FILE NAME: Talc (TALC)

DATE: 1973

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EMORANDUM

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
FOOD AND DRUG ADMINISTRATION

F-620

: Dr. Robert M. Schaffner, Director
Office of Technology (BF-400)

DATE: July 31, 1973

7/31/73

M : Dr. Alfred Weissler, Acting Director
Division of Color Technology (BF-430)

JECT: Summary and Comments on Prof. Lewin's Analytical Results for Asbestos in Talc

1. The purposes of this memorandum are to present a summary of the analytical results for asbestos in Cosmetic talcum-type powders obtained by Prof. Seymour Z. Lewin of New York University in his role of consultant to FDA; to compare his results with those obtained by other laboratories on some of the same samples; and to make some comments on the general question of suitable techniques for the analysis of asbestos in talc.

2. I asked Dr. Lewin in December 1971 to undertake asbestos analyses in 100 samples of cosmetic powders; the scope was expanded on two subsequent occasions, to include a total of 195 samples. I chose Dr. Lewin for this work because he is an internationally-recognized expert on mineralogical chemistry and because he is a member of the academic community and therefore likely to be impartial in a confrontation between industry and government. Furthermore, his competence had previously been recognized by industry (by virtue of their own use of him as a consultant) which appeared to confer a desirable immunity against possible industry attacks on the validity of the results.

3. Dr. Lewin's findings are shown in Table I; the key to the identities of the numbered samples is given in Table IV. Please note also the explanatory comments in Dr. Lewin's memo of July 10, 1973, which is an Attachment to Table I. No varieties of asbestos other than chrysotile (a serpentine) or tremolite (an amphibole) were found by Dr. Lewin in the 195 samples which he examined. As shown in Table I, Dr. Lewin found definite indications of chrysotile in 17 of the samples (many of these also had tremolite) and definite indications of tremolite but not chrysotile in an additional 18 of the samples. These results were obtained primarily by means of X-Ray diffraction, supplemented in some cases by optical microscopy and other techniques. However, Dr. Lewin points out on page 2, paragraph 1 of the Table I Attachment that the chrysotile he has identified in commercial products shows several significant differences from "classical" chrysotile: in the location of its X-Ray diffraction peaks, in its appearance under the microscope, in its reactivity toward dilute acid, and in its behavior with respect to differential thermal analysis.

4. In Table II, I have compared Dr. Lewin's results for tremolite with those obtained for some of the same samples at FDA (by means of optical microscopy) and at the Pfizer Minerals, Pigments, and Metals Division (by means of X-Ray diffraction). This comparison, which was undertaken in order to obtain additional information on the samples, shows good semi-quantitative agreement among the three laboratories. Whatever quantitative differences exist in the amounts of tremolite found can be understood readily on the basis of such factors as (a) preferred orientation of plates and fibers in the packing of the X-Ray diffraction sample, and (b) inhomogeneities in sample composition, caused for example by air elutriation within the container when it is shaken.

5. In Table III, I have compared Dr. Lewin's results for chrysotile with those obtained for some of the same samples by four other laboratories; the additional two laboratories included in this part of the study are Columbia Scientific Industries of Austin, Texas (who sell the Stone apparatus for differential thermal analysis) and the Health Protection Branch of the Department of National Health and Welfare of the Canadian government in Ottawa. The agreement of results from different laboratories is much less satisfactory for chrysotile than that discussed above for tremolite. For example, samples 89 and 163 were found by Dr. Lewin to contain 5% and 10% of chrysotile, respectively, but chrysotile was not found in these samples by the other laboratories. Also, a preliminary finding of chrysotile in a sample of Johnson and Johnson Shower to Shower Body Powder has been disputed by the company, which claimed that their own analyses by several different techniques fail to show the presence of chrysotile. The explanation for these differences is attributable largely to Dr. Lewin's inclusion in the term "chrysotile" of mineral species which show significant differences from classical chrysotile, as discussed in paragraph 3 above.

6. The difficulties involved in analyzing talc and other samples for small amounts of asbestos have been pointed out by many investigators. It is not surprising that the results of different laboratories disagree sometimes, especially in the presence of transitional or altered mineralogical species. Moreover, with regard to the two varieties of asbestos of concern here, it is unfortunate that the one which is a clear inhalation hazard to man, namely chrysotile, poses an intrinsically more difficult analytical problem than the other, tremolite, which has not yet been shown to present a biological hazard. This is due in part to the less prominent X-ray diffraction peaks of chrysotile and to the fact that the fibers are often too small to be seen in the optical microscope.

7. In connection with a proposed new regulation on the safety of cosmetic talcum powders, we face the problem of specifying an analytical test for asbestos which must be satisfied by the powders if they are not to be considerated adulterated. On the basis of information available at present, I recommend consideration of the following procedure. The powders shall be examined first by X-ray diffraction, which has a sensitivity of the order of 1% for chrysotile and somewhat greater sensitivity

for tremolate. If either species is found, confirmation that the species is present in fiber form is to be obtained by optical microscopy and electron microscopy. This is necessary because tremolite is known to occur in a non-fibrous form, and the X-ray diffraction pattern of chrysotile is the same as that of antigorite, a non-fibrous form of the same mineral. The sample is considered adulterated if the presence of fibrous tremolite or chrysotile is shown by the above procedure. An alternative procedure, based solely on optical microscopy (which is a less expensive and more widely available technique) might be proposed. However, the difficulty with optical microscopy alone is that it may completely miss the presence of chrysotile if the fibers are submicroscopic, which may well be the case in finely-milled talc; X-ray diffraction is not subject to this source of error.

