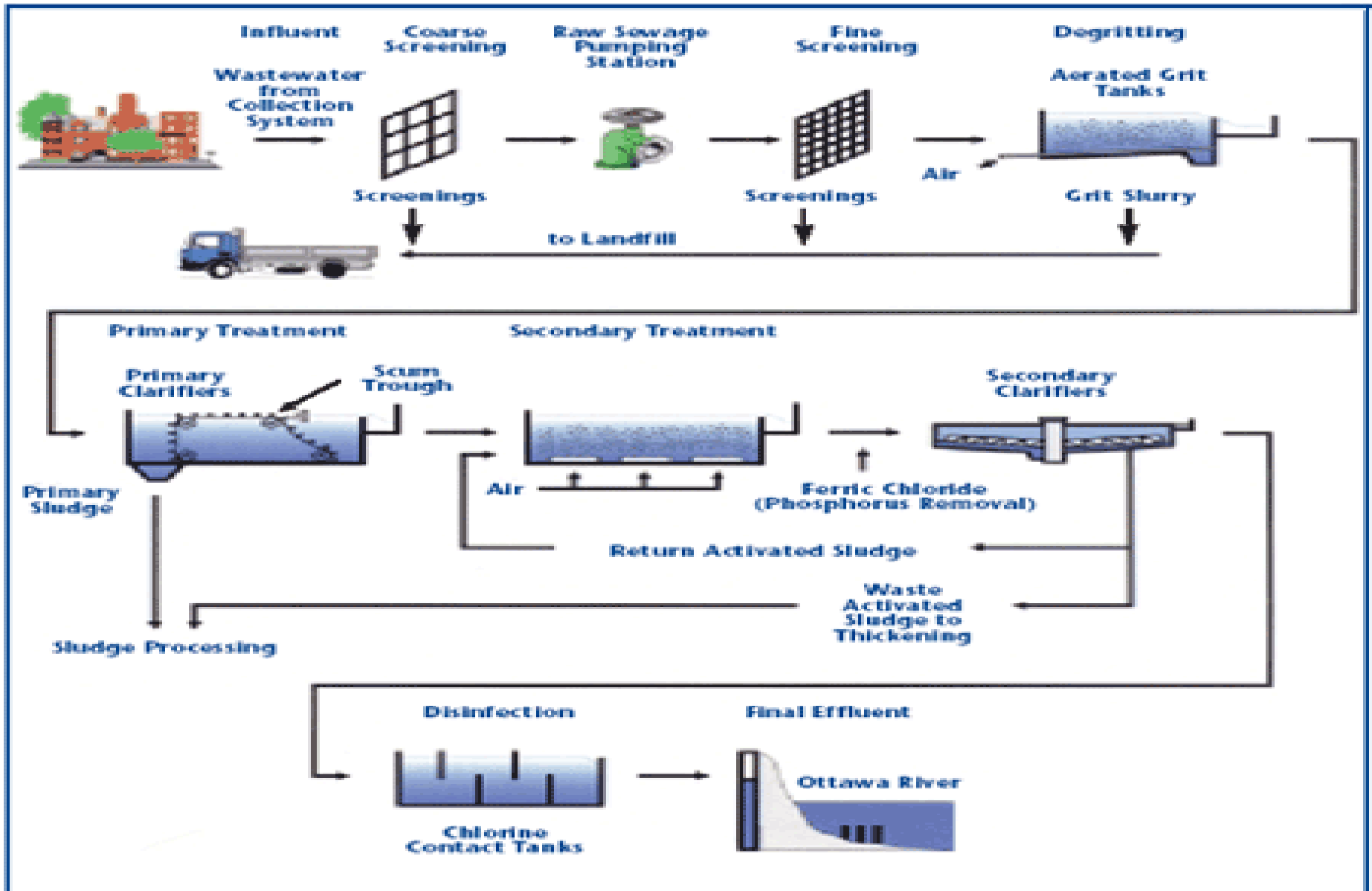
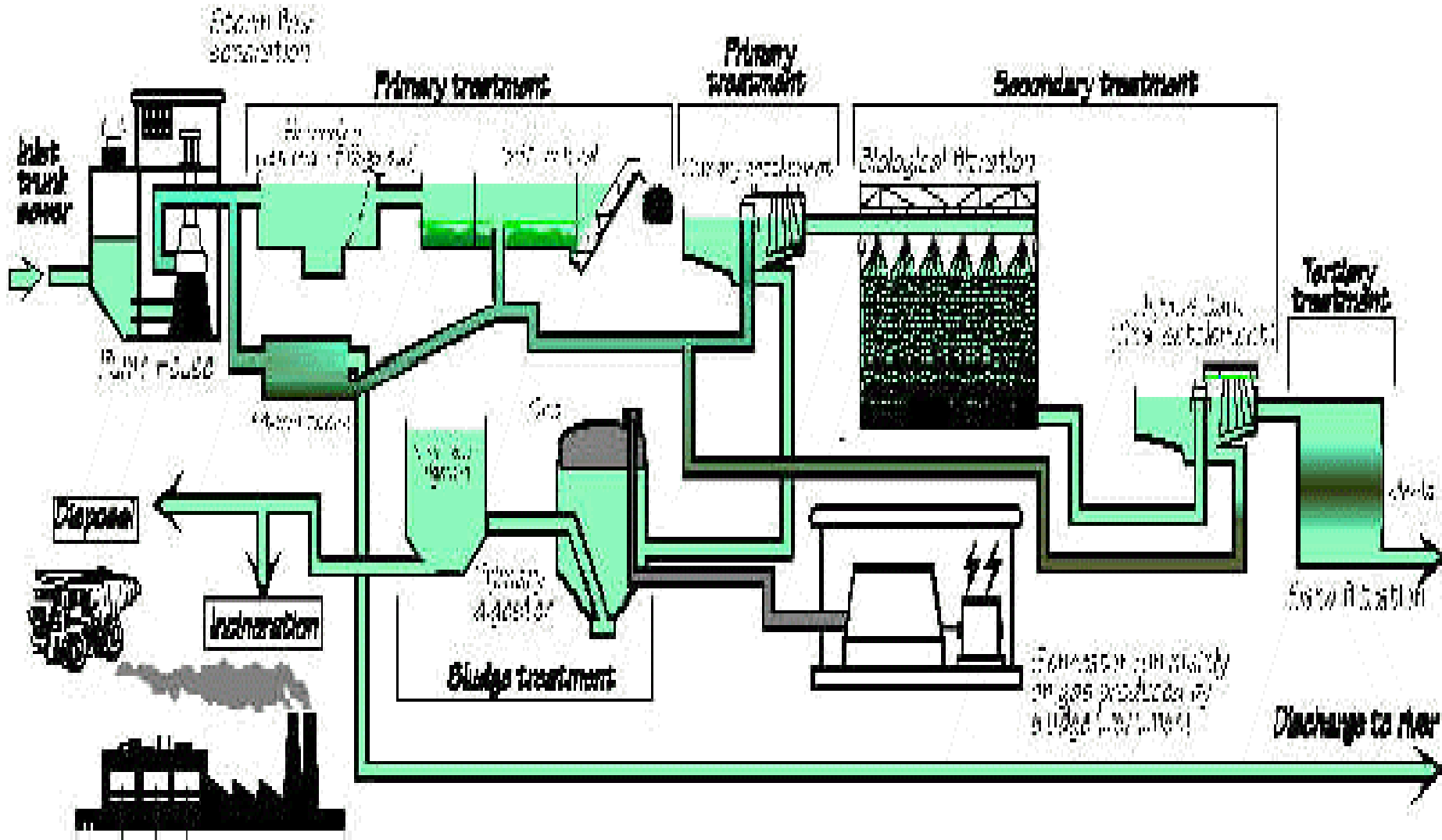


