

Ponds/Lagoons

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Anaerobic Lagoon

- ▶ An anaerobic lagoon is a deep impoundment, essentially free of dissolved oxygen, that promotes anaerobic conditions. The process typically takes place in deep earthen basins, and such ponds are used as anaerobic pretreatment systems.
- ▶ Typically not heated, aerated or mixed.
- ▶ Greater than eight feet deep.





Purpose of Anaerobic Lagoons

- ▶ Pretreatment of high strength industrial wastewaters.
- ▶ Pretreatment of municipal wastewater to allow preliminary sedimentation of suspended solids as a pretreatment process.





Why use Anaerobic Lagoons?

- ▶ These lagoons have been especially effective for pretreatment of high strength organic wastewaters.
- ▶ BOD removals of up to 60 percent are possible.
- ▶ Good for Rural areas where odors are not a major issue.



Process

- ▶ As with all wastewater treatment, Lagoons are preceded by a bar screen and sometimes grit removal.
- ▶ Should have some sort of influent flow measurement device. Name some?
- ▶ Raw wastewater enters near the bottom of the pond and mixes with the active microbial mass in the sludge blanket.



Process cont.

- ▶ Anaerobic conditions prevail except for a shallow surface layer in which excess undigested grease and scum are concentrated.
- ▶ Must deal with this scum layer routinely.
- ▶ Effluent is at the top opposite end of the pond.
- ▶ These lagoons must be further treated by aerobic or facultative lagoons.



Equilibrium

- ▶ When the system is working properly, the two phases of degradation occur simultaneously in dynamic equilibrium.
- ▶ Volatile organic acids are converted to methane at the same rate that they are formed from the more complex organic molecules.



Maintaining Equilibrium

- ▶ Ideally, temperatures should be maintained within the range of 25 to 40 degrees C.
- ▶ Anaerobic activity decreases rapidly at temps below 15 C, below freezing biological activity will virtually cease.
- ▶ pH value should range from 6.6 to 7.6



Maintaining Equilibrium cont.

- ▶ Volatile acid concentrations will be low if the lagoon system is working properly.
- ▶ As a general rule, Volatile acid concentrations should be less than 250 mg/L

Advantages

- ▶ More effective for rapid stabilization of strong organic wastes. Good for high organic loading
- ▶ Produces lots of Methane, if collected this can generate power.
- ▶ Produces less biomass which saves in sludge hauling.
- ▶ No additional energy required to operate.
- ▶ Less expensive to construct and operate.
- ▶ Can be operated in series.



Disadvantages

- ▶ Requires a relatively large area of land.
- ▶ Produces undesirable odors unless covers are used to collect the gasses produced.
- ▶ Require a relatively long detention time for organic stabilization. Desired DT is 1-50 days.
- ▶ Environmental conditions such as temperature, directly impact operations.
- ▶ Should be constructed with a liner.





Stabilization Ponds

- ▶ Most often used ponds. Must have some pretreatment such as primary clarification.
- ▶ The SP is designed to be aerobic throughout its depth.
- ▶ Provide secondary biological treatment.
- ▶ Average depths from three to five feet.
- ▶ Most states require multiple ponds in series with a detention time of 30 days plus.







Ponds

- ▶ Have multiple submerged inlets.
- ▶ Two to three feet of freeboard to prevent overflow.
- ▶ Embankment slope of one to three feet.
- ▶ Length to width is three to one.
- ▶ Must be protected against erosion by a type of grass or rip-rapping.



Ponds cont.

- ▶ Typical pond loadings of 35 to 50 pounds of BOD per surface acre per day are normal.
- ▶ One surface acre will provide treatment for 300 to 400 people.
- ▶ Most suited to small and rural communities that have large land areas.
- ▶ Very cost effective with minimal maintenance.

