

PRESENTATION  
ON  
INTEGRATED SEWAGE AND SOLID ORGANIC  
WASTE-TO-ENERGY PROJECT

***WASTE GENERATION  
SOURCES  
AND  
CHARACTERISTICS***

# SOURCES OF SEWAGE AND SOLID ORGANIC WASTE GENERATION

## ❖ SEWAGE

- Students Population,
- Teaching Staff And Dependants
- Auxiliary Staff And
- Outsiders Visitation To Campus Chapel

## ❖ SOLID ORGANICS

- General Domestic Waste
- Kitchen Organic
- Food Leftovers)

CURRENT  
HANDLING PRACTICES OF  
SEWAGE AND SOLID  
ORGANIC WASTE  
WITH PARTICULAR  
EMPHASIS ON EDUCATIONAL  
INSTITUTIONS

# SEWAGE HANDLING

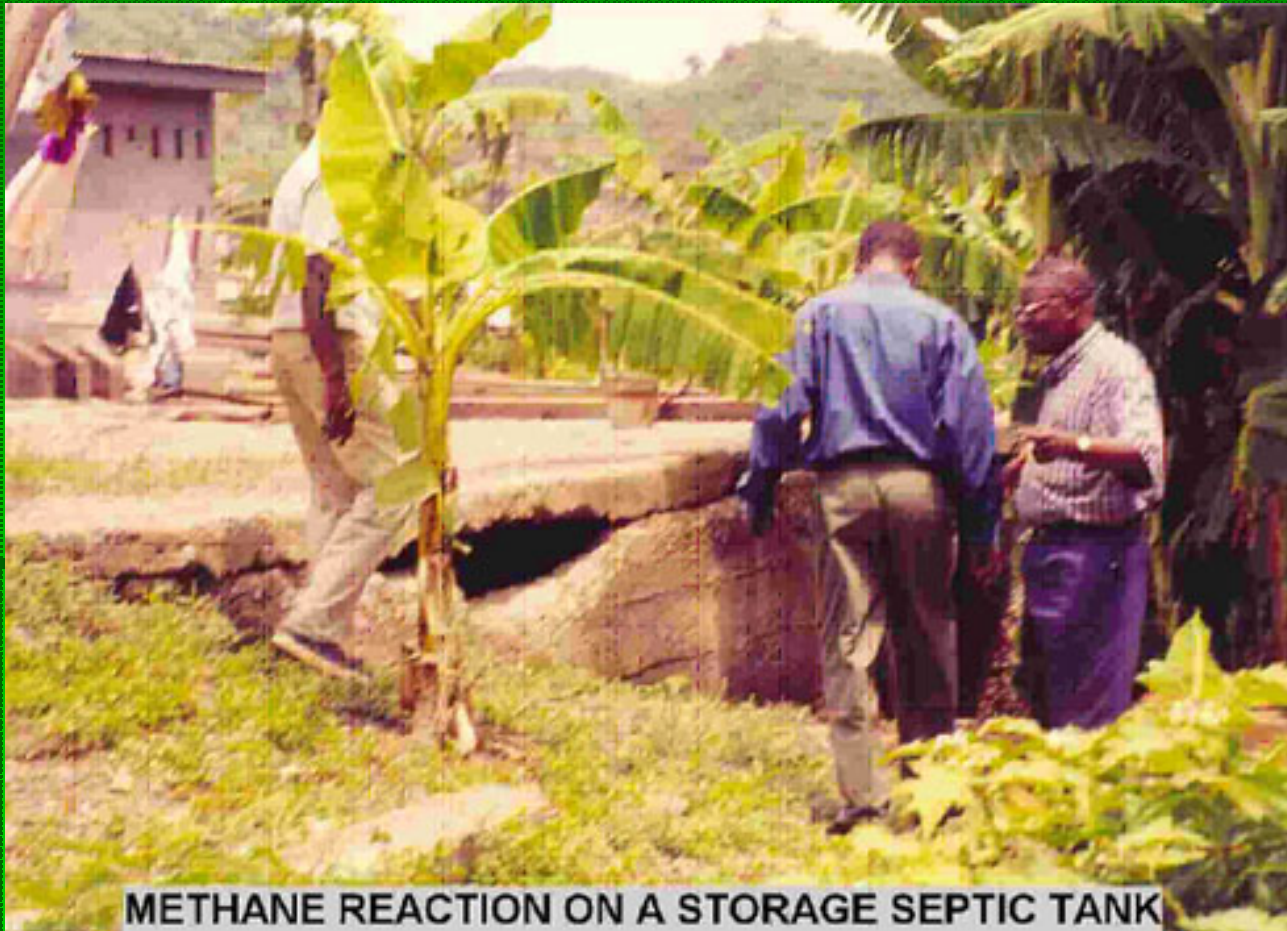
SEPTIC TANK COLLECTION,  
STORAGE, AND IMPACTS

