Preliminary Report

FIBER EXPOSURE DURING USE OF BABY POWDERS

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ABSTRACT

A number of investigators have found "asbestos bodies" in the lungs of persons who were not occupationally exposed to asbestos.[1] The use of talcum powders containing asbestos-type materials has been postulated as a possible source of these fibers.

In 1968, the U.S. Public Health Service examined 22 talcum products for the presence of fibrous materials and found a range of 8% and 22% by particle count.[2] No attempt was made to determine fiber exposure during the use of these products. In the present study nine commercially available baby powders were investigated for fiber and free SiO_2 content and a test conducted on each of these products to determine fiber exposure to both mother and baby during dusting. It was found that fiber concentrations reached a maximum during the first thirty seconds of powder use and diminished rapidly with time. Concentrations were found to range between 0-18 fibers greater than five microns in length per milliliter of air in the first thirty seconds of powder use. The percentage of free SiO_2 in the powders was found to range from 0.05% to 2.03% by weight. Further analysis of these powders will be necessary in order to properly identify the fibers which were observed.

INTRODUCTION

Concern about the presence of "asbestos bodies" in the lungs of persons not occupationally exposed to asbestos has brought about many studies to determine other possible modes of exposure. Microscopic examination of many commercially available talcum powders has revealed various quantities of what appears to be asbestos-type fibers.

Talc is a magnesium-silicate material belonging to the serpentine group. Other members of this group include picrolite and chrysotile. Talc is usually found with varying amounts of other mineral impurities such as tremolite, chlorite, magnetite, serpentine, dolomite, quartz, and in some cases chrysotile or anthophyllite. The impurities of major concern are chrysotile, anthophyllite, and tremolite since these are considered asbestos materials.

In order to investigate the presence of fibers in talcum products, nine commercially available baby powders were obtained. Bulk samples of each of the powders were examined for the presence of fibers and free SiO_2. Two of these products were found to contain corn starch with no talc. A test was conducted with each of the remaining seven samples to determine potential baby and mother fiber exposure during a typical diaper change.

METHODS

A total of nine (9) baby powders were purchased from Walgreen Drugs on March 28, 1972 for these experiments. These powders are listed in Table 1.

These powders have been tested by three different methods to determine the fiber content of both the bulk powder and the airborne fraction. Free SiO_2 determinations were also made on each of the powder bulk samples.[8]

In the first experiment an attempt was made to estimate the number of fibers per milligram in each bulk sample.[5] A known weight (0.1g) of each talcum sample was used. Each sample was mixed in 50 ml of distilled water and stirred with a magnetic stirrer for five minutes at a constant slow speed so as not to alter the physical characteristics of the particles. The sample was then filtered through an 0.8μm Millipore AA cellulose-ester filter. An additional 20 ml of distilled water was used to wash the sample from the sides of the syphon. Filters were allowed to dry and a fiber count was performed in the standard manner used for analyzing samples for asbestos fibers.[6]

The second experiment which used the seven (7) talcum powders which had been analyzed in the first experiment and diagnosed as having varying amounts of fibrous talc,[7] simulated a hypothetical exposure that might exist to a mother and child while changing a diaper.

The following is a step by step procedure used for each of these samples:

1. A doll was used in the experiment to simulate a baby. It was placed on its back with a diaper placed under it. (doll was 24" long)

2. A sample was collected at the breathing zone of the baby. This was accomplished with the use of a 37mm AA filter enclosed in a Millipore sampling head with a flow rate of 1.7 lpm. The distance between the breathing zone of the baby and the dusting of the talcum was about ten inches.

3. An identical sampling system was used on the individual who was putting the diaper on the doll. The sample was again collected at the breathing zone with a flow rate of 1.7 lpm.

4. Each talcum was dusted on the doll for a period of 15 seconds. The talcum was spread over the diaper area and then the diaper was pinned, achieving a total sampling time of two (2) minutes.

