1 General Data

Type of Project:
Final component of the Integrated Waste Management Scheme for Small and Medium-Scale Slaughterhouses

Project Period:
Start of planning: 05/2006
Start of construction: 05/2006
Start of operation: 08/2006

Project Scale:
Decentralized Waste Water Treatment for max 10 m³/day

Address:
A. Fernando St., Marulas, Valenzuela City, Philippines

Planning Institution:
APDC-BAI

Executing Institution:
APDC-BAI

Supporting Agency:
Basic Needs Services Philippines, Inc. (BNS-Phils.)
Bremen Overseas Research and Development Association (BORDA)
DILG-GTZ Water and Sanitation Program
FAO-LEAD-AGAL

2 Objective of the project

The in-house management concept promoted by BAI seeks to increase awareness on water and energy consumption, as well as wastewater and solid waste handling, alongside human resources management.

3 Location and general conditions

The Bureau of Animal Industry (BAI) promotes in-house management for small-medium scale slaughter houses in the Philippines. The in-house management approach is designed to assure a resources-saving and environmental friendly management of slaughterhouses and meat processing enterprises.
Current sanitary practices of slaughter houses in the country are far from the in-house management system.

Wastewater and solid waste are not localized. Tremendous volumes of water are used to clean up the tables, floor and walls after slaughtering. It is also common to let the solid waste (i.e. animal internal waste) be scattered on the floor then flushed to be discharged to the canal.

4 Technologies applied

The treatment process is composed of different steps that are designed to eliminate different pollutants, i.e. grease, solids, organic pollutants, etc.

Fresh wastewater from the slaughter process enters a grease trap to avoid scum entering the biogas digester. In the biogas digester, gas is produced as a by-product based on the calculated detention time. Gas then accumulates in the upper part of the digester before it is transferred to the collection tank. Gas in the collection tank can be utilized as energy source for boiling water and cooking.

As the gas accumulates, it will push the wastewater to flow to the outlet point entering the anaerobic baffled reactor. Wastewater flows in the anaerobic baffled reactor and filter for a calculated detention time. The treatment process will reduce BOD/COD (parameters for organic pollutants) up to 90%.

Prior to the project, the existing open sewerage system mixed rain water and wastewater to dilute wastewater. This leads to high possibility for “unexpected” solid and non-biodegradable waste such as sand, plastic, wood chip and soil to enter the biogas digester, which in turn, contributes to low or even non-production of gas from organic matters. This also increases maintenance due to clogging and frequent de-sludging. More solid waste will occupy more space in the treatment plant which reduces the treatment efficiency. Other factors contributing to low biogas production is the installation of facultative chambers which were found to be non-functional during the project assessment phase.

Figure 1: Cleaning of blood during slaughter process in BAI
(Source: DILG-GTZ Program)

Figure 2: View of anaerobic treatment; digester, anaerobic baffled reactor (ABR), and anaerobic filter (AF).
(Source: BORDA)

The treatment from the digester and anaerobic filter results in a smelly wastewater discharge due to the absence of oxygen. Thus, oxygen is introduced to the wastewater in the next step, a planted horizontal gravel filter.
By passing through the gravel and plant roots, wastewater comes in contact with oxygen which reduces remaining organic pollutants. The gravel filter is planted with Canna, local name Saging-Saging.

Figure 3: View of aerobic treatment; planted gravel filter (PGF) (Source: BORDA)

A polishing pond was also installed to finalize the aerobic process. It also functions as an indicator pond to monitor wastewater quality after treatment.

The three components are designed in such a way that they can be contained within the available space while blending with the landscape. The BAI treatment plant was designed for demonstration purposes. Therefore the treatment components are visible.

Figure 4: Low water-conscious attitude doubles water consumption. (Source: BORDA)

5 Further project components

The DEWATS introduces the final element of the Pilot Integrated Waste management Scheme for Small and Medium Scale Slaughterhouses of the Animal Products Development Center-Bureau of Animal Industry (APDC-BAI). It is based on four treatment steps combined according to the wastewater characteristics and the required effluent quality.

Part of the installation of DEWATS in Valenzuela is correcting the open sewerage system. The sewerage system must be covered to avoid mixture of fresh wastewater with rain water as well as any intrusion of solid waste such as plastic, dust, ash, and sand. Any intrusion of such solid waste reduces treatment performance and increases maintenance cost. Thus, the open canal connected to the internal canal and main pipe (drainage) was covered. A separate PVC pipe was installed to replace the drainage currently used. New PVC pipes were also installed connecting the treated wastewater to the next treatment stage (holding tank).