# Septic Tank Storage and Handling of Sewage (With Methane emission vent)



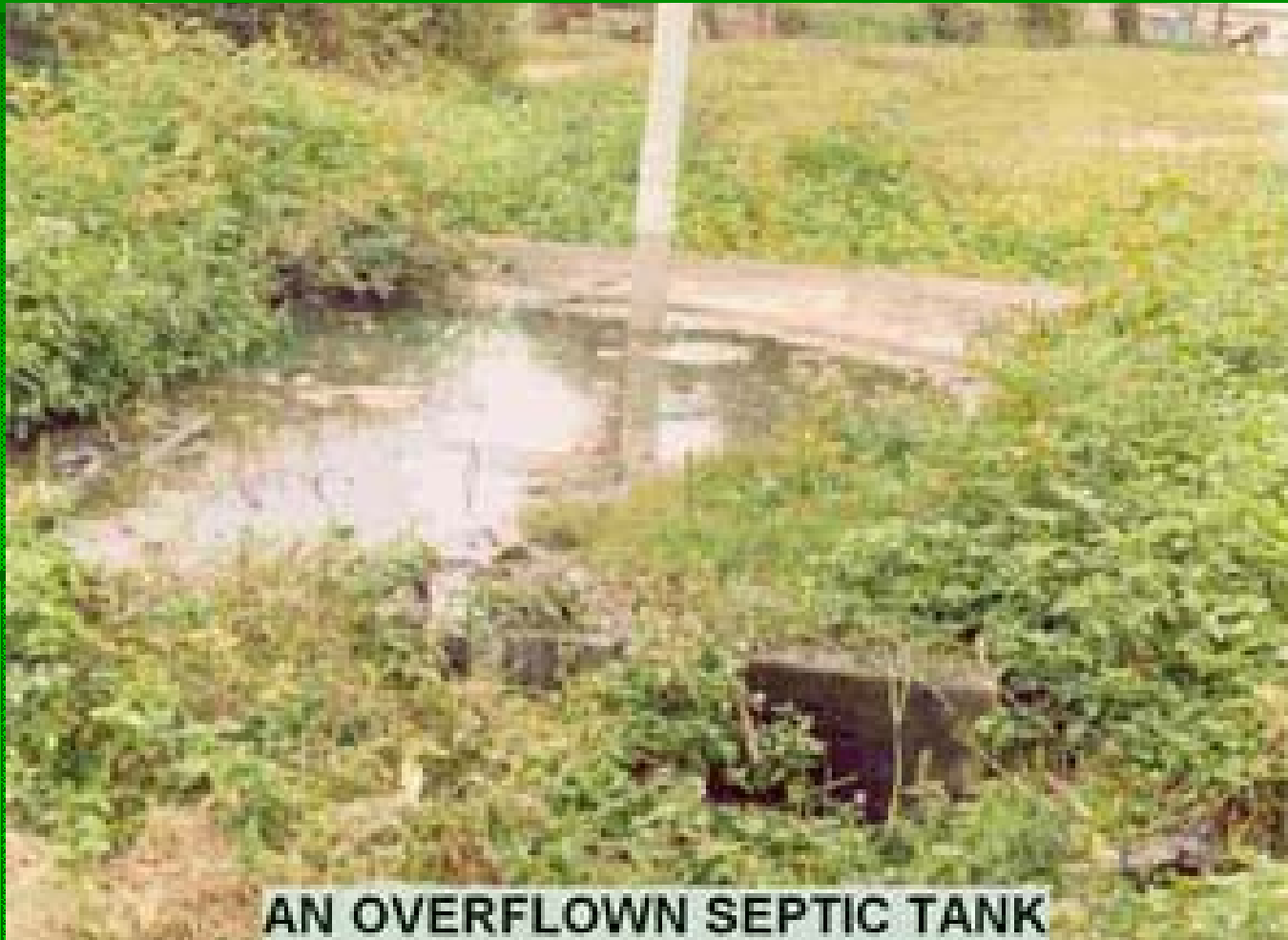
**SEPTIC TANK SHOWING METHANE VENT PIPES**

# Septic Tank Storage and Handling of Sewage (Without Methane emission vent pipes)



METHANE REACTION ON A STORAGE SEPTIC TANK

# Effect of Delays in Cesspool Emptying and Impermeable Soils



**AN OVERFLOWN SEPTIC TANK**

# Aerobic Handling System

**A TYPICAL AEOROBIC SEWAGE TREATMENT POND**



# CHARACTERISTICS OF SEWAGE

## ■ Inherent Health Hazards

### BACTERIA TYPES IN SEWAGE

- Salmonella
- Shigella
- Polioviruses
- Schistosoma Ova
- Hookworm Ova
- Ascaris Ova
- Typhoid
- Paratyphoid
- Cholera
- Dysentery Bacteria
- Bilharzias

# Final Disposal of Sewage

## OFF-SITE DISPOSAL

- Water bodies (Rivers, Lakes, Lagoons, etc.)
- Sea
- Stabilisation ponds

# Final Disposal of Sewage in Water Bodies: Impacts

- Degradation of water bodies
- Discharge of pathogens
- Reduce marine ecosystem productivity
- Odour Nuisance

# CURRENT HANDLING OF SOLID WASTE AND IMPACTS

# Municipal Solid Waste Handling

- Collected in steel containers and transported to :
  - Dump sites
  - Landfill sites
  - Incineration
- NOTE: 65% of MSW is organic

# CHARACTERISTICS OF SOLID ORGANIC WASTE

## ■ Inherent Health Hazards

### BACTERIA TYPES IN SOLID ORGANIC WASTE

- Schistosoma Ova
- Ascaris Ova
- Typhoid
- Paratyphoid
- Cholera
- Dysentery Bacteria
- Malaria Parasite

# Final Disposal of Solid Organic Waste

## OFF-SITE DISPOSAL

- **Landfill Sites**
- **Dump Sites**
- **Incineration (where applicable)**

# Final Disposal of Solid Organic Waste: Impacts

- Degradation of the Environment
- Distribution of communicable Diseases
- Odour Nuisance

# THE BIOGAS

TECHNOLOGIES, WEST AFRICA LIMITED (BTWAL) /  
ANAEROBIC DIGESTION SYSTEM (ADS)

SUSTAINABLE  
INTERGRATED APPROACH

WASTE-TO-ENERGY  
TECHNOLOGY

# BTWAL/ADS WASTE-TO-ENERGY TECHNOLOGY

- *An integrated solid organic waste and Sewage Treatment Plant*
- *An anaerobic digestion system (ADS) with biogas generation*
- *Combines solid organic waste to increase biogas generation*
- *Sustainable by addressing*
  - *sanitation,*
  - *health and*
  - *environmental impacts of septage and landfills*
- *Economical over time (income generation) from*
  - *water recycle,*
  - *use of treated effluent*
  - *biogas gas utilization and use*
  - *Avoidance of septic tanks installation cost*
  - *Cesspool emptying and its impacts*

