obvious A few measurements of "high" concentration, evaluated by an inadequately trained man may shut down an operation resulting in considerable financial loss On the other hand, with insufficient attention to the limitations of these instruments, it is quite possible to get seemingly "safe" readings and still have a real hazard leading to occupational disease and excessive work losses

Direct-reading vs lab analysis

There is no real qualitative distinction between direct-reading and laboratory analytical techniques, and in some cases they overlap For example, to measure the airborne concentration of hydrogen chloride, the industrial hygienist could have the chemist make up a solution containing known amounts of sodium hydroxide in a series of bubblers or impingers The contaminated air could be drawn through each bubbler at a measured rate for a fixed period of time and the samples returned to the laboratory There, the excess sodium hydroxide would be back-titrated by the chemist with hydrochloric acid and the air concentrations of hydrogen chloride calculated This is the laboratory analysis method

However, the industrial hygienist could have the chemist make up a smaller quantity of sodium hydroxide in each bubbler and place an indicator in the solution In the field, the industrial hygienist could bubble air through the solution at a known rate and measure the time it took to obtain a color change in the bubbler From the volume of air drawn through, he could determine the air concentration of hydrogen chloride by a very simple calculation This is essentially a direct-reading method

Both methods are adequate for measuring the air concentration at the point of sampling In both methods, the reagents were prepared by a trained chemist In one case the industrial hygienist took a sample for a fixed period of time, and in the other he sampled until he saw a color change Essentially, no difference in skills is required in the direct-reading method, he can now take his second sample with the facts about his first result already on hand

This is the crucial difference between the methods and here is where the user of the direct-reading method must be wary He may be led on a trail of seeking higher or lower concentrations and away from his objective of measuring the man's exposure under truly representative conditions A certain impartiality, created by ignorance of the immediately preceding results, may help in obtaining a more representative sample On the other hand, a trained industrial hygienist can utilize this progressively increasing knowledge of results to sharpen the precision of sampling

Safety professionals have been using direct-reading instruments for many years for detecting combustible and explosive gases and have saved many lives as a result In the case of explosive gases, peak concentrations, not related to a man's exposure, must be measured Explosive limits are physical constants which can be modified only within narrow limits, in contrast to threshold limit values which must be interpreted broadly

With a full knowledge of the facts, the trained industrial hygienist is in a position to utilize the direct-reading instruments to considerable advantage He can take more samples, get closer to the breathing zone, screen out areas for more detailed study, search out specific sources of air contamination, and adequately evaluate the workers' exposure

Evaluating the Hazard

Evaluation of environmental exposures requires teamwork by several professional disciplines no single group can solve all the many problems presented by occupational disease For example, the engineer ordinarily collects atmospheric samples in the field for subsequent chemical analyses In many cases, however, the chemist must go into the field to assist with the collection of samples and to advise on the chemical aspects of the particular problem under study

The evaluation of an industrial health hazard requires some knowledge of toxicology and an understanding of the concepts involved in the use of threshold limit values and maximal acceptable concentrations

The following material in this section on