

# **Wastewater Engineering**

## **Lecture - 9**



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# **Sewage Handling and Disposal**

# Introduction

- **Sludge** refers to the residual, semi-solid material left from, municipal wastewater or industrial wastewater treatment processes.
- Sustainable sludge handling may be defined as a socially acceptable, cost-effective method that meets the requirement of efficient recycling of resources while ensuring that harmful substances are not transferred to humans or the environment i.e. water, air or soil.

# **Sludge Handling Processes**

- 1. Primary operations**
- 2. Thickening**
- 3. Stabilization**
- 4. Dewatering**
- 5. Heat drying**

# 1) Primary Operations

This process includes:

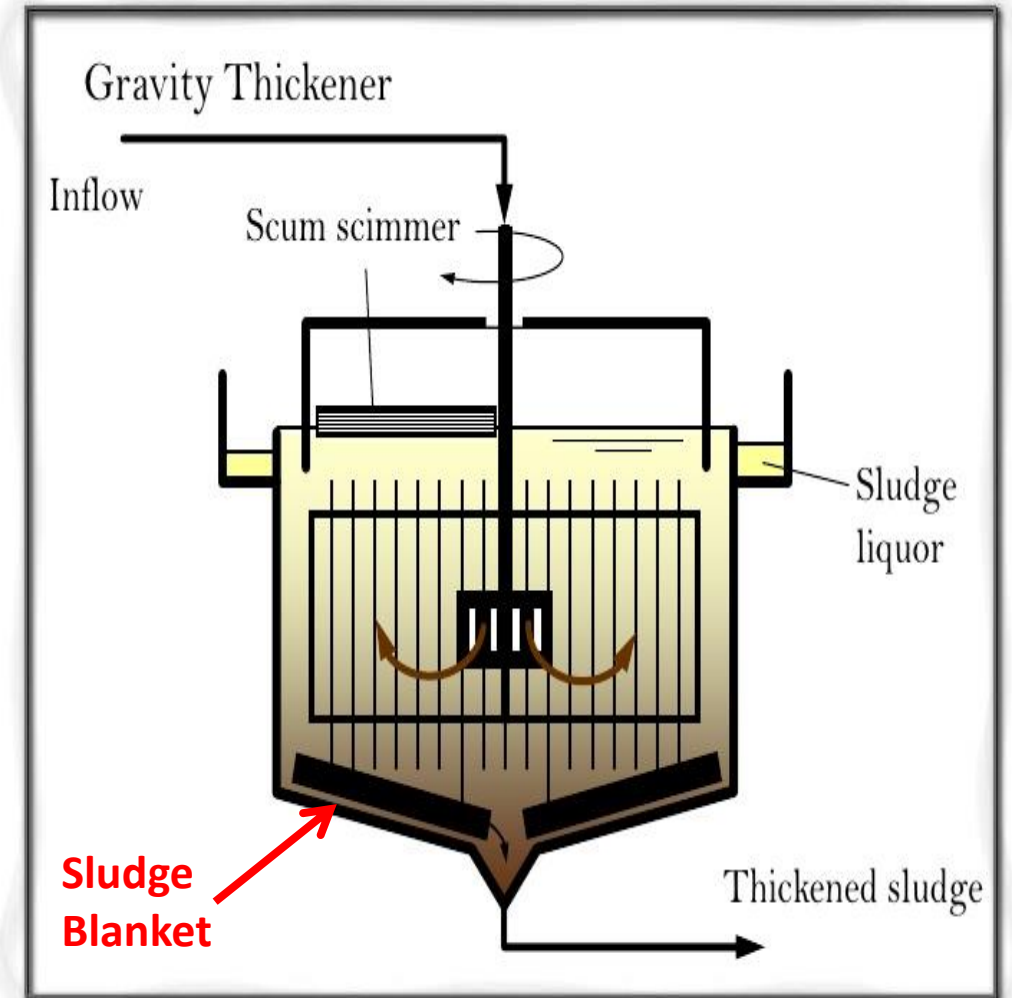
- i) **Grinding:** It includes particles size reduction
- ii) **Screening:** It includes removal of fibrous materials.
- iii) **Degritting:** It includes removal of sand or other inorganic materials.
- iv) **Blending:** It includes making the sludge homogenous.
- v) **Storage:** It ensures flow equalization in the system.

