USE OF DO2E AERATOR TECHNOLOGY FOR VARIOUS REMEDIATIONS IN INDUSTRIAL, ENVIRONMENTAL, AND MUNICIPAL APPLICATIONS

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Abstract: An introduction to this DO2E technology covers a variety of applications including environmental remediations, polishing ponds for municipal and industrial sites, and internal usage of this technology in municipal wastewater systems. The unique advantages of these are examined at length.

The DO2E Aerators are designed to aerate water streams. These may be in ponds, reservoirs, wastestreams, waste treatment plants, or elsewhere. They may be fitted with an ozone delivery capability. As the primary functionality of these Aerators is to deliver dissolved oxygen to water columns, other capabilities can be "piggy-backed" on these devices to effect a variety of other outcomes. Some of these are major applications such as the remediation of ponds, which can be considered a joint purpose of the Aerators. In these cases, ozone can add to the suitability for a specific remediation. For example, a pond can have pathogenic bacteria residing therein, and aerosols engendered may require control of this possibility. An ozone adjunct is a highly desirable addition to this particular remediation example. In a similar situation, toxic sludges may cause a problem by the release of noxious compounds, usually H_2S. Ozone rapidly removes hydrogen sulfide via oxidation. Ozone and its free-radical OH^- ion partner in the hybrid ozone AOP process react in the GASEOUS state almost instantaneously with hydrogen sulfide. In

most, if not all, sulfide-containing sludges, the sulfides are in STABLE metallic compounds.
Sulfides are insoluble in most waste streams arising from sludge deposits. Those malodorous ones are easily oxidized by even a small amount of ozone. One of the problems occurs attempting to understand the stoichiometry of this process from an unknown precursor. As a general rule, the necessity for an additional ozone requirement resides within the rate of fluid flow in the system as well as the chemical bonding involved. The vaporization of any H_2S present in the sludge would be easily addressed by a 4-6 tube ozone capability on a blower of 10HP or larger. In almost all cases, even this would be overkill.
How these aerators work, that is, the mechanism of action, is necessary for an understanding of their many applications. We have noticed that they can provide a germicidal effect as well as an odor reduction affect. These systems are equipped with a mixing chamber and air manifold system that is exclusive to them. These Aerators draw water at a depth of 46" (3.833' or 1168 mm), sending it through the air-mixing chamber. It is injected with atmospheric oxygen there, and the effluent is then discharged into the surface column of water. This mixing enables destratification of the liquid column. Regenerative Air Blowers are employed as the source of air. Low pressure, high volume air flow is used for injecting atmospheric oxygen. The combination of increased injection air pressure at this depth and the equilibrium water pressure enable maximum efficiency of O_2 transfer per HP/hour (up to 7 lbs. O_2 per HP/HR).
A combination of coarse and fine air bubbles is used for dual reasons: (1) The fine bubbles result in maximum O_2 transfer, and (2) the coarse bubbles increase the velocity at which the air bubbles traverse the mixing chamber. The velocity of the water moving

through the mixing chamber is related to blower output and manifold modifications. This velocity further increases the oxygen transfer. As the bubbles travel up and out of the chamber, the void created is filled with water entering from the bottom of the chamber, creating a Venturi (vacuum-type) system. Design modifications to shield these Venturi "drivers" from being "ragged" up have been added to further enhance their versatility.

This oxygenated water increases in density, and the horizontally-directed effluent from this stream results in a deep-water drawing effect. The specific curvature of the mixing chamber results in this effect as the directed effluent stream exhibits components that result in the momentum of the effluent column being projected both horizontally and vertically.

This results in these Aerators drawing water in from lower water levels, injecting it with atmospheric O_2, and discharging it horizontally at the surface. Most other aeration systems use mechanical aeration, often referred to as "surface aeration." Surface aerators are excellent for that purpose alone, aerating the top 4'-5' of the water column, but they are incapable of remediating sludge deposits from the bottoms of lagoons or other water impoundments or streams. Aerators primarily aerate but they also break-up solids – just to a lesser extent depending on the size of the blower units. It is not a good idea to specify a velocity by means of HP – particularly in the Aerators – as these units are sized for a particular job which may result in highly variable velocities depending on the blower size, the depth of draw, the temperature, the viscosity of the medium addressed, and even what the final outcome is intended to be. These units may be modified to deliver what is necessary under a variety of initial conditions.

We are all familiar with the Hippocratic Oath that physicians take: "First, do no harm." We can extend

this idea a little further in the use of various devices for remediation purposes: "Make sure that the cure is not worse than the disease." Most remediation problems involving water impoundments involve toxic sludges and heavy metals, odor-causing compounds, algal blooms, nutrient overloads, and other issues in which dissolved oxygen (and ozone) can be used to halt the progress of the deterioration, sequester certain dangerous ions in insoluble forms, and generally improve water quality.

This aerator technology can address all of these issues with a minimal energy requirement.

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