

Ozone (O₃) Concentration around PID UV Lamps

People are concerned about ozone due to health and environmental reasons. High ozone levels can irritate the respiratory system, harm lung function, and cause eye and skin irritation. Ozone contributes to smog, affecting air quality and impacting plants and ecosystems. Regulatory standards exist to limit ozone levels. While ozone in the stratosphere is beneficial, ground-level ozone is a contributor to global warming. Monitoring and managing ozone levels are essential for public health and environmental well-being.

During the preheating or operation of the photoionization detection (PID) sensor, it is essential to be aware that a small amount of ozone is generated as a byproduct. Ozone, composed of three oxygen atoms (O₃), is produced when oxygen molecules undergo photolysis in the presence of ultraviolet light with wavelengths shorter than 240nm. Although ozone has a distinctive odor similar to fresh grass, inhaling excessive amounts can have adverse effects on human health. It can irritate and damage the eyes, respiratory system, and particularly impact lung functionality.

Regulatory agencies, such as the United States Occupational Safety and Health Administration (OSHA), have established permissible exposure limits for ozone to protect workers. The limits are set at 0.1 parts per million (ppm) or 100 parts per billion (ppb) for Time-Weighted Average (TWA) exposure and 0.3 ppm or 300 ppb for Short-Term Exposure Limit (STEL).

The PID sensor employs a vacuum ultraviolet lamp with a wavelength less than 200nm. When the PID sensor is in operation, this ultraviolet lamp causes surrounding oxygen molecules to undergo photolysis, leading to the production of ozone. It is worth noting that the 7 series PID sensor has a larger window area for its ultraviolet lamp compared to the 4 series PID sensor. Consequently, the amount of ultraviolet light released, and therefore the ozone produced, is significantly higher for the 7 series PID sensor than the 4 series PID sensor.

For instance, at a distance of 0.5cm from the 7 series PID sensor, the measured ozone (O₃) concentration is less than 450 ppb, and at 1cm, it is less than 25 ppb. Similarly, measuring the ozone produced by the 4 series PID at a distance of 0.5cm from the PID sensor results in a concentration of less than 15 ppb, and at 1cm, it is less than 8 ppb.

In summary, irrespective of the PID sensor specifications, ozone is generated during its operation. However, the concentration of ozone rapidly decreases with increasing distance from the PID sensor outlet. Typically, beyond 1-2cm from the outlet, the ozone concentration falls well below the established safe value (TWA). Therefore, at a distance of 5cm from the PID sensor, the ozone concentration is already less than 10 ppb, indicating a very safe environment comparable to good outdoor air quality.