Particles in Surface Water, Lecture 5a; Contaminant Fate and Transport in the Environment

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Types of Particles

- Mineral- clay aluminosilicates, Iron and manganese hydroxide-approximated density~2.6/cc.
- Organic-plant material, dead bacteria and algal cells as well as decaying aquatic organisms.
- Anthropogenic- sewage biosolids, overflow particles and deposition of industrial emissions. See figure 2-11.

Particle Settling

- Average settling velocity is approximated by Stokes Law;

$\omega_f = (2/9)g(p_s/p_f - 1)r^2/\eta_f$

where ω_f is the settling velocity[L/T], g is acceleration due to gravity, p_s is solid density and p_f is fluid density, ris the particle radius and η is the **kinematic viscosity**(the ratio of the viscosity to the density of the fluid).

R is meant to be hydrodynamically equivalent diameter (so non-spherical particles can be assessed).

See figure 2-11 for settling velocities

Counterbalance of settling and Fickian Processes

- As particles settle they become more concentrated so there is a Fickian transport upward to counteract the downward settling.
- The downward flux density due to settling must equal the upward flux density of diffusion at equilibrium so;

$J_{stokes}=C\ ш_f = J_{fickian}= D\ dC/dx$ so by differentiating and rearranging

$C=C_o\ e^{-(шf/D)x}$ -the concentration of particles in the water column follows an exponential decay from the bottom upward. **Go over Example 2-3**