

Understanding ORP & Ozone

ORP is Oxidation Reduction Potential, or sometimes known as Redox. ORP is simply an *indicator* or reflection of the "available oxidizer" in the water. Note that it is not a measure of the level of the oxidizer itself, but it is broadly used in water treatment as a very reliable and universal measure of the oxidizing potential of the water at the point of measurement. The oxidizer can be Oxygen, Chlorine, Peroxide, Ozone, or any other oxidizer.

ORP readings are expressed in milli volts (mV). The full range of readings indicating oxidation potential is from -2000 to a +2000 mV. Most ORP meters indicate a range from -1200 to +1200 mV and this is entirely adequate for water treatment purposes. A reading above 0 mV indicates there energy available to oxidize, e.g. give up or impart a molecule to an element which can be reduced or accept an O molecule decreasing it's oxidation state.

If you have one molecule of ozone it will either react with a contaminant or organism or convert back to O₂. If it collides with an organism before it bumps into an oxidizable contaminant, then it will kill the organism, therefore it is disinfecting. With chemicals, such as Chlorine, it is more complicated and less predictable since these chemicals react so much slower than ozone with organisms making them much more likely to react with a contaminant first. Additionally, with many chemicals, the pH level of the water is much more critical in their reaction.

If there are *available* oxidizers (indicated by a positive ORP) in the water, given enough time and contacting, they will react with something or degrade. Of course the more available oxidizer you have (concentration) the more contaminants or organisms it can react with, creating more effective disinfection or oxidation. As the available oxidizer level increases the more likely it will react with a greater percentage of the contaminants and organisms. The predictability is largely dependent upon effective mixing, but also upon temperature since the warmer the water the faster the molecules are moving around, making them more likely to collide with contaminants or organisms. There are many other factors which effect different chemical oxidizers as well, such as turbulence, light levels, etc.

An additional advantage of ozone as an oxidizer is that ozone goes through a free radical phase as it converts back to oxygen. This free radical is the most reactive oxidizer possible and has tremendous disinfection capability. This reaction occurs in fractions of a second so the more ozone there is in solution the more free radicals will be available at any moment. Energy is what makes ozone release its third molecule of Oxygen creating the radical so if UV3 (ultraviolet light) light energy, or hydrogen peroxide is added to the solution, all the ozone converts at once forming a solution with the greatest number of free radicals possible and the greatest potential of reacting with the most contaminants or organisms.

ORP readings in most homes on municipal water systems in the US will average in the 200-300 mV range. This water has been disinfected, but its disinfecting capacity is low. A 650 mV reading in a water treatment system indicates that, essentially, any oxidizable contaminant entering the water will be killed. So it is most important to know the ORP reading is in the reaction chamber or contact tank, since this is where the most of the actual disinfection takes place. Once you clean up the water any positive oxygen level is quite effective at maintaining clean water.

The goal is to disinfect the water at the point of reaction or contacting then keep it in a state which is healthy to plants, people and animals...not to keep a toxic level in the water all the way to the root zone of the plant which is not healthy for the plant.