

**Topic: Water Well Monitoring with BART™ testers**

It is becoming very evident that all water wells are infested by microorganisms commonly dominated by bacteria since these have a much better ability to use little or no oxygen compared to the others. Bacteria are able to adapt to many conditions in, and around, a well and so it is common to see rings of different bacteria growing around the bore hole. Often closest to the well are the iron related bacteria (IRB). They have the ability to accumulate ferric forms of iron inside the biomass or around the slime tubes that they make or push it out of the cells as ribbons. They like a lot of oxygen and are largely responsible for the development of rust-like growths. Using a IRB-BART tester will detect these IRB by the type of reaction seen. Brown ring (BR) means a reaction specific to the aerobic slime forming IRB. If there is a brown clouding (BC) then that means a hole collection of different IRB are active. Normally the first reaction observed is either clouding (CL) which means an oxidative condition or foam (FO) which indicates that the sample was from a more reductive environment. When there are lots of general bacterial activities then the contents of the tester may turn to a black liquid (BL). Just outside of the IRB are the general (HAB) bacteria that are the “filter feeders”. That means that they feed within the natural filters that build around a well and have two very important competitive edges. These are that they can: efficiently break down many organics particularly in the presence of oxygen; and also adapt relatively easily to oxygen rich and oxygen deficient conditions. These are the main workers in the natural filters formed by the biomass. Using a HAB-BART tester will detect these general (HAB) bacteria by one of two types of reaction. When prepared the liquid in the tester become blue. If that blue color disappears from the bottom up (UP) then aerobic general bacteria dominate but if the blue disappears from the top down (DO) then anaerobic bacteria dominate and the sample may be from a reductive site.

When there is little oxygen in the environment by sulfates flowing in the groundwater then the sulfate reducing bacteria (SRB) become active in one of two ways. If they are in sulfate rich groundwater flows then they will reduce the sulfate releasing hydrogen sulfide which turn things black and causes corrosion to start. If the groundwater is rich in organics then hydrogen sulfide may still be produced but this time it is from the sulfur rich proteins. Using the SRB-BART tester will detect these SRB by one of two types of reaction. If the jet black reaction is first generated in the base of the tester (BB) then the bacteria are utilizing sulfates; if the black reaction occurs around the BART ball then the bacteria are breaking down sulfur rich organics.

These are three BART tests commonly employed to test well waters and others include SLYM-BART (for the detection of slime forming bacteria); DN-BART to detect bacteria associated with the reductive breakdown of nitrate; and N-BART to detect aerobic bacteria that generate nitrates. In all cases these bacteria can be found in samples pumped from the zones around the well where they are active. BART-SOFT version 6.08 can be used to determine the zones of interrogation (ZIP) where the bacteria are present. BART testers generate a time lapse (shorter meaning more bacterial activity) and the reactions which tell you the types of bacterial communities present.

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