Bull. Environ. Contam. Toxicol. (2005) 74:70–72

DOI: 10.1007/s00128-004-0549-z

Bulletin of Environmental Contamination and Toxicology

Airborne Exposure During Asbestos Abatement of Floor Tile, Wall Plaster, and Pipe Insulation

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Received: 28 July 2004/Accepted: 29 September 2004

Concerns related to asbestos diseases have existed for some time (Skinner, 2003) and have resulted in the development of various regulations to protect those working with asbestos products (Lange and Thomulka, 2002). Issues related to asbestos exposure have become important in the United States and elsewhere (Lange, 2004). Historically, workers in the asbestos abatement industry experienced “high” levels of exposure (Liddell et al., 1997). However, little information is available on recent exposure levels to specific categories of asbestos materials in the published literature (Lange, 2004). Based on the currently available published data (Lange, 2004) it is suggested that exposure for those involved in handing and removing asbestos is low. To determine the potential of disease and whether it is likely a “disease” is a result of asbestos it is necessary to have an estimate of exposure.

This study reports on area and personal exposure measurements during removal of floor tile, pipe insulation and plaster. Data presented provided information on exposure during abatement of these building materials.

MATERIALS AND METHODS

Area and personal air samples were collected during an actual asbestos abatement project that was performed in 2001’s and involved removal of floor tile, pipe insulation and wall plaster. Samples were collected as previously described (Lange, 2004a). This project involved about a two-week period that included setup and tear down. All materials abated met the definition as asbestos-containing materials, which is a material that has greater than one-percent asbestos.

Area samples were collected during wall plaster removal using a personal pump that was in a fixed location in the same method as personal samples. Personal samples were collected from the breathing zone of the worker as previously described (Lange, 2004a). Phase contract microscopy (PCM) was used to determined the asbestos concentration in air as is reported as fibers/cubic centimeter–f/cc. Exposure data were calculated as a task-length average (TLA) and time-weighted average (TWA) (Lange, 2004a).

The amount of floor tile, plaster and insulation abated was approximately 20,000 square feet (SF), 5,000 SF and 400 lineal feet. Abatement practices followed the US Occupational Safety and Health Administration (OSHA) requirements.

Airborne exposure concentrations are reported as summarized measures of central tendency (Lange and Thomulka, 2002). Values below the detection limit were used in calculations as one-half the reported concentration (Oehlert et al., 1995). The Grubbs and Shapiro-Wilk tests were used to evaluate area (plaster) and personal (floor tile) samples for outliers and distribution, respectively. Outliers and distribution were evaluated for TLA and TWA, and TLA, respectively.

Confidence coefficient, probability, that at least 5% of workers exceeded the OSHA permissible exposure limit-PEL (0.1 f/cc-TWA) was determined using a graphic method. (Leidel et al., 1977). These calculations were performed using geometric mean (GM) and geometric standard deviation (GSD) for TLA and TWA values.

RESULTS AND DISCUSSION

Exposure results are reported in the table as summary data (arithmetic mean-AM, GM, standard deviation-SD, GSD and range (Lange and Thomulka, 2002). Personal and area sample data (untransformed) were non-normally and normally distributed, respectively. GSD for samples, both TLA and TWA, suggest a non-normal distribution. Previous studies on airborne asbestos concentrations have reported that these values best fit a lognormal distribution (Lange and Thomulka, 2002). Normality of area samples is likely a result of the small sample number. There were no outliers for either area or personal sample measurements.

None of the individual exposure measurements exceed the OSHA PEL. Exposure levels associated with removal of floor tile are descriptively higher than for plaster and floor tile/plaster/pipe insulation. This can be due to the small number of samples collected and that asbestos PCM sampling can greatly overestimate the actual airborne concentration. It has been suggested that PCM can over estimate the actual asbestos concentration by 50% or greater (Lange, 2004a). Personal samples are also commonly greater than area samples and have been suggested to actually measure two different airborne fiber populations. However, other studies have reported that under appropriate conditions, area and personal samples may measure the same population (Lange and Thomulka, 2002).

The probability of exceeding the PEL for floor tile as determined by TLA and TWA was about 26% and 5% or less, respectively. This suggests that it was unlikely that the PEL was exceeded during this work. When examining the pipe and floor tile/plaster and pipe insulation data, although

Table 1. Summary statistics for types materials, in f/cc

Type of Sample/Material	Nos. of Samples	AM	GM	SD	GSD	Range
FT (TLA)	7	0.027	0.023	0.018	1.9	0.009-0.062
Personal (TWA)	-	0.010	0.010	0.024	1.6	0.004-0.013*
Plaster (TLA)+ Area	4	0.011	0.010	0.007	1.8	<0.012-0.020
Plaster (TLA)	1	<0.013	-	-	-	-
Personal (TWA)	1	<0.003	-	-	-	-
FT/plaster/ (TLA)	1	0.021	-	-	-	-
Pipe Personal (TWA)		0.017				

FT, floor tile; *one sample was collected for 510 minutes so hypothetically the TWA increased as compared to the TLA; +area samples were not converted to a TWA

measurements are limited, likelihood of exceeding the PEL also remains small, suggesting little occupational risk of disease.

Exposure levels for floor tile, plaster and pipe insulation are similar to that previously reported elsewhere (Lange and Thomulka, 2002; Lange, 2004a). This study along with others (Lange and Thomulka, 2002) suggest asbestos abatement, especially involving chrysotile asbestos (Lange, 2004), pose little occupational risk. These low exposure levels do not support many of the stringent regulatory requirements for asbestos.

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