5. After using each sample the doll was washed and a clean diaper used. The experiment was performed in a test chamber (dimensions 4' x 5'10" x 7'7") with two sealed windows and a double door to insure that the area would be draft free. A sketch of the layout of the apparatus in the test chamber is shown in Figure 1.

6. A control filter was sampled in each location before each talcum was tested.

7. All samples were analyzed in the same manner specified for airborne asbestos samples.[6] A hundred fields were counted since there was so few fibers on the filters due to the very short sampling time.

In the third and final experiment, an attempt was made again to simulate a hypothetical fiber exposure that might exist to a mother and child while changing a diaper. Modifications in experimental procedure were made from the previous test in all seven fibrous talcs tested. The modifications were as follows:

1. The flow rate was increased to 7.4 lpm in order to have a

larger volume of sample so that there would be more fibers on the filter and make the analysis by optically counting under phase contrast microscopy more accurate.

2. After each talcum was dusted on the doll, the powder was spread around until a total of one minute elapsed. The doll was undisturbed during the second minute of the test. In the third and final minute of the test the diaper was pinned on the doll.

3. A three minute sample was taken in the breathing zone of both the "baby" and "mother" to obtain an average airborne concentration for the total time period for each dusting test. In addition to the long running samples, filters were attached simultaneously for short intervals to a sampling site on the other side of the breathing zone of both "mother" and "baby" to obtain peak concentrations. The time intervals used were 0-30 seconds, 30-60 seconds, 60-120 seconds, and 120-180 seconds. With this procedure ten samples were taken for each dusting trial.

4. The above procedure was done for both a 15 second and a 5 second dusting time on the doll. Since seven powders were tested, a total of 14 dusting tests were performed in the third experiment.

Each of the seven powders which were found to contain talc were analyzed for free SiO_2 using the colorimetric method of Talvitie.[8]

RESULTS AND CONCLUSIONS

Table 2 contains the results of the second experiment in which the average exposure to both mother and baby over a two minute period for a 15 second dusting from each of the seven powders was determined. The highest concentration resulted from the use of powder number 2. All the powders produced similar concentrations of airborne fibers.

Tables 3 and 4 show the exposure levels which were obtained for both mother and baby for the 5 and 15 second dustings during the final experiment. Also shown in these tables are the results of the fiber counts on the bulk samples done in the first experiment. From these tables it is obvious that fiber levels were highest during the first 30 seconds in which the dusting took place and dropped off sharply during the rest of the diaper change. In a few instances, concentrations rose again in the third minute in which the diaper was placed on the baby indicating that some of the fibers which had settled became airborne during this motion. All powders which were tested showed some fiber exposure during the 15 second dusting; however, powders 4, 6, and 9 showed very few fibers during the 5 second dusting. For these powders only the three minute average is given in the tables. Some free SiO_2 was found in each of the seven powders containing talc.

From our analysis it appears that significant fiber exposures may occur during dusting of some baby powders (numbers 2,7, and 9). It is realistic to assume that most mothers would powder their babies for a period between 5 and 15 seconds, therefore, some exposure between the results found during these dusting periods would occur. If we assume that most infants need changing between 10 and 15 times per day, a cumulative exposure of 30 to 45 minutes per day would occur.

It must be emphasized that no positive identification of the fibers found in these powders has been made since the phase contrast microscope is not well suited for this purpose. Further work is needed to provide positive identification as to the nature of the fibers present.

RECOMMENDATIONS FOR FURTHER STUDIES

The work which has been carried out to date indicates possible asbestos fiber contamination of commercial baby powders. The method used to make this determination was phase contrast microscopy at 430X magnification. Further studies are indicated to provide more positive determination of the types of fibers present. The following are recommendations for further study:

1. Electron microscopy should be used to study the morphology of the fibers present. Chrysotile and tremolite should lend themselves to identification by this method.

