77

HEALTH AND ENVIRONMENTAL ENGINEERING FLIGHT TEST AT THE AIR FORCE FLIGHT TEST CENTER. S. Neumann, U.S. Air Force, Edwards AFB, CA.

This presentation will show how the new capability of the 412 TW Health and Environmental Engineering Test and Evaluation Branch merged health and environmental engineering considerations throughout flight test activities and optimized sustainment. Some examples include the F/A-22 Raptor, the Joint Strike Fighter (F-35), and Airborne Laser (ABL) test programs at the Air Force Flight Test Center, Edwards AFB, Calif.

This presentation will show tailored strategies for capturing health and environmental data, test outcomes, and lessons learned for fielding weapon systems with the least impact to the human and the environment. As a result, logistics footprint and total operating costs are minimized. The F/A-22, the F-35, and the ABL are at varying stages of flight and ground test within the acquisition cycle. Some examples within the F/A-22 Raptor flight test program associated with stealth maintenance, copper beryllium testing, and repair maintenance for the F119 engine are presented. The F-35 flight test activities example will show how early involvement in preparation to receive the aircraft can minimize facility contamination and maximize logistics testing. Finally, the ABL ground and flight test activities require emphasis on environmental and health planning to ensure success for total operation. When health and environmental engineering considerations are incorporated prior to the start of the flight test and throughout flight test activities, weapon system sustainment improves the readiness of the warfighter at lower total operating costs.

78

DERMAL EXPOSURE MEASUREMENT OF EPOXY COMPOUNDS. R. Lindahl, M. Rhen, A. Hagenbjörk-Gustavsson, National Institute for Working Life, Umeå, Sweden.

Epoxy compounds, such as diglycidylether of bisphenol A (DGEBA), may cause allergic contact dermatitis. The aim of this study was to develop and test two methods, patch sampling and tape stripping, for the determination of dermal epoxy exposure. The adhesive used for both tape stripping and patch sampling was Fixomull®, a self-adhesive gauze with woven polyester backing and a polyacrylate adhesive. The adhesive was, immediately after sampling, put into dimethyl formamide (DMF) to stop curing and other reactions with DGEBA. For the analysis, liquid chromatography with fluorescence or mass spectrometric detection was used. Laboratory tests showed no stability or recovery problem after dissolving in DMF.

The methods have been tested in three companies. In the first two there was only direct contact contamination and no air transport of DGEBA. The work tasks were application of seamless floors and liquid shim application. In the third company the main exposure occurred after air transportation of DGEBA in aerosols produced during spray painting. Blank levels were less than 1 ng/cm^2. A comparison of the two methods during application of seamless floors showed about three times the amounts for the patch sampling compared to tape stripping, probably due to a too thin stripping layer compared to the permeation rate and sampling time.

Both tested methods, tape stripping and patch sampling, are sensitive enough and can be used for dermal exposure measurement of epoxy compounds such as DGEBA. The methods can be used in different work tasks and with different exposure situations.

79

COMPUTERIZED STATISTICAL METHODS FOR ASSESSING OCCUPATIONAL EXPOSURES. P. Wambach, U.S. DOE, Washington, DC; E. Frome, Oak Ridge National Laboratory, Oak Ridge, TN.

The statistical methods recommended in J.R. Mulhausen and J. Damiano's *A Strategy for Assessing and Managing Occupational Exposures*, Second Edition (AIHA Press, Fairfax, Va., 1998) and some additional methods have been computerized. The free software provides lognormal and nonparametric estimates of means, upper tolerance limits, and percent exceedance metrics, for any size data set, with or without the presence of nondetected results. Industrial hygiene exposure measurements may be subject to left censoring, i.e., the measured value is less than a "limit of detection." Occupational exposure monitoring typically focuses on the mean exposure level and/or the probability that any measurement exceeds a limit. Parametric methods, used to determine acceptable levels of exposure, are often based on a two parameter lognormal distribution. The mean exposure level, an upper percentile (e.g., the 95th percentile), and/or the percent exceeding the limit are used to characterize exposure levels and confidence limits are needed to describe the uncertainty in these estimates. Statistical methods for random samples (without nondetects) from the lognormal distribution are well known for each of these situations. In this presentation, methods for estimating these quantities based on the maximum likelihood method for randomly left censored lognormal data are described. If the lognormal model is in doubt, then nonparametric methods for left censored data are used. All of these methods are well known but computational complexity has limited their use in routine data analysis with left censored data. The recent development of the R environment for statistical data analysis and graphics has greatly enhanced the availability of high quality nonproprietary (open source) software that serves as the basis for implementing the methods in this presentation. Numerical examples are provided and the availability of R functions is described.

