

AIRPHX[®]

Air and Surface Infection Control

AIRPHX Technology Overview¹ Summer, 2022

AIRPHX uses a proprietary non-thermal plasma technology to create a number of oxidizing molecules that are excellent disinfecting agents. AIRPHX technology relies on electricity to create a plasma field and the oxygen present in ambient air to produce these oxidizing molecules without using chemicals.² The oxidizing molecules created by AIRPHX include oxygen ions, free radicals and peroxides that are highly reactive due to the presence of an unpaired valence shell electron.

When the units are deployed consistent with the user guide,³ measurable levels of gas-phase hydrogen peroxide (or H₂O₂), ozone and other types of oxidizing molecules are produced within AIRPHX's proprietary and patented plasma chamber. The hydrogen peroxide produced is different than vaporized or aerosolized hydrogen peroxide. Gas-phase hydrogen peroxide has a more acute bond angle and a variable half-life measured in hours. Ozone has a half-life of approximately 20-30 minutes in typical real world environments, but, as explained below, is generated by AIRPHX units at extremely low levels. A number of other oxidizing molecules are created within the plasma chamber but do not leave it (or exist only momentarily after leaving it) due their short half-lives. These include: atomic oxygen (O), singlet oxygen (O₂ with displaced electron), hydroxyl radicals and superoxide (O²⁻). Even though they do not as a practical matter leave the unit, within the unit they are additional highly-effective oxidizing agents for any microorganisms that pass through the units. Other than hydrogen peroxide and ozone, none of the oxidizing molecules created by AIRPHX are regulated by governmental entities.

AIRPHX units have been verified by the Washington State Department of Agriculture to comply with USDA National Organic Standards (7 CFR Part 205).

Gas-Phase Hydrogen Peroxide Molecules

Gas-phase hydrogen peroxide is an excellent disinfecting agent with a very long half-life and occurs naturally in the air. The National Institute of Health confirms the efficacy of hydrogen peroxide: “[n]onflammable, hydrogen peroxide is a powerful oxidizing agent” <https://pubchem.ncbi.nlm.nih.gov/compound/Hydrogen-peroxide>. Hydrogen peroxide is seen as an environmentally safe alternative to chlorine-based bleaches, as it degrades to form oxygen and water and it is generally regarded as safe (GRAS) as an anti-microbial by the Food and Drug Administration (FDA). CFR, Title 21 Part 184, Sec. 184.1366. Hydrogen peroxide has no known carcinogenic potential.

Hydrogen peroxide is regulated by the Occupational Safety and Health Administration (OSHA) and the Center for Disease Control (CDC) through The National Institute for Occupational Safety and Health (NIOSH), both of which have established limits of 1.0 parts per million (ppm). AIRPHX has tested

¹ This summary relates to the AIRPHX CID 75k (a wall-mounted unit) and AIRPHX in-duct units that will shortly be made available for sale. AIRPHX's PA2400 and PA3100 wall-mounted units, which used nearly identical but slightly more powerful technology, are being or have been phased out of production.

² AIRPHX believes it holds the only patents issued in the U.S. and internationally related to the generation and use of non-thermal plasma to generate disinfecting molecules.

³ The user guide contains guidance on appropriate use of the units, including instructions on mounting the units (elevated), the requirement that there be constant and consistent airflow to disperse the oxidizing molecules and the proper size of the treatment space. Note that each installation location is different in size, layout, type of HVAC system, composition of ambient air due to, among other things, other cleaning protocols, humidity level, etc.

for hydrogen peroxide levels using the Interscan Hydrogen Peroxide Analyzer generally registering levels of less than 0.01 ppm of hydrogen peroxide (1/100 the OSHA limit) when AIRPHX units are operated in accordance with the user guide. AIRPHX is aware of no CDC, FDA or Environmental Protection Agency guidelines or any other studies suggesting that gas-phase hydrogen peroxide at these low levels raise any health concerns.

Ozone Molecules

Ozone levels are regulated by OSHA, which has generally established limits of 0.100 ppm. Ozone levels are also regulated by the California Air Resources Board (CARB), which has established more stringent limits of 0.050 ppm. International product testing company InterTek has confirmed that AIRPHX's CID 75k generates levels of ozone that pass CARB's stringent several ozone emission standards (UL 867). See the InterTek report (Attachment 1). AIRPHX's soon to be available in-duct units have been tested by Blue Heaven Technologies (a CARB approved laboratory whose testing is accepted by InterTek and Underwriters Laboratories). The Blue Heaven report (Attachment 2) confirms AIRPHX in-duct units produce levels of ozone that satisfy CARB's stringent general ozone emission standard (UL 867), as well as the UL 2998 standard – certifying AIRPHX in-duct units as “ozone free”.

Conclusion

AIRPHX technology has been operating safely for years in thousands of installations such as commercial gyms, college athletic programs, hospitals (including wards of hospitals with immune-challenged patient populations), casinos, military bases, police and fire stations, food processing facilities, commercial buildings, residences, dental offices and country clubs. Independent testing of these AIRPHX installations demonstrate industry leading reductions of surface and airborne pathogens, typically greater than 95% reduction on surfaces and greater than 90% in the air.