## 2) Sludge Thickening

- Sludge thickening is undertaken to increase percentage of solid content in sludge by removing a portion of liquid fraction.
- Volume reduction of approximately 30 – 80 % can be reached with sludge thickening.
- Various methods of sludge thickening are:
  - i. Gravity thickening
  - ii. Flotation thickening
  - iii. Rotatory drum thickening

## 2) Sludge Thickening

- **Gravity Thickening** : Gravity thickening employs gravity to do the job of sludge thickening. The sludge solution is made to flow under a baffle and up through a sludge blanket – a layer of sludge lying on the bottom of a container. The sludge is filtered out as soon as it contacts or strikes the sludge blanket.



### **3) Sludge Stabilization**

- Sludge Stabilization is undertaken to reduce pathogens, eliminate offensive odors, minimize production of usable gas (methane).
  
- Methods of stabilization are:
  - i. Alkaline Stabilization
  - ii. Anaerobic Digestion



## 3) Sludge Stabilization

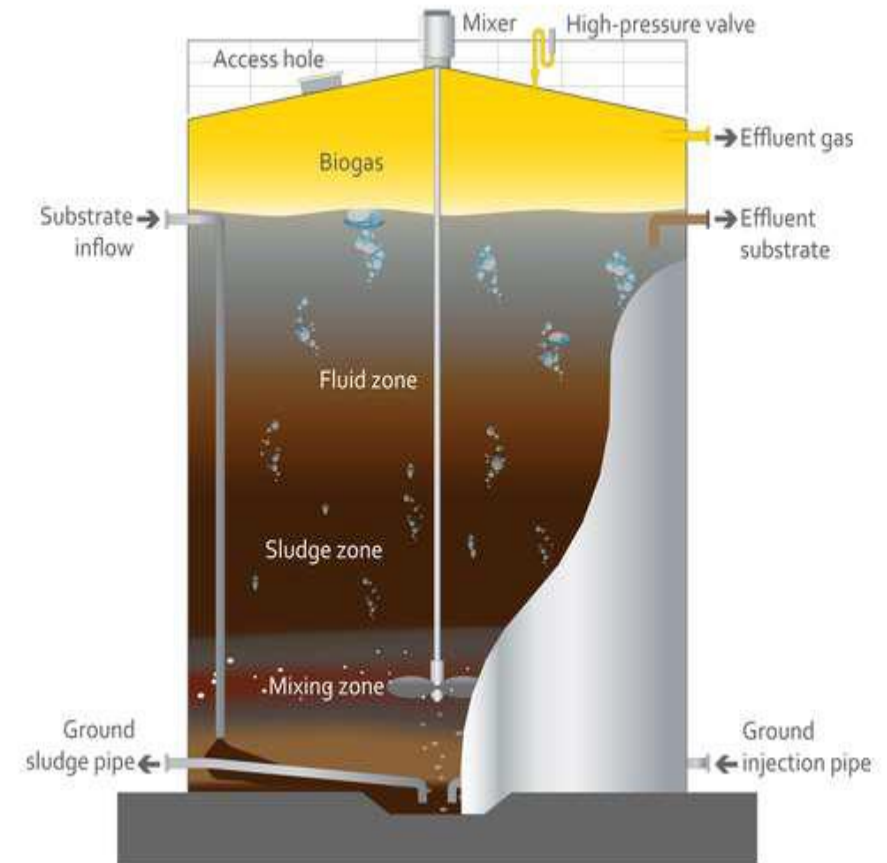
### i) Alkaline stabilization :

- Lime is added to untreated sludge , to raise the pH to 12 or higher.
- Retards microbial reaction . Materials such as cement kiln dust ,fly ash are used instead of lime .

