

PERSONAL PASSIVE SAMPLERS USED TO MONITOR THE EXPOSURE OF MAINTENANCE WORKERS (INDUSTRIAL PLUMBERS) TO ASBESTOS. D. Bard, G. Burdett, Health and Safety Laboratory, Sheffield, United Kingdom.

Past industrial manufacture and use of asbestos-containing products has led to a high incidence of asbestos-related diseases and this accounts for a high proportion of all industrially-related cancers. The annual mortality rates due to past asbestos exposure are predicted to continue to rise over the next 15 years, regardless of any further controls that could be applied now. Although the UK and USA have taken measures to reduce the risk from asbestos exposure, there are a number of sources that have the potential for continuing exposure and future disease. Large amounts of asbestos are still in place in buildings and epidemiological data suggest that there has been and continues to be a significant risk to demolition and maintenance workers who may, through their work, use or disturb asbestos-containing materials.

The sampling and assessment of maintenance workers' exposure is a particular problem because they may not know that they are working with asbestos-containing materials. A strategy to monitor their true exposure has been developed and applied to one group of workers.

The asbestos exposure of industrial plumbers was measured using personal passive samplers developed at the Health and Safety Laboratory. The lightweight samplers, which collect particles by electrostatic attraction, are simple to use and do not require prior knowledge that asbestos is to be disturbed as does conventional sampling. The samplers, along with activity logs, were issued by post and analysed, after return, using transmission electron microscopy. The activity logs were used to assess whether maintenance workers were knowingly or unknowingly exposed to airborne asbestos fibres during the course of a working week. The monitoring carried out in parallel with a questionnaire provided a detailed picture of workers' awareness, assumptions, and responses to working with asbestos containing materials.

THE INVESTIGATION OF THE IMPACT OF WORKER LOCATIONS, ORIENTATION, AND ACTIVITY ON EXPOSURE.

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Worker exposure is a complex function of the many factors that affect contaminant transport to the worker's breathing zone. Here the impact of worker position, orientation, and activity was studied in an experimental room. Simulated personal exposures to a tracer gas (propylene) were measured by monitoring the concentration in front of a worker's respirator facepiece. For a stationary worker, simulated

exposure was measured at 12 locations within the room, and for four orientations at each location. Simulated exposures of a moving worker were measured along two paths, one close to the source and the other farther from the source. All measurements were made for each of four factorial combinations of air inlet types (wall jet and ceiling diffuser) and air flowrates (5.5 m³/min and 3.3 m³/min).

Over the 12 worker locations, the breathing zone concentrations were significantly higher when the worker was facing the source than when not facing the source with ratio ranging from 1.15 to 1.25 (all p-values < 0.05). Exposure downwind of the source, and upwind but close to the source, was higher when the worker was facing the source than when facing away from the source. The TWA exposure of the worker walking along a path near the source was about 1.76 times greater than the exposure of the worker walking along the other path. Also, the exposure of the worker walking along the two paths within the room was significantly higher than the average exposure of the worker standing still at several points along these paths, possibly because worker movement prevents formation of a convective boundary layer found around a stationary worker.

These experiments clearly demonstrate the importance of basing exposure estimates on personal sampling when possible rather than area sampling as a result of the impact of worker orientation and movement on breathing zone concentration.

CHARACTERIZATION OF THE CUMULATIVE ASBESTOS EXPOSURES OF U.S. AUTOMOBILE BRAKE MECHANICS.

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An analysis of the cumulative exposures of U.S. brake mechanics to asbestos during the period 1960 to 2000 was conducted. Cumulative exposures in fibers per cubic centimeter times years (f/cc*year) were estimated based on published data regarding typical airborne asbestos concentrations experienced by U.S. brake mechanics and their job tenure. Cumulative exposures were calculated using Monte Carlo methods based on three different distributions of eight-hour TWA exposure concentrations reported by NIOSH for brake mechanics and the distribution of job tenure for automobile mechanics working in repair garages. The median (50th percentile) and upper bound (95th percentile) estimated cumulative exposures for mechanics in garages with no dust control procedures ranged from 0.20 to 0.56 f/cc*year and 2.2 to 2.9 f/cc*year, respectively. The estimated median and upper bound cumulative exposures of mechanics in garages employing dust control procedures ranged from 0.01 to 0.02 f/cc*year and 0.08 to 0.11 f/cc*year, respectively. An evaluation of the trends in cumulative exposure based on the

initial date of exposure indicate that those mechanics that started work in 1955 had an upper bound cumulative exposure of 2.5 f/cc*year while those that started in 1975 had an upper bound exposure of 1.2 f/cc*year. European brake mechanics have higher estimated upper bound cumulative exposures (ranging from 6.0 to 13 f/cc*year), likely the result of longer job tenure than U.S. mechanics and inclusion of higher concentration data for truck and bus mechanics, which were not considered in the evaluation of U.S. mechanics. Because epidemiological studies of automobile mechanics worldwide have consistently shown no association between occupational exposures and an increased risk of mesothelioma, the form of cancer most often associated with asbestos exposure, the upper bound cumulative exposure estimates for brake mechanics provide a conservative estimate of the cumulative exposure threshold for mesothelioma risk in workers exposed to short chrysotile fibers.