# Components of BTWAL/ADS Waste-to-Energy Plant

- **The Bio-digester**
- **The Expansion Chambers**
- **Filtration Beds**
- **Treated Effluent storage**
- **Biogas Recovery Balloon**
- **Biogas end-use accessories**

# THE TECHNOLOGY

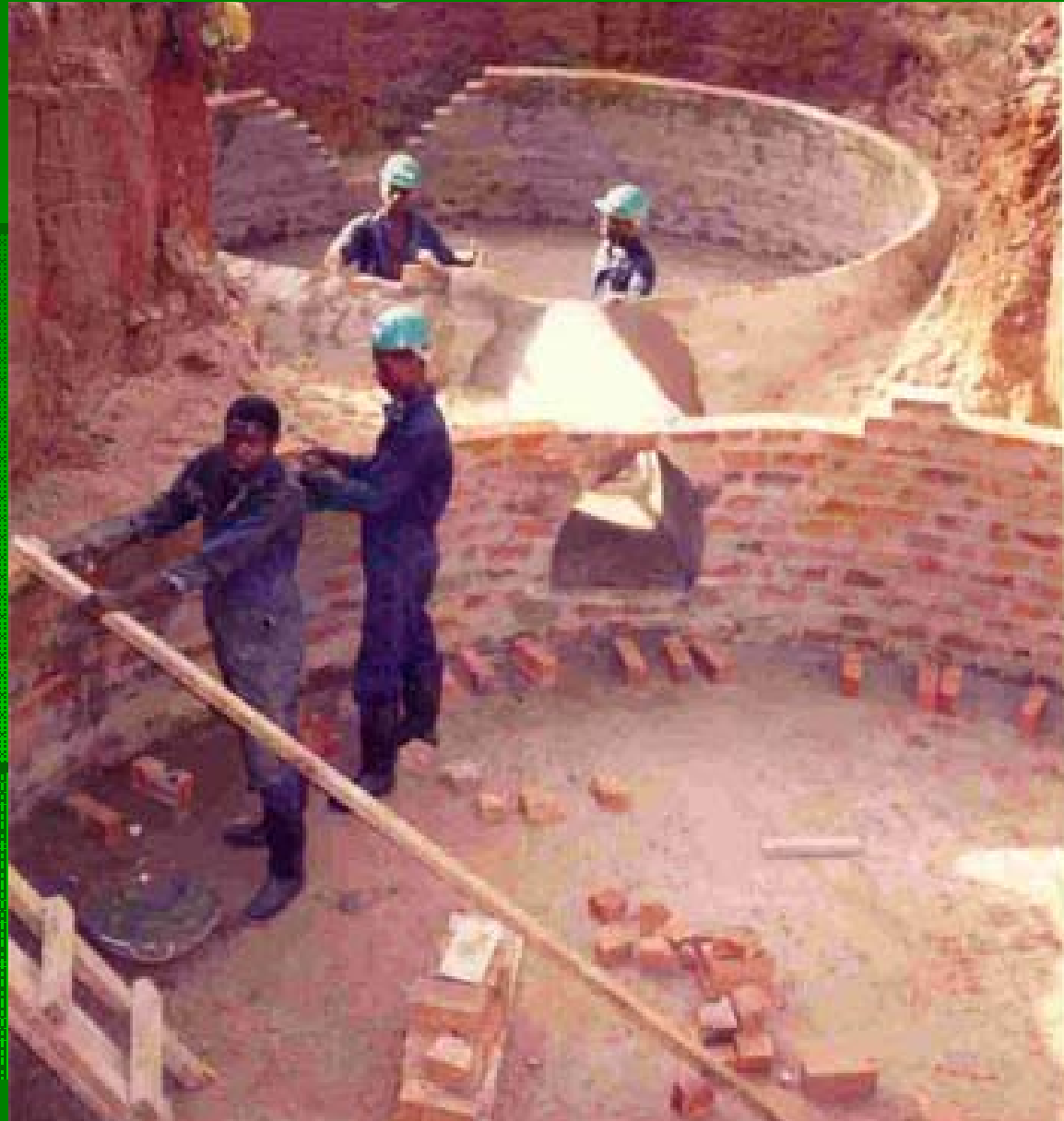
## The Digester (s)