# 3) Sludge Stabilization

## i) Anaerobic Digestion:

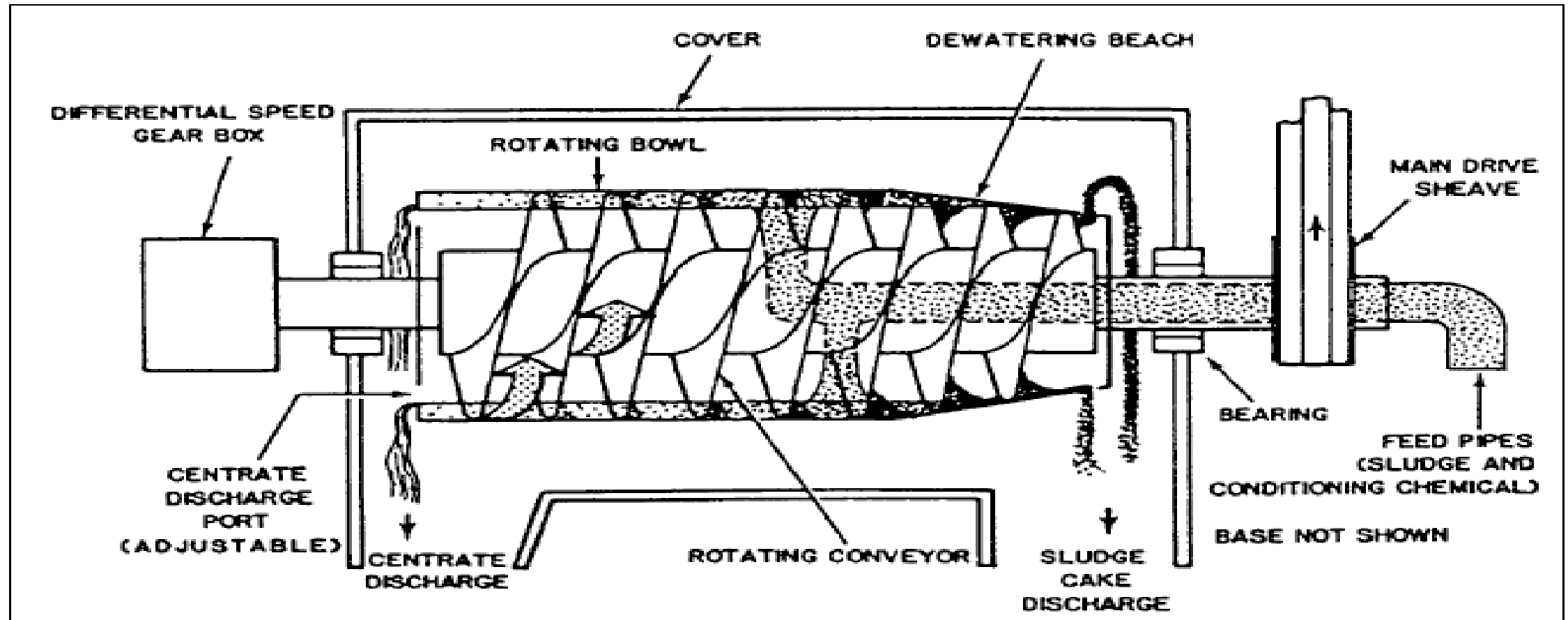
- A biological process that uses bacteria in an oxygen free environment.
- These bacteria converts volatile solids into carbon dioxide, methane and ammonia .



## 4) Dewatering

- Dewatering is undertaken to reduce the moisture content of sludge.
- Compared to thermal (evaporative processes) for water reduction, mechanical dewatering is often selected due to its low energy requirement.
- Centrifugation is the method used for separating liquids of different densities, thickening slurries.