Sludge treatment

Sources of sludge



Flow line in primary and secondary wastewater treatment





Screening



Grit Removal



Clarification



Aeration



Secondary Clarifier



Filtration



UV Disinfection

alternate process



MBR



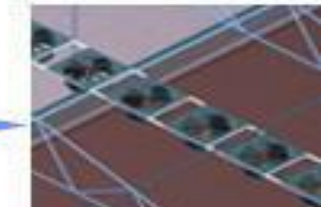
Sludge Thickening



Sludge Digestion



Sludge Dewatering



Sludge Drying

	P.S.T	F.S.T
Sludge type	Non oxidized	Oxidized
Quantity	Depends on: Qd, withdrawal time (min twice a day)	Depends on: Qd+QR, withdrawal time (min twice a day) in case of H.R.T.F and a part of it return before A.T
Description	Large particles which collected after sedimentation under its own weight Easy to treat	Small particles produced from the previous biological treatment unit Difficult to treat

Purpose of sludge treatment:

- 1- Treatment the organic matter in sludge to avoid undesirable release of gasses.
- 2- Destroy the pathogenic bacteria to dispose it safely.
- 3- Decrease the water content to decrease the area needed for drying beds.
- 4- To be able to use it as a fertilizer.
- 5- Decrease the volume of sludge.
- 6- save the cost of chemicals used to prepare the sludge for disposal by decreasing the sludge volume and dewatering facilities.
- 7- Producing bio gas used as a source of energy.

