

CE 474/574 - Unit Operations in Environmental Engineering

Design Assignment 9

Sludge Digestion for the Greater Drain, OR Sewage Treatment Plant

Now we consider anaerobic digestion with methane production. Since this is a small plant, we'll keep things simple and go with a single-stage (unmixed) reactor.

Use calculations of TOTAL sludge produced by the proposed treatment plant. Assume average annual flows, NOT daily peak flows. Assume that the lime addition to the primary clarifiers (for phosphate removal) has been made. If you did not do this calculation, check the solution set on the web page.

1. Calculate the total raw sludge volume using a volume-weighted average solids concentration, where the primary sludge is 8% solids by weight and the secondary sludge is 1.5% by weight.
2. Assume that the digester reduces the total solids content by 40% in a digestion period of 25 days. We will also allow an additional 45 days of digested sludge storage within the digester. Calculate the total volume required for the tank.
3. Estimate the daily methane production in cubic feet.
4. If the final digested sludge removed from the tank is 7% solids with a specific gravity of 1.04, what is the weight of sludge (in pounds) produced per **year**, and what is the volume in cubic yards per **year**.
5. Now use your professional judgment: From the information provided in the reading on sludge process, choose a method of dewatering (your choice). Report your choice and state in 2-3 sentences *why* you chose that method. Then state what you expect the solids content of the final sludge to be. Recalculate the weight and volume of sludge from above using your new estimate of solids content. For specific gravity you can roughly assume a value of 1.XX where XX = % solids content. (E.g., for 15% solids, s.g. = 1.15).

Let's get back to the cover letter format. Write a cover letter that summarizes all your findings, and then attach the supporting calculations.