cc: W. M. Smith / R. Spiegelhalter

Air Products and Chemicals INC.

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INTER-OFFICE MEMORANDUM

Subject PERSONAL VCM MONITORS

To J. T. Barr — VF (Location, Organization, or Department)

From J. C. Novak — VF (Location, Organization, or Department)

RESEARCH & DEVELOPMENT
APR 8 1974
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I have checked into the use of "air bag" method of sampling for different organic vapors, including vinyl chloride.

It is a reasonably old technique to collect industrial gases for analysis in glass bottles, bombs and recently in bags. During the recent years, it became increasingly important to obtain a good sample of the working atmosphere and be able to analyse it with reasonable accuracy and reproducibility. Such demand for better performance brought along a critical review of sampling methods and errors which can effect the out-come of a subsequent analysis.

It was shown that sampling for industrial gases (organic and inorganic) in glass containers resulted in loss of such gases due to adsorption on the walls. These losses became increasingly critical as the concentration of the "contaminant" for which the sampling was perfromed was at a very low level. The decay of the concentration is time dependent and varies with the gases.

Plastic bags, besides providing an increased surface area for adsorption, are good absorbers of the organic gases. The mechanism that is involved is as follows:

1. adsorption occurs on the surface of the plastic.
2. the adsorbed gas molecules migrate into the plastic due to the solubility.
3. a new monolayer of gas adsorbs on the surface and the cycle continues on.

This is not a uniform occurance on the plastic surface depending on the uniformity of the plastic itself and the structure of the polymer, plasticiser used, etc.

The migration of the gas through the bag is temperature, concentration, time and pressure (in the bag) dependent. It also varies from gas to gas.

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Permiation tubes employ this property of the plastics for new analytical techniques. They are gases contained in TEFLON tubes; the rate of permiation of a given gas through the Teflon yields a uniform concentration of such gas at a constant temperature to be used for such techniques as calibrations.

To achieve any degree of accuracy in analyzing for samples collected in plastic bags, a decay curve must be established for any given gas. Even after such involved (rather time consuming) effort, there is still the unknown of temperature change during and after sampling, the effect of concentration on the validity of the established decay curve, as well as the pressure in the bag. Also, there is the question of aging of the plastic bag; and how well can the sampled contaminant be removed before a new sampling is started.

In view of the above points and unanswered questions as well as the extent of work that it would require to establish the numerous parameters for acceptable results; (not mentioning the fact that the system is not intrinsically safe) I recommend to continue using the present method of collection on activated charcoal.

Admittedly, there is the question of percent adsorption and desorption of vinyl chloride (or any other gas) on the charcoal. However, this has been established by our laboratories and to my knowledge they are periodically rechecked. This is a method recommended by NIOSH and used by OSHA. There are no ambiguous parameters which are left open to criticism.

There have been complaints that the batteries used with the presently used Bendix C-115 pumps will not give more than 4-5 hours running time. This is due to the high pressure drop against which the pump must work with the large quantity of charcoal used. There is no other pump (for personal sampling) on the market which can out-perform the C-115 pump at the present time.

Since the vinyl chloride in the working area will be governed by a ceiling value (even if it may be on a temporary basis) continuous personal monitors for a long duration (several hours) are meaningless. These are integrated samples and will not show peak concentrations. I am preparing a procedure for using commercial charcoal tubes, for no longer than an hour duration and continuously monitoring a person during a shift, using 7 or 8 charcoal tubes.

The frequency of resampling will be established by me after the initial results are analyzed and evaluated.

As for the air bags to be used in our sampling efforts, I recommend against them. Our laboratories are taxed to the limit now; it would be an undue burden on them to become involved in such a lengthy calibration program as would be needed to obtain meaningful data in using the air bags.

J. C. Novak

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