Alfred Weissler

Alfred Weissler, Ph.D.

Enclosures

FINAL REPORT

X-RAY POWDER DIFFRACTION ANALYSES OF COMMERCIAL COSMETIC POWDERS

Sample	Talc	Chlorite	Phlogopite	α-Quartz	Dolomite	Calcite	Tremolite	Chrysotile	Other Species
1	70%	3%	7%	n.d.	n.d.	n.d.	n.d.	n.d.	
2	100%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
3	99%	n.d.	1%	n.d.	n.d.	n.d.	n.d.	n.d.	
4	100%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
5	95%	2%	3%	n.d.	n.d.	n.d.	n.d.	n.d.	
6	80%	2%	5%	n.d.	n.d.	n.d.	n.d.	n.d.	CaUndecyl
7	86%	7%	2%	3%	2%	n.d.	n.d.	?	
8	95%	2%	3%	n.d.	n.d.	n.d.	n.d.	n.d.	
9	89%	7%	2%	2%	n.d.	n.d.	n.d.	n.d.	
10	93%	3%	2%	2%	n.d.	n.d.	n.d.	n.d.	
11	90%	2%	2%	4%	2%	n.d.	n.d.	n.d.	
12	100%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
13	60%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	ZnUndecyl
14	31%	50%	2%	10%	7%	n.d.	n.d.	n.d.	
15	100%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
16	--	--	--	--	--	--	--	--	Kaolin, Starch
17	60%	30%	4%	n.d.	6%	n.d.	n.d.	n.d.	
18	90%	4%	2%	2%	2%	n.d.	n.d.	n.d.	
19	97%	1%	2%	n.d.	n.d.	n.d.	n.d.	n.d.	
20	35%	60%	1%	4%	n.d.	n.d.	n.d.	n.d.	
21	67%	25%	2%	3%	3%	n.d.	n.d.	n.d.	
22	59%	35%	1%	n.d.	5%	n.d.	n.d.	n.d.	
23	42%	50%	2%	3%	3%	n.d.	n.d.	?	
24	94%	1%	2%	3%	n.d.	n.d.	n.d.	n.d.	
25	95%	2%	3%	n.d.	n.d.	n.d.	n.d.	?	
26	95%	1%	4%	n.d.	n.d.	n.d.	n.d.	?	
27	78%	n.d.	2%	n.d.	20%	n.d.	n.d.	n.d.	
28	ca. 20%	1%	n.d.	n.d.	n.d.	10%	n.d.	n.d.	Kaolin, Mica
29	ca. 94%	n.d.	2%	n.d.	2%	n.d.	n.d.	n.d.	Kaolin
30	97%	1%	2%	n.d.	n.d.	n.d.	n.d.	n.d.	
31	47%	50%	2%	3%	8%	n.d.	n.d.	n.d.	
32	80%	7%	3%	2%	8%	n.d.	n.d.	n.d.	

ample	Talc	Chlorite	Phlogo-pite	α-Quartz	Dolo-mite	Calcite	Trem-olite	Chryso-tile	Other Species
33	55%	40%	2%	n.d.	3%	n.d.	n.d.	n.d.	
34	78%	7%	4%	3%	8%	n.d.	n.d.	n.d.	
35	78%	5%	2%	10%	5%	n.d.	n.d.	n.d.	
36	ca.81%	4%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	Mica
37	38%	50%	5%	n.d.	7%	n.d.	n.d.	n.d.	
38	87%	5%	4%	2%	2%	n.d.	n.d.	n.d.	
39	94%	3%	n.d.	3%	n.d.	n.d.	n.d.	n.d.	
40	67%	25%	n.d.	3%	5%	n.d.	n.d.	n.d.	
41	33%	8%	2%	2%	5%	n.d.	n.d.	n.d.	
42	89%	6%	n.d.	n.d.	3%	2%	n.d.	n.d.	
43	97%	n.d.	n.d.	3%	n.d.	n.d.	n.d.	n.d.	
44	--	--	--	--	--	--	--	--	ZnO, Kaolin
45	66%	30%	n.d.	n.d.	4%	n.d.	n.d.	n.d.	
46	48%	40%	n.d.	5%	7%	n.d.	n.d.	n.d.	
47	98%	n.d.	n.d.	n.d.	n.d.	2%	n.d.	n.d.	
48	88%	4%	2%	2%	4%	n.d.	n.d.	n.d.	
49	100%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
50	95%	5%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
51	100%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
52	87%	8%	2%	3%	n.d.	n.d.	n.d.	n.d.	
53	90%	4%	2%	2%	2%	n.d.	n.d.	n.d.	
54	ca.87%	3%	4%	n.d.	4%	n.d.	n.d.	?	
55	80%	15%	n.d.	5%	n.d.	n.d.	n.d.	n.d.	
56	90%	7%	n.d.	3%	n.d.	n.d.	n.d.	n.d.	
57	80%	15%	n.d.	n.d.	5%	n.d.	n.d.	n.d.	
58	96%	n.d.	n.d.	4%	n.d.	n.d.	n.d.	n.d.	
59	ca.90%	n.d.	n.d.	3%	n.d.	n.d.	n.d.	n.d.	Starch
60	ca.60%	30%	n.d.	n.d.	7%	2%	n.d.	n.d.	ZnStear.
61	38%	40%	n.d.	4%	18%	n.d.	n.d.	n.d.	
62	85%	2%	n.d.	3%	n.d.	10%	n.d.	n.d.	
63	87%	2%	2%	4%	n.d.	n.d.	5%	n.d.	
64	ca.80%	5%	3%	2%	3%	n.d.	n.d.	n.d.	ZnStear.
65	ca.78%	15%	n.d.	n.d.	4%	n.d.	n.d.	n.d.	ZnStear.
66	84%	5%	3%	3%	3%	n.d.	n.d.	2%	
67	78%	15%	n.d.	n.d.	5%	n.d.	2%	n.d.	
68	80%	15%	n.d.	n.d.	5%	n.d.	n.d.	n.d.	
69	97%	1%	n.d.	n.d.	n.d.	2%	n.d.	n.d.	

