

Monitoring Exposures to Vinyl Chloride Vapor: Breath Analysis and Continuous Air Sampling

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Ⓒ An environmental survey was conducted to determine the time-weighted average exposure (TWA) of a group of chemical plant workers to vinyl chloride (VCl) vapor. This survey featured continuous multipoint air sampling and analysis using an infrared spectrophotometer. The inhalation exposure data were digitized and recorded on paper tape for subsequent computer analysis and derivation of daily TWA values for each worker. A breath sampling program was conducted concurrently with the environmental survey, and a series of breath decay curves relating post-exposure breath concentration to vapor exposure were derived from the data. To validate the breath curves derived from on-the-job data, postexposure breath curves were also constructed from breath data obtained following experimental human exposures to carefully controlled concentrations of VCl vapor. The close agreement between postexposure breath concentrations at the corresponding TWA's obtained by each of the methods suggests that either continuous air monitoring or breath analysis is valid for estimating the worker's individual daily exposure to VCl, and provides further evidence that breath analysis is a useful industrial hygiene technique for evaluating vapor exposure.

Introduction

THE QUESTION THAT MAY ARISE following an environmental survey is whether the chemical vapor concentrations measured are truly representative of the exposure being experienced by the workmen. Evaluation of the ranges of atmospheric concentrations and estimates of time-weighted average concentration (TWA) are all too often based on a few spot samples obtained under conditions which are not representative of all phases of a given operation. A more exact measurement of vapor exposure would have to be based on continuous monitoring of air in the workman's breathing zone during his entire work shift. Obviously this task is made difficult and often impossible

by the large number and variety of tasks performed by today's modern chemical plant worker.

Recent improvements in automatic monitoring and data processing equipment have provided a means for a more satisfactory solution. Sequential samplers and automatic analyzers and recorders can now be used to continuously monitor several locations or operations to provide more valid data on which to base estimates of chemical exposure. Computers can be utilized to manage the large volume of data generated by continuous monitoring.¹

Meanwhile a technique has been under development which more precisely defines the level of individual exposure. The realization that the total body burden of a volatile chemical is directly related to its concentration in expired air led to the development of techniques for collecting and analyzing breath samples useful in estimating the more indi-

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