

iSOC[®] Performance

Due to the enormous surface area presented by the iSOC[®] device, an oxygen saturated zone is quickly established around the device at the bottom of the groundwater well. The actual oxygen content achieved through use of the iSOC[®] is governed by the depth of water/gas pressure on the unit—Henry's Law.

This saturated zone spreads up and throughout the well, and diffuses out of the well. Higher in the well, the head pressure begins to fall. This results in water that is no longer saturated, but is now supersaturated. Conventionally produced supersaturation is unstable and effectively unattainable. However with Gas inFusion, the release of oxygen from this supersaturated state is such an extremely slow process, from such a high dissolved concentration, that a relatively stable supersaturated state is created. This is especially true in the absence of other bubbles. An excess of bubbles actually works to strip out dissolved gas from a liquid, as bubbles tend to grow on bubbles.

Anything in nature is always working toward an equilibrium state. The supersaturation 'half-life', i.e., the time required for the level of saturation between normal solubility and this ultra-high level of Gas inFusion supersaturation to be reduced by one-half, was demonstrated to be up to 7 days in a 10' (120") by 2" column. This results in a supply of oxygen that is readily transferred to lower dissolved oxygen groundwater entering the well zone, or that is consumed for biological treatment by biomass.

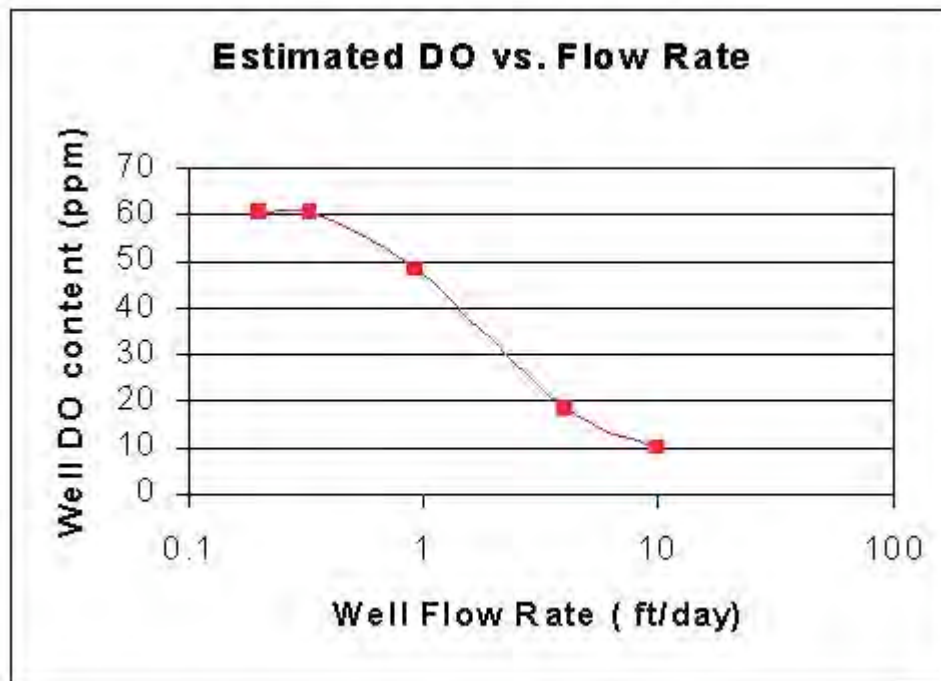


Figure 1: Estimated iSOC[®] DO vs. Flow Rate

As a function of the ground-water flow rate, the graph illustrated in Figure 1 indicates the expected dissolved oxygen concentration that each groundwater well equipped with an

iSOC[®] can be expected to reach. This example assumes the water depth to be 10 feet (120 inch) with the iSOC[®] located at the bottom of the well. Obviously, as the groundwater flow rate increases to very high levels, the achievable dissolved oxygen concentration is reduced.

