

INDUSTRIAL HYGIENE

stant, that the physiological effects produced are proportional to this product, and that peaks are not disproportionately above the accepted limit. This may not always be valid because of variations and differences in factors such as rates of absorption and elimination and the type of effects produced. Time-weighting does not consider the chronological sequence in which these peaks occur; the response from two or three peaks occurring within a short time can be much more serious than if these peaks occur at widely spaced intervals.

It is most important to emphasize the importance of sampling procedures. Spot sampling too is a poor way to assess total exposure—it is easy to miss peak exposures. Conversely, in the hands of the untrained investigator, it may be too easy to sample only obvious peak exposures. Samples taken over a long period may be adequate for estimating total exposure, but they only give the average concentration over the sampling period. This may be adequate only when one employs continuing sampling procedures which record the concentration at successive short intervals over this prolonged period of time.

Measuring the Hazard

To determine exposure levels to chemical and biological atmospheric contaminants, as well as to measure physical energy stresses, the industrial hygienist uses either direct-reading instruments or laboratory analytical methods.

The limitations and applications of the various instruments and techniques used to measure environmental stresses are discussed in this section, which is adapted from a paper* presented by H. F. Schulte at the 1963 National Safety Congress.

Sampling techniques

What must be measured and evaluated in industrial hygiene sampling is usually the dosage the worker receives—the amount of toxic material he takes into his body. Duration of exposure and concentration and type of material are important. For the concentration measurement, a test can be made on the air in the worker's breathing zone. In some cases, the measuring instrument can be attached directly on the worker and he can carry it throughout the working day (this is done with a film badge for measur-

ing radiation exposure). Relatively few samplers are available at the present time for taking continuous samples in the breathing zone. The other technique is to measure concentration in the breathing zone over carefully selected intervals, then average the results and weight each measurement according to the length of exposure. The result is a time-weighted average concentration.

A satisfactory average exposure measurement during a particular time period, is affected by changes from day shift to night shift, from winter to summer, routine changes in process operations, or daily changes in rate and direction of air movement, temperature, or altitude. Then too, will the presence of the sampler alter the routine of the operation in any manner? Is the contaminant soluble or insoluble in bodily fluids? What is its particle size distribution and in what portion of the respiratory tract is it likely to deposit? What is its chemical nature? Organic mercury acts quite differently from mercury vapor, which, in turn, is quite distinct from mercury oxide. Finally, are there limitations on the peak dose rates as there are for beryllium and some other compounds?

If the samples are collected at the right places and combined with a time study of the worker's activity, they can give a measure of the worker's intake of the toxic substance. Methods of collection are given in Table 39-D.

Whether direct-reading or laboratory techniques are to be used is a matter of professional judgement. The results obtained must be compared with a threshold limit value with a full knowledge of its limitation and consideration of other factors in the situation. Urine assays add to the facts available for making an evaluation of exposure. These, in turn, must be combined with knowledge obtained by the physician directing an adequate medical program. All this serves to emphasize the basic teamwork approach of the industrial health program.

*National Safety Council Transactions, 12 37-42, 1963