PRO-TEK™ ORGANIC VAPOR G-AA AIR MONITORING BADGE NO. 1 TECHNICAL BULLETIN LABORATORY AND FIELD TESTING OF THE ORGANIC VAPOR G-AA BADGE

Currently a number of laboratories, governmental, academic and industrial, are testing the PRO-TEK™ Organic Vapor G-AA Badge. This bulletin is being issued to assist these laboratories in evaluating the Du Pont PRO-TEK™ Organic Vapor G-AA Badge and other competitive products using their own techniques and analyses. Many of the suggestions and comments which follow are a result of Du Pont's own experience in developing appropriate test methods for evaluating the performance of passive monitors.

LABORATORY TESTING

A. Face Velocity Effects

Passive monitors require a minimum amount of air movement in order to accurately measure the actual contaminant concentration in the air. On the average, personnel wearing a passive dosimeter will be exposed to an effective face velocity of 100 ft/min or higher due to movement of the individual in his/her environment. The PRO-TEK™ Organic Vapor Badge has been calibrated to accurately measure between 35 and 400 ft/min face velocities when operating with both protective covers off. Below 35 ft/min the badge will read low because of starvation occurring at the face of the badge. This effect can be reduced by keeping one of the covers on the badge, effectively reducing the sampling rate by one-half.

Because of the high sampling rate of the PRO-TEK™ Badge (approximately 100 cc/min) when both covers are off, it will be more sensitive to starvation effects than the 3M and Abcor Organic Vapor Badges (30-40 cc/min) and the PRO-TEK™ Colorimetric Badge (1-2 cc/min) but approximately equal to or less than the 3M Mercury Badge. *When one cover is on the PRO-TEK™ Badge (50 cc/min), sensitivity to starvation should be approximately the same as the 3M and Abcor Organic Vapor Badges.*

It is important that laboratory testing of the PRO-TEK™ Organic Vapor Badge reflect the face velocity conditions existing in the field; these are considered by NIOSH to average 100 ft/min (NIOSH Contract Proposal No. 210-78-0115-0000, Evaluation of Passive Organic Vapor Monitors).

B. Dynamic Test Atmospheres

Dynamic methods of generating atmospheres should be considered where complete mixing (nonstratification) of the contaminant in air occurs. This can be accomplished by various techniques, the best of which we feel is the use of a wind tunnel where face velocity effects can be precisely controlled. Static methods such as single rigid chambers or plastic bags have a

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number of disadvantages, such as nonequilibrium conditions (wall effects) and insufficient air movement of the contaminant through the device.

C. Concentration Depletion

Depending on the airflow or face velocities existing in the testing chamber, there are a maximum number of badges that can be tested at one time. We have found that no more than eight PRO-TEK™ Organic Vapor Badges and charcoal tubes should be tested at one time with a minimum distance of 6 inches between each device. If this distance is not maintained, the badges will influence each other because of the development of localized concentration gradients in and around the device leading to low results.

D. Dual Sampling Rate

The choice of when to use the 100 cc/min or 50 cc/min sampling rate will depend on the ppm-hours exposure anticipated during the test. This is illustrated in the following diagram:

EXPECTED SAMPLING RANGE (PPM-HOURS)

		0.2 – 100	100 – 4000	Special Situations
Relative Humidity	< 90%	100 cc/min	50 cc/min	50 cc/min
	≥ 90%	50 cc/min	50 cc/min	50 cc/min
Face Velocity (Ft/Min)	< 35	50 cc/min	50 cc/min	50 cc/min
	≥ 35	100 cc/min	50 cc/min	50 cc/min

The 50 cc/min sampling rate (one cover removed) should be used under the following conditions:

(1) Expected sampling range of 100 – 4000 ppm-hours exposure. This condition would exist in either long sampling times such as 24 hours or for measuring gases with high TLV's® (i.e., up to 500 ppm for eight hours).

(2) High relative humidities (i.e., >90% where breakthrough or saturation of the charcoal is suspected).

(3) Stagnant air conditions where face velocities of < 35 ft/min are anticipated.

(4) Special situations, as if poor adsorption or migration of the contaminant is anticipated during or after exposure.

The 100 cc/min sampling rate (both covers removed) should be used when the expected sampling range will be 0.2 – 100 ppm-hours exposure and when relative humidities will be less than 90% or when face velocity will be at least 35 ft/min. This sampling range would exist for either short sampling times such as 15 minutes or for measuring gases with low TLV's® (i.e., less than 12.5 ppm for eight hours).

E. Desorption Efficiencies

Desorption efficiencies should be verified by the user under charcoal loading conditions which are expected during test exposures. Various methods have been described involving spiking of the charcoal in a closed container or vial (i.e., recommended NIOSH procedure, P&CAM 127). This method, however, has been shown to have poor precision at times, and in general we recommend using the phase equilibrium method in which a known concentration of contaminant in the desorbing solvent is added to the charcoal strip in a vial and allowed to equilibrate overnight to determine how much has transferred from solution onto the charcoal. If no transfer occurs, then one has a desorption efficiency of 100%.

The PRO-TEK™ charcoal strip will fit into a 2 ml G.C. vial if folded lengthwise and tapped into the bottom half of the vial. In general 1.0 ml of desorbing solvent is sufficient to maintain contact with the charcoal strip when accompanied with gentle agitation. However, 1.5 ml can also be used to further ensure the contact of liquid with the charcoal. The vial with the charcoal strip should be capped first before adding the desorbing solvent. One should also attempt to minimize the air space between the liquid and the top of the vial or tube. This will reduce the effect of contaminant leaving solution by entering the air space, thus effectively reducing the concentration in solution.

F. Field Testing

a. Personnel Monitoring Precautions

1. In order to minimize concentration depletion effects no more than one sampling device should be placed on each side of the front of the worker's body.

2. If low face velocity conditions are suspected, the 50 cc/min sampling rate (only one cover removed) should be used.

3. Badges and other devices should be at least 6 inches from each other during exposure to minimize concentration depletion effects.

4. Protective covers should be replaced after exposure and badge sealed into pouch.

b. Area Monitoring Precautions

1. Stagnant areas should be avoided.

2. If low face velocity conditions are suspected, the 50 cc/min sampling rate (only one cover removed) should be used.

3. Badges and other devices should be at least 6 inches from each other during exposure to minimize concentration depletion effects.

These suggestions and comments are not meant to be exhaustive and will be updated.

For more information on Du Pont's PRO-TEK™ badge system, contact:

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