ample	Talc	Chlorite	Phlogo-pite	α-Quartz	Dolo-mite	Calcite	Trem-olite	Chryso-tile	Other Species
70	28%	60%	n.d.	5%	7%	n.d.	n.d.	n.d.	
71	85%	10%	n.d.	2%	n.d.	n.d.	3%	n.d.	
72	86%	5%	3%	4%	n.d.	2%	n.d.	n.d.	
73	ca.80%	10%	n.d.	3%	5%	n.d.	n.d.	n.d.	ZnStear.
74	90%	n.d.	n.d.	n.d.	5%	5%	n.d.	n.d.	
75	75%	5%	n.d.	n.d.	15%	5%	n.d.	n.d.	
76	75%	n.d.	5%	5%	10%	n.d.	5%	n.d.	
77	91%	n.d.	4%	2%	n.d.	n.d.	3%	n.d.	
78	85%	2%	1%	4%	3%	n.d.	5%	n.d.	
79	81%	5%	4%	n.d.	2%	8%	n.d.	n.d.	
80	ca.50%	40%	n.d.	8%	n.d.	n.d.	n.d.	?	
81	ca.80%	7%	1%	6%	4%	n.d.	n.d.	?	
82	ca.78%	12%	2%	4%	3%	n.d.	n.d.	?	
83	ca.84%	6%	5%	n.d.	4%	n.d.	n.d.	?	
84	ca.92%	4%	n.d.	n.d.	3%	n.d.	n.d.	?	
85	ca.86%	5%	n.d.	n.d.	8%	n.d.	n.d.	?	
86	85%	4%	2%	4%	4%	n.d.	n.d.	?	
87	ca.30%	50%	n.d.	4%	12%	3%	n.d.	?	
88	61%	n.d.	n.d.	5%	25%	n.d.	4%	5%	
89	68%	1%	3%	8%	10%	n.d.	5%	5%	
90	55%	n.d.	3%	7%	25%	2%	3%	5%	
91	ca.50%	1%	n.d.	n.d.	3%	5%	n.d.	5%	Mica
92	64%	n.d.	n.d.	6%	20%	n.d.	5%	5%	
93	55%	1%	4%	6%	25%	n.d.	5%	4%	
94	ca.46%	4%	3%	6%	35%	n.d.	4%	?	
95	86%	n.d.	n.d.	5%	4%	n.d.	2%	3%	
96	28%	n.d.	3%	6%	45%	n.d.	8%	10%	
97	31%	1%	1%	5%	35%	n.d.	12%	15%	
98	ca.40%	n.d.	3%	n.d.	6%	2%	n.d.	n.d.	Kaolin, Mica
99	ca.40%	n.d.	3%	n.d.	6%	2%	n.d.	n.d.	Kaolin, Mica
00	ca.80	10%	4%	n.d.	2%	n.d.	n.d.	n.d.	ZnStear.
01	63%	8%	3%	7%	4%	n.d.	15%	n.d.	
02	63%	2%	n.d.	3%	15%	n.d.	10%	7%	
03	93%	3%	n.d.	n.d.	4%	n.d.	n.d.	n.d.	
04	91%	3%	1%	2%	3%	n.d.	n.d.	n.d.	