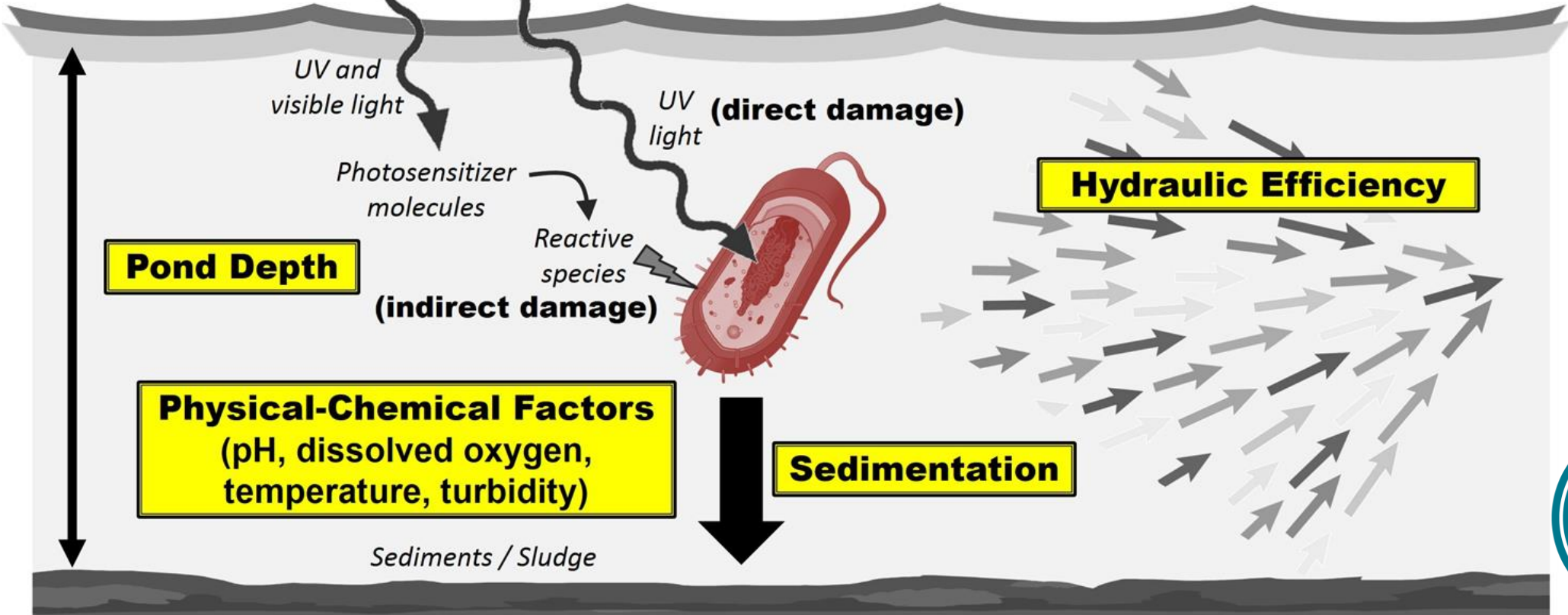
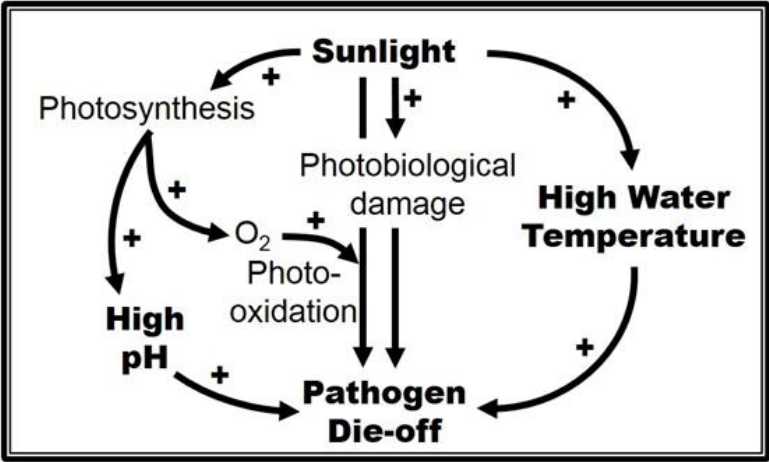


Facultative Lagoons

- ▶ Most often used with in conjunction with stabilization ponds.
- ▶ Similar in design with SPs but are five to eight feet deep. Common for inlet depths to be 10-12 ft deep.
- ▶ Bottom of the FL provides area for anaerobic decomposition/treatment.
- ▶ Top allows for aerobic secondary treatment.



Sunlight







Pond Systems

- ▶ Pond systems stabilize organic material through natural processes involving sunlight, water, nutrients, algae, atmospheric oxygen and bacterial action.
- ▶ Ponds use a multitude of organisms in the treatment process. Bacteria, algae, protozoa, and insects all have a part in this treatment process.
- ▶ Can eliminate 80% to 90% of the BOD.



