PRINCIPLE AND MECHANISM OF ACTION

The process involves 1 essential step :

STEP 1: HYDROGEN PEROXIDE DISPERSION

The Hydrogen Peroxide is delivered as a dry mist (aerosolized solution) through a venturi nozzle (5-8µm).

The Hydrogen Peroxide oxidizing action involves:

- Oxidation of the lipidic structures of the membrane;
- Production of hypochlorite and radical hydroxyls;
- Deterioration of ribosomes and DNA per cytoplasmic penetration;
- Cell death (Lysis).

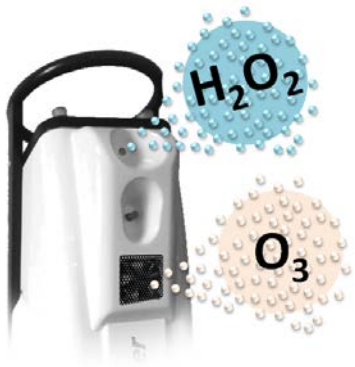
Peroxide is a chemical compound that contains the peroxide ion (O_2^{2-}).
The peroxide ion consists of a single bond between two oxygen atoms: $(O\text{-}O)^{2-}$. It is a strong oxidiser.

Hydrogen peroxide has the chemical formula H_2O_2 and the following structural formula: *H-O-O-H*
The Hydrogen peroxide solutions look like water and can be dissolved in water unrestrainedly. At high concentrations these solutions give off an irritating, acidic smell. Hydrogen peroxide is inflammable at high concentration. At low temperatures it becomes solid. The amount of hydrogen peroxide in the solution is expressed in weight percentage. For water treatment, concentrations of 35 or 50 % hydrogen peroxide are used. For room decontamination, concentrations from 4 to 35% hydrogen peroxide are used
Hydrogen peroxide is used for different applications. It is a strong oxidiser. It is more powerful than chlorine (Cl_2), chlorine dioxide (ClO_2) and potassium permanganate ($KMnO_4$). Through catalysis, hydrogen peroxide can be converted into hydroxyradicals (OH). The oxidation potential hydrogen peroxide is just below that of ozone.

Contrary to other chemical substances, hydrogen peroxide does not produce residues or gasses. Safety depends on the applied concentration. The higher the concentration, the higher the risk. The Hydrogen peroxide slowly decomposes into water and oxygen. An elevation of temperature and the presence of some agents enhance this process.

There are now new advanced disinfection processes using hydrogen peroxide solutions. These processes produce reactive oxygen radicals, without the interference of metal catalysers. Examples are the combination of hydrogen peroxide with ozone (**peroxone**) or Ultra Violet Light.

Airborne disinfection using ozone should be always restricted to unoccupied room only.



$$OH + e^- \rightarrow OH^- \qquad E^0 = +2.8V$$

$$O_3 + 2H^+ + 2e^- \rightarrow O_2 + H_2O \qquad E^0 = +2.07V$$

$$O_3 + H_2O + 2e^- \rightarrow O_2 + 2OH^- \qquad E^0 = +1.24V$$

The process involves 2 essential steps :

STEP 1: OZONE DISPERSION
STEP 2: HYDROGEN PEROXIDE ADDITION

There are two major effects from the coupling of the ozone with hydrogen peroxide:

- Oxidation efficiency is increased by conversion of ozone molecules to hydroxyl radicals; and
- Ozone transfer from the gas phase to the liquid is improved due to an increase in ozone reaction rates.
- Production of hypochlorite and radical hydroxyls;
- Deterioration of ribosomes and DNA per cytoplasmic penetration;
- Cell death (Lysis).

Ozone spontaneously decomposes when in contact with Hydrogen Peroxide.

Peroxone, as a combination of ozone and hydrogen peroxide, is a new and advanced oxidation process that can be used for the treatment of contaminated rooms (In the case of a suspected or confirmed outbreak, Multiresistant bacteria (MRB)…), polluted soils, groundwater and wastewater. Peroxone can be actively used to decompose pollutants, such as volatile organic compounds, chlorinated solvents, munition, diesel, volatile organic hydrocarbons, PAH's (polinuclear aromatic hydrocarbons), other hydrocarbons, petrol, metals and TNT. It can also be applied in drinking water disinfection.

The peroxone process uses ozone (O_3) combined with hydrogen peroxide (H_2O_2). Particles are formed; the so-called hydroxyradicals (OH). These radicals react with or oxidize most organic pollutants in a solution.

The United States and Germany use peroxone in the drinking water preparation process for the removal of color, flavor and pollutants, such as pesticides, from water. **The addition of hydrogen peroxide accelerates the dissolution of ozone, causing the hydroxyl radical concentration to be enhanced.** The net free hydroxyl radical production rate is 1 mol per mol of ozone.

Oxidation is more reactive and much faster in the peroxone process compared to the ozone molecular process.

Any disinfection process using ozone should be always restricted to unoccupied room only.

OXIDISER	OXIDATION POTENTIAL
Fluorine	3.0
Hydroxyradicals (Ex: Ozone + Hydrogen Peroxide)	**2.8**
Ozone	**2.1**
Hydrogen peroxide	**1.8**
Potassium permanganate	1.7
Chlorine dioxide	1.5
Chlorine	1.4