BIOGAS DIGESTERS UNDER CONSTRUCTION IN A WATER LOGGED AREA

**BIOGAS DIGESTERS UNDER CONSTRUCTION IN A  
WATER LOGGED AREA**

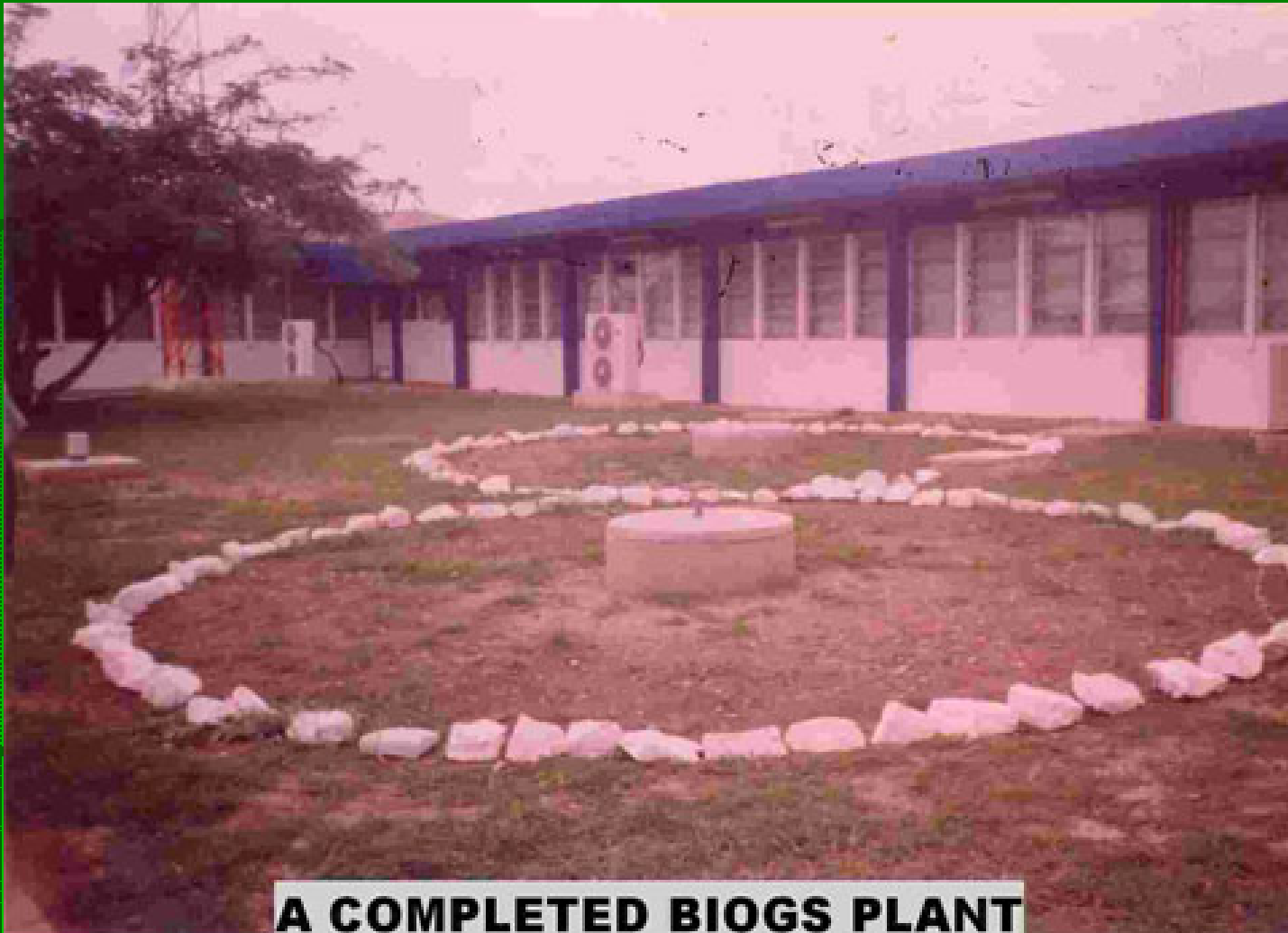
# A TYPICAL TWIN DIGESTER UNDER CONSTRUCTION



