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A PROPOSED RESPIRATOR CARTRIDGE SERVICE LIFE CALCULATOR. C. Marlowe, Camp Dresser & McKee, Scotch Plains, NJ.

This paper proposes a calculation for industrial hygienists to use in determining respirator cartridge service lives for use with mixtures of organic solvents in soil or water. This calculator is based on a Henry's Law calculation that derives an estimate of the head space concentration of vapors and gases, which determines the ratios of the vapors. The procedure calculates a cartridge service life for the mixture using an anharmonic addition (like the calculation for resistance in a parallel electrical circuit) based on the service life provided by the manufacturer. This calculation responds to real conditions measured in the field. It uses the ambient temperature, total vapor concentration, and relative humidity. When the calculated service life is shorter than 30 minutes, air purifying respirators are impractical. When the calculated service life is between 30 minutes and 120 minutes, air purifying respirators are a hassle. For service lives between 120 and 480 minutes a reasonable change schedule can be achieved. For service lives over 500 minutes the cartridge would be good for a whole day.

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METAL REMOVAL FLUID EXPOSURE TO MACHINIST ENTERING AN ENCLOSED MACHINING CENTER. K. Huber, University of Michigan, Lafayette, IN.

Metal Removal Fluids (MRF) are widely used in manufacturing industries, creating exposure potential for millions of workers. In response, OSHA-SAC recently proposed a new Permissible Exposure Limit (PEL) for MRF of 0.5mg/m³ time-weighted-average (TWA). A common engineering control practice to reduce worker exposure to MRF is to enclose machinery. While most work is done outside the confines of the enclosure, it is necessary for employees to enter enclosures to inspect tooling and verify parts are within tolerance. During these short incursions, employees are potentially exposed to high concentrations of aerosolized MRFs. Such short-term exposure will be significantly higher than the TWA "total particulate" sample. Due to the health concerns associated with MRF, including occupational asthma and hypersensitivity pneumonitis, MRF mist characterization and assessment are important components of exposure control for machinists. These serious respiratory effects are observed even when TWA values are below the suggested 0.5 mg/m³ as reported at the Metalworking Fluids Symposium II. Therefore, the possibility that short-term high exposures contribute significantly to the risk of disease may be real. A study was conducted; personal breathing zone samples were taken and analyzed using the OSHA 0500 method and the ASTM MRF extraction method, as well as mock personal samples with a direct-reading aerosol monitor. Sampling by these separate methods was conducted simultaneously. The direct-reading instrument measured total mist levels as TWA and peak exposure level in the enclosure, and did indicate peak exposures well above exposure criteria. While 10 of 15 TWA measurements exceeded the OSHA-SAC recommendation, the most significant contribution to exposure occurred during entry into the

machine enclosure for as little as 20 seconds for as few as 10 times a day. Real time measurements offered a descriptive element that personal samples were unable to provide, and offered insight into the time-varying nature of aerosol exposures of the workers in question and how this impacts the application of current standards.

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DETERMINANTS OF EVAPORATIVE LOSSES FROM METALWORKING FLUID MIST SAMPLING FILTERS. P. Raynor, University of Minnesota, Minneapolis, MN.

Metalworking fluids (MWFs) are semi-volatile liquids that form potentially hazardous mist droplets when they are applied during machining. Field measurements and laboratory experiments show that droplets sampled onto filters can evaporate into passing air after they have been collected. Such losses introduce negative biases into MWF mist concentration measurements. To complement field and laboratory measurements, two numerical models are used to explain why volatilization occurs and identify situations in which evaporation may be particularly important. The first model predicts airborne droplet evaporation from generation to sampling to determine the composition of the air stream that enters the sampling filter. For input, this model requires the initial droplet size distribution, the mist generation rate, background mist and vapor concentrations, fluid composition, compound properties, the ambient temperature, and information on mist dispersion. The second model predicts evaporation from the sampling filter as droplets accumulate on the filter. In addition to the incoming concentrations and compositions predicted by the first model, the second model requires information on filter properties and ambient conditions. Compared to data from laboratory tests, the models predict volatilization losses accurately. The models have been used to predict evaporative losses during sampling for a variety of conditions. Results suggest that vaporization of the sample can be large in some situations and minimal in others. Losses tend to be greater when straight oils are used rather than soluble oils or synthetic fluids. In addition, evaporation is much more significant when mist concentrations are low. Other important factors include the distance from the point of droplet generation to the sampler, the ventilation conditions in the workplace, and whether personal or area sampling is used. The results suggest that corrections to MWF mist concentration measurements can not be made using a simple factor.