ample	Talc	Chlorite	Phlogopite	α-Quartz	Dolomite	Calcite	Tremolite	Chrysotile	Other Species
05	92%	3%	1%	2%	2%	n.d.	n.d.	n.d.	
06	91%	3%	1%	3%	2%	n.d.	n.d.	n.d.	
07	87%	5%	2%	n.d.	6%	n.d.	n.d.	n.d.	
08	81%	10%	2%	2%	3%	n.d.	2%	n.d.	
09	74%	15%	3%	3%	3%	n.d.	2%	?	Kaolin
10	99%	n.d.	1%	n.d.	n.d.	n.d.	n.d.	n.d.	
11	42%	40%	2%	n.d.	15%	n.d.	1%	n.d.	
12	ca.60%	n.d.	n.d.	4%	n.d.	10%	n.d.	n.d.	Salicylic A., Boric
13	75%	15%	n.d.	3%	7%	n.d.	n.d.	n.d.	
14	53%	40%	n.d.	3%	4%	n.d.	n.d.	n.d.	
15	53%	40%	n.d.	3%	4%	n.d.	n.d.	n.d.	
16	53%	40%	n.d.	3%	4%	n.d.	n.d.	n.d.	
17	42%	35%	n.d.	15%	4%	2%	n.d.	?	
18	53%	40%	n.d.	3%	4%	n.d.	n.d.	n.d.	
19	49%	40%	n.d.	6%	5%	n.d.	n.d.	n.d.	
20	46%	40%	n.d.	8%	4%	n.d.	n.d.	?	
21	87%	8%	2%	n.d.	3%	n.d.	n.d.	n.d.	
22	56%	35%	n.d.	5%	4%	n.d.	n.d.	?	
23	51%	40%	n.d.	3%	4%	n.d.	n.d.	?	
24	54%	40%	n.d.	3%	3%	n.d.	n.d.	?	
25	55%	40%	n.d.	2%	3%	n.d.	n.d.	?	
26	75%	10%	3%	4%	8%	n.d.	n.d.	n.d.	
27	85%	n.d.	n.d.	4%	n.d.	n.d.	n.d.	n.d.	Boric Acid
28	60%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	CaUndecyl.
29	97%	n.d.	n.d.	n.d.	3%	n.d.	n.d.	n.d.	
30	ca.88%	7%	n.d.	2%	3%	n.d.	trace	trace	
31	ca.92	3%	3%	n.d.	2%	n.d.	trace	n.d.	
32	95%	3%	2%	n.d.	n.d.	n.d.	n.d.	n.d.	
33	94%	2%	4%	n.d.	n.d.	n.d.	n.d.	n.d.	
34	93%	3%	2%	n.d.	2%	n.d.	n.d.	n.d.	
35	93%	2%	3%	n.d.	2%	n.d.	n.d.	n.d.	
36	89%	4%	3%	2%	2%	n.d.	n.d.	n.d.	
37	91%	4%	n.d.	3%	2%	n.d.	n.d.	n.d.	
38	85%	7%	3%	2%	3%	n.d.	n.d.	n.d.	
39	ca.85%	n.d.	n.d.	2%	n.d.	n.d.	n.d.	n.d.	ZnStear. $MgCO_3$
40	ca.85%	n.d.	n.d.	2%	1%	n.d.	n.d.	n.d.	ZnStear. $MgCO_3$

Sample	Talc	Chlorite	Phlogopite	α-Quartz	Dolomite	Calcite	Tremolite	Chrysotile	Other Species
141	80%	n.d.	n.d.	2%	1%	n.d.	n.d.	n.d.	ZnStear, $MgCO_3$
142	79%	7%	5%	4%	5%	n.d.	n.d.	n.d.	
143	55%	2%	n.d.	3%	25%	n.d.	5%	10%	
144	ca.70%	10%	n.d.	6%	n.d.	n.d.	5%	?	ZnStear. Kaolin
145	ca.70%	3%	n.d.	n.d.	3%	n.d.	n.d.	2%	ZnStear. Kaolin, ZnO
146	ca.85%	n.d.	n.d.	4%	n.d.	5%	n.d.	n.d.	ZnStear.
147	ca.85%	n.d.	n.d.	n.d.	n.d.	5%	n.d.	n.d.	Kaolin
148	ca.45%	40%	n.d.	n.d.	8%	n.d.	2%	n.d.	ZnStear.
149	ca.50%	10%	n.d.	10%	12%	n.d.	8%	?	Kaolin
150	80%	2%	n.d.	5%	n.d.	5%	n.d.	n.d.	Kaolin
151	63%	25%	n.d.	2%	10%	n.d.	n.d.	n.d.	
152	ca.70%	2%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	Pyrophyllite
153	ca.80%	2%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	ZnO, Boric Acid
154	ca.70%	10%	4%	4%	2%	n.d.	2%	n.d.	ZnO
155	ca.84%	10%	n.d.	4%	2%	n.d.	n.d.	?	
156	79%	10%	n.d.	6%	3%	n.d.	2%	n.d.	
157	63%	2%	n.d.	3%	18%	n.d.	6%	8%	
158	78%	7%	n.d.	3%	2%	10%	n.d.	n.d.	
159	ca.74%	10%	2%	n.d.	4%	10%	n.d.	?	
160	60%	25%	n.d.	n.d.	4%	10%	n.d.	trace	
161	59%	25%	n.d.	2%	4%	10%	n.d.	n.d.	
162	58%	25%	n.d.	2%	5%	10%	n.d.	n.d.	
163	55%	2%	n.d.	3%	20%	n.d.	10%	10%	
164	92%	3%	2%	n.d.	2%	n.d.	n.d.	1%	
165	92%	5%	n.d.	n.d.	2%	n.d.	n.d.	?	
166	ca.50%	40%	n.d.	2%	8%	n.d.	n.d.	?	
167	76%	10%	n.d.	n.d.	12%	n.d.	2%	n.d.	
168	—	—	—	—	—	—	—	—	Gypsum
169	—	—	—	—	—	ca.80%	—	—	
170	52%	n.d.	n.d.	5%	25%	n.d.	n.d.	8%	
171	70%	10%	n.d.	5%	15%	n.d.	n.d.	n.d.	
172	43%	50%	n.d.	n.d.	5%	n.d.	2%	n.d.	
173	ca.99%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	?	
174	ca.60%	1%	2%	15%	n.d.	n.d.	n.d.	n.d.	Kaolin, Mica