2. Dispersion staining techniques should be investigated as possible means of identification of larger fibers (>1μ). This method has been described by Julian and McCrone.[3]

3. Although X-ray diffraction methods are not sensitive to small percentages of asbestos in any sample (5% - 10%), it may be possible to concentrate fibers by a density gradient method.[4] With this method it may be possible to give a semi-quantitative estimate of the different fibers present.

4. The electron microprobe should be investigated as a means of fiber identification. This method is of special use when relatively small amounts of material are present.[4]

5. Differential Thermal Analysis (DTA) should be investigated as a possible means of identifying and determining the weight percent of chrysotile, tremolite, and other impurities.

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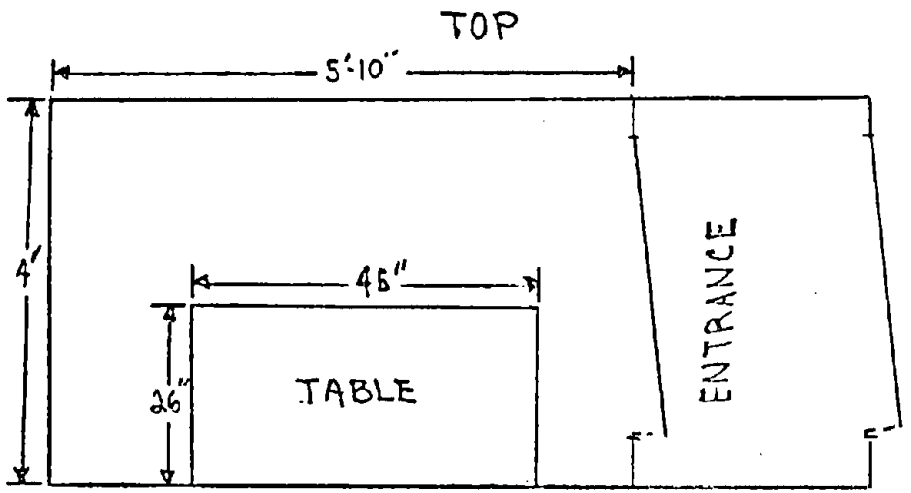
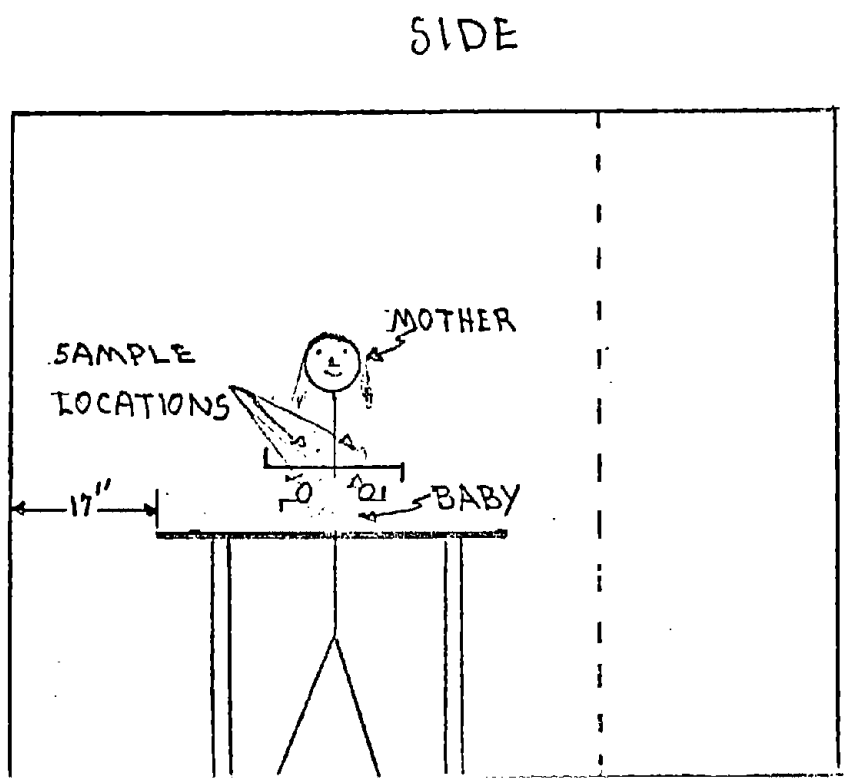
FIGURE 1 SCHEMATIC OF TEST CHAMBER





