DROPS OF WATER INFORMATION

Laboratory Notes from Water Systems Engineering

POTENTIAL BACTERIAL ACCUMULATION IN WELL SYSTEMS

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Bacteria and their associated colonies and biomass account for 80% of the fouling problems found in well systems. This write-up will introduce you to some of the more common bacteria identified in well systems.

Slime Bacteria

All bacteria produce slime or polysaccharide exopolymer, often referred to as biofilm, but some are very prolific at it like the Pseudomonas and Flavobacter species. These are the bacteria most often spoken of as the slime formers which foul screens, gravel pack and aquifer formation. They often lead to general fouling of the well because they not only block the flow of water with their own heavy slimy growth but they encourage the deposit of mineral in this slime matrix. These bacteria make up the bulk of the count observed on the Heterotrophic Plate Count (HPC). Significant increase in plate count (50+% for counts over 100), or any bulk count of bacteria, of samples collected after extended pumping usually indicates substantial increase in biofouling activity which leads to well slow down.

Anaerobic and Sulfur Reducing Bacteria

These of course live in an anaerobic (without oxygen) environment, which is typically found in the lower extensions of the well and borehole. Areas of low flow and clay lenses can also harbor anaerobic bacteria. Sulfur Reducing Bacteria (SRBs) reduce sulfur and produce the characteristic “rotten egg” odor of hydrogen sulfide gas. This gas is acidic and therefore it changes the pH of the surrounding area to an acid condition, which can lead to corrosion of metal present. The other anaerobes while not producing hydrogen sulfide will produce other compounds, which produce acidic conditions and lead to odor and taste problems. Recently, we have observed in our laboratory and backed up in surveys across the country that this anaerobic growth is capable of harboring coliform bacteria in its biofilm. Increasing anaerobic or SRB activity may lead to a coliform nuisance problem. Of course corrosion, odor, and taste problems may also be occurring.

Iron Oxidizing Bacteria

Commonly grouped and referred to as Iron Related Bacteria. These bacteria and related species are capable of oxidizing either iron or manganese or both. This means that the organism can convert the iron or manganese in the water to a very viscous oxyhydroxide. There are numerous types; some produce stalks filled with the iron compound that become encrusted on the screens or openings blocking water flow. Others, more like the slime formers, are usually seen in the gravel pack and form a slimier matrix which can collect heavy mineral and sand deposits making their blockage very dense and difficult to remove. The presence of the stalked iron oxidizing bacteria may indicate an active corrosion condition if iron was not detected in the aquifer water initially.

In either the case of corrosion or the use of aquifer iron, iron oxidizers will collect in screen areas and pump intakes,

resulting in a loss of production and operating capacity. As the population expands the organism can spread through the distribution system wherever soluble iron is present.

Coliform Bacteria

These are really members of the slime former group but because they are the organisms that come to our attention from a regulatory point of view, we have listed them separately. Coliforms are aerobic or facultative anaerobic which means they can live in both environments (with or without oxygen). The industry monitors for them because of their tendency to indicate contamination. Knowledge of their habits will help you to deal with them when they do raise their ugly heads. Excessive levels indicate infiltration or contamination, but counts below 16 per 100 milliliters usually indicate their presence in an anaerobic biofilm. Specific identification of the bacteria present is also helpful in identifying the occurrence and source of coliform bacteria.

Branching or Filamentous Bacteria

These organisms are usually not observed in well systems unless the well is left idle for extended periods of time. They proliferate like all bacteria during idle periods however because they grow on surfaces spreading like crab grasses they require longer periods to develop dense growth. Their growth usually follows the borehole wall and can block flow as much as 90%.

For additional information or assistance in identifying your well's problem, please contact our office.

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