



## FACTS ABOUT SURFACE BACTERIA FILM (Herein after known as Biofilm)

The swimming pool industry developed under the mistaken belief that the majority bacteria remain in suspension in water systems (called “planktonic” bacteria). Only “planktonic” bacteria can be effectively treated by sanitizers, ozone, or UV. Current scientific research has confirmed that as much as 99% of the bacteria actually thrive on the surfaces of water systems where they build surface bacteria film (Biofilm).

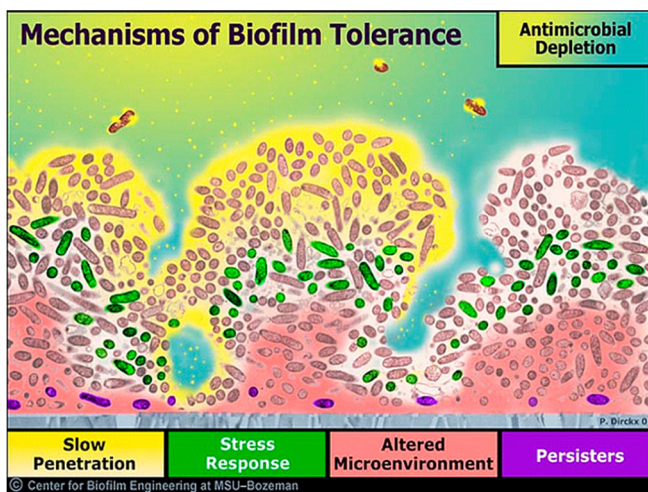
Surface Bacteria Film, also known as Biofilm protects the bacteria from today’s methods of sanitization. Majority of water quality management issues are caused by biofilm contamination where massive numbers of bacteria exist and thrive.

Bacteria like to be where the water has movement in it. Even stagnant water has movement just by the heating and cooling of the water itself causes flow as the hotter water moves to the surface. As the water then cools, it drops and moves to the bottom and flow is created. Any water body has a natural flow just from the heating and cooling process.

Biofilms (surface bacteria film) normally have multiple species of bacteria such as a Pseudomonas, Staphylococcus, and Legionella. This effect is called heterogeneity and it means that there is a variety of types of bacteria living in little cluster inside a biofilm. This proximity allows them to trade DNA and communicate with each other.

### Does biofilms cause corrosion?

The Center for Biofilm Engineering (CBE) has ascertained that the bacteria existing at the bottom of a biofilm can create an environment with a very acidic PH. When the very acidic is combined with the discovery that these bacteria can create an electronic current, it explains how biofilm creates a highly corrosive effect. This data means that biofilm contamination can now be identified a major component of the corrosion seen in the pool and spa industry.



- The tinted chlorine molecules, shown here in yellow, are shown attaching to the individual planktonic bacteria still suspended in the water. The chlorine is highly efficient at killing these planktonic bacteria.
- Chlorine coming into contact with the top surface of the biofilm, depicted here by the yellow coloration gets absorbed and integrated into the biofilm structure.
- The first layers of the bacteria are killed by the chlorine, however as the chlorine diffuses throughout and is absorbed by the biofilm the chemical sanitizer is diluted to a sub-lethal dose.
- This exposure to a sub-lethal dose allows the bacteria to adapt to the cidal agent and

develop resistance to the toxic chemical. It can be assumed, therefore, to contribute to the longevity of the biofilm.

- The existence of “Persister Cells” shown in purple in the picture are a very interesting phenomenon. They are a bacteria cell that goes into a state of hibernation.
- Persister cells remain even if the water environment dries up. They remain dormant and when re-hydration occurs they come back to life and create a new biofilm. What affect might this have on a spa?
- Time is not a factor, they can lie dormant for years.

### Quick Facts on Biofilm:

- Does not allow sanitizers to penetrate it and kill bacteria
- Major source of chlorine demand
- Appears to be the major generator of chloramines
- Confirmed as the cause of rust and corrosion on pool and spa equipment
- Has a pH reading of less than one (a huge contributor to acidity that causes corrosion)
- Present in all water bodies
- Contributes directly to water clarity issues
- Acts as the sticky matrix for all scaling and staining
- Coats and contaminates all filter media

*The New safer way to swim*