# 4) Dewatering

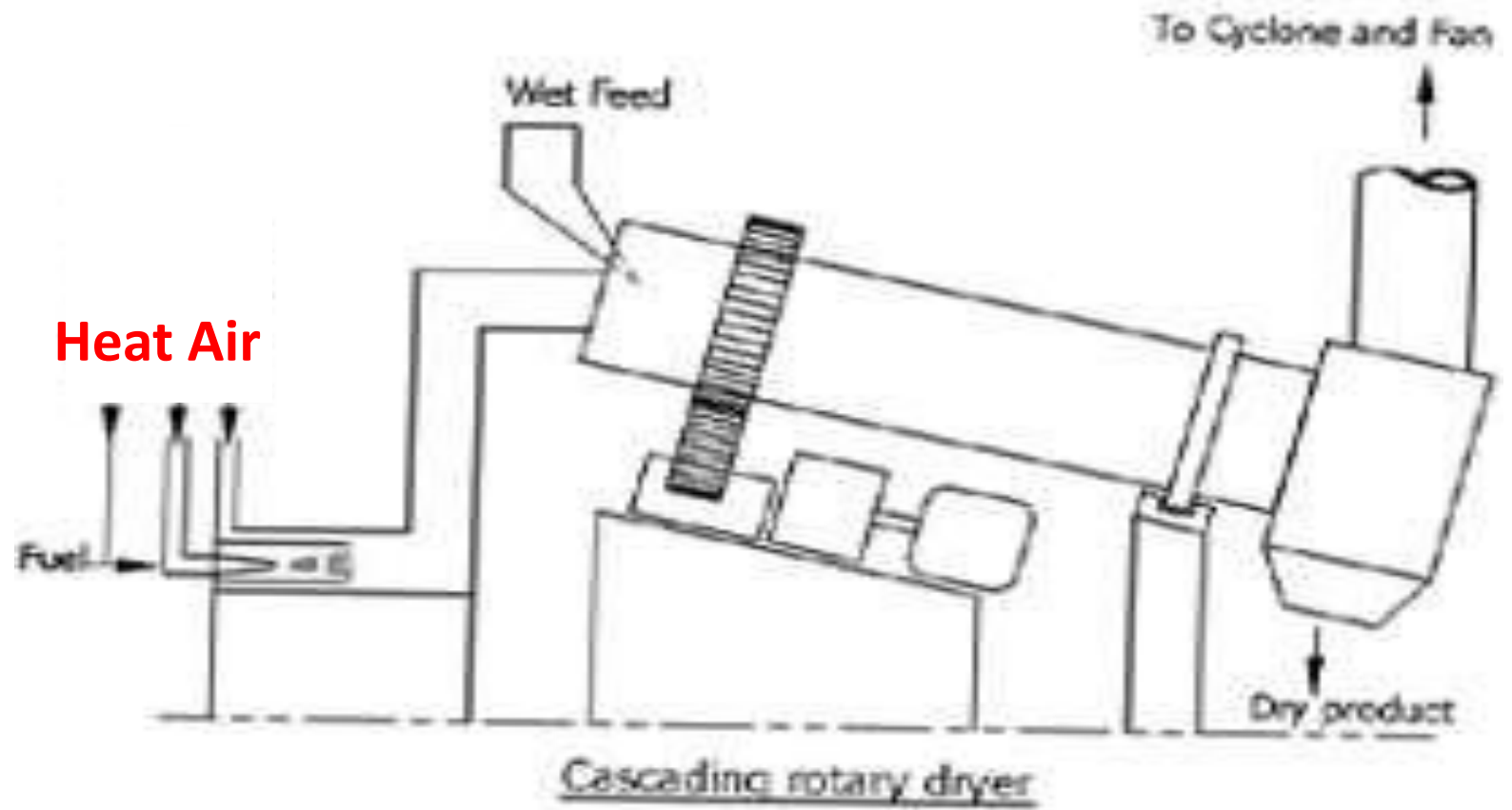


## Centrifugation

## 5) Heat Drying

- It involves the application of heat to evaporate water and to reduce the moisture content of biosolids.
- Advantage of this method is to reduce product transportation costs, improve storage capability, and marketability.
- **Direct drying** involves the wastewater solids come into contact with hot gases, which cause evaporation of moisture. Dryers such as rotary dryers and fluidized bed dryers are used.

# 5) Heat Drying



# Sludge Disposal

- Sewage sludge contains both compounds of agricultural value and pollutants:
  - i. **Agriculture value-** organic matter, nitrogen, phosphorus and potassium.
  - ii. **Pollutants-** heavy metals, organic pollutants and pathogens

