Sludge Generation And Handling

Introduction:

Sludge is a byproduct of wastewater treatment activity. It may be comprising of chemicals, bacterial floc, oily materials, and inert suspended materials depending on the type of wastewater treated. Considering the treatment section from which sludge is generated, sludge can be divided in two parts : 1) Primary Sludge and 2) Secondary Sludge.

Sludge generation:

When wastewater (sewage or industrial) is treated in wastewater treatment plant, it always contains suspended particles and materials carry forwarded from the source of generation. For example, when sewage is entered into sewage treatment plant it carries forward many things along with the flow such as plastic, sand particles, soil particles. Out of this materials larger particles such as plastic, wood etc. can be separated by screens installed at the inlet of sewage treatment plant, but the smaller particles which escapes from the screen, is having tendency to settle down, when enough time of settling is provided. These particles settle down in clarifier and form sludge. Similarly, when chemical treatment is given to wastewater in effluent treatment plant, coagulating agents such as lime, ferrous sulphate, ferric chloride, alum etc. are used. This chemical coagulates smaller suspended particles and enhance settling of suspended particles in clarifiers. Thus, sludge generated in chemical treatment section of ETP is commonly known as 'Primary sludge', which contains remaining of treatment chemicals, settled suspended particles and other chemicals present in effluent itself. This sludge is considered as Hazardous waste and needs proper treatment.

In case of sewage treatment plant and many effluent treatment plant sludge is also generated during secondary treatment (i.e. biological treatment). Once the biomass level reach above the optimum level in biological processes, operator needs to 'waste' additional biomass commonly known as 'Secondary sludge'.

Components/ Processes involved in Sludge Handling System:

Main components of the sludge handling system are:

- Sludge transfer system – pumps
- Sludge thickener and digester
- Sludge de-watering

Brief Description of each component /process:

- Sludge transfer system – pumps
  - Needed to transfer sludge from settler to sludge collection sump. However, in many plants the hydraulic pressure of settler is used for sludge transfer from bottom of settling tank to sludge storage tanks.
  - High pressure slurry pumps such as Screw pumps are required for transferring sludge from sludge storage tank to dewatering units,
- Sludge thickener and digester
  - Sludge Thickener :
    - The role of sludge thickening is to thicken the sludge of low concentration generated in STPs, and to make subsequent processes such as sludge digestion and sludge de-watering more effective.
    - Chemicals (mostly poly electrolytes) charged into sludge feed system, this unit facilitated proper separation of water from sludge and is helpful to reduce load to sludge filtering system and moisture management in sludge.
    - Sludge thickening may be broadly classified into four types, gravity thickening, centrifugal thickening, floatation thickening and belt-type thickening.
  - Sludge Digester (Anaerobic digestion):
    - In anaerobic digestion, anaerobic bacteria thrive in an environment without dissolved oxygen.
    - Two major types of bacteria are present in the digester. The first group starts degrading the organic portion of the sludge to form organic acids and carbon dioxide gas. These bacteria are called acid formers. The second group breaks down the organic acids to simpler compounds and forms methane and carbon dioxide gas. These bacteria are called gas formers.
    - The methane gas is usually used to heat the digester or to run engines in the plant. The production of gas indicates that organic material is being degraded by the bacteria.

- Sludge is usually considered properly digested when 50 % of the organic matter has been destroyed and converted to gas.

- Sludge de-watering:
  - Most of the digested primary or mixed sludge can be compacted to a water content of about 90% in the digester itself by gravity, but mechanical de-watering with or without coagulant aids or prolonged drying on open sludge drying beds (SDBs), may be required to reduce the water content further.
  - The de-watering of digested sludge is usually accomplished on sludge drying beds, which can reduce the moisture content to below 70%. But excess oil or grease in the sludge will interfere with the process.
  - Where the required space for sludge drying beds is not available, sludge conditioning, followed by mechanical de-watering on centrifugation, belt press, filter press, screw press, rotary press and vacuum filters is the better choice.

Reference: Manual on Sewerage and Sewage Treatment Systems, Central Public Health & Environmental Engineering Organization (CPHEEO), Ministry of Housing and Urban Affairs, Government of India