Lessons learned: Further studies are needed to better characterize and validate the exposure to Manganese containing particulate from grinding tasks.

SR-401-03

A Cyclone for End of Shift Silica Measurement

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Objective: 1) To develop a respirable size selective sampler for direct-on-filter silica measurement at the End of Shift (EOS) using a portable Fourier transform infrared spectrometer, and 2) to determine its size selective sampling performance compared to international standards respirable convention.

Methods: A new cyclone, based on the concept of the GS3 respirable dust cyclone, was designed to use a 25-mm filter holder with an effective dust deposition diameter of approximately 8.5 mm. The new sampler (EOS cyclone) was constructed using a 3 dimensional printer loaded with ABS-M30 material. Sampling efficiency of the EOS cyclone was determined using polydisperse glass sphere particles and a time of flight real time direct reading instrument (Aerodynamic Particle Sizer). The test aerosol was generated with a fluidized aerosol generator and the aerosol was introduced into a calm air chamber. The EOS cyclone and a reference sampler were placed horizontally inside the chamber positioned at the same sampling plane. The flow rates of the reference sampler were the same as the test cyclone and the inlet diameter for the reference sampler was calculated so as to obtain a representative sample of the aerosol in calm air conditions. Five EOS cyclones were tested at flow rates of 1.1 and 1.2 l min^{-1}. Using the bias map approach, the measured performance for the EOS cyclone was assessed against the respirable convention defined in American Conference of Governmental Industrial Hygienists (ACGIH®)/Comité Européen de Normalisation (CEN)/International Standards Organization (ISO).

Results: Sampling efficiency of newly developed EOS cyclone was determined. Average cut off diameters of the EOS cyclone at flow rates of 1.1 and 1.2 l min^{-1} were 4.4±0.06 and 4.1±0.15 µm, respectively. Bias of the EOS cyclone ranged -4-10% at 1.1 l min^{-1} and -16-4% at 1.2 l min^{-1}. Coal mine dust was used to assess the deposition area on the filter; the preliminary assessment showed an area with an 8.7 mm diameter.
Conclusions: The newly developed EOS cyclone showed minimum bias compared to the international standard respirable convention with flow rates of 1.1 or 1.2 l min^{-1}. The cyclone will be further investigated for direct on filter silica measurement with coal and non-coal mine dusts using a portable Fourier Transform infrared spectrometer.

SR-401-04

Development and Validation of Sampling and Analytical Methods for Determination of Mold Spores Concentration in Settled Dust of Heating, Ventilation and Air-Conditioning systems (HVAC)

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Objective: The objectives of this project were to (1) evaluate a sampling method for dust in air duct surfaces and (2) compare analytical methods for the evaluation of mold content in the collected dust in HVAC.

Methods: Five dust generations were made in an exposition chamber mimicking a HVAC duct system. Twelve preweighed plates were placed on the horizontal surface of the chamber during generation. A modified 37-mm cassette with a pre-weighed PVC filter was used to collect the settled dust. Particles recovery percentages collected by the cassettes and those deposited on the filters were calculated for 54 samples. Once the sampling method has been optimized, ten other generations were performed with dust using different levels of mold spores. Sixty samples were analyzed with four methods for evaluation of fungal biomass: Beta-N-Acetylhexosaminidase assay (BNA) (modified Mycometer), Spore Counting Method (SCM) by direct microscopy, 18S-q-PCR assay and culture on Malt Extract Agar (reference method). The detection limit (DL), repeatability and reproducibility of each method were calculated

Results: For the dust generation samples, the recovery percentage between the pre-weighed plate and the cassette varied between 88 % and 100 % with a median at 99 % recovery efficiency. The recoveries obtained between the cassette and the filter varied from 65 % to 95 % with a lower median of 88 %. The median concentrations of spores/100 cm^2 measured in the contaminated dust samples were 10,000 for the SCM; 676,000 for the enzymatic BNA, 224,000 for the q-PCR and 10,000 CFU/100 cm

Conclusions: The new proposed sampling method showed very good dust collection efficiency. The PCR method is recommended due to its higher sensitivity and a better correlation with the culture reference method.

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