SONOZAIRE ODOR NEUTRALIZER

Installation Section

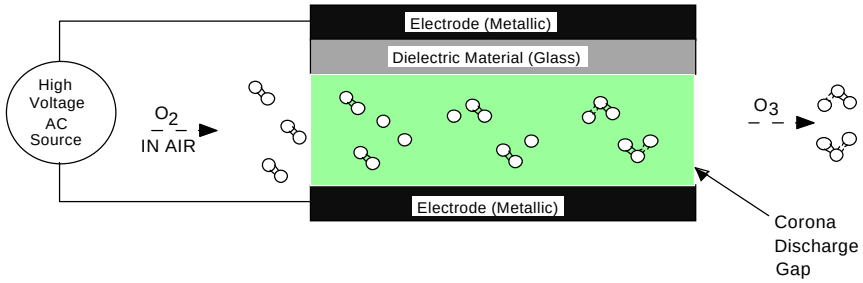
UNDERSTANDING OZONE

What is ozone?

The earth's air is typically 21% (210,000 ppm) oxygen and 78% (780,000 ppm) nitrogen. The remaining 1% is made of miscellaneous chemicals, including ozone that makes up only 0.02 to 0.07% of the air, based on seasonal variation. An oxygen molecule (O_2) is composed of two oxygen atoms with a stable bond. It has no color, odor, or taste, and its molecular weight is 31.9988. An ozone molecule (O_3) is composed of three oxygen atoms instead of the normal two, but the bond between the third atom is very unstable. Ozone has a molecular weight of 47.998, and in concentrated form has a clear to pale blue color. In trace concentration form, it has a sweet clean fragrance associated with thunderstorms. At higher concentrations, the odor is sharp and pungent, and irritating to the eyes and lungs. Due to its instability, the ozone molecule reacts with the first molecule it can oxidize. It is this reaction mechanism of ozone that destroys the odors and other contaminants in the air.

The production of ozone is quite simple: $3\ O_2 \rightarrow 2\ O_3$. This basic reaction can be created in a high voltage electrical field. See the figure below, which shows how ozone is formed. The reaction occurs when the high voltage electrical field provides the energy that breaks one O_2 molecule into two 'O' molecules. These 'O' molecules attach themselves onto two oxygen molecules, forming two ozone molecules. Once the ozone is introduced to other reactive molecules, it begins the process of oxidization, or breaking down, chemical structures into simpler or more stable compounds. Since it is air-borne, it reacts with available air-borne odors.

TYPICAL CONFIGURATION OF CORONA DISCHARGE OZONE GENERATION



When ozone is introduced into an area, it will begin to react with airborne odors. By the oxidization process, it begins to convert many odors into simple and stable compounds of carbon dioxide, water, and oxygen. This process may be a single step, or it make take several steps, which means that several molecules of ozone may be required to breakdown certain odors. This is why larger concentrations or longer exposure times of ozone are needed to handle strong odors. During treatment, the amount of ozone that lingers in the air awaiting reaction with odors is referred to as **residual**. If the air is agitated, the residual ozone will be reduced due to the mixing and reacting with odor molecules. This is why it is recommended that fans be used in many applications to speed up the reaction time and keep the residual ozone level at a minimum.

How can residual ozone be measured?

The nose can detect ozone concentration as low as 0.01 to 0.04 ppm. This is an extremely low concentration. This is similar to one penny in a million dollars. However, the nose has the ability to become desensitized to odors, and this is also true with ozone. Removing strong odors from garbage, sewage, and disasters such fires and floods, require a high concentration of ozone. Commercial or industrial ozone generators can produce levels that exceed occupied limits. This means that when treating these odors, the areas of treatment must not be occupied. Ozone in high concentrations is irritating enough to quickly cause someone to vacate the treatment area, if someone should inadvertently enter a treatment area. However, if ozone must be used in an occupied area then the ozone level is to be controlled for maintaining it below a safe level. Monitoring devices available are: ozone badge monitors, manual pumps with ozone sensitive tubes, electronic ozone meters, and electronic ozone controls that limit the amount of ozone in the air.

What happens to excess ozone?

