

## **A REVIEW OF HISTORICAL EXPOSURES TO ASBESTOS AMONG SKILLED CRAFTSMEN (1940–2006)**

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This article provides a review and synthesis of the published and selected unpublished literature on historical asbestos exposures among skilled craftsmen in various nonshipyard and shipyard settings. The specific crafts evaluated were insulators, pipefitters, boilermakers, masons, welders, sheet-metal workers, millwrights, electricians, carpenters, painters, laborers, maintenance workers, and abatement workers. Over 50 documents were identified and summarized. Sufficient information was available to quantitatively characterize historical asbestos exposures for the most highly exposed workers (insulators), even though data were lacking for some job tasks or time periods. Average airborne fiber concentrations collected for the duration of the task and/or the entire work shift were found to range from about 2 to 10 fibers per cubic centimeter (cm<sup>3</sup> or cc) during activities performed by insulators in various nonshipyard settings from the late 1960s and early 1970s. Higher exposure levels were observed for this craft during the 1940s to 1950s, when dust counts were converted from millions of particles per cubic foot (mppcf) to units of fibers per cubic centimeter (fibers/cc) using a 1:6 conversion factor. Similar tasks performed in U.S. shipyards yielded average fiber concentrations about two-fold greater, likely due to inadequate ventilation and confined work environments; however, excessively high exposure levels were reported in some British Naval shipyards due to the spraying of asbestos. Improved industrial hygiene practices initiated in the early to mid-1970s were found to reduce average fiber concentrations for insulator tasks approximately two- to five-fold. For most other crafts, average fiber concentrations were found to typically range from <0.01 to 1 fibers/cc (depending on the task or time period), with higher concentrations observed during the use of powered tools, the mixing or sanding of dry-wall cement, and the cleanup of asbestos insulation or lagging materials. The available evidence suggests that although many historical measurements exceeded the current OSHA 8-h time-weighted average (TWA) permissible exposure limit (PEL) of 0.1 fibers/cc, average fiber concentrations generally did not exceed historical occupational exposure limits in place at the time, except perhaps during ripout activities or the spraying of asbestos in enclosed spaces or onboard ships. Additionally, reported fiber concentrations may not have represented daily or actual human exposures to asbestos, since few samples were collected beyond specific short-term tasks and workers sometimes wore respiratory protective equipment. The available data were not sufficient to determine whether the airborne fiber concentrations represented serpentine or amphibole asbestos fibers, which would have a pronounced impact on the potential health hazards posed by the asbestos. Despite a number of limitations associated with the available air sampling data, the information should provide guidance for reconstructing asbestos exposures for different crafts in specific occupational settings where asbestos was present during the 1940 to 2006 time period.