## A COMPLETED BIOGAS DIGESTER AND FILTRATION BED



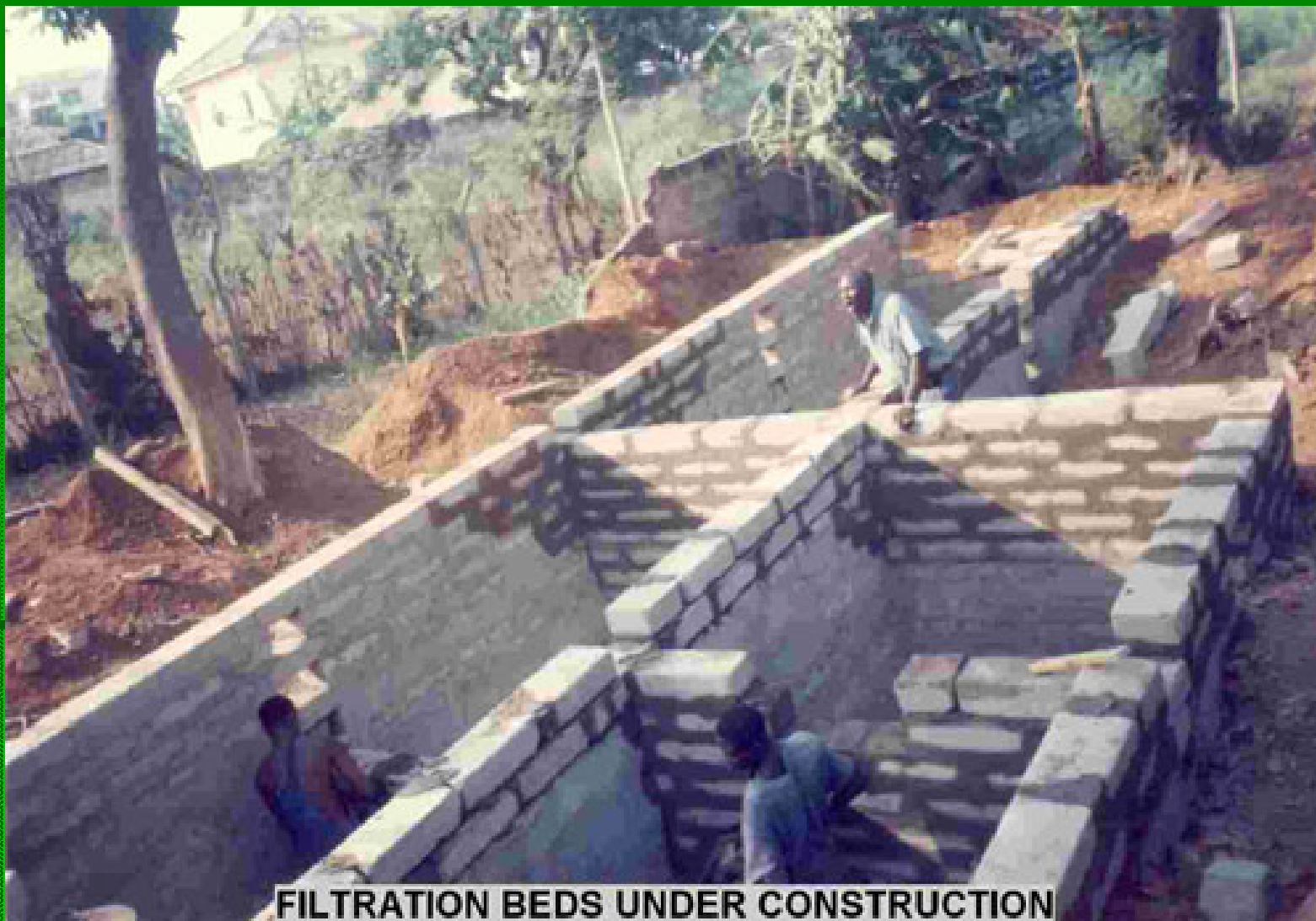
A TYPICAL DIGESTER SERVING CLUSTERED HOUSES AT TRASACCO VALLEY ESTATES SITE 6



**A COMPLETED BIOGAS PLANT**

**A COMPLETED BIOGAS DIGESTER**

# The Filtration Beds



**FILTRATION BEDS UNDER CONSTRUCTION**



**A COMPLETED FILTRATION BED**

# BY-PRODUCTS OF THE BTWAL/ADS PLANTS

❖ **BIOGAS**

