

August 15, 1974

SUBJECT: An Estimate of a Safe Detection Level of Asbestos
Fiber in Baby Powder Talc.

TO: Mr. G. Sandland, Chairman
Subcommittee on Asbestos in Talc

Summary

Comparative calculations have illustrated that liberal dusting of an infant with a hypothetical cosmetic talc containing one percent asbestos fiber by weight would result in an infant cumulative exposure of asbestos only 1/48,000th as much as the Threshold Limit Value - Time Weighted Average, which is considered safe for the repeated exposure of industrial workers.

On the basis of these data any analytical procedure capable of detecting one percent by weight of asbestos fibers in talc would be adequate to insure that the asbestos content of talc is acceptably low.

Discussion

To date, a safe upper limit for the percentage of asbestos fibers in baby powder talc has not been established. On the basis of existing information, however, it is possible to determine the maximum concentration of asbestos fibers which could be present in talc without subjecting an infant to asbestos exposure in excess of the TLV. We can also determine if and what additional safety factors exist when talc is liberally applied to infants. Since the TLV is the only available standard for a "safe" concentration of asbestos fibers in air, its use in providing a point of reference is justified in this instance.

According to the Federal Register Vol. 37 No. 110, Wednesday, June 7, 1972, the permissible exposure (TLV) to airborne concentrations of asbestos fibers is as follows: "The 8-hour time-weighted average airborne concentrations of asbestos to which any employee may be exposed shall not exceed five fibers, longer than 5 micrometers, per cc of air ----." This limit of 5 fibers will be reduced to 2 fibers per cc on July 1, 1976. Excursions up to 10 fibers per cubic centimeter (ceiling concentration) will be permitted provided that the Time Weighted Average (TWA) does not exceed 2 fibers per cc. The 2 fiber standard and the ceiling limit will be employed as the basis for calculations in this memorandum.

For any person exposed to asbestos fibers the allowable weekly exposure under the TLV is 2 fibers per cc of air for a total of 2400 minutes per week (40 hrs. x 60 minutes per hr.). If this person were exposed to the ceiling concentration of 10 fibers per cc, the maximum permitted exposure time according to the TWA would be 480 minutes per week (2 x 2400/10).

In an earlier report⁽¹⁾ the total weekly exposure time for an infant to talcum powder when the latter was applied liberally onto the diaper area was estimated at 43.8 minutes. During the actual talc application (13.6 percent of the total exposure time) the talc concentration was 8.58 particles per cc of air, and during the time the talc dust settled (86.4 percent of the total exposure time) the average concentration was 4.38 particles per cc of air (See Note 1).

Even if the 8.58 particles per cc were asbestos fibers, the exposure of an infant would be less than the ceiling limit of 10 asbestos fibers per cc. The total weekly exposure time of 43.8 minutes would be considerably less than the 480 minutes permitted under the TWA for any exposed person, and inversely the safety factor for the infant would be considerably greater.

The safety factor under this type of exposure and for a hypothetical cosmetic talc containing only one percent asbestos can be estimated as follows:

1. Compute the number of asbestos fibers which any person exposed to the TLV could inhale in a week, based on an inhalation rate of 12.72 liters per minute (See Note 2).

$$2 \text{ fibers/cc} \times 12.72 \times 1000 \text{ cc of air/min} \times 2400 \text{ mins.} = 61,100,000 \text{ fibers/week}^*$$

2. Compute the number of fibers an infant might inhale if we assume all talc particles were asbestos fibers during the application of powder and during the dust settling period based on an inhalation rate for an infant of 0.584 liters per minute⁽²⁾.

$$(8.58 \times .136 + 4.38 \times .864) \text{ fibers per cc} \times 584 \text{ cc per min.} \times 43.8 \text{ mins.} \\ = 126,600 \text{ fibers per week}^*$$

3. Compute safety factor if all particles were asbestos fibers.

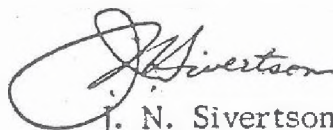
$$61,100,000 / 126,600 = 483$$

4. Compute safety factor for a hypothetical cosmetic talc containing only one percent asbestos fibers by weight.

$$483 \times 100 = 48,300$$

With a safety factor of this magnitude it appears that an upper limit of one percent of asbestos fibers in talcum used on infants would insure that the exposure of infants to asbestos fibers would be far less than the TLV for adults. Thus, an analytical method capable of detecting one percent asbestos in talc would be more than adequate to confirm an acceptably low level of asbestos in a talcum powder used on infants.

*Normal lung clearance mechanism was not considered in either case; therefore, the number of fibers shown do not represent fibers retained in the lung.



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Notes

1. In reference (1) it was shown that the time spent in applying talc liberally to the diaper site was 0.17 minutes per application and that there was an additional time period of 1.08 minutes per application during which the dust settled. Thus, the total weekly exposure is 43.8 minutes = $(0.17 + 1.08)$ minutes per application x 5 applications per day x 7 days per week.

The exposure conditions outlined in reference (1) were based on conservative assumptions and represent exposure levels which were greater than average. For example, the data were based on applying the talc directly to the diaper area from the container, which is the mode of application that creates the greatest concentration of talc dust, while in practice many mothers use hand application. In addition, Dr. Pooley⁽³⁾ in his simulation studies produced a greater dust concentration by applying talc to a hard, dry surface than would be produced using a soft, moist surface such as an infant's skin.

In reference (1) the airborne concentration was reported as 0.243 million particles per cubic foot (mppcf) while "applying talc" and as 0.124 mppcf during the dust settling period. These values were converted to particles per cc of air by multiplying by the factor 35.3 resulting in the 8.58 and 4.38 particles per cc of air, respectively, as stated in the body of this memorandum.

2. According to the data in reference (2) an adult male at rest has a minute volume (inhalation rate) of 7.43 liters per minute and 28.6 liters per minute when performing light work. If we assume conservatively that an adult exposed to asbestos dust performs light work one-fourth of the time and is at rest three-fourths of the time, his expected inhalation rate is:

$$.25(28.6) + .75(7.43) = 12.72 \text{ liters per minute}$$

References

- (1) Comparison of Talc Dust Exposure for Infants and Talc Miners, J. N. Sivertson, Johnson & Johnson Statistical and Computer Operations, Feb. 19, 1974.
- (2) Biology DataBook, Federation of American Societies for Experimental Biology, 1964, p. 220.
- (3) See Reference (1), Section II.