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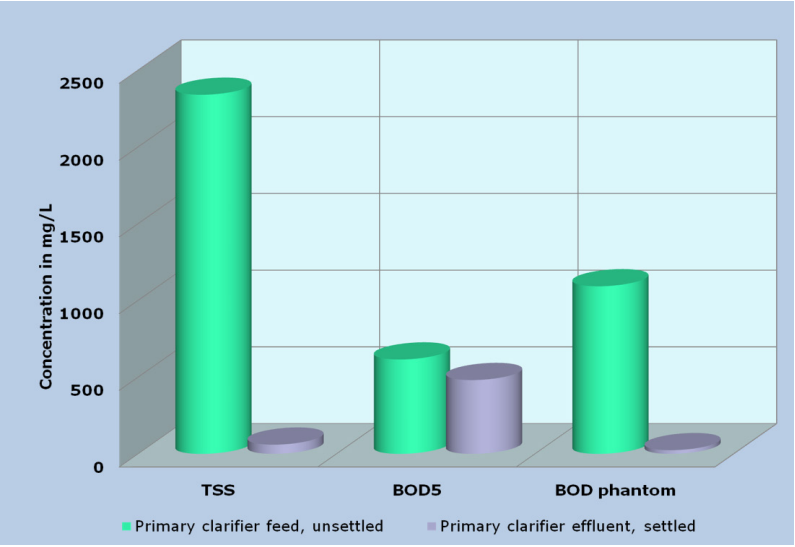
THE IMPORTANCE OF PRIMARY CLARIFICATION

ESSENTIAL FOR SUCCESS

Primary clarifiers are often neglected pieces of equipment in pulp and paper mills. However, proper primary clarification is essential to a smooth-running biological wastewater system. Their main purpose is to remove insoluble BOD (fiber) and inorganic solids (lime, ash, etc.) to reduce the loading to the biological component of the system. Primary clarifiers often remove more BOD and TSS for less operating money than any other treatment process because rejected fiber from the process can exert as much as 0.4 pounds of BOD per pound of TSS.



The diagram shows the difference between what enters the primary clarifier versus what leaves.

The green bars represent the TSS and BOD concentrations coming into the primary clarifier from the mill. If operators bypass the clarifier, this feed will go directly into the ASB. The purple bars in the diagram represent the TSS and BOD concentrations in a typical settled primary clarifier effluent. These concentrations typically enter the ASB when the primary clarifier is functioning correctly.

Phantom BOD represents the insoluble portion of BOD that will not show up in the 5- day BOD test. This fraction will settle out somewhere in the ASB and break down to soluble BOD, creating additional oxygen demand later on. The primary clarifier significantly reduces the phantom BOD load to the ASB in this example.

As seen in this diagram, a primary clarifier serves not only to reduce TSS but also a significant portion of BOD. Since more solids enter the ASB when bypassing the clarifier, bacteria will need time t o acclimate to the higher BOD loading. There will likely be carryover of BOD and TSS into the effluent. Also, since more phantom BOD will be added to the ASB, the consequences of clarifier bypass may be seen weeks later in the treated effluent.