❖ **EFFLUENT SLURRY**

# Biogas Capture and Storage



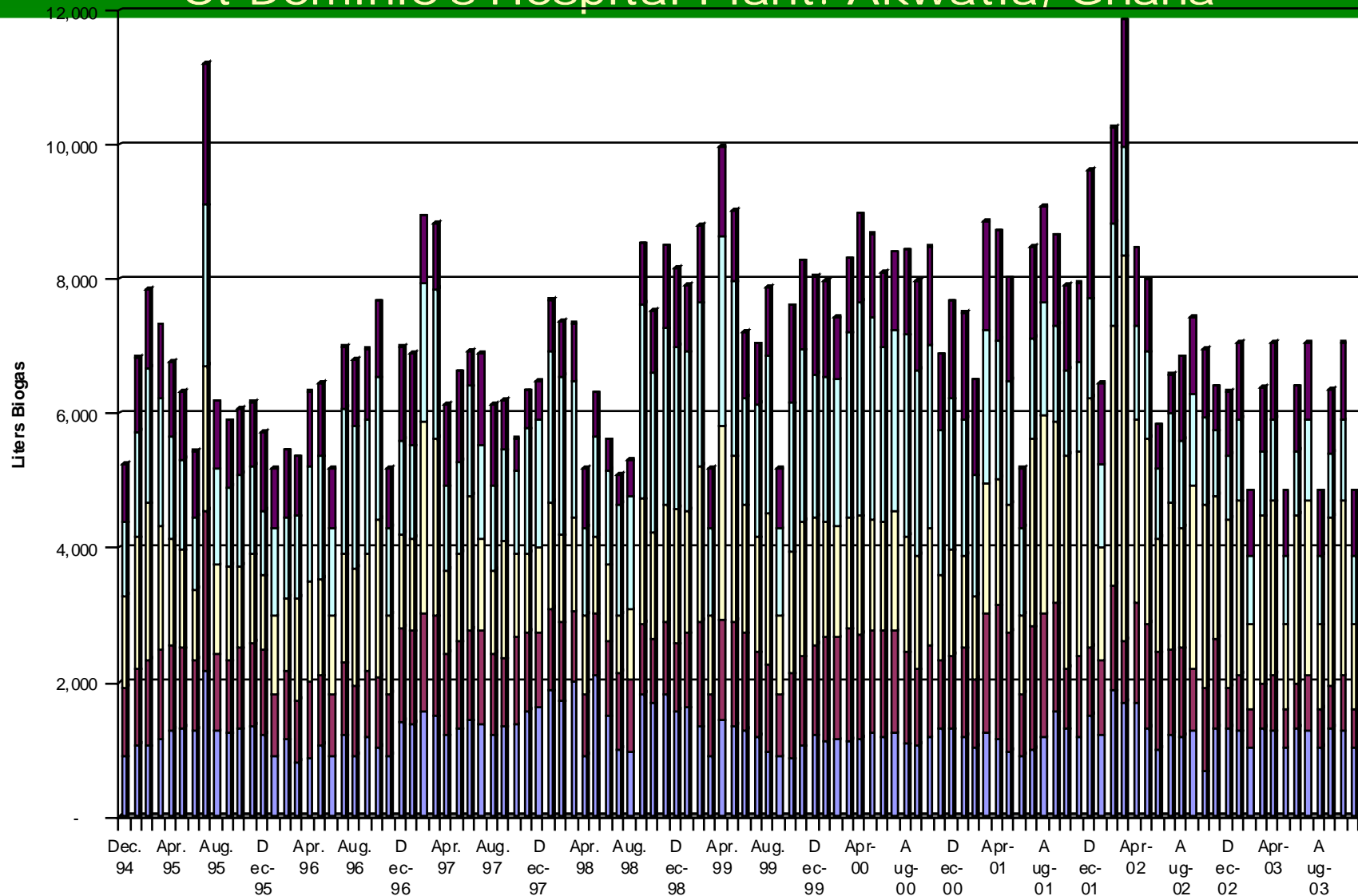
Biogas Collection Balloon 1

# Biogas Meters



# Typical Monthly biogas generation Metering Data, 1995-2003`

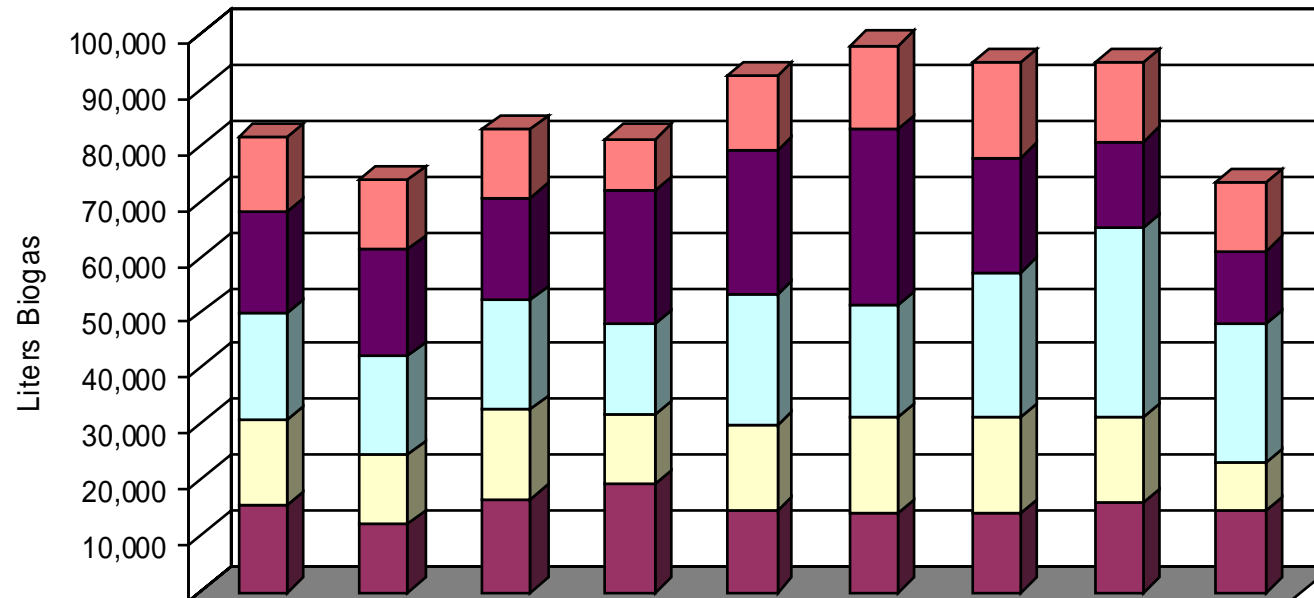
- St Dominic's Hospital Plant. Akwatia, Ghana



