

plete a computer-based multimedia course at some point during their first week of employment. Attendance sheet and evaluation forms were compared for this exercise. The computer-based multimedia course was well-received by second shift employees, and first shift employees had a preference for the multimedia option.

## 218

**DEVELOPING COST-EFFECTIVE CUSTOM INTERACTIVE MULTIMEDIA TRAINING PROGRAMS.** D. Wolski, Environmental Resources Management, Inc., Exton, PA

Health and safety training programs have progressed from slides and lectures through straight video presentations and recently into train-the-trainer formats. The recent advent of computers with high speed microprocessors and CD-ROM technology has allowed the creation of another type of format: computer-based interactive multimedia training (IMT). IMT has been demonstrated to be one of the most effective and efficient ways of training workers. Increased retention, flexibility, documentation, and tracking are some of the reasons IMT is being regarded as one of the best ways to train employees. The only way to make IMT more effective is to customize it. Installing company logos, site-specific video footage, corporate-specific operating procedures, messages from facility managers are all ways to send the message a little deeper. The ultimate outcome is a well-trained workforce capable of responding in the most appropriate way to physical and chemical hazards they encounter in their workplaces. It is concluded that customized IMT programs are the best way to get this accomplished.

## 219

**GRADUATE EDUCATION VIA DISTANCE LEARNING.** R. Soule, Indiana University of Pennsylvania, Indiana, PA

The escalating emergence of the safety/health profession has increased the demand for academically prepared professionals. It has had similar effect on the need for continuing education and graduate studies in the safety sciences. However, manpower surveys have indicated that the rate of supply of new professionals is not keeping pace with the demand. A significant roadblock is the physical distance the typical practicing safety professional has to travel to access formal professional education and training. One potential answer to the problem is making graduate study (and other forms of training and education) available by means of various forms of distance learning. The Safety Sciences Department at Indiana University of Pennsylvania (IUP) offers an ABET-accredited program leading to a Master of Science in safety sciences. In 1996, a commitment was made to make the program available through distance learning, with the first course, Concepts of Risk Assessment, available in the Fall of 1997. The format for "distance delivery" of each course consists of a major component, approximately two-thirds of course content, that is delivered via the Internet. For this component, students can register, participate in "lectures," conduct research, and complete

assignments and projects all via the Internet. A second component, approximately one-quarter of the course content, is delivered by way of interactive audio, and in select locations video, teleconferencing. A final component for most courses is a "residency" aspect in which the instructor of record interfaces directly with students at appropriate sites determined by the location of registered students. Although the academic, technological, and administrative problems encountered in development of the courses are substantial, the contribution of the effort to needs of industrial hygienists and other safety professionals is vital to their continuing education.

## Sampling & Lab Analysis Papers 220-229

### 220

**CUSTOMER VIEWS ON THE NIOSH MANUAL OF ANALYTICAL METHODS (NMAMTM).** M.E. Cassinelli, P.C. Schlecht, National Institute for Occupational Safety and Health, Robert A. Taft Laboratories, Cincinnati, OH

The American Industrial Hygiene Association (AIHA) and the National Institute for Occupational Safety and Health (NIOSH) conducted a survey of over 1700 laboratories participating in the Proficiency Analytical Testing (PAT), the Environmental Lead Proficiency Analytical Testing (ELPAT), and the Asbestos Analyst Registry (AAR) Programs. The survey was designed to obtain customer feedback on the NIOSH Manual of Analytical Methods (NMAMTM) and industrial hygiene methods from other sources. Preliminary results of the survey indicate that laboratories prefer the current format of NIOSH analytical methods. In general, they found the NIOSH format to be direct, concise, and easy to read. The summary page of NIOSH methods was found to provide useful quick information on the subject chemical, its sampling and analysis, and its accuracy with respect to NIOSH criteria. Similarly, laboratories found the Method Finder, a list of chemicals with corresponding method name and number, as well as basic sampling information and analytical techniques, to be very helpful in locating methods. Comments related to a specific method or methods were received where laboratories felt that procedures were sometimes too brief, particularly in the calculations section. Numerous substances were suggested for method development. The most frequently stated dislike was that methods are not always up-to-date, particularly the GC methods where the specified packed analytical columns need to be replaced with capillary columns. The survey responses revealed a need for a central bank of methods so that all the industrial hygiene methods could be found in one place. The vast majority of respondents favor NIOSH publication of methods developed by others provided that NIOSH method validation criteria are met.