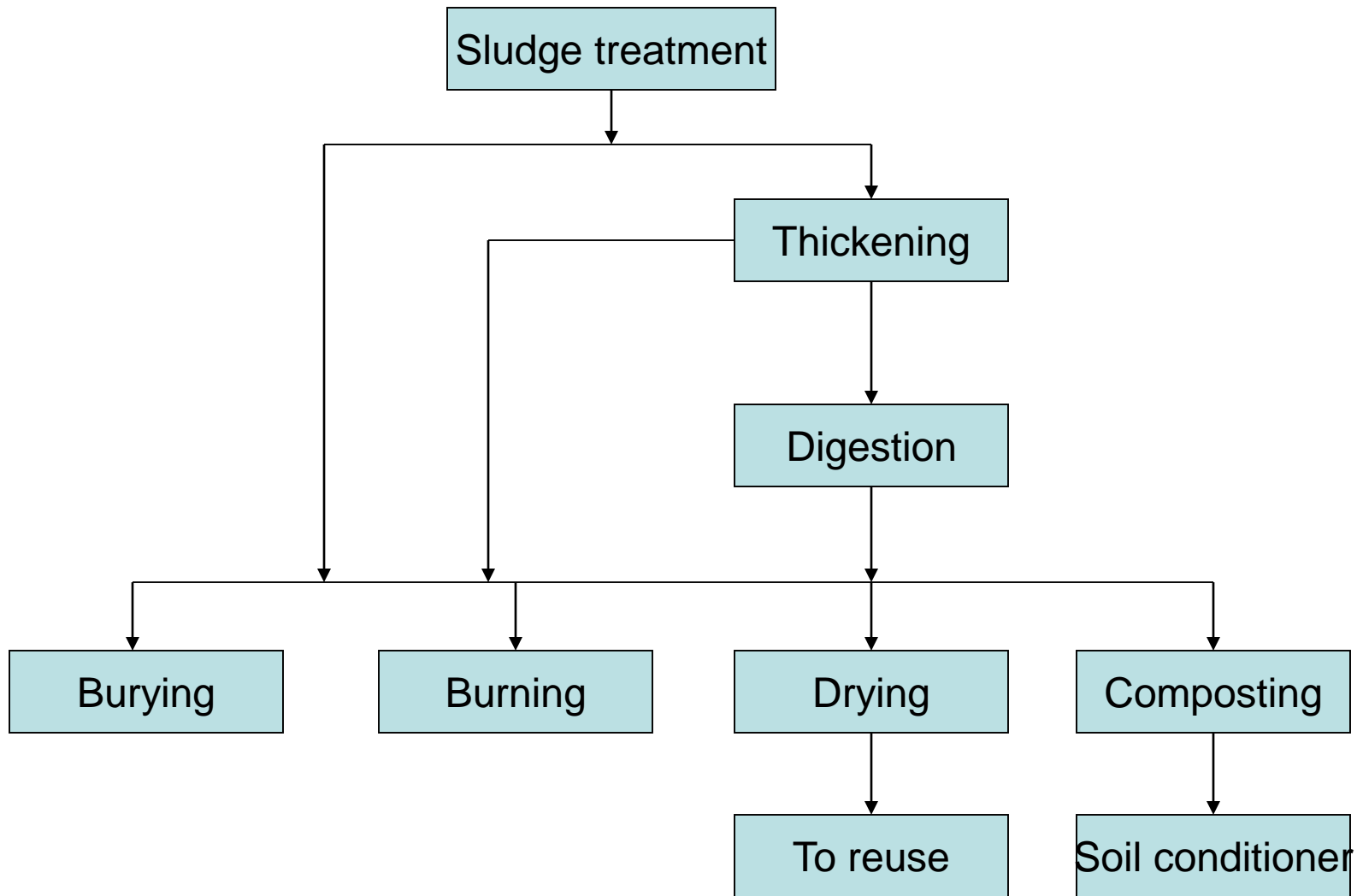
The final products of sludge treatment:

- 1- Stable solid matter which can be dried and used as fertilizer.
- 2- Supernatant which contain colloidal solids of high concentration (500 – 1000 P.P.M).