Sample	Talc	Chlorite	Phlogopite	α-Quartz	Dolomite	Calcite	Tremolite	Chrysotile	Other Species
175	ca.86%	3%	n.d.	10%	n.d.	n.d.	n.d.	?	
176	ca.79%	3%	2%	15%	n.d.	n.d.	n.d.	?	
177	84%	10%	4%	2%	n.d.	n.d.	n.d.	n.d.	
178	ca.50%	20%	2%	5%	4%	n.d.	n.d.	?	Kaolin
179	97%	n.d.	n.d.	3%	n.d.	n.d.	n.d.	n.d.	
180	88%	n.d.	n.d.	n.d.	12%	n.d.	n.d.	n.d.	
181	ca.70%	n.d.	n.d.	n.d.	n.d.	10%	n.d.	n.d.	Kaolin
182	ca.40%	25%	15%	n.d.	n.d.	n.d.	n.d.	?	ZnO
183	ca.76%	10%	n.d.	n.d.	2%	10%	1%	?	
184	93%	2%	n.d.	2%	n.d.	n.d.	3%	n.d.	
185	ca.50%	8%	n.d.	n.d.	n.d.	25%	n.d.	n.d.	ZnO
186	ca.50%	5%	n.d.	n.d.	n.d.	25%	n.d.	?	ZnO
187	ca.85%	5%	n.d.	2%	n.d.	5%	2%	n.d	
188	70%	15%	2%	3%	4%	5%	1%	?	
189	72%	12%	n.d.	3%	2%	5%	1%	n.d.	
190	ca.82%	12%	2%	n.d.	3%	n.d.	n.d.	?	
191	96%	2%	n.d.	n.d.	2%	n.d.	n.d.	n.d.	
192	100%	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
193	ca.93%	2%	n.d.	2%	2%	n.d.	n.d.	?	ZnStear.
194	ca.94%	2%	n.d.	n.d.	3%	3%	n.d.	?	
195	97%	n.d.	n.d.	n.d.	3%	n.d.	n.d.	n.d.	

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ATTACHMENT TO TABLE I

Memorandum to: Dr. George Thompson
Food and Drug Administration

From: S. Z. Lewin
Chemistry Department, New York University

Re: Determination of Asbestos Contents of Commercial Talcum Powders.

This will serve to summarize the main points of our discussion on this date of July 10, 1973 with respect to the factors involved in the detection and estimation of asbestos in talc, and the status of the tabulation of results of the analyses of commercially available consumer products containing talcum powder.

My research group has been engaged in studies of talc and its accessory minerals continuously since July 1971, and we are continuing to work in this field. We have undertaken to investigate the following problems:

A. Tabulation of the x-ray diffraction data for talc and all solid phases (whether naturally occurring, or added in the course of processing) encountered with talc in mineral, industrial, cosmetic and pharmaceutical products.

B. Elucidation of the x-ray diffraction spectrum (i.e., precise locations and relative intensities of peaks and variability thereof) of chrysotile. Assignment of the diffraction peaks to the crystal planes responsible for them, and interpretation in terms of crystallography of the effects of grinding, orientation, and sample preparation.

C. Investigation of the chemical properties of chrysotile, antigorite, chlorite, tremolite, and talc; specifically, measurement of the rates of hydrolytic and ion replacement reactions.

D. Microscopy, both optical and electron, of chrysotile and of talcs containing various accessory minerals, including chrysotile and tremolite.

E. Measurement of the degree of enrichment, due to air elutriation, of asbestos in the lightest fractions of the dust from commercial

F. Development of a method based on the combination of x-ray diffraction, chemical reactivity, and microscopy for the estimation of the chrysotile and tremolite contents of consumer products (these two being the only asbestiform minerals encountered in all the American products examined so far, with only one possible exception), and application of the method to the analysis of about 200 standard store-purchased specimens.

G. Investigation of alternative analytical methods, viz., differential thermal analysis and density gradient centrifugation, as alternative or supportive techniques.

Our results to date support the following conclusions:

1. The chrysotile that is found in commercial talcs is generally different in significant respects from the chrysotile that occurs as massive, fibrous growths in veins in serpentine rocks. That is, the former has diffraction peaks that may differ from the latter by as much as 0.2 A (at 7.3 A); it is more reactive toward dilute acids; it shows a different appearance under the microscope; and its DTA endotherms and exotherm are shifted relative to those of the latter (and apparently diminished).

2. The presence of chrysotile as a minor constituent in talc may be established with reasonable certainty on the basis of (a) the presence of x-ray diffraction peaks in the vicinity of 7.23 to 7.43 A and 3.59 to 3.65 A, (b) the pronounced weakening or complete disappearance of these peaks upon treatment ~~upon treatment~~ of the specimen with 1 M HCl at 80°C for 1 hour, (c) the presence of fiber bundles of visible size under 250× or higher magnification in the optical microscope which show a refractive index of about 1.54 (these fiber bundles may be short and straight, and may be coated with a bumpy encrustation of $MgCO_3$, or may be embedded in talc or other particles), and (d) the presence of fibers under the electron microscope which yield an electron diffraction pattern that corresponds in d-values to those found in the x-ray diffraction pattern (these fibers typically do not have a hollow central capillary running through them).

