REAL–TIME AND VIDEO EXPOSURE MONITORING DURING CELLULOSE INSULATION APPLICATIONS

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Abstract

The National Institute for Occupational Safety and Health (NIOSH) is engaged in a workplace exposure assessment of cellulose insulation (CI) applicators. Real–time sampling for airborne particulates is conducted during CI application activities with a light scattering aerosol spectrometer designed for real–time particulate measurement with particle size discrimination. Eight channels collect count information for particle sizes greater than 0.75, 1, 2, 3.5, 5, 7.5, 10, and 15 micrometers (µm). Data are collected to monitor the particulates generated by distinct events during CI installation activities in the attic and hopper areas. For each operation, data are integrated for 1 minute (min) and stored sequentially on the Grimm data card over the entire time period. The collected particle count and size information is downloaded to a laptop computer following the completion of the operation. Start and stop times for significant operations are recorded during each sample collection period.

The mass distribution of particles is reported as a concentration in micrograms of particulate per cubic meter of air ($\mu g/m^3$). Particles are sized based upon the amount of light scattered by individual particles. The portable dust monitor (PDM) operates at a flow rate of 1.2 liter per minute (lpm). Estimates were made of the mass median aerodynamic diameter (MMAD) and the associated geometric standard deviation (GSD) based on the integrated particle size discrimination provided by the instrument. The density of the CI particulates is assumed to be 1.0 gram per cubic centimeter (g/cm^3) at the time of sampling, but a CI density correction factor for the PDM is applied during data analysis. The density correction factor consists of a gravimetric weight of the instrument filter and an internal instrument weight of the CI sampled.

Video exposure monitoring (VEM) consists of real–time particulate sampling coupled with video recording and is designed to evaluate worker exposures. During CI installation activities, a Hand–held Aerosol Monitor (HAM) is used to measure personal breathing zone (PBZ) relative air contaminant concentrations. In using this instrument, the workplace aerosol is drawn through a sensing chamber. The aerosol scatters the light emitted from a light emitting diode. The scattered light is detected by a photomultiplier tube. The analog output of this instrument is proportional to the quantity of the scattered light detected by a photomultiplier tube. The quantity of scattered light is a function of aerosol concentration, particle size, and refractive index. Because the calibration of the HAM varies with aerosol properties, the analog output of the HAM is viewed as a measure of relative concentration. The analog output of the HAM is recorded by a data logger. The information collected on the data logger is downloaded to a computer and converted into a spreadsheet for analysis. The HAM is operated on the 0–200 volt scale during monitored activities in the attic and the truck with the hopper.

While air concentrations are being measured with the HAM, workplace activities are recorded on videotape. These techniques were employed during two contractor site visits with the data indicating that there is high exposure potential to CI dust when the hopper operator dumps the bags of CI into the hopper, and when the CI installer is working in enclosed areas of the attic and when installing the CI close to the body. The analog output from direct reading instruments will be overlaid on a video recording as a moving bar or graph that has a height proportional to the air contaminant concentration. This technique shows how worker exposures are related to work activities, and it permits control recommendations that are focused upon actual exposure sources.

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