# Methods of Sludge Disposal

1. Land fill
2. Agricultural use
3. Other methods



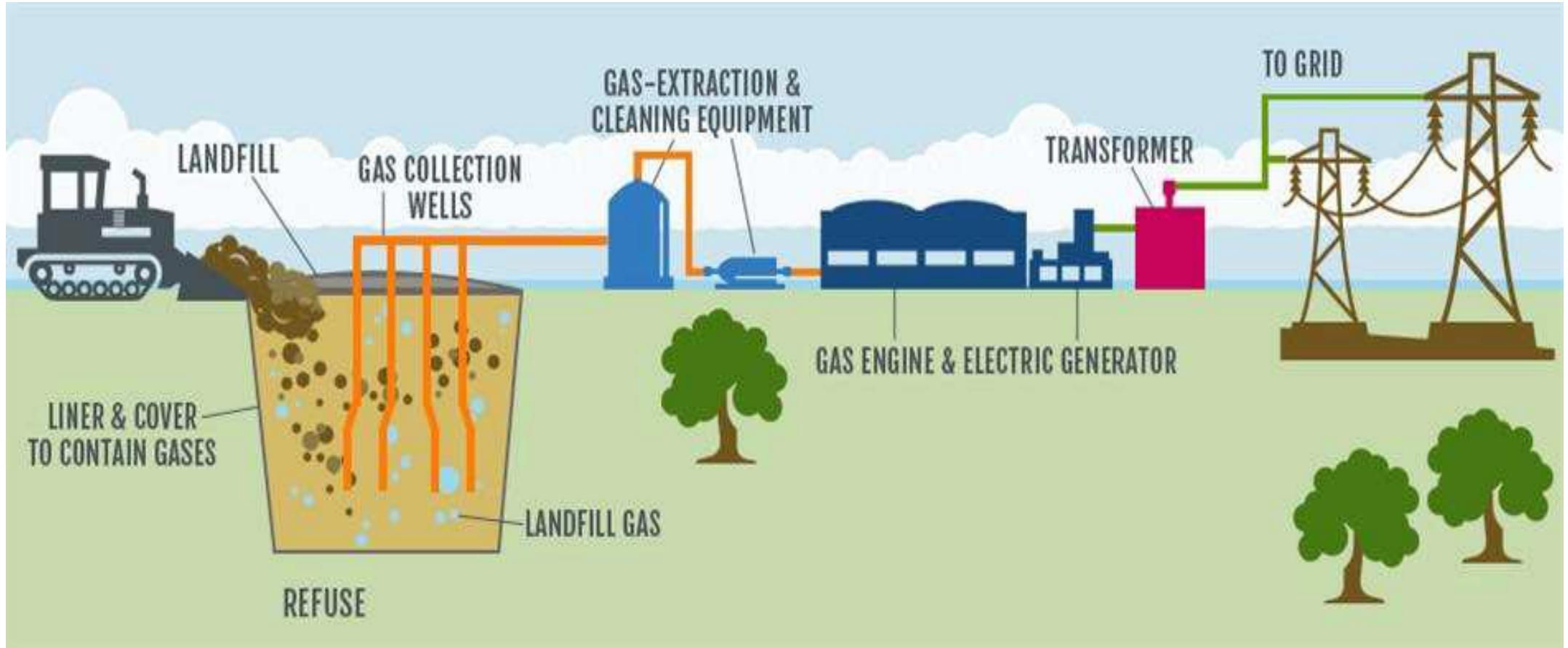
# Methods of Sludge Disposal

## 1. Land fill:

- A site for the disposal of waste materials by burial and is the oldest form of waste disposal.
- Problem with this method is that many landfills are filling up, and towns are having trouble finding places to put new ones.

# Methods of Sludge Disposal

## 1. Land fill:



# Methods of Sludge Disposal

## 2. Agriculture Purpose:

- The purpose of using sludge in agriculture is partly to utilize nutrients such as phosphorus and nitrogen and partly to utilize organic substances for soil improvement.
- All types of sludge can be spread on farmland if they fulfill the quality requirements (heavy metals, pathogens, pretreatment)

# Methods of Sludge Disposal

## 2. Agriculture Purpose:

### ➤ Advantages:

1. Utilization of nutrients contained in the sludge, i.e. phosphorus and nitrogen.
2. Utilization of organic substances contained in the sludge for improvement of the humus.
3. Soil improvement
4. The cheapest disposal route

# Methods of Sludge Disposal

## 2. Agriculture Purpose:

### ➤ Disadvantages:

1. Major investments in storage facilities as sludge can only be spread on farmland a few times a year.
2. Dependency on the individual farmers and considerable administration of agreements.
3. Lack of knowledge as to the content of organic micro-pollutants and pathogenic organisms in sludge and their impact on the food chains.

# Methods of Sludge Disposal

## 3. Other Methods:

1. **Ocean Disposal** – Dumping or controlled release of sewage sludge into marine water.
2. **Distribution and Marketing** – The give-away, transfer, or sale of sewage sludge or sewage sludge product in either bagged or bulk form.
3. **Surface Disposal** – A controlled area of land where only sewage sludge is placed for a period of one year or longer. Sludge placed in this area is not provided with a daily or final cover.

# Effluent Reuse

1. Land scape Irrigation
2. Agriculture Irrigation
3. Ground water Recharge
4. Street washing
5. Fire Fighting
6. Non-portable domestic uses

**Thank You**