**RESULTS**

Exposed workers were compared to the relevant occupational exposure limits, specifically, OSHA permissible exposure limits (PELs) and excursion limits (ELs) for asbestos. The OSHA PEL is 0.01 f/cc for a 10-hour time-weighted average (TWA); the EL is 0.015 f/cc for a 30-minute period. The exposure assessment did not identify any detectable levels of asbestos fibers during the exposure simulations. EMSL identified zero samples with detectable fibers at a level of 0.02 f/cc during analysis by PCM, which detects all fibers; no fibers were detected in personal or background samples. EMSL determined that the fibers detected in the single sample were not asbestos by TEM methodology, and asbestos exposure for this sample was reported to be less than 0.0099 f/cc. The maximum detection limit in any sample was 0.02 f/cc, and the average detection limit for personal samples was 0.009 f/cc. A summary of the brake replacement times can be found in Table 1. A summary of exposure results for each ATV can be found in Table 2.

All brakes that were removed and replaced in the study were analyzed by the bulk analysis methods previously described to confirm intact asbestos content. Brakes removed during the study were sent for analysis for verification that they were asbestos-containing. The brakes contained actinolitic and/or chrysotile and tremolite ranging from 6% to 44% total asbestos by TEM.

**CONCLUSION**

The results of this study indicate that relying on OSHA’s wet method guidance for automobile brake replacement when removing asbestos-containing brake on ATVs—consistent with the conditions of this assessment—would lead to controlled exposure. That is, the asbestos exposures during ATM brake replacement would be well below the OSHA PEL or EL for asbestos. The presence and amount of intractable and actinolitic asbestos identified in bulk samples was particularly notable as these forms of asbestos have not been historically added as a constituent in brakes.

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**Occupational Asbestos Exposure Monitoring of Brake Replacement Activities on All-Terrain Vehicles (ATVs)**

AUTHORS

Jennifer Ellis, MPH, CIH, CSP, Michael Holton, MS, CIH, CSP, Evan Anderson, MPH, CIH, MSc, Ramboll; Benjamin Kin, PhD, EMSL

INTRODUCTION

Asbestos-containing brakes were discovered upon inspection of all-terrain vehicles (ATVs) into a country with a ban on the use of asbestos-containing products. The authors of this study were involved with the bulk characterization of asbestos in the brakes along with the assessment of a mechanism for the replacement of brakes on several ATVs.

Asbestos was historically used in automotive friction products such as brakes and clutches; however, the known use of asbestos fricton in the US is currently limited. In California and Washington prohibited the use of asbestos-containing brakes (US EPA 2017, Washington State Legislature Chapter 389, Division 13 California Code of Regulations Title 22, Chapter 33). Gotham evaluated the use of asbestos-containing brakes on an ATV fleet and found that asbestos-containing brakes are a common product in injury, which includes friction products. Asbestos has not been wholly banned as a constituent ingredient in products in the US. In 2016, asbestos was identified for evaluation of health risk by USEPA under the puruse of the 2006 amendments to TSCA. The amendment requires USEPA to determine whether identified substances—in this case, asbestos—pose an unreasonable risk to human health or the environment.

US EPA is currently evaluating the risk associated with the handling of asbestos-containing brake on ATVs. The authors of this study were involved with the bulk characterization of asbestos in the brakes along with the assessment of a mechanism for the replacement of brakes on several ATVs. All brakes used were from lots of products previously identified to contain asbestos and were previously used in a prior replacement. The mechanical performance brake replacements on 8 ATVs during a single day following a removal procedure consistent with OSHA’s wet method for automotive brake removal.

METHODS

Prior to the commencement of brake replacement, 4 background air samples were collected in the work area to determine the background level of asbestos and asbestos fibers on the day prior to the start of brake replacement activities. The samples were collected over a period of 1 hour at a flow rate of approximately 15 lpm. An exposure assessment was conducted during the replacement of brakes from affected models of ATVs. All brakes used were from lots of products previously identified to contain asbestos and were previously used in a prior replacement. The mechanical performance brake replacements on 8 ATVs during a single day following a removal procedure consistent with OSHA’s wet method for automobile brake removal.

Three personal air samples were collected in the mechanic’s breathing zone throughout the entire process of replacing the asbestos-containing brakes on an ATV. The personal air samples were collected by attaching a stationary high-flow pump to an employee with sufficient slack. Tagen tubing to minimize interference with the mechanics movements. Stationary pumps were used to achieve a flow rate of approximately 15 lpm by traditional personal sampling pumps, allowing for reduction of the detection limit by a factor of 3. Detection limits ranged from 0.008 to 0.016 f/cc for area samples. Area samples were collected from the corners of the work area during the brake replacement activity. The area samples were placed at a height of approximately 3 ft to be representative of the breathing zone of a bystander in the work area and the dispersion of fibers into the workplace. Area samples were collected at a flow rate of approximately 0.5 cfm, achieving detection limits.

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During each brake replacement activity (ATV) a dedicated field notes were recorded documenting the overall timing of the process, the timing of sub-activities, the work methods and tools used during the process, and any deviations from OSHA’s wet method for brake replacement. Background area samples were collected over a period of 30 minutes from the stationary pumps used for area samples between each brake replacement. Area background air samples were collected at a flow rate of approximately 15 lpm and achieving detection limits ranging from 0.008 to 0.016 f/cc for area background samples. All area air samples were transported under proper chain of custody to EMSL. Analysis at EMSL for analysis by Mass Spectrometry (MS)- Mass Spectrometry (MS) was performed. The asbestos content was determined that the fibers detected in the single sample were not asbestos by TEM methodology, and asbestos exposure for this sample was reported to be less than 0.0099 f/cc. The maximum detection limit in any sample was 0.02 f/cc, and the average detection limit for personal samples was 0.009 f/cc.

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**REFERENCES**

Various sources were used in the preparation of this document, including literature reviews, expert interviews, and company records. The information presented is based on the best available evidence and is intended for educational purposes. The views expressed in this document do not necessarily reflect the views of any organization or individual.