AIRBORNE ASBESTOS FIBER EXPOSURE ASSESSMENT OF HEAVY EQUIPMENT MECHANICS. F. Boelter,

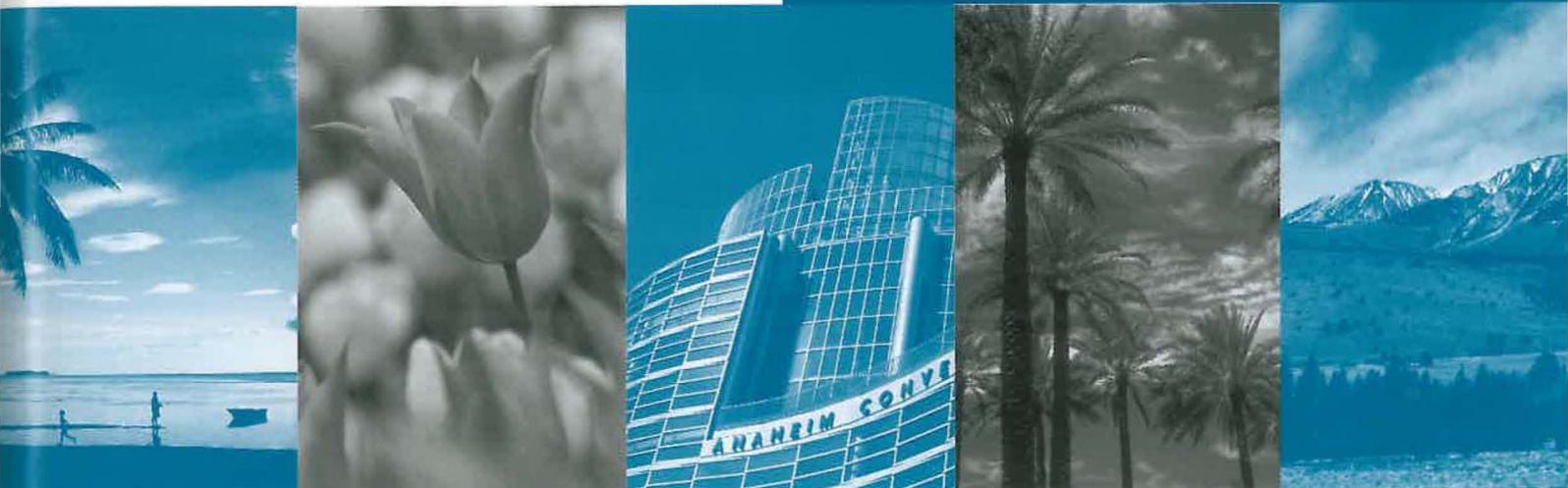
C. Simmons, Boelter & Yates Inc., Park Ridge, IL; J. Spencer, Environmental Profiles Inc., Baltimore, MD.

The purpose of this study was to determine the concentration of airborne fibers during maintenance and repair activities involving asbestos-containing friction products and gaskets on heavy equipment. Both personal and area air samples were collected inside a heavy equipment repair facility over a period of nine days during removal and replacement of asbestos-containing friction products and gaskets from four different pieces of heavy equipment. Samples were collected while four mechanics, experienced in heavy equipment repair and maintenance, removed and replaced asbestos-containing friction and gasket materials. Samples were analyzed using NIOSH Method 7400 for phase contrast microscopy (PCM) and NIOSH Method 7402 transmission electron microscopy (TEM). Statistical methods were used to calculate likely upper limits during full-shift and short-term exposures. Full-shift personal samples ranged from 0.005 to 0.049 f/cc by PCM and 0.002 to 0.041 asbestos f/cc TEM. Personal excursion limit (short-term exposure limit) exposures ranged from 0.043 to 0.56 f/cc by both PCM and TEM. Statistical analysis determined with 95% confidence that 95% of eight-hour TWA exposures were below 0.061 f/cc by PCM and below 0.057 asbestos f/cc by TEM. Statistical analysis indicated with 95% confidence that 95% of short-term (30-minute) exposures were below 0.19 f/cc by PCM and 0.13 asbestos f/cc by TEM. Repair and maintenance of asbestos-containing friction products and gaskets in heavy equipment results in exposures well below both OSHA's standard for an eight-hour TWA and the 30-minute excursion limit.

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