3. The concentration of chrysotile in a talc may be estimated by measuring the area under the x-ray diffraction peak at about 7.3 A [illegible] that of an internal standard. The best internal standard

is calcium oxalate monohydrate (peak at 5.83 A).

4. The quantitative results are conditioned by the fact that segregation effects in talc powders are considerable; the analytical method gives a reproducibility of ±2 to 3% average deviation in replicate determinations on the same sample, but different samples from the same bulk container are found to vary by as much as 200%.

5. The quantitative results are further complicated by the fact that antigorite gives an x-ray pattern that is indistinguishable from that of chrysotile. The HCl treatment specified above does not affect ground antigorite, but it is not yet known whether antigorite, if it occurs in talc, has the same chemical reactivity as the ground material from massive antigorite, or whether (like chrysotile) its properties may be variable depending upon the rock matrix in which it is found.

6. Subject to the qualifications inherent in the above, we have obtained quantitative estimates of the chrysotile contents of about 200 commercial talcum powder specimens. We have also determined the contents of the other minerals in these products, including tremolite, quartz, chlorite, dolomite, and others. There is no ambiguity in the identification of these latter species, but the quantitative results for these are also affected by the segregation problem, which is most serious for those constituents present in the smallest amounts.

7. Most of the commercial talcs tested are free of any detectable amount of any of the asbestiform minerals, according to the criteria enumerated above. Thus, there appears to be an adequate supply of talc for which there is no ambiguity about the absence of chrysotile or tremolite. In about 10% of the samples tested, there appear to be definitely detectable amounts of either chrysotile or tremolite present.

L. J. Lewis

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TABLE II

INTERLABORATORY COMPARISON OF ANALYTICAL RESULTS FOR TREMOLITE IN COSMETIC TALCUM-TYPE POWDERS

	RESULTS		
SAMPLE NO.	N.Y.U. (X-RAY DIFFRACTION)	FDA[a] (OPTICAL MICROSCOPY)	PFIZER[b] (X-RAY DIFFRACTION)
1	n.d. (not detected)		
2	n.d.		
3	n.d.		
4	n.d.		
5	n.d.		
6	n.d.		
7	n.d.		
8	n.d.		
9	n.d.		
10	n.d.		
11	n.d.		
12	n.d.		
13	n.d.		
14	n.d.		
15	n.d.		
16	--[c]		
17	n.d.		
18	n.d.		
19	n.d.		
20	n.d.		
21	n.d.		
22	n.d.		

SAMPLE NO.	RESULTS N.Y.U. (X-RAY DIFFRACTION)	FDA (OPTICAL MICROSCOPY)	PFIZER (X-RAY DIFFRACTION)
23	n.d.		
24	n.d.		
25	n.d.		
26	n.d.		
27	n.d.		
28	n.d.		
29	n.d.		
30	n.d.		
31	n.d.		
32	n.d.		
33	n.d.		
34	n.d.		
35	n.d.		
36	n.d.		
37	n.d.		
38	n.d.		
39	n.d.		
40	n.d.		
41	n.d.		
42	n.d.		
43	n.d.		
44	--		
45	n.d.		
46	n.d.		
47	n.d.		
48	n.d.		

SAMPLE NO.	RESULTS N.Y.U. (X-RAY DIFFRACTION)	FDA (OPTICAL MICROSCOPY)	PFIZER (X-RAY DIFFRACTION)
49	n.d.		
50	n.d.		
51	n.d.		
52	n.d.		
53	n.d.		
54	n.d.		
55	n.d.		
56	n.d.		
57	n.d.		
58	n.d.	n.d.	
59	n.d.		
60	n.d.	n.d.	
61	n.d.	n.d.	
62	n.d.		
63	5%	moderate amount	
64	n.d.		
65	n.d.		
66	n.d.		
67	2%		
68	n.d.		
69	n.d.		
70	n.d.	small amount	
71	3%	n.d.	
72	n.d.	n.d.	
73	n.d.		
74	n.d.	small amount	

SAMPLE NO.	RESULTS N.Y.U. (X-RAY DIFFRACTION)	FDA (OPTICAL MICROSCOPY)	PFIZER (X-RAY DIFFRACTION)
75	n.d.		
76	5%		
77	3%	small amount	
78	5%	moderate amount	
79	n.d.		
80	n.d.	n.d.	
81	n.d.		
82	n.d.		
83	n.d.		
84	n.d.		
85	n.d.	n.d.	
86	n.d.		
87	n.d.	n.d.	
88	4%	large amount	
89	5%	large amount	1.6%
90	3%	large amount	
91	n.d.		
92	5%	large amount	
93	5%	large amount	
94	4%	large amount	1.9%
95	2%		
96	8%	moderate amount	0.7%
97	12%	large amount	8.1%
98	n.d.		
99	n.d.	n.d.	
100	n.d.	very small amount	

SAMPLE NO.	RESULTS		
	N.Y.U. (X-RAY DIFFRACTION)	FDA (OPTICAL MICROSCOPY)	PFIZER (X-RAY DIFFRACTION)
101	15%	large amount	10 to 15%
102	10%	large amount	
103	n.d.		
104	n.d.		
105	n.d.		
106	n.d.		
107	n.d.	n.d.	
108	2%		
109	2%		
110	n.d.		
111	1%		
112	n.d.		
113	n.d.		
114	n.d.		
115	n.d.		
116	n.d.		
117	n.d.		
118	n.d.		
119	n.d.		
120	n.d.		
121	n.d.		
122	n.d.		
123	n.d.		
124	n.d.		
125	n.d.		
126	n.d.		