Figure 5: Combined sewerage reduces the performance of treatment plant (Source: BORDA)

6 Project History

As part of the in-house management, BAI would also like to promote a wastewater treatment plant for small and medium scale slaughter houses in the Philippines. Hence, BORDA was invited to provide conceptualization of Decentralized Wastewater Treatment Systems (DEWATS).

As soon as the preliminary concept was agreed, the Memorandum of Agreement of Detailed Engineering Design (DED) was prepared and signed by both BAI and BORDA representatives. The DED takes about 8 weeks to prepare. The result of DED was used as basis for the project proposal including detailed engineering design, detail cost plan and detail construction process.

Once construction had started, BORDA engineers provided supervision to assure quality control of the project implemented. Training on operation and maintenance was provided to the appointed operator. After the construction, BORDA together with BAI has been monitoring the treatment plant performance.

7 Costs

The wastewater treatment designed for APDC-BAI has the capacity to treat a maximum of 10m³ wastewater discharged daily or equal to the volume of wastewater from slaughtering 30 hogs and 10 cattle per day. Currently, BAI only slaughters 10-15 heads of cattle on Mondays, Wednesdays and Fridays, and 20-25 heads of hog on Tuesdays and Thursdays.

The construction cost is an estimated PhP 500,000 with projected monthly operation cost of PhP 2,000.

The system requires only simple operation and maintenance with monitoring of effluent quality on a regular basis.

8 Operation and Maintenance

The wastewater treatment plant will be operated and maintained by a technical team of BAI after completing training sessions on operation and maintenance.

DEWATS only requires regular checking of chambers by opening manholes, cleaning of gravel bed from rubbish/plastic, cleaning of pond in which frequency will be determined through daily observation. However, desludging in the digester and baffled reactor should be done every 2 years. Sludge thickness should be monitored before desludging.

The baffled reactor is easy to maintain since no chemical and mechanical system is introduced. Weekly monitoring of scum and solid particles in each chamber by opening the manholes should be done. Removal of scum should be done when it starts to form a thick layer on the upper portion of the water surface. Scum should be put in a plastic bag and treated as solid waste to be disposed of in a sanitary land fill.

Removal of sludge (desludging) is done on a regular basis. Sludge removal in the DEWATS system is designed to be done every 18-24 months. Longer intervals of desludging will compact the sludge accumulated in the bottom and will make the removal difficult.

Maintenance of the anaerobic filter is simultaneous with the regular monitoring of scum accumulation and desludging of the baffled reactor. Another maintenance activity is back washing or flushing which should be done whenever the filter becomes covered by bacteria that can cause clogging. This can be detected from the reduced performance of the treatment.
In this case, back wash should be done by emptying the water in the chamber and then washing the filter by spraying pressurized water from the manhole. Dead bacteria will fall off and accumulate in the bottom of the chamber. The dead bacteria should be removed by using a vacuum pump (mostly utilized by Malabanan). Spraying can be done several times until dead bacteria in the filter are removed. After years of operation, the filter material can also be replaced with the new ones while the old filter should rest for about 3-6 months. Resting period will bring back the performance of the filter and it is ready to be used after the resting period.

Maintaining a planted gravel filter is like maintaining a garden when blended with the landscape. Once the plants have fully matured, cutting of old leaves and removal of old/dead plants should be done on a regular basis. Cleaning of filter surface from falling leaves should also be done to ensure the flow of oxygen and exposure to ultra-violet rays from the sun.

Figure 6: DEWATS Scheme (Source: BORDA)

9 Design information and technical specifications

As part of pre-treatment, a grease trap must be installed before the digester. Wastewater should first pass the grease trap before entering the digester. It must be designed so that there is enough time for FOG to float while eliminating FOG intrusion into the next treatment phase. When FOG accumulates in the treatment plant, it forms scum. Gas will not accumulate in the upper part of the digester when a thick layer of scum covers the wastewater.

Figure 7: Grease trap (Source: BORDA)

A grease trap must also be designed so that there should not be enough time to introduce any mechanical or biological process to interact with the wastewater. Treatment of wastewater must be done only in the treatment plant, not in the grease trap.

