PROCEDURE FOR PPB-LEVEL VOC DETECTION WITH MULTIRAE

MultiRAE is a highly integrated portable instrument that monitors multiple chemical threats. Because it can be configured with different sensors, its target gas type and range can vary. When configured with a PID (photoionization detector) that can detect at the parts-per-billion, or ppb, level, MultiRAE Pro (PGM 6286) can detect volatile organic compounds (VOCs) over a range from 50 ppb (parts per billion) to 2000 ppm (parts per million).

To accurately measure such a wide range of VOCs, the instrument must combine high sensitivity and a wide dynamic linear range. In most cases, the instrument can detect VOCs at concentrations above 1 ppm without special care. However, special steps should be taken when using the MultiRAE to detect VOCs at very low VOC concentrations (less than 1 ppm).

Why are special steps needed when detecting ppb-level VOCs?

PIDs detect VOCs by measuring the current output resulting from ionization of gas molecules by ultraviolet light from a PID lamp. Therefore, a PID's intensity variations affect measurement of low VOC concentrations.

PID lamp stability is critical to accurate readings

When we turn on a fluorescent tube in our home or office, we see the light intensity increase with time, especially if it has been off for a long time. After a while, the light intensity becomes stable. An ultraviolet lamp used in a PID acts in a similar way, requiring time to stabilize, especially after a long time with the power off. The effect of changing lamp intensity during startup is significant, particularly when the PID is used to detect VOCs with concentrations lower than 1 ppm. Because lamp intensity is generally not stable when the PID is just powered on, performing zero calibration too soon sets the baseline at an unstable point.

Steps to a reliable zero calibration for low VOC concentrations

The key to accurately measuring low concentrations of VOCs is to set a stable, precise zero point. To achieve this, the following steps should be taken:

1. Turn off the "Zero At Start" option before calibrating the MultiRAE Pro to detect VOCs at low concentrations. Please refer to "7.3.7.4 Zero At Start" section in the MultiRAE user guide.
2. If the instrument is turned on after a long time (>24 hours) with its power off, it is recommended to wait for 30 to 45 minutes before performing a zero calibration.
3. About 5 to 10 minutes before performing a zero calibration, attach a zero tube to the MultiRAE's inlet.

Note: Installing a zero tube too early might cause VOCs to pass through if the calibration is performed in an environment with high VOC concentrations.

After zero calibration, the MultiRAE can accurately detect very low concentrations of VOCs. A two-point calibration with 10 ppm as span gas is sufficient. The following chart shows the response of three MultiRAEs to trace amounts of VOCs with concentrations of 200 ppb, 300 ppb and 100 ppb (left, center, and right).

Note: The three colors indicate the three different instruments' response.