SAMPLE NO.	RESULTS N.Y.U. (X-RAY DIFFRACTION)	FDA (OPTICAL MICROSCOPY)	PFIZER (X-RAY DIFFRACTION)
127	n.d.		
128	n.d.		
129	n.d.		
130	trace		
131	trace		
132	n.d.		
133	n.d.		
134	n.d.		
135	n.d.		
136	n.d.		
137	n.d.		
138	n.d.		
139	n.d.		
140	n.d.		
141	n.d.		
142	n.d.		
143	5%		
144	5%		
145	n.d.		
146	n.d.		
147	n.d.		
148	2%	small amount	
149	8%	present	
150	n.d.		
151	n.d.		
152	n.d.	n.d.	

SAMPLE NO.	RESULTS		
	N.Y.U. (X-RAY DIFFRACTION)	FDA (OPTICAL MICROSCOPY)	PFIZER (X-RAY DIFFRACTION)
153	n.d.		
154	2%	small amount	approx. 0.5%
155	n.d.		
156	2%		
157	6%		
158	n.d.		
159	n.d.		
160	n.d.		
161	n.d.		
162	n.d.		
163	10%	large amount	3.8%
164	n.d.	n.d.	
165	n.d.		
166	n.d.		
167	2%		
168	--		
169	--		
170	n.d.		
171	n.d.		
172	2%		
173	n.d.		
174	n.d.		
175	n.d.		
176	n.d.		
177	n.d.		
178	n.d.		

SAMPLE NO.	RESULTS N.Y.U. (X-RAY DIFFRACTION)	FDA (OPTICAL MICROSCOPY)	PFIZER (X-RAY DIFFRACTION)
179	n.d.		
180	n.d.		
181	n.d.		
182	n.d.		
183	1%		
184	3%		
185	n.d.		
186	n.d.		
187	2%		
188	1%		
189	1%		
190	n.d.		
191	n.d.		
192	n.d.		
193	n.d.		
194	n.d.		
195	n.d.		

Footnotes:

a. Work done by Mr. Arnold E. Schulze, Division of Microbiology. (See Appendix A)
b. Pfizer, Inc.; Minerals, Pigments, and Metals Division, Easton, Pa.
c. The use of a dash means that the powder does not contain talc and therefore is not expected to contain tremolite or chrysotile as contaminants. No asbestos was found.

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TABLE III

INTERLABORATORY COMPARISON OF ANALYTICAL RESULTS FOR CHRYSOTILE IN COSMETIC TALCUM-TYPE POWDERS

SAMPLE NO.	RESULTS				
	N.Y.U. (X-RAY DIFF.)	FDA (OPT. MICR.)	PFIZER[a] (X-RAY DIFF.)	COLUMBIA SCIENTIFIC[b]	HPB[c]
1	n.d. (not detected)				
2	n.d.				
3	n.d.				
4	n.d.				
5	n.d.				
6	n.d.				
7	?				
8	n.d.				
9	n.d.				
10	n.d.				
11	n.d.				
12	n.d.				
13	n.d.				
14	n.d.				
15	n.d.				
16	--				
17	n.d.				
18	n.d.				
19	n.d.				
20	n.d.				
21	n.d.				
22	n.d.				

AMPLE NO.	RESULTS N.Y.U. (X-RAY DIFF.)	FDA (OPT. MICR.)	PFIZER[a] (X-RAY DIFF.)	COLUMBIA SCIENTIFIC[b]	HPB[c]
23	?				
24	n.d.				
25	?				
26	?				
27	n.d.				
28	n.d.				
29	n.d.				
30	n.d.				
31	n.d.				
32	n.d.				
33	n.d.				
34	n.d.				
35	n.d.				
36	n.d.				
37	n.d.				
38	n.d.				
39	n.d.				
40	n.d.				
41	n.d.				
42	n.d.				
43	n.d.				
44	--				
45	n.d.				
46	n.d.				
47	n.d.				
48	n.d.				

SAMPLE NO.	RESULTS N.Y.U. (X-RAY DIFF.)	FDA (OPT. MICR.)	PFIZER[a] (X-RAY DIFF.)	COLUMBIA SCIENTIFIC[b]	HPB[c]
49	n.d.				
50	n.d.				
51	n.d.				
52	n.d.				
53	n.d.				
54	?				
55	n.d.				
56	n.d.				
57	n.d.				
58	n.d.	n.d.			
59	n.d.				
60	n.d.	n.d.			
61	n.d.	n.d.			
62	n.d.				
63	n.d.	n.d.			
64	n.d.				
65	n.d.				
66	2%				
67	n.d.				
68	n.d.				
69	n.d.				
70	n.d.	n.d.			
71	n.d.	n.d.			
72	n.d.	n.d.			
73	n.d.				
74	n.d.	n.d.			