Why does the clean air fragrance, created during a thunder and lightning storm, disappear? Several reasons including the reaction with the large quantity of polluting emissions in the urban environment, and due to the fact that ozone is unstable and highly reactive and. If there are no lingering contaminants for ozone to destroy, it will soon revert back to oxygen, from which it came. Ozone molecules reacting with other ozone molecules accomplish this. The half-life of ozone is generally 2-13 minutes. At a 12-minute half-life, ozone levels will drop to approximately 3% in about 66 minutes after the ozone generator is stopped. This is one of the many advantages of using ozone as a deodorizing agent. It does the job we want done and converts itself back to oxygen. This safety factor of ozone is also enhanced by a noticeable and irritable odor at high concentrations. A short life span and warning of high concentration, makes ozone capable of being used safely in many applications.

CONT'D - (UNDERSTANDING OZONE)

How much ozone is allowed by various regulatory and advisory agencies?

The Environmental Protection Agency (EPA) determines the amount of ozone for national air quality standards for ambient air. This value is presently 0.12 ppm per volume measured over one hour, and 0.08 ppm measured over eight hours. The Occupational Safety and Health Administration (OSHA) determines the amount of ozone for the workplace. This value is 0.1 ppm per volume for an 8-hour work shift. The U.S. National Institute for Occupational Safety and Health (NIOSH) advises that the immediately dangerous to life and health (IDLH) level is 5 ppm per volume for a maximum of 30-minute exposure. Ozone can clean the air of unwanted odors and bacteria and make the air better to breathe, but large concentrations, or prolonged levels above 0.1 ppm should be avoided. As mentioned previously, ozone generators can be supplied with controls that limit the amount of ozone to levels below all regulated values.

What are proper precautions when using ozone?

- Use in uninhabited areas to prevent exposure of excessive residual.
- After the ozone generator's switch or timer is turned off, allow time for the ozone to revert back to oxygen before entering the area. The recommended time period is 30 minutes to two hours.
- Ventilate the area thoroughly after using ozone to eliminate problems for people with chemical sensitivities.
- Do not use in areas that are wet or have high humidity. Ozone reacts very fast in humid areas, but can produce a mild form of hydrogen peroxide when mixed with water. This might cause bleaching on some fabrics. Use a dehumidifier to remove excessive moisture.
- Remove all pets from the area while treating. If fish tanks cannot to be moved, then cover them to prevent excess ozone from mixing with the water. Locate the aquarium oxygen pump so that it has fresh air to pump into the water. Remove plants, especially moist type, if treatment time is more than a few hours, or if located in a small room with a high concentration of ozone.
- Do not expose natural rubber (latex) to ozone, as it will cause it to deteriorate. Remove it from the treating area, or coat it with dry silicon spray. If VCRs, or other electronic equipment, are suspected of having rubber drive belts, cover them.
- Leather should only be exposed to ozone for a few hours. Over exposure can cause possible drying of material or cause some of the oils to be driven out.

What are some uses of ozone?

- Controls odors from garbage or waste compactors for industrial applications.
- Oxidizes odors from buildings sustaining fire and smoke damage.
- Destroys odors from clothing or fabrics damaged by fire or other disaster.
- Removes odors from offices, homes, schools, hotels, casinos, restrooms, autos, gyms, funeral homes, etc.
- Retards or destroys bacteria in food storage on meats, fish, fruit and vegetables, eggs, etc.
- Destroys mold and mildew.
- Removes pet odors from kennels, pet stores, homes, clothing, etc.
- Controlling tobacco odors in restaurants, bars, smoking lounges.
- Eliminates odors from sewage lift stations or holding tanks.
- Removes exhaust hood odors from cooked food, or chemicals.
- Treats drinking water, bottled water, swimming pools, and wastewater.

After reviewing this list it is quite obvious that ozone is widely used. Why is it widely used? The answer is simple – it works. It works fantastic because it removes odors that no other process can match. Ozone needs special precautions that have been indicated; this useful chemical can be effectively applied by:

- Being knowledgeable about ozone.
- Utilizing ozone properly, following all safety requirements.
- Being aware that ozone has a self-destructive nature.
- Being aware of the odor of ozone, while using the proper tools and precautions to prevent exposure in excessive concentrations.

The bottom line is that ozone, like many effective chemical products, must be used properly and safely. You would never intentionally breathe strong chemical products; therefore, ozone gas should be used with the same common-sense precautions. As with all commercial and industrial manufacturers of ozone equipment, it is stressed that the units are used in unoccupied areas, unless other methods of control are utilized to limit the concentrations to regulatory values.