Considering the high organic load of wastewater discharged in BAI (BOD > 1500 mg/l), the existing digester was used. Further check on the construction quality was done to find out any leakage or possible breakage of the digester. Volume check was also done to determine calculated detention time for current discharge and gas produced. Utilizing the existing digester has two benefits; the re-use of by-product and avoiding the construction of a new digester, thus saving on expenses.

The baffled reactor is a series of chambers which assists the digestion of difficult degradable substances by mixing wastewater with active sludge present in the reactor. It is suitable for industrial wastewater and pre-settled domestic wastewater with narrow BOD/COD ratio. It is constructed underground and has a high efficiency performance and requires only 1 m² surface area per cubic meter of wastewater discharge. The series of chambers will also protect the next treatment, such as planted gravel filter, from any hydraulic and organic shock loads. Shock loads in planted gravel filter may cause treatment failure due to clogging of gravel or high velocity of wastewater. Though it is less efficient for weak wastewater, a baffled reactor can reduce COD up to 75%. Depending on site conditions, depth can be designed in the range of 1.5-2.5 m.

For both the baffled reactor and the anaerobic filter, inoculation should be done during the starting phase by introducing active sludge to every chamber. It will create a better atmosphere for beneficial bacteria to thrive. For a slaughter house, inoculation of fresh cow dung is one alternative to start the process.

Figure 8: Anaerobic Baffled Reactor (Source: BORDA)

Figure 9: Anaerobic Filter (Source: BORDA)
The Anaerobic filter uses microorganisms attached to a medium (rocks, cinder, plastic, metal, etc.). The module allows wastewater to circulate facilitating the exchange of microorganisms during the treatment process. The microorganisms are able to trap and consume BOD and ammonia from the wastewater. The treatment is constructed underground and is highly durable if it is well-constructed and wastewater has been properly pre-treated. Area required is 1m² per cubic meter of wastewater discharged. Water depth in an anaerobic filter should be about 1.5-2.5 m. An anaerobic filter can reduce COD up to 80%.

The planted gravel filter is also called a constructed wetland, root zone treatment plant or sub-surface flow wetland. It is suitable for pre-treated domestic or industrial wastewater. Wastewater must be pre-treated to eliminate clogging from suspended solids and colloidal suspended solids which may reduce the hydraulic conductivity of the filter. Various perennial plants with a spreading root system are suitable. In the Philippines, Phragmites (Tambo) and Canna (Saging-Saging) have been successfully introduced as plant material for planted gravel filters. Combined with anaerobic treatment steps, space required is about 3-4m² per cubic meter of wastewater discharged.

### 10 Practical experience and lessons learned, comments

The APDC in-house management approach serves as a showcase for the sustainable operation of small and medium scale slaughterhouses at the national and regional level. The integrated management of solid and liquid slaughterhouse waste significantly reduces the amount of pollutants in the final discharge released to the environment.

Consumers also benefit from the hygienic processing of meat and by-products while the threat of contamination of food-borne diseases is minimized.

Based on the data gathered, by using the in-house management system promoted by BAI, water consumption can be lowered to 47%. At the same time, the slaughter house area is cleaner and more hygienic, and the meat processed has guaranteed quality.

### 11 Available documents and references

- APDC-BAI, Case Study, Wastewater Treatment Plant, Final Component of the Integrated Management Scheme for Small and Medium Scale Slaughterhouses.
- BORDA, Preliminary Concept of Decentralized Wastewater Treatment Systems for Bureau of Animal Industry, (no date).

### 12 Institutions, organisations and contact persons:

**Project Management and Implementation**
Animal Products Development Center – Bureau of Animal Industry (APDC-BAI)
Fernando St., Marulas, Valenzuela City, Philippines

**Project Technical Assistance**
BNS-BORDA Coordination Office
103 Minnesota Mansion, 267 Ermin Garcia St., Cubao, Quezon City, Philippines

Email: Philippines@borda.de
Web: www.borda.de

**DILG-GTZ Water & Sanitation Program,**
5th Fl. DILG-WSSPMO, Francisco Gold Condominium II, EDSA corner Mapagmahal Street, POBox 1176 QCPO, Diliman, Quezon City, Metro Manila Philippines

Email: gtzwater@info.com.ph
Web: www.watsansolid.com.ph