FACTS ABOUT PID MEASUREMENT

MiniRAE, ToxiRAE, ppbRAE, MultiRAE and ModuRAE VOC monitors are designed to provide continuous total organic vapor exposure monitoring in hazardous environments using a Photoionization Detector (PID). A few important factors affect the operation and measurement accuracy of PID instruments. These factors are explained below:

1) Accuracy: The specified measurement accuracy (i.e., +/- 2 ppm or 10% of reading, whichever is greater) is defined for a single gas (e.g., isobutylene) obtained after the unit is calibrated with zero gas and 100 ppm isobutylene gas. The 100 ppm isobutylene calibration gas is balanced with air and is accurate to within +/- 2% or 2 ppm. The measurement accuracy specification applies to bottled isobutylene gas only.

For other organic gases and vapors, the specified measurement accuracy can be achieved if the specific gas of interest is used as calibration gas and the relative sensitivity of this particular gas is similar to that of isobutylene gas.

2) Correction Factor: The correction factors (CFs) in Technical Note 106 (www.raesystems.com) provide a convenient way to obtain approximate readings of other organic gases, when only isobutylene calibration gas is available. Refer to the instrument manual for the procedures to do so. Please note that using the CF will not achieve the specified accuracy. This is because are accurate to about 20% and may change slightly with age and cleanliness of the lamp and with concentration. Such factors become more pronounced when the CF is much greater than 1. The instrument sensitivity can be estimated by multiplying the correction factor by 0.1. Therefore, a compound with CF of 10 will have a resolution of about 1 ppm instead of 0.1 ppm.

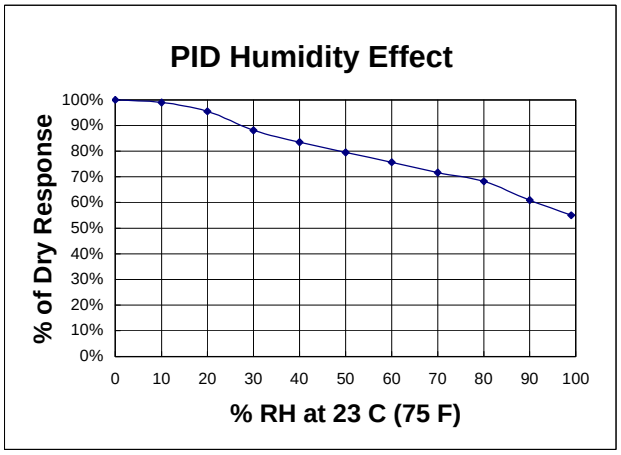
3) Limitation of Gas Detection: A PID cannot detect all organic vapors present. In general, if the Ionization Energy (IE, formerly ionization potential or IP) of a given compound is higher than that of the UV lamp energy (9.8, 10.6 or 11.7eV), it cannot be measured by a PID.

4) Mixtures of Chemical Vapors: The PID detector cannot distinguish one ionizable gas from another. Therefore, if there is more than one compound present, the PID will not provide an accurate concentration of a particular gas. It will give an approximate reading of total gas concentration.

5) Humidity and Interference from other gases: In real applications, the humidity level and the presence of other non-ionizable gas (such as methane) can reduce the sensitivity of the PID. It has been observed that the water vapor can reduce the instrument response by 50% when the relative humidity level is increased from 10% to 90%. This is because high concentrations of water molecules or other non-ionizable gas molecules block out some of the UV light. This well-known effect is called "quenching" and occurs with most existing photoionization detectors. Methane at 10 vol% reduces the response by a factor of about five, and most organic compounds very high concentrations have similar effects. Many inorganic gases including argon, oxygen, nitrogen, hydrogen, and carbon dioxide have little or no effect on PID response and the PID can be used to measure contaminants in nearly pure streams of these gases.

On the RAE PIDs, the detector chambers are specially designed to minimize the "quenching" effect. In addition, membrane filters are used to remove any moisture droplets from the incoming gas stream. As a result, RAE PIDs show improved response at high humidity and high concentration of non-ionizable gases.

The following figure shows the humidity response of MiniRAE 2000. The horizontal axis is the relative humidity and the vertical axis is the relative response of the PID instrument. Curves for ppbRAE and ToxiRAE are similar,



although the effect is somewhat less for the ToxiRAE PID.

6) Very High Concentration of Gases: When the VOC concentration exceeds a few thousand ppm, the PID response will "flatten out" because some of the gas molecules will be blocked from the UV light source and will not be ionized. This is a “self-quenching” effects similar to the quenching effects of water vapor or methane at high concentrations. This “flattening” is compensated by the instrument firmware to greatly improve the linearity, but the measurement error increases above a few thousand ppm. Therefore, to obtain the specified accuracy in high concentration range, the instrument should be calibrated using a similarly high concentration calibration gas or use a dilution device at the input of the gas stream.

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