It is very contaminated and should be return before the P.S.T.

3- Gasses produced from sludge treatment

60 – 70 % methane, 20 – 30 % carbon dioxide, hydrogen sulphade and ammonia. Which can be used as a source of energy for the operation of the digester and other unite of wastewater treatment plant.



Thickener:

Purpose:

Increase solid concentration in sludge and decrease the volume by 20 – 40 %

Design criteria:

1- $T = 16 - 36$ hr

2- $d = 2.5 - 3.5$ m

3- $\Phi \leq 35$ m

4- Total solid = $49 - 59$ kg/m²/d

5- S.L.R. = $24 - 30$ m³/m²/d

6- $V = Q_s \times T$



Gravity thickener



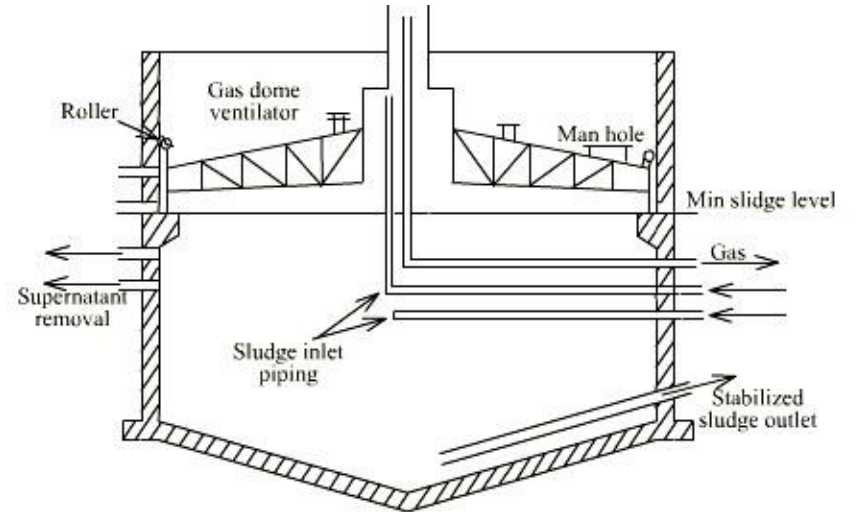
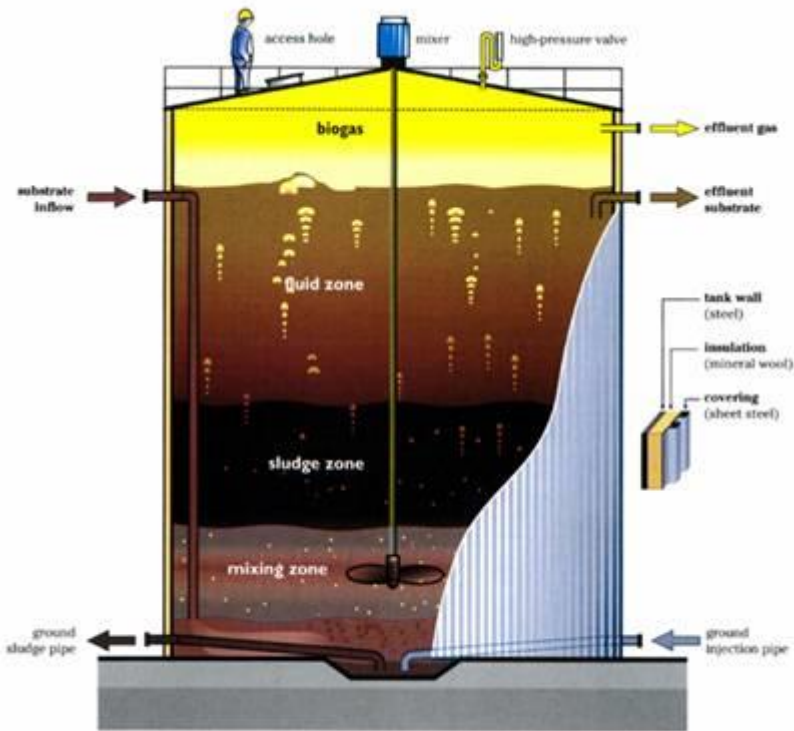
Digester:

