the treated water is less compared to other areas. Therefore it is advisable to select a site along the marine coastal area of Kattankudy. This will eventually cut the operational cost of the wastewater treatment plant. It is also to be noted that there is no more bear land is available other than the coastal area.

- **Size:** all the above said facilities to be made available in the premises of the slaughterhouse. It is important to give a strong wind-break to the neighborhood to unsure that there is no unpleasant odour is experienced in the surroundings. Therefore we recommend that the minimum size of the site should be around half acres (80 perch/ 2000 Sq.m). The length to width aspect ratio of the land should not be more than 4/3.
Conclusion

The present practice of the Kattankudy slaughterhouse is outdated, unhygienic and has a great impact on the environment. The Urban Council has totally failed to address the issues as it has been incompetent for more than last 5 years. It could have been saved if proper attention was paid to the present slaughterhouse.

This report has briefly analyzed the operation of a slaughterhouse and identified the problem faced by the current practices and recommended solution for each and every issue with the consideration of appropriate criteria. The most important and critical of the above is the treatment of slaughterhouse wastewater that can be successfully carried out by an Anaerobic Sequencing Batch Reactor (ASBR). Bones, hides and the blood are dried while the stockyard manure is collected as raw and sold.

A piece of land, along the marine coast, minimum area of 2000Sq.m (40mx50m) is required for the setting-up of the proposed slaughterhouse facility. The funding can be generated and proper consultancy for the maintenance can be given free of charge by the PMGG if required in the successful implementation and maintenance of this project.
References:


APPENDICES

Exploration visit photos

1. U.K visit: Mr. Abdul Rahuman (Eng.) visiting to see the Solid Waste Management Accessories (June 2011)

Figure: 14 Solid waste sorted disposal Bins

Figure: 15 An officer explaining the variety of available accessories to Mr. Abdul Rahuman talking to the
2. U.K visit: Mr. Abdul Rahuman (Eng.) visiting to see the Slaughterhouse facility of Bermingham (June 2011)

Figure: 16 MR. Abdul Rahuman posing with the supervisor of the plant in Birmingham. Internal photography not allowed

3. Sammanthurai visit: A team of PMGG members visiting Sammanthurai to study the Wastewater Treatment Plant. A Pilot plant of Up-flow Sludge Blanket Reactor (USBR) is under construction. The Chairman of Sammanthurai U.C Mr. Nowshad is explaining the Structure of the plant.

Figure: 17 Mr. Nowshad is not convinced that the plant will work as proposed
Figure: 18 The meeting was very informative and Mr. Nowshad shared his views on solid waste management.

Figure: 19 Sammanthurai Slaughterhouse. The facility is clean.
Figure: 20 UASBR is under construction. No access to the inner facilities. Cracks and honeycomb were observed in the concrete casting.

Note: An Up-flow Sludge Blanket Reactor (UASBR) is under construction. The plant has been designed for a 15m3/day wastewater treatment for a daily slaughter of less than 10 cattle per day. The proposed ASBR by PMGG will be treating far less quantity of water meanwhile number of slaughtering animals will be higher than 40 per day.

Figure: 21 Mr.A.G.M.Haroon talking to the Cattle owners

Figure: 22 Animals immediate after the slaughter
Figure: 23 The Bones and other Intestinal wastes are on the floor

Figure: 24 Intestinal Wastes are on the floor (15th July 2011)
5. Kattankudy U.C’s Present Dumping sites

Figure: 25 U.C tractors at routine work

Figure: 26 The dumping site along the beach
Figure: 27 Slaughterhouse staff in dumping activity (14th July 2011)

Figure: 28 A path has been set for the tractors to run along the sandy yard
6. Sewage wastewater Treatment Plant

Figure: 29 A floating Air Diffuser at the present water treatment facility of Kattankudy U.C

Figure: 30 A working staff explains how the treatment flows are connected
Figure: 31 Wastewater is pumped in for aeration (14th July 2011)