

# Safely Working with Ozone in the Restoration Industry

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As restoration contractors it is our responsibility to use technology safely. Not only for our technicians but for our clients and the property they have entrusted us to restore. Therefore, we need to understand the nature of ozone and how to protect ourselves while working with it. I would like to discuss three aspects in this article. First, how long ozone lives before reverting to simple oxygen. Second, what the ozone is doing to the quality of the air during the treatment in the treatment area. Third, how to protect ourselves, primarily our lungs and eyes from the effects of ozone and particulate exposure.

## How long does ozone really live?

There is a common misconception that ozone has a half-life of 30 minutes in the air. Half-life refers to the time it takes for the concentration of a substance to diminish by half. Some sources have said that the half-life of ozone is 3 days in the air and 30 minutes in water. One of the best studies regarding ozone's half-life is done by Perdue University. It states that "Half-Life Time (HLT) averaged ~1500 minutes in still air at room temperature (24°C) and zero humidity, which was substantially longer than previously published data (i.e., 30-40 minutes)."<sup>1</sup> That's just over 40 hours. Now, at normal temperatures (24°C) at 45% rh (relative humidity), ozone's HLT is just under 12 Hours. Therefore, to eliminate ozone in an area you want to increase airflow, temperature and humidity. As you increase airflow and increase temperature, you increase the speed the ozone molecules move, forcing ozone molecules into other ozone molecules. The collision reverts them back to 3 oxygen molecules. As you raise the humidity, you give the ozone a place to infuse. Making these changes to the environment will lower ozone concentration. The conditions during the treatment and what we do upon completion will affect the life of ozone. After the treatment, one of the best ways to get it down below the Permissible Exposure Limit (PEL), is to change the air 7 times. This imitates half-life. Thus, making it safe for anyone to re-enter the treatment area.

## What is happening to the air quality during the ozone treatment?

Ozone, with its unstable oxygen molecule, seeks equilibrium by sluffing it to go to a lower energy state. When it attaches to a contaminant, it begins to break it into smaller particles. There is more surface area to release possible VOC's along with the particles into the air. Other ozone molecules intercept the VOC's and particles and continue the breakdown process. With higher ozone production, the air will get dirtier with VOC's and particles. It won't smell like ozone until the excessive contaminates are purged. Don't be surprised if it doesn't smell like ozone until you are purging the area.

## How do we protect ourselves from ozone, partially broken-down particles, and VOC's?

First, we want to use a timer to turn on an exhaust fan to reduce concentrations before we enter. Second, we want to protect our eyes and lungs by wearing a full-face respirator with an organic vapor cartridge with HEPA pre-filter. According to 3M<sup>2</sup>, the activated carbon will adsorb the VOC's and ozone while the HEPA will trap the 99.97% of the particles down to .3 microns. According to OSHA, ozone has a Permissible Exposure Limit (PEL) of .1 PPM with a Time Weighted Average (TWA) of 8 hours and a Short-Term Exposure Limit (STEL) of .3 PPM. Its IDLH (Immediately Dangerous to Life and Health) is 5 PPM. Even with proper respiratory protection, no one can enter an area where ozone exceeds 5 PPM (it's IDLH). After 2-3 air exchanges, you will probably be below the IDLH. If you didn't have on any protection you would need to wait a long time to enter the treatment area. By wearing a full-face respirator with an organic vapor cartridge with a HEPA pre-filter, you can enter at 5 PPM which is 50 times the .1 PPM limit or the PEL.

Conclusion, respect the technology, understand how it works, and protect yourself. Make sure you post at the entrances to keep people out during the treatment. As you can see, ozone cannot be used in occupied spaces. It lives too long to enter within 30 minutes unless you purge the ozone and contaminants before entry. If you enter before the purge is complete, then only enter wearing a full-face respirator with organic vapor filter cartridge with ozone below 5 PPM.

1- [Perdue University Ozone Study](#) 2- [3m Organic Vapor Respirator](#)