

there are limitations to this sampling protocol that should be considered before performing inhalable sampling. Sampling data was reviewed to determine the differences between traditional total particulate sampling results and inhalable sampling results. Similar exposure groups/activities were reviewed and comparisons between inhalable and total results (where applicable) were considered as part of this data review. Generally inhalable sampler results often much higher than traditional total particulate sampling results. Field use of the inhalable sampling devices has shown that they are subject to a number of potential sources of error that may result in these higher values. The field errors may include inadvertent influence due to employee work postures or inversion of the inhalable sampler allowing particulates to settle directly onto the filter. Large particulates (greater than the inhalable criteria) and those generated at high velocity may impact or fall onto the filter distorting the results. The larger opening of the inhalable sampler allows the filter to potentially become damaged during the sampling process by compressed air, etc. There is also the issue of electrostatic attraction of the particulate matter to the outside edge of the filter cassette or to the outside surface of the sampler.

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DEVELOPMENT OF A NEW, DIRECT-READ HYDROGEN CYANIDE PASSIVE MONITORING SYSTEM

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Hydrogen cyanide (HCN) is an industrial chemical widely used in the production of plastics and synthetic fibers. It also finds use in agricultural industry as a fumigant. Due to its significant toxicity and high production volumes, hydrogen cyanide is considered to be a high risk toxic industrial material (TIM). Hydrogen cyanide is classified as a blood agent *in vivo*. The cyanide ion complexes with iron heme centers in cytochrome oxidase preventing cellular respiration and ultimately leading to cell death. Symptoms of exposure to hydrogen cyanide include weakness, headache, confusion, and asphyxia followed by unconsciousness, cardiac arrest, and death. To limit the health risks associated with HCN exposure in industrial settings and to protect first responders, it is important to have a tool that provides an early warning of the presence of hydrogen cyanide at or below the permissible exposure limit (PEL) (10ppm TWA).

A passive, colorimetric badge system including a direct reading badge and a comparative color scale has been developed for this purpose. The badge consists of a thin-film indicating layer and a protective, hydrophobic membrane. At hydrogen cyanide exposure doses of 0.33 ppm-hr or greater, one half of the triangular viewing window will change color to indicate the presence of the agent. By using the color scale, continued color development can be further quantified.

As outlined by the National Institute for Occupational Safety and Health (NIOSH) protocol for the evaluation of passive monitors, the badge system is validated for dose interchangeability and performance under a wide range of humidity, temperatures, and face velocities. Additionally, a three-month room temperature shelf life and 24-hour service life have been validated through accelerated aging studies.

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DEVELOPING A BERYLLIUM DECONTAMINATION PROTOCOL FOR OCCUPATIONAL SETTINGS

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The aim of this project is to support industries through the elaboration of a beryllium decontamination and surface cleaning protocol that will help make acceptable levels of beryllium contamination more obtainable. This goal will be accomplished through the production of a decontamination guide that is partially based on laboratory studies and field work.

Laboratory studies were conducted to evaluate the cleaning efficiency of acidic, basic and neutral commercial solvents with pre-moistened wipes (Ghost Wipes™). The performance of each solvent was evaluated on Petri dishes spiked with beryllium chemicals, on clean unused CuBe plates and on surfaces of moulds made of CuBe alloy that are used for the extrusion of plastic bottles.

To explore the efficiency of current decontamination methods, field work was conducted in the following industrial settings: plastic manufacturing, dental technology, aerospace machining, and aluminum smelting. Assessment methods consist of the following three steps: (1) a baseline assessment of the distribution and extent of surface contamination, (2) an evaluation of each step in the decontamination procedure, and (3) a final round of wipe sampling to validate the termination of the decontamination procedure. In addition to the field work described above, each solvent tested in the laboratory was also tested in a field setting on various surfaces.

The results obtained from the above methods will provide the foundation necessary for a guide in which the elements of an effective beryllium decontamination operation are described in detail. These elements include decontamination methods, sampling strategies, clothing decontamination procedures, and exposure prevention methods for workers directly involved in decontamination operations.

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ANALYSIS OF HISTORICAL AIR MONITORING DATA FOR COPPER BERYLLIUM AT A MANUFACTURING PLANT (1964-2000)

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Beryllium exposure to employees at a manufacturing plant was evaluated using historical industrial hygiene samples collected between 1964 and 2000. With the exception of a few projects conducted in the 1960s, it is believed that over 95% of the operations involved copper beryllium only. Long term (>120 minutes) and short term (<120 minutes) personal and area samples were collected during a variety of activities including machining of copper beryllium-containing parts. A total of 627 beryllium air samples were analyzed (313 personal samples and 277 area samples). Overall, the average airborne beryllium concentration, based on all personal samples available from 1964 through the end of 2000 (n=313), was 1.50 µg/m³ (standard deviation: 24.14 µg/m³; range: <0.001–426.67 µg/m³). However, 96.8% of the samples were below the analytical limit of detection so a value of one-half LOD was used in statistical analyses of samples reported as non-detects or below the limit of detection. 81 personal samples were collected on machinists between 1980 and 2000. The average airborne concentration based on these samples was 0.04 µg/m³ (standard deviation: 0.07 µg/m³; range: <0.007–<0.77 µg/m³). 97.5% of the machining samples were below the limit of detection. The average airborne beryllium concentrations based on area samples (1964–2000) was 0.038 µg/m³ (standard deviation: 0.205 µg/m³; range: 0–2.5 µg/m³). Of these, 75.8% of the samples were below the analytical limit of detection. In total, airborne concentrations were consistently below the OSHA PEL for beryllium (2 µg/m³). Overall, the data indicate that manufacturing operations involving copper beryllium did not result in airborne concentrations above contemporaneous occupational exposure limits or the 1999 DOE action level of 0.2 µg/m³ and, in most cases, were below the analytical limits of detection.

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UNIVERSAL STANDARD FOR ALLERGEN EXPOSURE ASSESSMENT

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Sensitization and exposure to indoor allergens is a major risk factor for asthma. The gold standard for measuring allergens is the two site monoclonal antibody (mAb) based enzyme immunoassay (ELISA). Assessments of allergen exposure by ELISA rely on standards of known allergen concentrations. However, there are only two WHO/IUIS International Reference Preparations, which are not purified allergens. Our aim was to develop a single "Universal Standard" containing purified natural allergens with verifiable allergen content to serve as a standard for ELISA and next generation multiplex arrays. A single Universal Standard using eight purified allergens (Derp1, Derf1, mite Group 2, Feld1, Canf1, Blag2, Rat n 1, Mus m 1) was developed at concentrations of 250–5,000 ng/ml. Protein content was compared by amino acid analysis,