■ PLANT NO 1 ■ PLANT NO 2 ■ PLANT NO 3 ■ PLANT NO 4 ■ PLANT NO 5

# Typical Annual biogas generation Metering Data, 1995-2003` - St Dominic's Hospital Plant. Akwatia, Ghana

Annual Biogas Generation, 1995-2003

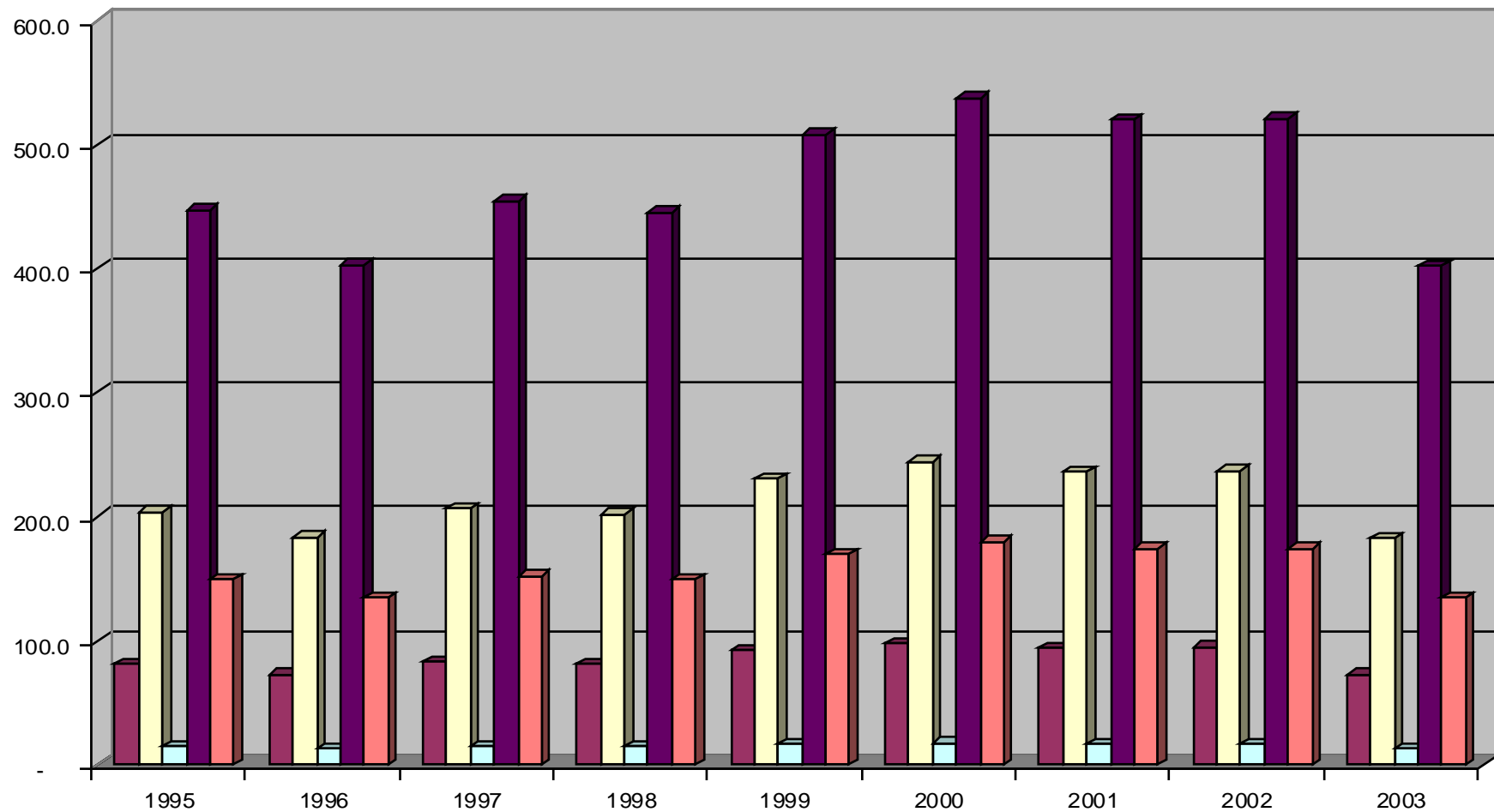


	1995	1996	1997	1998	1999	2000	2001	2002	2003
■ PLANTNO 5 (Liters)	13,478	12,059	12,266	9,105	13,237	15,015	16,790	14,023	12,310
■ PLANTNO 4 (Liters)	18,175	19,224	18,393	23,903	25,920	31,387	20,726	15,845	12,866
□ PLANTNO 3 (Liters)	19,068	17,644	19,622	16,189	23,608	20,144	25,808	33,817	25,307
□ PLANTNO 2 (Liters)	15,335	12,303	15,709	12,814	15,155	17,119	17,262	15,155	8,255
■ PLANTNO 1 (Liters)	15,281	12,065	16,588	18,924	14,359	14,047	13,964	15,898	14,377

# Annual biogas generation and Equivalent in other fuel types, 1995-2003

- St Dominic's Hospital Plant. Akwatia, Ghana

Biogas Generation Equivalent to Other Fuel Types



■ TOTAL BIOGAS (m3/year)   ■ LPG Equivalent (kg/year)   ■ LPG Equivalent (Cylinders/year)   ■ Wood Fuel Equivalent   ■ Charcoal Equivalent

# Gas Filtration System (Hydrogen Sulphide)



**HYDROGEN SULPHIDE FILTER**

# Biogas Utilization Equipment for Gas Combustion

- ❖ **STOVE**
- ❖ **REFRIDGERATOR**
- ❖ **ELECTRICITY GENERATOR**

# COOKING EQUIPMENT – Biogas Stoves 1



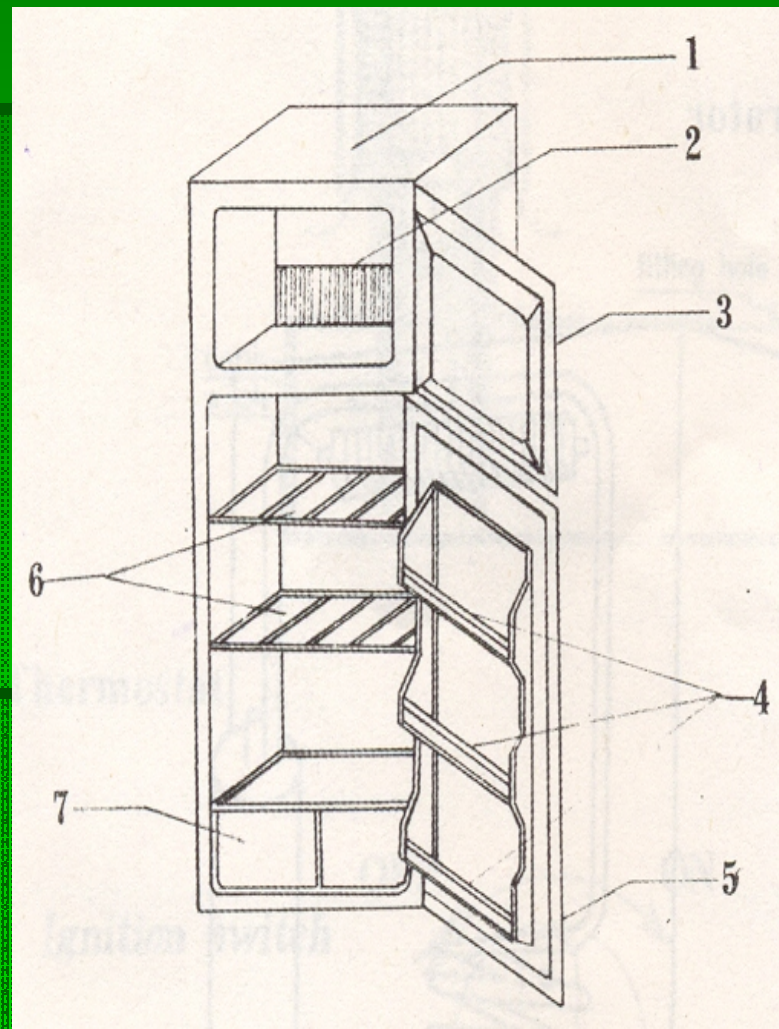
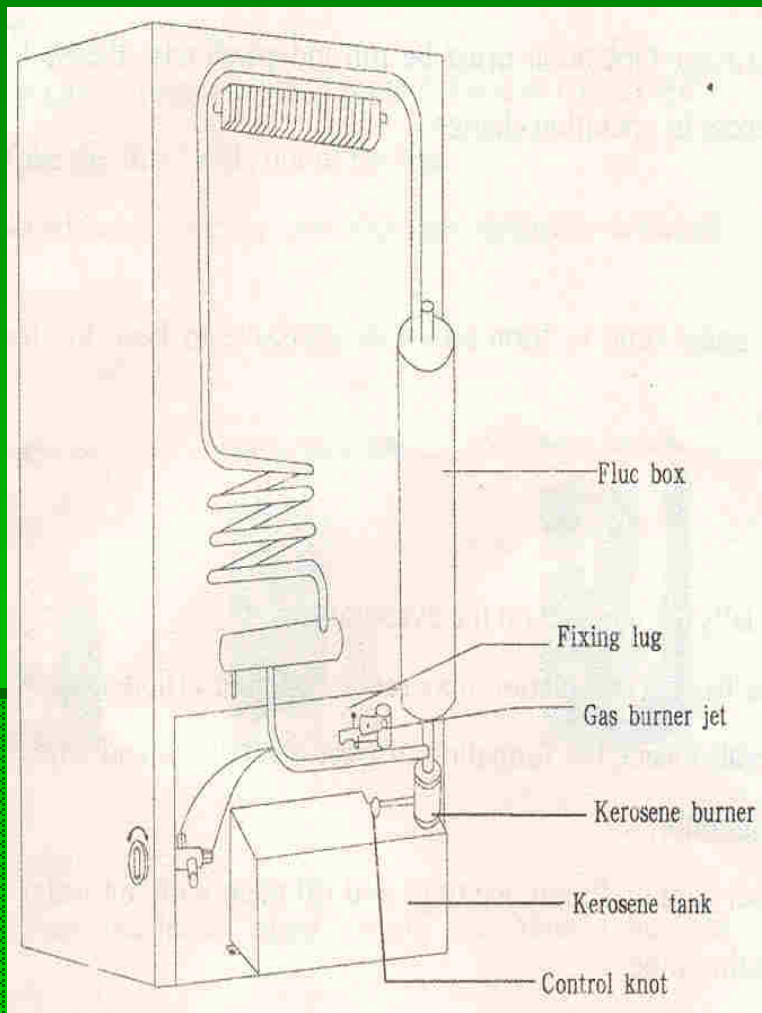
# COOKING EQUIPMENT – Biogas Stove 2