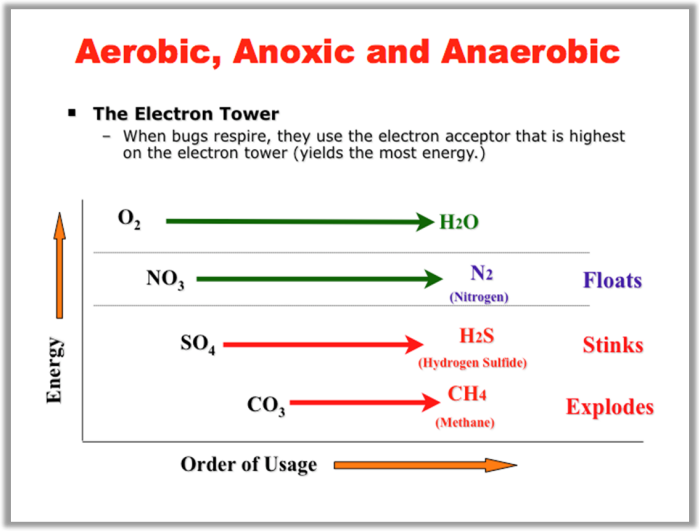
Technology Corner

Odor and hydrogen sulfide control - case study

In 2021, EBS assisted a paper mill with odor issues associated with their aerated stabilization basin (ASB) wastewater treatment system. The formation of reduced sulfur compounds (hydrogen sulfide, methyl mercaptan, dimethyl sulfide) was occurring in a large unaerated holding pond that followed the aeration basin, leading to odor complaints from the community. The odor from reduced sulfur compounds (RSCs) can be a difficult issue to deal with, as other effluent parameters (BOD,TSS) can be well within permit limitations, but these odor-causing compounds can still be produced.

As shown in the chart below, heterotrophic bacteria preferentially utilize oxygen for cellular respiration, and produce CO_2 as a byproduct. If oxygen isn't present, they prefer nitrate, which produces odorless N_2 gas. Lastly, if neither O_2 or NO_3 are available, the bacteria utilize sulfate, which produces odorous hydrogen sulfide and other RSCs.

To understand mitigation strategies, it's important to understand how these odors are generated in large settling basins after aeration. Typically, most of the RSCs coming from the process are oxidized in the aeration basin, as they quickly react with the oxygen supplied by the aerators. However, these compounds can form again in the treatment system if the following conditions occur:



A) moderate/high concentration of BOD is still present
B) dissolved oxygen and nitrate concentrations are negligible
C) sulfate concentration is high

To prevent the formation of RSCs in the final holding pond, EBS worked with the mill to:

1. Deploy strategies to minimize soluble BOD in the ASB Effluent
2. Utilize supplemental nitrate (EBS CalNit) to ensure nitrate was utilized instead of sulfate
3. Utilize additives (ferric chloride) which would precipitate the RSCs if they formed in the holding pond

A supplemental nutrient program was initiated to improve BOD removal efficiency in the ASB, and mill personnel did an excellent job of monitoring and limiting organic loading into the treatment system. RSC formation in the holding pond was significantly reduced in a short period of time.

As a result of this and other similar opportunities, EBS is introducing Ferrox™, a ferric nitrate solution. This unique product provides the powerful combination of nitrate as a terminal electron acceptor to prevent H_2S formation and ferric ions to precipitate any existing aqueous sulfide molecules. To learn more about this creative option, contact Lauren Westphal (westphal@ebsbiowizard) or Lauren Peterman (peterman@ebsbiowizard.com.