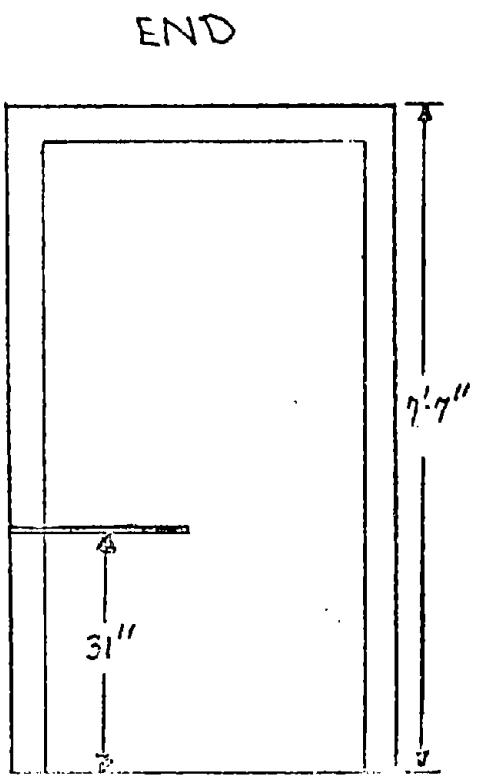


TABLE 1

BABY POWDER PURCHASED

FROM

WALGREEN DRUGS

March 28, 1972

Powder #	*Brand Name*	*Manufacturer*	*Ingredients*	*Net Wt.*	*Price*
1	Vaseline Intensive Care	Cheesbrough Ponds Inc. New York, New York 10017	Petroleum Jelly, Talc	14 oz	$1.0
2	Crib Age	Walgreen Co. Distributor Chicago, Ill. 60646	Talc	14 oz	.6
3	Mexsana	Plough, Inc. Memphis, Tenn. 38101	Cornstarch, Hexachlor-ophene, Kaolin, Zinc Oxide, Oil of Eucalyptus & Camphor	6.25oz	1.2
4	Johnson & Johnson Medicated Powder	Johnson & Johnson New Brunswick, N.J. 08903	Hexachlorophene, Talc	5.5 oz	.7
5	Diaparene	Breon Laboratories, Inc. New York, New York 10016 Subs. of Sterling Drug	Methylbenzethomium chloride, Cornstarch & Magnesium carbonate	9 oz	.9
6	Johnson Baby Powder	Johnson & Johnson New Brunswick, N.J. 08903	Talc	9 oz	.7
7	Baby Magic	Mennen Company Morristown, N.J.	Methylbenzethomium Chloride, Pure Talc	9 oz	.6
8	Desitin	Chas. Pfizer & Co., Inc. Leeming Division New York, New York 10017	Bi-endazel(Hexachlor-ophene, chloroxylenol) and Talcum	6.5 oz	.8
9	Caldesene	Pennwalt Corporation Rochester, N.Y. 14623	Calcium Undecylenate	2 oz	.9

TABLE 2

FIBER EXPOSURE

TO BOTH

MOTHER AND BABY DURING 15 SECOND DUSTING

(SECOND TALCUM POWDER EXPERIMENT)

Powder	*Subject*	*Sample Time (Min)*	*FIBERS >5μm IN LENGTH* Average *Fibers/Field*	Conc. *Fibers/cc*
#1, Vaseline Intensive Care	Mother	2.0	.06	2.7
	Baby	2.0	.05	2.2
#2, Crib Age Powder	Mother	2.0	.10	4.5
	Baby	2.0	.12	5.4
#4, Johnson & Johnson Medicated	Mother	2.0	.04	1.8
	Baby	2.0	.02	0.9
#6, Johnson Baby Powder	Mother	2.0	.05	2.2
	Baby	2.0	.04	1.8
#7, Baby Magic	Mother	2.0	.05	2.2
	Baby	2.0	.04	1.8
#8, Desitin	Mother	2.0	.07	3.1
	Baby	2.0	.05	2.2
#9, Caldesene	Mother	2.0	.06	2.7
	Baby	2.0	.05	2.2