Purpose:

- 1- Decrease the sludge volume to $\frac{1}{2}$ - $\frac{1}{3}$ Vs
- 2- Removal of most of organic matters
- 3- Removal of harmful bacteria
- 4- Improve sludge quality for usages

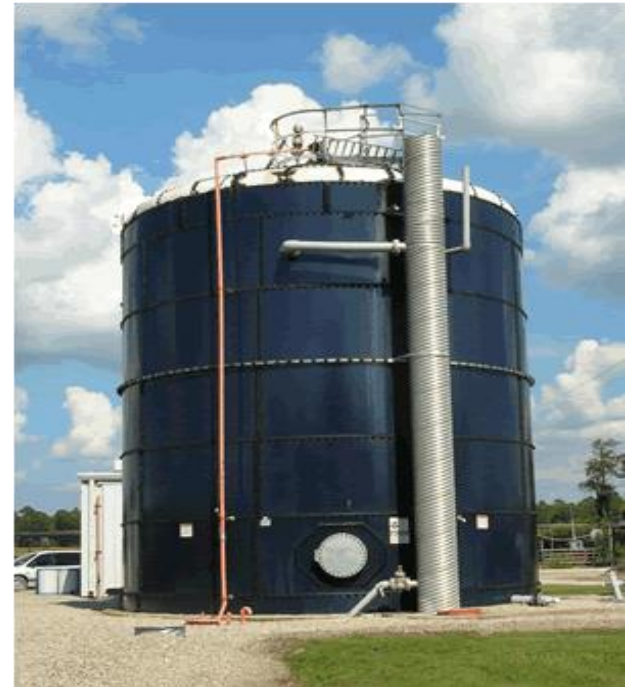
Design criteria:

- 1- $T = 30 \sim 45$ days ... at temperature = $30 \sim 37$ degree
Or $T = 10 \sim 20$ days ... at temperature = $45 \sim 50$ degree
- 2- Φ not > 35 m
- 3- $d = (1/2 \sim 2/3) \Phi$
- 4- Out let sludge = $1/3$ inlet sludge
- 5- Volume = $((Q_{eff} + Q_{inf}) / 2) \times$ time



Anaerobic sludge digester

Anaerobic digester



Drying beds

Purpose:

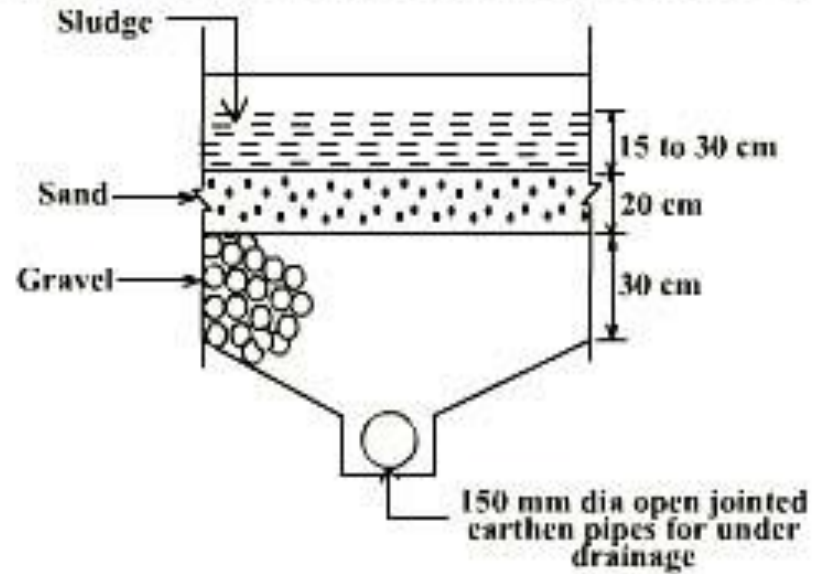
Removal of all water content in the sludge facilitate its reuse.

Design criteria:

- 1- Gravel layer thickness 30 cm.
- 2- Sand layer thickness 25 cm.
- 3- Sludge layer thickness 10 cm, and another two layers are allowed to be added after 5 – 7 days each the last layer should be covered by sand to avoid breeding flies.
- 4- drying period 5 – 7 days.
- 5- Area of bed 5x5m – 20x20m



Cross-sectional View of an Open Sand Bed



Drying beds