Operation/Maintenance

- ▶ Most ponds are somewhat maintenance free.
- ▶ Many are designed with no pumps or motors.
- ▶ All flows are by gravity.
- ▶ Maintenance is geared towards keeping grass mowed and removing weeds that have deep roots.
- ▶ Must have strong fences to keep livestock away, to prevent heavy damage.



DANGER

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Pond slopes can be slippery



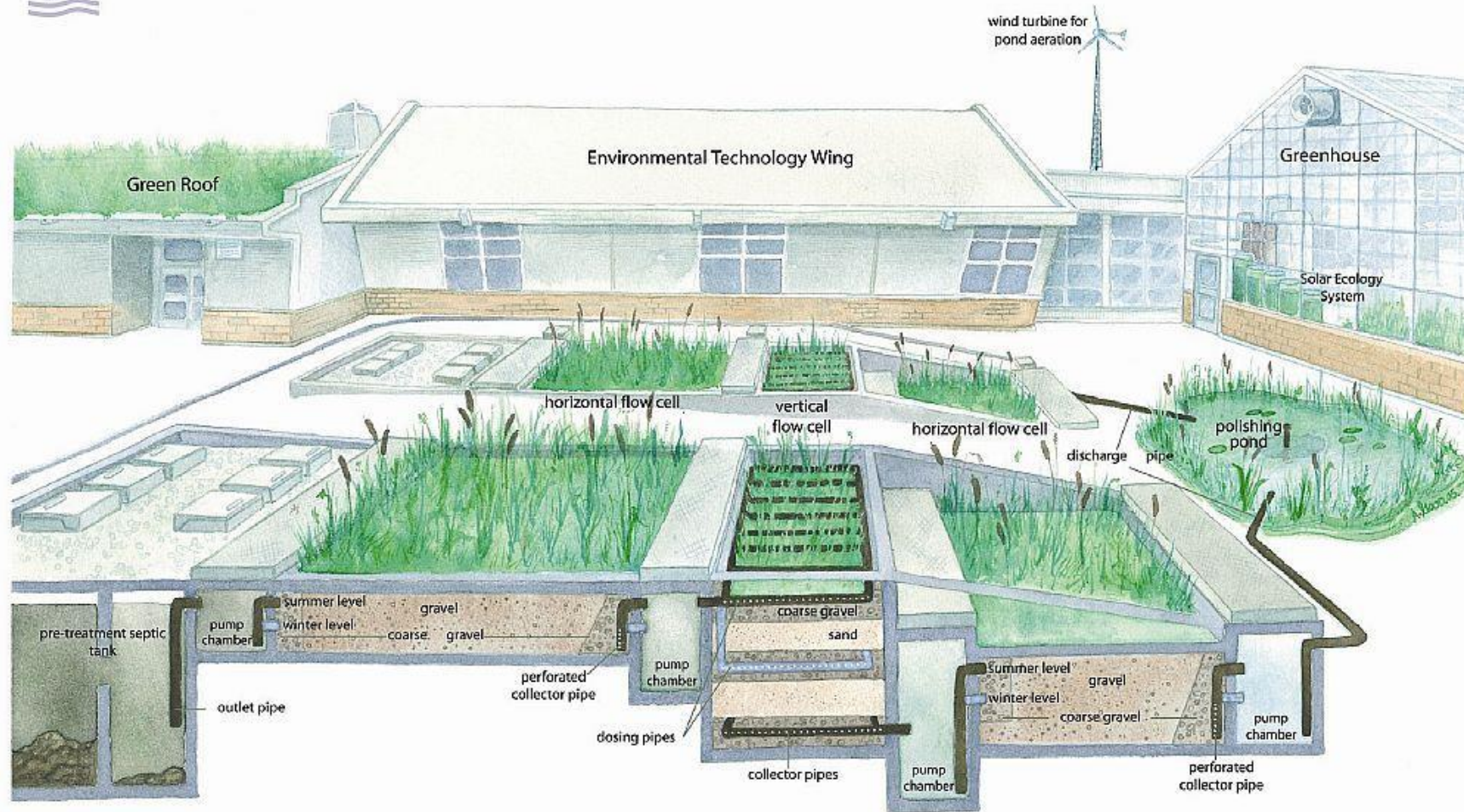
What do you do if you see this?