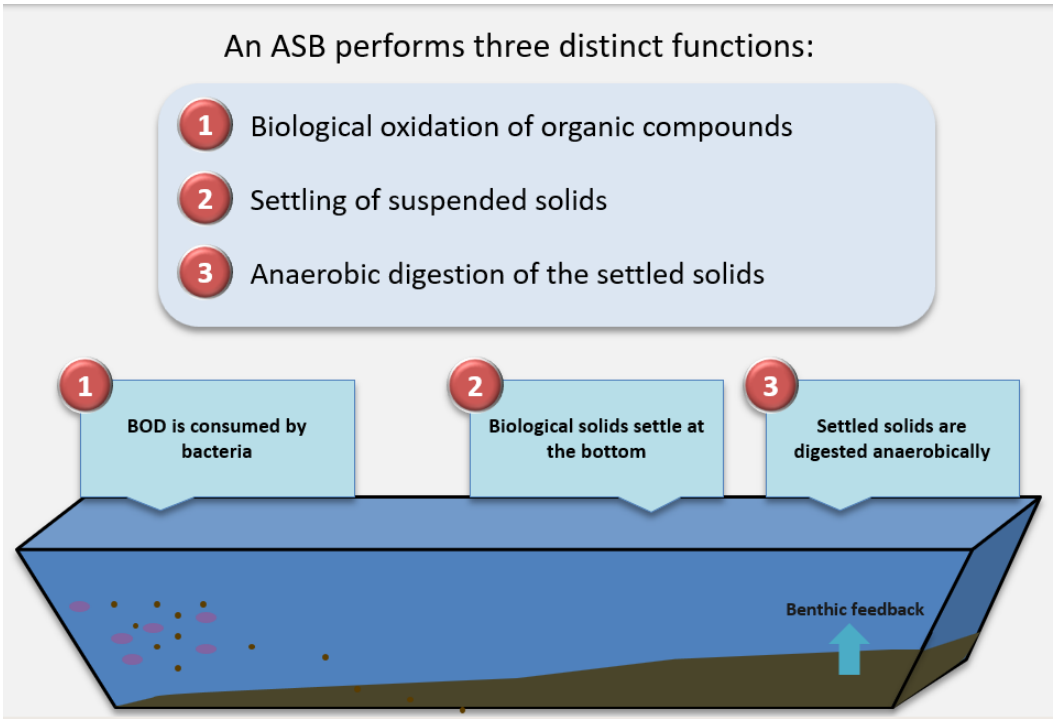
Ask the BioWizard

What is benthic feedback and how can I control it?

For metabolism and cell reproduction, bacteria need nutrients. The two most essential nutrients for wastewater treatment are nitrogen and phosphorus, collectively called macronutrients. Effluents from pulp and paper mills are typically heavy in carbon and low in nitrogen and phosphorus. Longer aeration retention times or large settling/holding ponds after aeration will typically result in lower nutrient requirements. Providing the necessary nutrients to attain and sustain the bacterial reproduction rates required for the best BOD reduction is crucial.

Although nutrients play a vital role in treatment efficiency, mills must be aware of the dangers linked to high nutrient residuals in the treated effluent. Benthic feedback refers to the process whereby components of settled sludge in an ASB or lagoon's benthic zone are reintroduced to the water. Benthic feedback can transfer BOD, TSS, ammonia, and phosphorus to the basin or lagoon. High effluent ammonia levels might lead to effluent toxicity and possible failures of WET tests. In final settling ponds, too much nitrogen or phosphorus can also promote the growth of algae or hyacinth. Excess nutrients are discharged to a mill outfall, ending up in rivers and streams. Any confirmed stream impairments may result in future permit restrictions. If regulators implement final effluent ammonia or nitrogen limits, mills with ASBs will undoubtedly need to increase capital expenditures or operational costs.

Due to the impacts that benthic feedback can have, mills must consider the amount of sludge in an ASB or lagoon when designing and maintaining their system. Proper monitoring of solids (sludge) inventory in unaerated or poorly aerated zones, and a rigorous dredging program are critical to minimizing the effects of benthic feedback.



Making a Difference

EBS Philanthropy

Here at EBS, we pride ourselves on providing for the community and environment around us. Many of our employees give their time and energy to volunteering at several nationally recognized organizations throughout the year. The organizations we volunteer for range from animal shelters to coastal restoration projects, food and toy drives, and even construction projects. This spring, EBS donated hundreds of dollars' worth of toiletries to help Unity of Greater New Orleans, an organization that helps find permanent housing for unhoused individuals in New Orleans, Louisiana. EBS employees not only find fulfillment in protecting our natural resources but also in helping all who enjoy them.

Specialized training programs offered

Course Name	Dates	Location
Spring Seminar	April 11-13	EBS HQ - Mandeville, LA
Greenville Workshop	June 21-22	Greenville, SC
Savannah Workshop	July 19-20	Savannah, GA
Birmingham Workshop	August 9-10	Birmingham, AL
Fall Seminar	October 10-12	EBS HQ - Mandeville, LA

ebsbiowizard.com/training-seminars

We want to hear from you! For more information regarding upcoming training programs, operational issues at your facility, request a specific article topic, or want to participate in our “Ask the BioWizard” questions, please contact us by phone, email info@ebsbiowizard.com or through our Contact Us form located on our website.

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