80

THE EFFECT OF A WORKER'S PRESENCE IN A ROOM ON CONTAMINANT DISPERSION. E. Lee, C. Feigley, J. Khan, S. Tamanna, University of South Carolina, Columbia, SC; M. Ahmed, Hydek Inc., Atlanta, GA.

Previous studies have shown that contaminant concentrations in the breathing zone strongly depended on the worker's position relative to a contaminant source. However, most investigations were performed in a wind tunnel or in rooms with displacement ventilation—air flow patterns that are not typical of workrooms in the U.S. Here the effect of worker presence near a source was investigated in an experimental room (2.86 m(L) x 2.35 m(H) x 2.86 m(W)) to determine if one worker's presence could influence contaminant dispersion patterns in a room, and thus potential exposure levels of others in the room. A heated mannequin was placed in four locations near a source for a wall jet (WJ) air inlet and one location for the ceiling diffuser (CD) inlet. Tracer gas (99.5% propylene) concentrations were monitored automatically at 144 sampling points with a photoionization detector. Two flowrates (5.5 and 3.3 m^3/min) were employed.

The worker presence influenced the contaminant dispersion pattern in the occupied portion of the room for all conditions investigated, except for CD-5.5 m^3/min; for WJ-5.5 m^3/min, concentrations were higher near the source pedestal for all worker locations compared to those without a worker present. Relatively more variation of contaminant concentrations was observed in the occupied zone of WJ-5.5 m^3/min (CVs = 0.42–0.58) than those of WJ-3.3 m^3/min (CVs = 0.2–0.28). For the CD-3.3 m^3/min, the worker present north of the source generated better mixing of room air (CV = 0.17) in the breathing zone compared to when the worker was absent (CV = 0.49). Perhaps, thermal convection from the heated worker promoted better mixing of room air.

These experimental results indicate that contaminant dispersion patterns depend upon the location of the worker and the worker's interaction with the air velocity field. Also, they suggest that a greater understanding of concentration variability in workrooms is needed to develop more sophisticated methods of exposure estimation.

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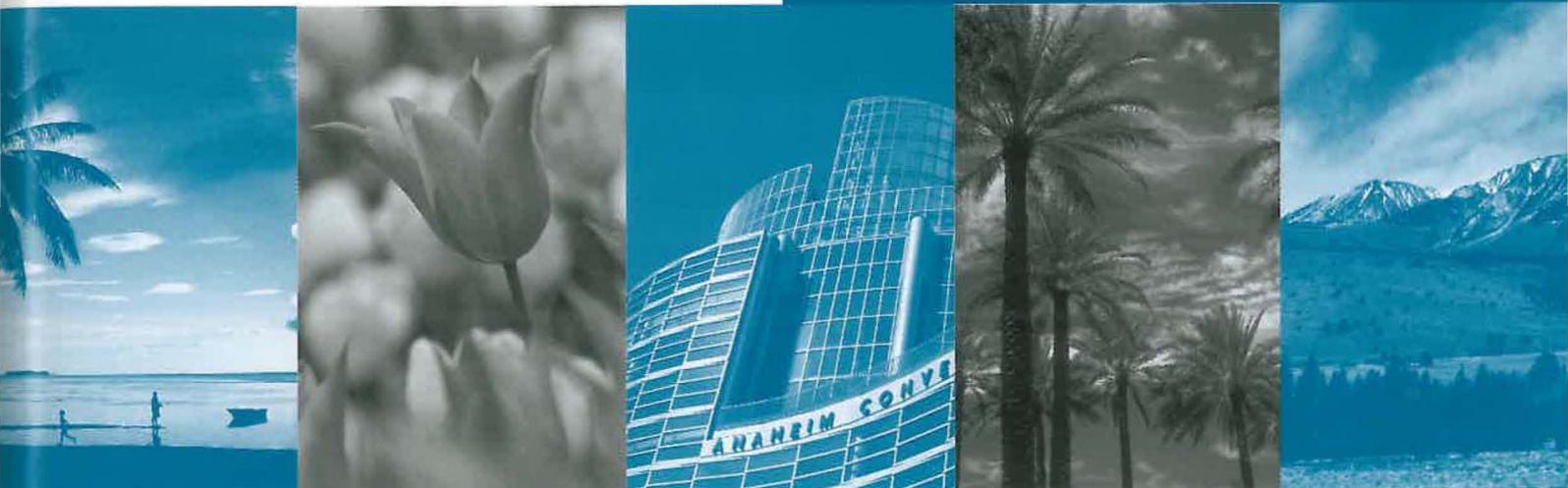
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