# BIOGAS REFRIDGERATOR



# ABSORPTION DIFFUSION GAS REFRIDGERATOR



# BIOGAS ELECTRICITY GENERATOR



# THE TREATED EFFLUENT SLURRY

## Nitrogen Rich Liquid Slurry (Fertilizer)



# THE TREATED EFFLUENT SLURRY FOR NON-CRITICAL APPLICATION

❖ **W. C. FLUSHING**

❖ **AFFORESTATION**

❖ **LANDSCAPING**

## THE TREATED EFFLUENT STORAGE FOR RE-USE IN TOILETS



**BIO LATRINE WITH TREATED EFFLUENT FOR RE-FLUSHING**

# Alternative uses of Treated water for Woodlot Plantation Irrigation



# Alternative uses of Treated water for landscaping



**The Effluent used for Land Scaping**

# THE DIRECT ECONOMIC BENEFITS

- **Avoidance Cost of Constructing Septic Tank**
- **Water Savings (Cistern Methods)**
- **Treated Effluent (water) Utilization**
  - **Alternative Uses**
  - **Water use reduction**
  - **Treated Effluent for re-flushing**
- **Biogas Generation**

# Community and Health Benefits

- **Pathogen Destruction**
- **Sanitation and Health Benefits**
  - Avoidance of odour nuisance from Septic Emptying
  - Elimination of seasonal overflows of septic tanks

## SURVIVAL TIME OF PATHOGENS IN BIOGAS PLANTS (ANAEROBIC DIGESTION)

BACTERIA	THEMOPHILIC FERMENTATION 33 – 55°C		MESOPHILIC FERMENTATION 55 – 37°C	
	Fatality Days	Rate (%)	Fatality Days	Rate (%)
Salmonella	1 – 2	100.0	7	100.0
Shigella	1	100.0	5	100.0
Poliviruses	-	-	9	100.0
Schistosoma Ova	Hours	100.0	7	100.0
Hook worm Ova	1	100.0	10	100.0
Ascaris Ova	2	100.0	36	98.0
Typhoid	7	100.0		
Para yphoid	10 days	100.0		
Cholera	8	100.0		
Dysentery Bacteria	11	100.0		
Bilharzia	4	100.0		

## c) Effluent Water Quality Analysis

Sample Code: VALLEY VIEW UNIVERSITY

Sampling Date: 13/8/2004

Sampling Time: 11.45 a.m. – 12.10 a.m.

Date of Analysis: 13 – 18 /8/2004

Source/Purpose: Valley View Effluent Quality Evaluation

Sample Size: 2 Litres

Date of Report: 21/8/2004

Parameters	Site 1: BIOGAS Effluent	E.P.A. Guideline Values
Temperature (°C)	34.6	<3°C above ambient
PH	7.15	6-9
Conductivity (µS/cm)	709	1500
Dept	1.9 meters	-
Salinity (%)	0.1	-
Total Dissolved Solids (mg/l)	40	1000
Dissolved Oxy gen (mg/l)	1.9	-
Total Suspended Solids (mg/l)	46	50
COD (mgO <sub>2</sub> /l)	142	250
BOD (mgO <sub>2</sub> /l)	14	50
Sulphate (mg/l)	9	300
Nitrate-Nitrogen (mg/l)	30	50
Iron (mg/l)	0.10	1.0
Ammonium Nitro gen	16.9	400
Total coliforms (MPN/100 ml)	137	10
Zinc	0.4	0.1
Lead	0.2	

\*Exceeds Environmental Protection Agency Effluent Quality Guidelines

Submitted by

**MR. EMMANUEL APPOH (ENVIRONMENTAL SCIENTIST)**

**E. P. A.**

***www.biogasonline.com***

***info@biogasonline.com***