Abstract Book

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surface copper mines. The adoption of this technique could allow field-based silica monitoring in the future. The second objective is to investigate the variability of the crystalline silica content in the respirable dust present in surface copper mine operations in Arizona.

Methods: Area samples of respirable dust were collected at several copper mines in Arizona, in different areas of the mine except for the pit. Primary and secondary crushers, together with the mill were selected as preferred sampling areas for the high levels of respirable dust and crystalline silica generally present in those environments. After the collection, the samples were analyzed with a portable FTIR set up for DoF analysis for the estimation of collected crystalline silica. Because this approach does not destroy the sample, the same samples were then analyzed by an accredited laboratory with the X-ray diffraction NIOSH 7500 method for the quantification of crystalline silica. The accuracy of the DoF-FTIR estimation compared to the results of the NIOSH 7500 method was evaluated for each sample and analyzed statistically within the same set and among sets collected in different mines. The identification and quantification of the minerals present in the respirable dust in different areas of every mine was also conducted to investigate the effect of geological confounders in the silica quantification with the FTIR method. Finally, the respirable crystalline silica results obtained were used to investigate the spatial variability of both respirable crystalline silica concentration within the same mine and crystalline silica content in the dust among different mines.

Results: The estimation of the DoF-FTIR technique correlates well with the results of the standard NIOSH 7500 method. The accuracy of the estimation is independent from the amount of the silica present in the samples collected in different mine. More comprehensive analysis will be given at the meeting. Finally, the DoF-FTIR technique showed an LOQ for the estimation of silica of 15 micrograms.

Conclusions: The exposure to respirable dust containing crystalline silica is a recognized occupational hazard in mining. In surface copper mines, activities in the crusher and mill areas are known sources of respirable dust with mass concentrations that can vary in time and can rise above action levels. In general, the monitoring of crystalline silica dust is still conducted with the use of traditional hygiene practices with limitations in terms of timely information available for the adoption and optimization of control technologies. The use of a field-based silica monitoring approach can allow operators to obtain early detection of concentration levels above the action limit.

SR-113-05

Toluene Diisocyanate Exposure: Exposure Assessment and Development of Cross-Facility Similar Exposure Groups Among TDI Production Plants

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Objective: The objective was to characterize workplace toluene diisocyanate (TDI) exposures in U.S. TDI production plants using standardized industrial hygiene exposure assessment procedures for use in a prospective epidemiologic study of occupational asthma.

Methods: A uniform exposure assessment strategy was developed by a team of industrial hygienists from the National Institute for Occupational Safety and Health (NIOSH) and from representatives of each participating plant who were knowledgeable of the plants processes and operations. To provide the exposure data needed to achieve the study's aims, the assessment strategy included: development of similar exposure groups, identification of high potential exposure tasks, quantitative and qualitative exposure assessment, and the utilization of standardized sampling and analytical methods. Air samples were collected with calibrated personal sampling pumps and analyzed using a method equivalent to the OSHA 42 Method for measuring airborne personal exposures to TDI.

Results: A total of over 2600 samples were collected. 1594 representative routine full shift time-weighted average (TWA) and 755 routine short term high potential exposure task (HPET) air samples were collected among groups with similar job titles across three TDI plants over a nearly seven-year period. Data derived similar exposure groups (SEGs) were developed across the plants based on TWA sampling using cluster analysis. Individual cumulative exposure estimates were developed based on the cross-facility similar exposure groups. The arithmetic mean TWA exposure was 0.65 ppb. Without adjusting for the use of respirators, the highest TWA exposures occurred among field operators, TDI loading, and TDI drumming SEGs. Of the 1594 TWA routine samples, 35 were > 5 ppb and of the 755 HPET routine samples, 83 were > 20 ppb. Workplace routine TWA exposures to TDI were adequately characterized, but HPET exposures were inadequately sampled.

Conclusions: The TDI exposure assessment of the primary producers of TDI in the U.S. was one of the most complete to date. The measured exposures can be used to support epidemiologic analysis of the relationship between exposures to TDI and asthma.

SR-113-06

Estimates of Occupational Inhalation Exposures on the Four Rig Vessels During the Deepwater Horizon Oil Release Cleanup

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Objective: After the 2010 Deepwater Horizon oil release, the National Institute of Environmental Health Sciences initiated an epidemiological study (GuLF STUDY) to investigate the potential adverse health effects associated with the oil spill response and clean-up work. One component of the study, a quantitative exposure assessment, is critical because it allows the investigation of the exposure-disease relationship.

The objective of this paper is to characterize inhalation exposures to crude oil components for workers on the four rig vessels (Enterprise, DDII, DDIII, and Q4000) that had primary responsibility for remediation of the oil release at the well site.