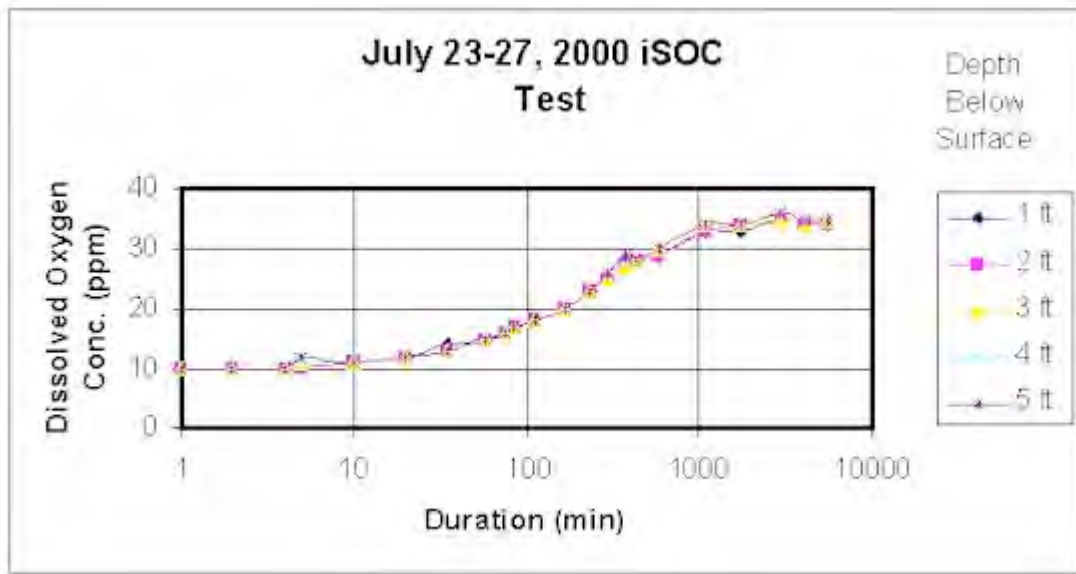


Figure 2: iSOC[®] Performance Start Up

Due to a natural mixing effect of the oxygenated water in the groundwater well, the dissolved oxygen concentrations should be relatively equal throughout the depth of the well. Once the iSOC[®] is first installed in a well, it takes a little while for the dissolved oxygen concentration to build up to maximum levels. Figures 2 and 3 illustrate a short duration test of some 100 hours, recording the dissolved oxygen concentration at various depths in a well over time from start up. Figure 2 shows a log time scale to indicate that it took about 16 hours (~1000 minutes) for the iSOC[®] to maximize the dissolved oxygen concentration in the well to 35 ppm. Figure 3, with a conventional time scale, illustrates that once the maximum oxygen level was attained, it remained relatively constant over time. Also, note that the oxygen concentrations at 1-foot intervals were roughly the same.

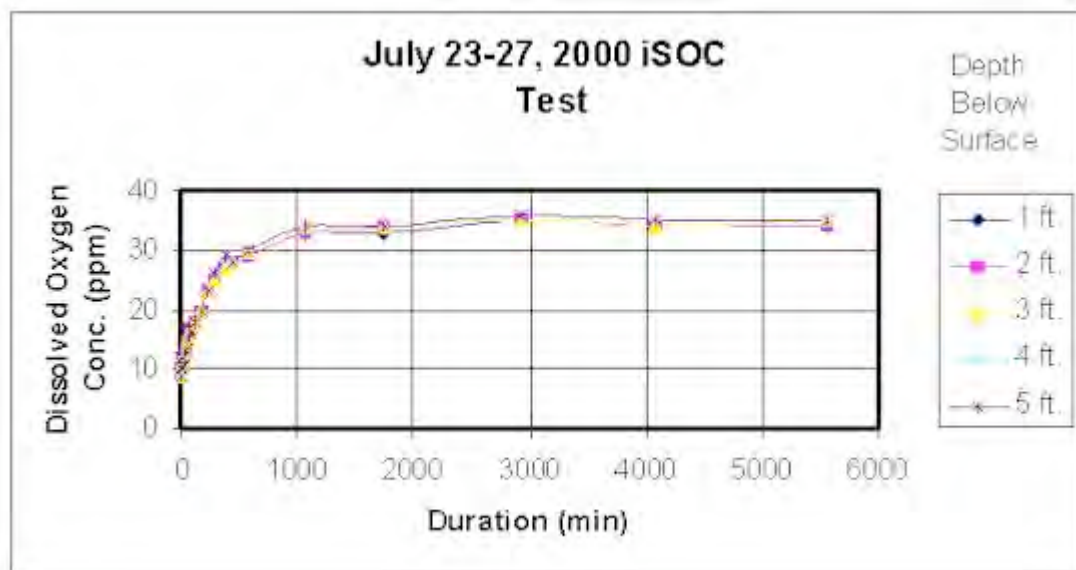


Figure 3: iSOC[®] Performance

As discussed earlier, the maximum attainable iSOC[®] dissolved oxygen concentration is determined by the gas and water depth pressure over the iSOC[®] unit—Henry's Law—and the groundwater flow rate. In the Installation & Start Up Procedures, an equation is provided to determine the maximum head pressure created by the depth of water over the iSOC[®] unit. The start up gas pressure from the oxygen cylinder is then adjusted to be slightly above this calculated maximum head.

iSOC[®] will deliver about 41 PPM of dissolved oxygen (DO) per atmosphere of head pressure on the iSOC[®] unit. Based on standard atmospheric pressure of 14.7 psi (1 Bar) at sea level to about 10 psi at 10,000 feet elevation, an iSOC[®] unit positioned at the bottom of a well with a water depth of 35 feet—roughly 2 atmospheres (2 Bar)—can be expected to deliver in the order of 82 PPM DO. This is simply based on the atmospheric pressure of 14.7 psi (1 Bar) plus the water head pressure of 15.6 psi (~1 Bar) creating a total pressure of 29.9 psi or about 2 atmospheres or 2 Bar. A 33-foot (10-meter) water column is equal to one atmosphere being 14.7 psi or 1 Bar.

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