Centre for Alternative Wastewater Treatment

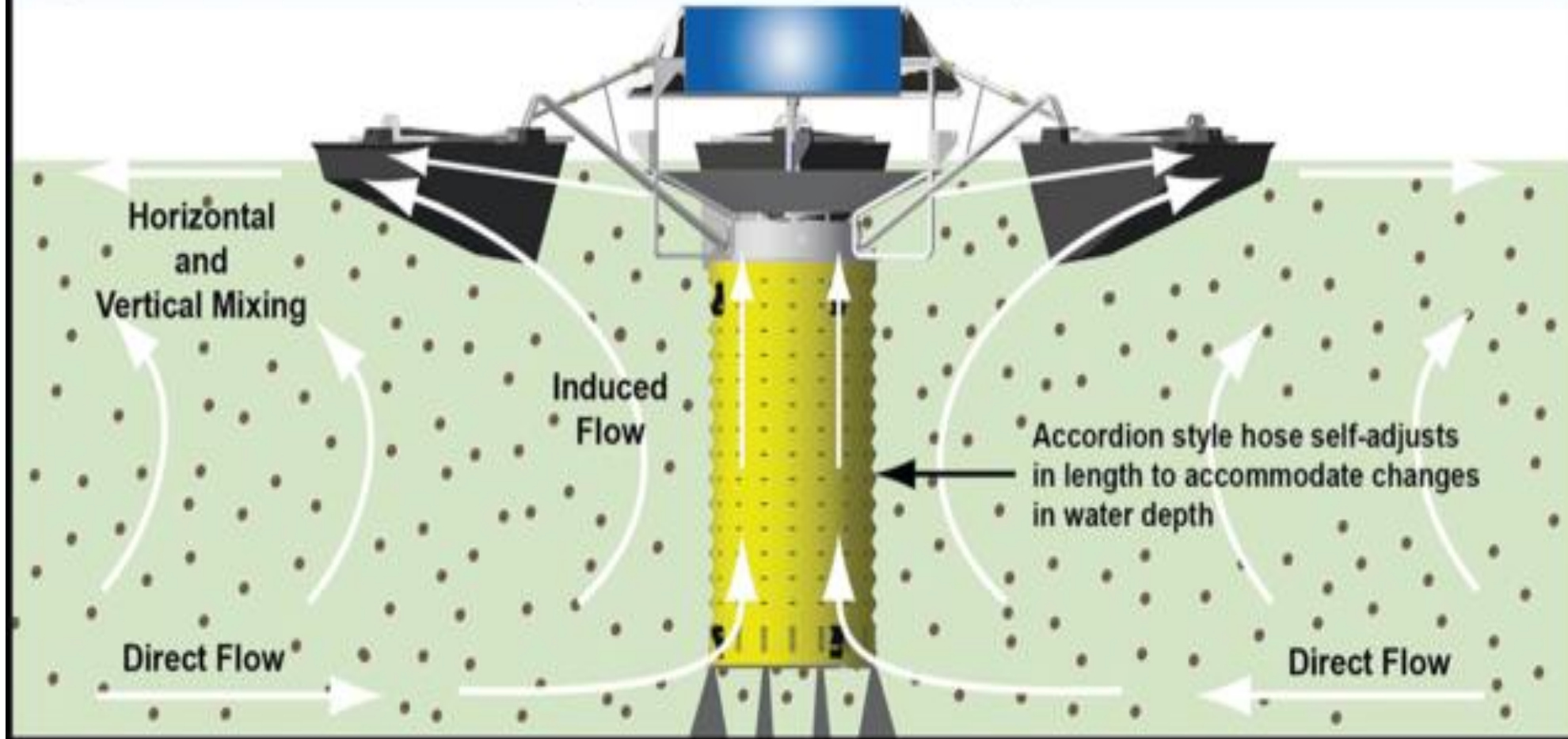


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Floating wastewater mixers have been used for thoroughly mixing equalization basins with over 8,000 mg/l total suspended solids (TSS)

Wastewater Mixing Equalization Basin







Remember that Trucks are heavy



Questions?

- ▶ Thank you for your time.
- ▶ Remember to be clear-headed for the test. Only a few beers the night before.
- ▶ Always check question number matches the answer number, don't skip a question for later. I did that and failed a test.
- ▶ Good luck and have a great day.

