Table 1 - Asbestos Emissions from "Normal Use" Braking

Dynamometer Data for Production Disc Brake*

Background asbestos in ambient air	$<19 \times 10^{-9}$ g/m^3
Asbestos fiber from brake in exhaust air	$<13 \times 10^{-9}$ g/m^3
Total asbestos fiber in exhaust air	$<32 \times 10^{-9}$ g/m^3
Estimated brake asbestos fiber in urban air	$<0.07 \times 10^{-9}$ g/m^3
Asbestos fiber from brake in airborn wear dust	<0.05%
Asbestos fiber released from lining wear	<0.02%

*Reported values are 10 times the observed test values to provide upper bounds.

collection, processing, and counting. These values, therefore, should provide upper bounds for asbestos emissions from brake uage. For example, the local (Detroit) atmospheric asbestos concentration ranges 0.5-13.4 ng/m^3. The observed background asbestos value was 1.9 ng/m^3, for the normal use test, but is reported in Table 1 as 19 ng/m^3. The low asbestos emissions from the test disc brake under "normal use" conditions is underscored by the addition of only 13 ng/m^3 (1.3 ng/m^3 observed) in the undiluted exhaust air stream.

The lining wear rate during the first 82 break-in stops was found to be about five times above the "normal use" rate. Asbestos fiber release during break-in was also higher, an average sevenfold increase. However, since the break-in wear is less than 1% of the total lining wear, the increase of emitted asbestos fiber resulting from this temporary sevenfold increase would be about 3%, when averaged over the life of the linings.

High temperature brake usage also increased lining wear rates, in this case by a factor of 11. Asbestos fiber emissions increased by less than a factor of three. Frequent vehicle operation under such high temperature conditions would lower lining life to levels far below present averages. However, even if all brake wear provided the same fiber emission rate as found in the high temperature use test, the percentage fiber release to the atmosphere would still be under 0.06% of the lining wear.

The remaining brake wear was a mixture of nonfibrous organic and inorganic matter. Of the estimated 62-77% collectable wear debris, 47% were accounted for by the test filter on the normal use test. The remaining 15-30% presumably were retained on the lining edges, the caliper, spindle, rotor, wheel, and tire. Accurate measurement of this material was not possible, due to the added retention of dust from the ambient air.

More precise values of brake lining asbestos emissions or the determination of their particle size distributions appear possible, for these low fiber concentrations, only by testing brakes in an asbestos-free atmosphere. This approach was used in an EPA sponsored study (9), where prefiltered air was flowed through sealed brakes at a flow rate greatly reduced from normal.

CONCLUSIONS

1. Automotive brake usage provides a very small emission of asbestos fiber (less than 0.02% of the lining worn).
2. Automotive brake usage provides a very small asbestos fiber input to urban atmospheres (estimated to be below 0.07 ng/m^3).
3. Intense local heating and severe local mechanical action causes the decomposition of most asbestos fiber in brake linings during typical usage.

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