### 221

**DETERMINATION OF LOW MOLECULAR WEIGHT ALDEHYDES AND KETONES BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY.** K. Wiesenthal, S. Que Hee, University of California, Los Angeles, CA

Human activities contribute to the production of low molecular weight aldehydes and ketones in air and water. They are released in to air as byproducts of combustion processes and industrial uses. Aldehydes and ketones are formed as byproducts of ozone reaction during water treatment processes. They are irritants; formaldehyde, acetaldehyde, and crotonaldehyde are carcinogens. While there is a gas chromatography method, there is no high performance liquid chromatography (HPLC) method for these derivatives. This was the aim of the present study. O-(2,3,4,5,6-pentafluorobenzyl)-hydroxylamine hydrochloride (PFBHA) is a derivatizing agent for the carbonyl compound to produce oxime derivatives. The oximes were extracted with hexane, the solvent evaporated, and then dissolved in acetonitrile. Eleven different oxime derivatives were mixed in a cocktail. They were resolved on a 25-cm length Bio-Sil ODS-5S reverse phase of film thickness 5  $\mu$ m column, with the following conditions: mobile phase 57% acetonitrile and 43% water; temperature 39 degrees C; flow rate 0.8 mL/min; UV detector wavelength 22 nm. These conditions allowed baseline resolution of 11 oximes. The run time was 113 minutes. The detection limit for most derivatives was 1 mg/L. The linear region for most derivatives was 1 mg/L to 36 mg/L. HPLC can be used to complement the standard GC method for quality control and quality assurance. It is inexpensive and easily performed.

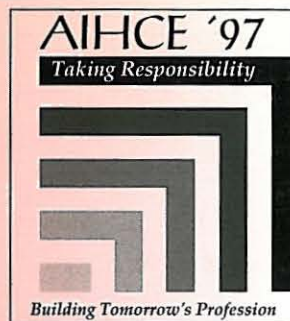
### 222

**SYNTHESIS OF ALDEHYDE OXIME STANDARDS.** J. Tso, S. Que Hee, University of California, Los Angeles, CA

Carbonyl compounds (especially those that are low molecular weight aldehydes) are receiving increasing attention in workplace air exposures, indoor air quality, and as disinfection byproducts in drinking water. Formaldehyde, acetaldehyde, and crotonaldehyde are known animal carcinogens. There is need to have a method that can be utilized for both water and air samples at ppb-ppm concentrations. While 2,4-dinitrophenylhydrazine is presently the only method used in this manner, other methods need to be developed because of difficulties with this method. The reagent O-(2,3,4,5,6-pentafluorobenzyl)methylhydroxylamine hydrochloride (PFBHA) is the most promising alternative reagent. Unfortunately, there are no commercial standards for the oxime derivatives of the carbonyl compounds. The conditions to produce pure oxime standards at yields >80% have been optimized for a number of low molecular weight aldehydes relative to temperature, reaction time, and isolation procedures. The optimum synthesis procedure differs for different aldehydes. About 1.1 to 1.3 times PFBHA is usually necessary, and heating by turntable microwaving at 87 degrees C is important for three heating-cooling cycles. Cooling at room temperatures is more efficient

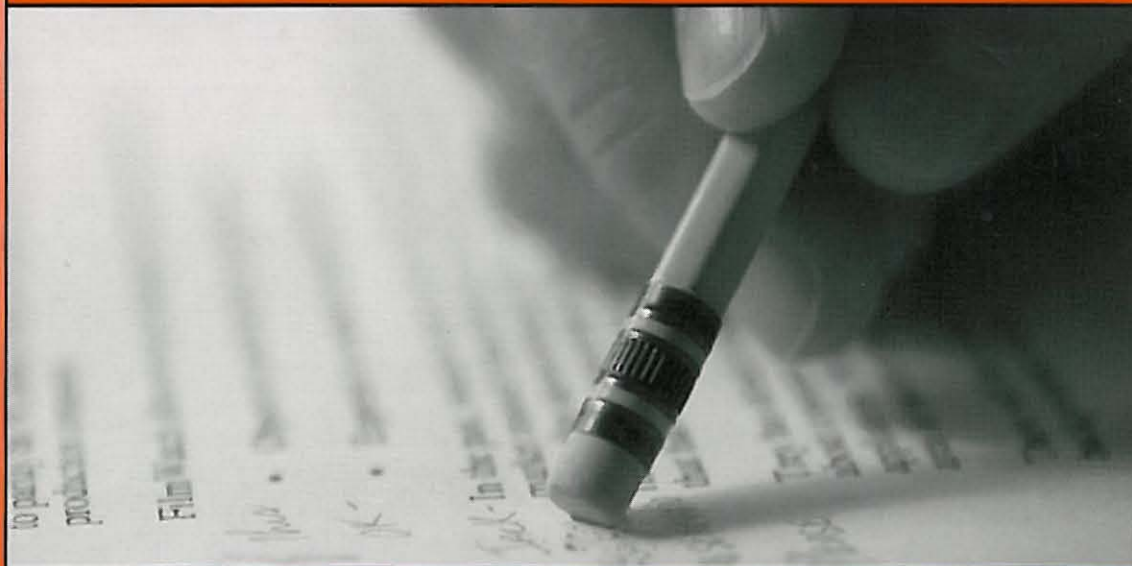
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