TABLE 3

MOTHER'S EXPOSURES DURING DIAPER CHANGE

FIBERS ≥ 5μm IN LENGTH PER MILLILITER

Powder	*Bulk Sample Fibers 5 Per Mg*	*5 Second Dusting*					*15 Second Dusting*				
		*0-30**	*30-60*	*60-120*	*120-180*	*0-3 Min*	*0-30*	*30-60*	*60-120*	*120-180*	*0-3 Min*
1, Vaseline Intensive Care	19,000	2.9	2.0	0.5	0.2	0.6	2.9	1.2	0.8	2.5	0.6
2, Crib Age Powder	28,000	2.5	1.3	0.6	0.8	1.2	7.9	2.1	2.7	1.7	2.0
4, Johnson & Johnson Medicated	10,000	Few Fibers Seen				**	0.4	0.9	0.4	0.2	0.2
6, Johnson Baby Powder	18,000	Few Fibers Seen				0.3	3.3	1.2	0.8	2.3	0.9
7, Baby Magic	41,000	4.1	2.9	1.9	0.6	2.1	18.2	12.8	2.3	3.3	2.3
8, Desitin	14,000	Few Fibers Seen				0.1	1.7	1.7	1.2	1.2	0.4
9, Caldesene	------	2.1	2.1	1.2	1.0	0.8	1.0	4.9	1.7	0.4	2.2
Powders 3 & 5 were corn starch											

* *Sample period in seconds*

** *Some fibers present; however, quantitative analysis not justified*

TABLE 4

BABY'S EXPOSURES DURING DIAPER CHANGE

FIBERS ≥ 5μm IN LENGTH PER MILLILITER

Powder	*Bulk Sample Fibers >5μ Per Mg*	*5 Second Dusting*					*15 Second Dusting*				
		*0-30**	*30-60*	*60-120*	*120-180*	*0-3 Min*	*0-30*	*30-60*	*60-120*	*120-180*	*0-3 Min*
1, Vaseline Intensive Care	19,000	2.0	1.2	0.6	0.0	0.6	5.0	2.1	1.7	0.4	0.6
2, Crib Age Powder	28,000	2.8	1.2	1.4	0.8	0.5	12.0	4.5	2.9	0.8	2.3
4, Johnson & Johnson Medicated	10,000	Few Fibers Seen				**	1.2	0.8	0.2	0.0	0.5
6, Johnson Baby Powder	18,000	Few Fibers Seen				0.3	3.3	1.7	0.8	0.8	0.2
7, Baby Magic	41,000	5.4	2.9	1.4	0.8	0.9	15.7	12.8	0.8	3.5	3.0
8, Desitin	14,000	Few Fibers Seen				0.3	2.9	1.7	1.4	0.6	0.6
9, Caldesene	------	3.3	2.5	1.2	1.0	0.6	8.3	8.5	1.7	1.7	4.3

Powders 3 & 5 were corn starch

* *Sample period in seconds*

** *Some fibers present; however, quantitative analysis not justified*

TABLE 5

PERCENT FREE SiO_2 CONTENT BY WEIGHT
OF
COMMERCIAL BABY POWDERS TESTED

Powder #	*Powder Name*	*% Free SiO_2 By Weight*
1	Vaseline Intensive Care	0.05
2	Crib Age Powder	2.03
4	Johnson & Johnson Medicated	0.81
6	Johnson Baby Powder	0.82
7	Baby Magic	1.68
8	Desitin	0.70
9	Caldesene	0.20