Methods: We used personal measurements collected for BP during the remediation for our analysis. Exposure groups (EGs) were created based on the specific vessel, location on the vessel, job titles/tasks for four time periods from April 20 to December 31, 2010. The study utilized a large number of personal measurements collected for BP, many of which also contained the analytical limits of detections (LOD). Bayesian methods accounting for the LODs were used to analyze exposures for total hydrocarbons (THCs), benzene, toluene, ethylbenzene, xylene (BTEX chemicals) and hexane.

Results: THC exposures changed over time and varied by vessels and EGs. The highest exposures were generally observed in the time period from when the oil release was occurring until the well was successfully top capped (THC up to 15 ppm). Exposures gradually decreased over time to approximately 0.1 ppm except a few that were probably involved in decontaminating the vessels. BTEX chemicals and hexane exposures were substantially lower than THC. The variability of the EGs was generally high, likely reflecting the non-routine, time-dependent nature of spill response as well as the high uncertainty associated with estimating exposures with small sample sizes and high degree of censoring in some EGs.

Conclusions: This study, along with the ongoing epidemiologic investigation, hopes to provide new information to the limited literature on the chemical exposures during oil spill remediation and the potential health effects associated with such efforts.

P0114
Mold and Fungal Contaminants - Detection and Prevention in the Built Environment
Wednesday, May 25, 2016, 10:00 AM - 12:00 PM

SR-114-01
Mold Remediation & Certification Laws in the United States: A Look at Where We Are & What We Need
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Objective: Concern about mold in buildings and homes increased in the United States in the aftermath of Hurricane's Katrina and Sandy. Mold is a known allergen and can cause a plethora of health issues, including mycotoxin poisoning and a range of respiratory ailments. As a naturally occurring irritant, there is great debate about the best means to safely remove mold. In order to protect the public against unscrupulous and unskilled contractors, a growing number of states enacted legislation requiring training, certification and other regulations of those in the business of mold remediation

Methods: In this study, we used principles of legal epidemiology to conduct policy surveillance to explore which states enacted mold remediation and certification laws. We used LEXIS/NEXIS and https://legiscan.com/ to evaluate the laws and regulations of all 50 states against sixteen preset codes using LawAtlas WorkBench. Coders crosschecked for consistency.

Results: Our review found that only a minority of states established mold remediation and certification laws and these vary in stringency and effectiveness. Some states (in the minority) are attempting to reduce consumer fraud in the mold removal industry and provide guidelines about how to both conduct proper mold removal and how to train those engaged in mold removal to protect both worker and building occupant safety. Moreover, penalties for violating laws in the few states that do provide guidelines are generally relatively insignificant; amounting to the regulatory equivalent of a parking ticket.
Conclusions: Overall the data shows a paucity of states establishing legal guidance and protection assuring that mold removal specialists are properly trained and/or licensed to protect the health of both removal workers and building occupants.

CS-114-02
What Do Those Spore Trap Categories Mean?
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Situation/Problem: Spore trap reports list counts for a variety of fungal spores. The categories listed are based on the analysts' ability to recognize the spores by their morphology. Only a very few spores can be assigned to a genus and species on microscopic morphology alone (e.g., Epicoccum nigrum). Other spore types can be recognized to the genus level, but there may be hundreds of different species (e.g., Cladosporium). Other categories group spores of different (related) genera based on similar spore morphology (e.g., Drechslera/ Helminthosporium, Penicillium/Aspergillus). A fourth category unites all the spores of a particular large group that all produce spores in a similar way. Each of these groups includes hundreds of genera and thousands of species (e.g., Ascospores and Basidiospores). Finally, one of the groups often listed includes spores of completely unrelated fungi that happen to have spores of similar morphology (smuts, myxomycetes).

Resolution: So, given this lack of precision, of what use are these categories? They are generally used to compare populations of spore types indoors and outdoors. In fact, some reports list outdoor and indoor fungi. Note that ALL fungi are found in the natural outdoor environment, and none can grow exclusively indoors. Because of the lack of precision of listed spore categories, it is important to be familiar with the kinds of fungi included in each group, and to recognize that within each group there are those that often are found indoors, those that are occasionally found indoors, and those that have not been found in the indoor environment

Results: Understanding the complexity of these categories is important for interpreting spore trap data, especially when indoor/outdoor comparisons are being made. For example, high concentrations of ascospores both outdoors and in may indicate either penetration of the outdoor aerosol, or growth of an ascospore forming fungus indoors. A solution that the labs might provide would be to indicate whether or not the indoor and outdoor ascospores are similar or not. This would, of course, add expense to the analysis. Understanding the