

A study of airborne chrysotile concentrations associated with handling, unpacking, and repacking boxes of automobile clutch discs

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Although automotive friction products (brakes and manual clutches) historically contained chrysotile asbestos, industrial hygiene surveys and epidemiologic studies of auto mechanics have consistently shown that these workers are not at an increased risk of developing asbestos-related diseases. Airborne asbestos levels during brake repair and brake parts handling have been well-characterized, but the potential exposure to airborne asbestos fibers during the handling of clutch parts has not been examined. In this study, breathing zone samples on the lapel of a volunteer worker ($n = 100$) and area samples at bystander ($n = 50$), remote area ($n = 25$), and ambient ($n = 9$) locations collected during the stacking, unpacking, and repacking of boxes of asbestos-containing clutches, and the subsequent cleanup and clothes handling, were analyzed by phase contrast microscopy (PCM) and transmission electron microscopy (TEM). In addition, fiber morphology and size distribution was evaluated using X-ray diffraction, polarized light microscopy, and ISO analytical methods. It was observed that the (1) airborne asbestos concentrations increased with the number of boxes unpacked and repacked, (2) repetitive stacking of unopened boxes of clutches resulted in higher asbestos concentrations than unpacking and repacking the boxes of clutches, (3) cleanup and clothes handling tasks yielded very low asbestos concentrations. Fiber size and morphology analyses showed that amphibole fibers were not detected in the clutches and that the vast majority (>95%) of the airborne chrysotile fibers were less than 20 μm in length. Applying the ratio of asbestos fibers:total fibers (including non-asbestos) as determined by TEM to the PCM results, it was found that 30-min average airborne chrysotile concentrations (PCM adjusted) were 0.026 ± 0.004 f/cc or 0.100 ± 0.017 f/cc for a worker unpacking and repacking 1 or 2 boxes of clutches, respectively. The 30-min PCM adjusted average airborne asbestos concentrations at bystander locations ranged from 0.002 ± 0.001 f/cc and 0.004 ± 0.002 f/cc when 1 or 2 boxes of clutches were handled, respectively. Estimated 8-h TWA asbestos exposures for a worker handling 1 or 2 boxes of clutches over a workday ranged from 0.002 to 0.006 f/cc. The 30-min PCM adjusted average airborne asbestos concentration for a worker continuously stacking unopened boxes of clutches was 0.212 ± 0.014 f/cc; the 8-h TWA was 0.013 f/cc. Additionally, 30-min PCM adjusted average airborne asbestos concentrations following cleanup and clothing handling were 0.002 ± 0.001 f/cc and 0.002 ± 0.002 f/cc, respectively, both resulting in estimated 8-h TWA asbestos exposures of 0.0001 f/cc. The results of this study indicate that the handling, unpacking, and repacking of clutches, and the subsequent cleanup and clothes handling by a worker within a short-term period or over the entire workday, result in exposures below the historical and current short-term and 8-h occupational exposure limits for asbestos.