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A Guide to Gas Monitoring Instruments

Make sure you understand the monitoring equipment you are using, the gases you are looking for, and the methods the monitor uses for collecting the data.

by David D. Wagner

Industrial hygiene gas surveys play a key role in helping industrial hygienists evaluate and determine whether workers are being exposed to hazardous conditions within their workplace environment. Portable gas monitoring instruments can be a valuable tool used in these surveys to provide data that is vital to the success of the mission. In order to ensure the data collected from the instruments is accurate, it is important that the industrial hygienist performing the survey has a clear understanding of the workings of the instrument and the methods it uses for collecting information.

First, there must be an understanding of the detection limits of the instrument. Not what it is detecting--we'll discuss that later--but *where*. In general, portable gas monitoring instruments and the sensors in them are designed to be diffusion sensing devices. Relying on gases diffusing into the instrument from the atmosphere means instruments serve as point detectors, capable only of detecting hazards in the immediate vicinity of the face of the monitor. The instrument may be aspirated with an integral or an add-on sampling pump, but even then, at the minimal sample flow rates used in gas monitoring instruments, the unit can effectively evaluate only the atmosphere directly at the end of the sample tube.

If you are trying to accurately measure the respiratory exposure of a worker to hazardous vapors, it is critical that the instrument collecting the data is located as close as possible to the worker's breathing zone. This will help to ensure the instrument is exposed to the same atmosphere that is being drawn into the worker's lungs. This can be accomplished by attaching the monitor to the subject's hard hat or collar or by placing the end of the sample tube in one of these areas. If you are trying to assess the hazards that exist in a particular work area, it is necessary to place multiple detection units throughout the area in order to get a clear representation of as much of the atmosphere in the area as possible.

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Know What You're Measuring

Now, let's get back to exactly *what* the instrument is detecting. Presumably, you have some idea of the target gases of the survey. If not, a portable gas monitor is likely the wrong choice for conducting the investigation. You will be better served to start your search by capturing air samples from the atmosphere in question and sending them to an analytical lab for a full spectral analysis. If you use the portable instrument in this case, it will be difficult for the manufacturer to help you make determinations of what the

sensor readings mean, and you will end up sending samples to the lab anyway. However, if you do know which potential target vapors may exist, install the proper sensors in the instrument and start collecting data.

Instruments are available which hold as many as five or six sensors to detect various gases. While many of these sensors are designed to detect a specific gas, they probably will provide responses to gases other than their specified target. It is commonly thought that sensors that provide cross-interfering responses on each other's target vapor should not be included in the same instrument. This thought is misunderstood and is usually contrary to what you should do.

For example, nitrogen dioxide vapors generally will produce a negative response from a sulfur dioxide sensor and subtract from the overall response of that sensor in an atmosphere that contains sulfur dioxide. Therefore, many would mistakenly think these two sensors should never be placed in the same instrument. However, if these two gases might possibly be present in your target atmosphere, both sensors must be in the instrument in order to make a reasonable assessment of the data. Because the sulfur dioxide does not produce any response on the NO_2 sensor, one could deduce that a positive NO_2 reading indicates the SO_2 level is accordingly higher than the instrument records. At any rate, a clear understanding of the cross-interfering gases of all the sensors in the instrument is necessary if you expect to make a useful interpretation of the data from the survey.

Of course, the data collected from the instrument will only be as accurate as the instrument's calibration. Portable gas monitoring instruments should be calibrated immediately prior to beginning the survey to ensure their accuracy. Subsequently, the calibration should be verified at the completion of the survey in order to ensure the validity of the data. If cross-interfering sensors are installed in the instrument, special caution should be taken to ensure the instrument is calibrated properly.

Know How You're Measuring
Finally, there must be an understanding of exactly *how* the instrument collects data. Portable gas monitoring instrument typically have flexible recording intervals that range from one second to several minutes. Generally, these instruments employ one of three methods for collecting information.

Data may be collected by storing the highest gas level detected during the recording interval, by capturing the gas level measured at the end of the recording interval, or by accumulating a running average of the gas level detected during the entire recording interval. If the instrument stores the peak gas concentration detected during the interval, a prolonged exposure to an elevated gas concentration may be hidden by a momentary exposure to a higher-level spike. If the instrument captures the concentration detected at the end of the recording interval, any differentiating exposures taking place during the recording interval may be missed. If the instrument accumulates an average exposure over the recording interval, a large concentration spike may be lost in the average. In the latter case, any exposure spikes will be captured if the instrument has an additional peak/hold function.

It is up to you to decide which one of these methods best suits your needs and which instrument employs the data recording scheme you desire.

Data Collection
You also may find it beneficial if the instrument has the ability to identify *who* is collecting the data or who the survey subject is, and from where the data is being collected.

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All gas monitoring instruments capable of storing data will place time and date stamps on the information. Some provide the added capability of recording user and location information and coordinating it with the survey data itself. This may be keyed into the instrument through the keypad interface, selected from instrument display menus, or scanned into the instrument from an external identification device. Find the method that best suits your need and use the information to validate the data in your survey.

Gas exposure data collected in industrial hygiene surveys is critical for establishing practices and making decision affecting workers' health and safety. Before beginning your next survey, make sure you have a clear understanding of the monitoring equipment you are using, the gases you are looking for, and the methods the monitor uses for collecting the data. Paying careful attention to these factors will decrease the chances of your having to repeat the survey and help to ensure you get the job done right the first time.

This article appears in the May 2004 issue of *Occupational Health & Safety.*

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