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A NEW INTERNATIONAL STANDARD FOR GRAVIMETRIC ANALYSIS OF AEROSOL COLLECTION MEDIA. L. Kenny, Health and Safety Laboratory, Sheffield, United Kingdom.

Gravimetric analysis is frequently used for measurement of airborne dust in the workplace. The method is subject to errors from instability in the mass of the elements that must be weighed. In many aerosol samplers a filter and cassette are weighed together, and errors arise if the cassette absorbs or loses water between the weighings. A new International Standard (ISO/CD 15767) describes how such errors can be minimised, quantified and corrected. The most common cause of weight instability is water sorption and different aerosol sampling media vary widely in this respect. The use of blank substrates is the best way to correct for weight instability. The International Standard recommends

weighing at least one field blank for every 10 samples, with a minimum of three blanks per batch of samples. Blank weight changes depend on the media used, the balance and the environmental controls in the laboratory. Errors are minimised by weighing the samples and blanks after overnight conditioning in an environment with stable temperature and humidity. The International Standard demonstrates how to calculate the Limits of Detection and Quantitation for the weighing procedure, from the standard deviation of the blank media weight changes. To illustrate application of the International Standard, a batch of 30 blank samples was tested. The samples were IOM stainless steel cassettes containing both polycarbonate filters and respirable selector polyurethane foams. Weighing was carried out at HSL using a five-figure balance, in an environmentally-controlled room ($\pm 2\%$ RH). The cassettes were posted to regional laboratories where they were retained for between four and 12 weeks before being posted back, unused, to HSL. The samples were post-weighed and the blank weight changes calculated. The standard deviation of blank weight changes was 0.24 mg, which gives an LOD of 0.72 mg for gravimetric analysis using this method, in the HSL facility.

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CONVERSION OF PARTICLE NUMBER TO BERYLLIUM PARTICLE NUMBER CONCENTRATION. M. Berakis, M. McCawley, NIOSH, Morgantown, WV; M. Kent, Brush Wellman, inc., Elmora, OH.

Previous work has hypothesized that beryllium particle number may be the proper exposure metric for inhaled dose. The difficulty has been in obtaining an estimate of the beryllium number concentration. We are now able to obtain the beryllium mass and total mass using a polycarbonate substrate material for Microorifice Uniform Deposit Impactor (MOUDI) stages. The polycarbonate substrates are weight stable, unlike MCE filters which are prescribed for beryllium sampling. After they are post-weighed the polycarbonate can be digested and analyzed for beryllium. By dividing beryllium mass by total mass on the filter we can obtain the percent beryllium for each size range from the MOUDI. A Submicrometer Particle Sizer (SMPS) was used to derive count data, but in narrower size ranges than the MOUDI, 100 increments in all. These much smaller particle count size increments are clustered together to match the MOUDI range and the percent beryllium is applied to the clustered range. However, the overall range for values of beryllium content only extended from a little less than a tenth of a percent to a little over one percent. For the size range in which most of the particle counts actually occur, the beryllium content range averaged around 0.1% +/- 0.05%. The beryllium content can therefore be considered constant for that size range. By applying these percentages to measurements in areas in which workers were found to have chronic beryllium disease, beryllium particle number concentrations were found to extend from 10/cubic centimeter to over 10,000/cubic centimeter. This information is to be used in an epidemiological investigation to determine the risk of disease in a study population.

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ABSTRACTS