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## P-608 EVALUATION OF BACKGROUND EXPOSURES TO AIRBORNE ASBESTOS ON MARITIME SHIPPING VESSELS (1972-1992)

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### Introduction

Health risks associated with exposures to asbestos have been well documented in the literature for workers involved in the manipulation, repair, or rip-out of asbestos insulation. However, there exists limited data characterizing general background concentrations of asbestos on ships, which are not associated with particular work activities. The objective of this analysis is to understand background airborne concentrations of asbestos on 53 maritime shipping vessels between 1972 and 1992.

### Methods

Air and bulk monitoring databases were built based on industrial hygiene surveys conducted while 53 ships, including oil tankers and cargo ships, were docked and/or at sea. Samples were collected when the sailors were not disturbing or repairing asbestos containing materials in an attempt to understand "background" or ambient airborne concentrations of asbestos on-board ships that contained tons of asbestos containing materials (especially insulation). All air samples (753 area, 8 personal) were analyzed by phase contrast microscopy (PCM). Of these samples, 25 were subsequently analyzed by transmission electron microscopy (TEM). In addition, 245 bulk samples of asbestos insulation were collected from either pipe, valve, or boiler coverings and analyzed by polarized light microscopy (PLM).

### Results

All air samples collected during this period of time were below the contemporaneous OSHA permissible exposure limits (PELs) for asbestos. Only one percent of samples analyzed by PCM and four percent of samples analyzed by TEM were above the current OSHA PEL of 0.1 f/cc. An average airborne asbestos concentration of 0.008 f/cc (PCM) was observed for all the vessels with a 95<sup>th</sup> percentile concentration of 0.05 f/cc. Average and 95<sup>th</sup> percentile concentrations, as analyzed by TEM, were 0.006 f/cc and 0.003 f/cc, respectively. Air samples collected in the crew areas of the ships (crew quarters, recreational rooms and passageways), ranged from 0.00017 f/cc to 0.124 f/cc, whereas concentrations in the engine rooms and machine shops ranged from 0.00015 f/cc to 0.39 f/cc. Of the 245 bulk samples collected, 50% were found to contain greater than 1% asbestos. Among these samples, amosite, chrysotile and crocidolite asbestos were found in concentrations ranging from 1-61%, 1-100% and 3-10%, respectively.

### Conclusions

Despite the fact that area, rather than personal, samples were collected the information presented here should be useful in characterizing background concentrations of airborne asbestos for crew members aboard marine shipping vessels in the post-OSHA era. These data indicate that background exposure to airborne asbestos on board these vessels is low.

## P-609 EVALUATION OF BRICKLAYER EXPOSURES TO AIRBORNE ASBESTOS IN STEEL MILLS (1972-1981)

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### Introduction

Although there have been a number of studies of worker exposure to chemicals in steel mills, less attention has been devoted to characterizing the exposure of craftsman in these facilities. For example, the exposure to asbestos by bricklayers in steel mills has been suggested as being possibly significant. The objective of this analysis was to characterize the airborne concentrations of asbestos of these craftsmen as reflected in samples collected in two steel mills between 1972 and 1981.

### Methods

An asbestos air monitoring database was created from industrial hygiene surveys conducted during repair and/or maintenance work on open hearth furnaces and stoves. Personal (n=110) samples were collected while bricklayers and bricklayer helpers handled asbestos millboard and asbestos expansion allowance sheets. Some area (n=11) samples were collected in the vicinity of the work environment. The sample durations for all personal and area samples averaged 22 min (range 9-50 min) and 37 min (range 13-95 min), respectively. Most air samples were analyzed using phase contrast microscopy (PCM). Descriptive summary statistics were conducted to characterize both personal and area airborne asbestos concentrations. These data were combined with time-motion information to estimate 8-hour time-weighted average (TWA) concentrations, and these were compared to the contemporaneous OSHA permissible-exposure limit (PEL) for asbestos.

### Results

Results of all personal air samples ranged from 0.03-3.2 f/cc (average: 0.3 f/cc; standard deviation (SD): 0.5 f/cc). These samples were collected during the periods of the day during which exposure was expected to be the highest and don't reflect the 8 hr-TWA. Of all the personal samples, six had results greater than or equal to 1 f/cc, but all were below the contemporaneous OSHA 15-min ceiling limit of 10 f/cc. Four of these relatively high samples were associated with the relining of a stove and the remaining two were associated with relining an open hearth furnace. Neither task is normally performed by bricklayers or masons. The estimated 8-hr TWA concentrations for these workers ranged from 0.04-1.34 f/cc (average: 0.33 f/cc; SD: 0.348 f/cc) for those days when mason were rebuilding furnaces. These values can not be used to depict the typical daily exposures of masons since fraction of their careers were involved in lining furnaces.

### Conclusions

Based on these results, it appears that bricklayer exposure to airborne asbestos, in these steel mills during this period of time, were generally below the contemporaneous OSHA permissible exposure limits (PELs).

## P-610 THE ANALYSIS AND INTER-CALIBRATION OF BONE LEAD DATA GENERATED BY UPDATED IN VIVO K-X-RAY FLUORESCENCE (KXRF) INSTRUMENTS

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**Introduction:** <sup>109</sup>Cd g-ray induced K-x-ray fluorescence (KXRF) bone lead measurement systems have been used for over 20 years to measure bone lead levels, a biological marker of cumulative lead exposure. The systems used by the Harvard Metals Epidemiology Research Group, which has been conducting several longitudinal cohort studies using KXRF for over 15 years, and the McMaster University group, which has been building and refining KXRF systems for 15 years, have gone through several technical improvements, and the methodologies for the analysis of KXRF data have also gone through several updates. This paper will illustrate how different algorithms used for spectral analysis will affect the calculated bone lead concentrations, and for each algorithm, how refinements of the algorithm will improve the results of the calculated concentrations, especially for the more sensitive systems.

**Method:** The spectral data obtained from three types of systems, namely the old system (Harvard), the conventional system (Harvard and McMaster), and the state-of-the-art system (McMaster), were analyzed. Two algorithms were used for data analyses; these were the base line construction algorithm and the Marquardt fitting algorithm. As a check on inter-calibration, two sets of phantoms were analyzed by both ICP-MS and the KXRF systems at Harvard. Forty-three people were measured by the old system and the conventional system at Harvard and 20 people were measured by another conventional system and a state-of-the-art system at McMaster.

**Result:** Two sets of the phantoms were measured by both systems at Harvard, and the results show a very good consistency, particularly when using the refined Marquardt fitting algorithm for the spectral analysis. There is a significant difference between the concentrations of the 43 people as measured by the old system in comparison to the conventional system. The difference is mainly due to the different algorithms used for the data analysis. When two different versions of the Marquardt algorithm were used to analyze the data for the 20 people measured by the conventional system and the state-of-the-art system, the results from the revised algorithm showed a better consistency. When the data collected by the conventional system were analyzed the results from the two versions of the Marquardt algorithm did not show a significant difference. However, the difference became significant when these two versions of the algorithm were used to analyze the data collected by the state-of-the-art system.

**Conclusion:** Work is still needed to improve and standardize methodologies for the analysis of data generated by <sup>109</sup>Cd induced K-XRF bone lead measurements, particularly as the systems become more and more sensitive, so that small differences become significant. Standardization will be critical to ensuring the comparability of these data within studies over time, across studies within laboratories, and between laboratories.