SAMPLE NO.	RESULTS N.Y.U. (X-RAY DIFF.)	FDA (OPT. MICR.)	PFIZER[a] (X-RAY DIFF.)	COLUMBIA SCIENTIFIC[b]	HPB[c]
75	n.d.				
76	n.d.				
77	n.d.	n.d.			
78	n.d.	n.d.			
79	n.d.				
80	?	n.d.			
81	?				
82	?				
83	?				
84	?				
85	?	n.d.			
86	?				
87	?	n.d.			
88	5%	n.d.			
89	5%	n.d.	n.d.	inconclusive	
90	5%	possible, in talc grains			
91	5%				
92	5%	possible, in talc grains			
93	4%				
94	?	much antigorite[d] ?	n.d.	inconclusive	
95	3%				
96	10%	possible, in talc grains	n.d.	inconclusive	<0.1%
97	15%	moderate antigorite?	n.d.	inconclusive	

AMPLE NO.	RESULTS N.Y.U. (X-RAY DIFF.)	FDA (OPT. MICR.)	PFIZER[a] (X-RAY DIFF.)	COLUMBIA SCIENTIFIC[b]	HPB[c]
98	n.d.				
99	n.d.	n.d.			
100	n.d.	possible, in talc grains			
101	n.d.	much . antigorite?	n.d.	n.d.	
102	7%	n.d.			
103	n.d.				
104	n.d.				
105	n.d.				
106	n.d.				
107	n.d.	n.d.			
108	n.d.				
109	?				
110	n.d.				
111	n.d.				
112	n.d.				
113	n.d.				
114	n.d.				
115	n.d.				
116	n.d.				
117	?				
118	n.d.				
119	n.d.				
120	?				
121	n.d.				
122	?				

AMPLE NO.	RESULTS N.Y.U. (X-RAY DIFF.)	FDA (OPT. MICR.)	PFIZER[a] (X-RAY DIFF.)	COLUMBIA SCIENTIFIC[b]	HPB[c]
123	?				
124	?				
125	?				
126	n.d.				
127	n.d.				
128	n.d.				
129	n.d.				
130	Trace				
131	n.d.				
132	n.d.				
133	n.d.				
134	n.d.				
135	n.d.				
136	n.d.				
137	n.d.				
138	n.d.				
139	n.d.				
140	n.d.				
141	n.d.				
142	n.d.				
143	10%				
144	?				
145	2%				
146	n.d.				
147	n.d.				
148	n.d.	n.d.			

AMPLE NO.	RESULTS N.Y.U. (X-RAY DIFF.)	FDA (OPT. MICR.)	PFIZER[a] (X-RAY DIFF.)	COLUMBIA SCIENTIFIC[b]	HPB[c]
149	?	n.d.			
150	n.d.				
151	n.d.				
152	n.d.	n.d.			
153	n.d.				
154	n.d.	n.d.	0.1%[e]	n.d.	
155	?				
156	n.d.				
157	8%				
158	n.d.				
159	?				
160	trace				
161	n.d.				
162	n.d.				
163	10%	n.d.	n.d.	inconclusive	n.d.
164	1%	possible, in talc grains			
165	?				
166	?				
167	n.d.				
168	--				
169	--				
170	8%				
171	n.d.				
172	n.d.				
173	?				
174	n.d.				

SAMPLE NO.	RESULTS N.Y.U. (X-RAY DIFF.)	FIA (OPT. MICR.)	PFIZER[a] (X-RAY Diff.)	COLUMBIA SCIENTIFIC[b]	HPB[c]
175	?				
176	?				
177	n.d.				
178	?				
179	n.d.				
180	n.d.				
181	n.d.				
182	?				
183	?				
184	n.d.				
185	n.d.				
186	?				
187	n.d.				
188	?				
189	n.d.				
190	?				
191	n.d.				
192	n.d.				
193	?				
194	?				
195	n.d.				

Footnotes:

a. Pfizer, Inc., Minerals, Pigments, and Metals Division, Easton, Pa.
b. Columbia Scientific Industries, Austin, Texas, using Differential Thermal Analysis.
c. Health Protection Branch of Canadian Government, Ottawa, by electron microscopy, oral communication by Drs. Pontefract and Cunningham.
d. Antigorite is a non-fibrous form of the same mineral as chrysotile.
e. By transmission electron microscopy.

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TABLE IV

KEY TO SAMPLE NUMBERS OF COSMETIC TALCUM-TYPE POWDERS

AMPLE NO.	PRODUCT NAME	FURTHER IDENTIFICATION
1	Ammens Powder, Medicated	Bristol-Myers (No. IF25)
2	Amolin Deodorant Powder	Norwich
3	Aquamarine Cooling Spray Bath Powder	Revlon (143)
4	Bagatelle Amber Dusting Powder	Corand (DCH)
5	Bourjois Bath Powder	
6	Caldesene Medicated Powder	Pennwalt (5274)
7	Cashmere Bouquet Body Powder	Colgate-Palmolive
8	Chanel No. 5 Bath Powder	
9	Countess Rocheau Cake Dusting Powder	Jergens
10	Crepe De Chine Dusting Powder, Millot	House of Fragrance (L1132)
11	Crepe De Chine Poudre Mist, Millot	House of Fragrance
12	Cuticura Talcum Powder	Purex (07170)
13	Desenex	WTS-Pharmacraft
14	Desitin Baby Powder	Pfizer (1139Z) (3/29/72)
15	Desitin Baby Powder	Pfizer (115A) (5/10/72)
16	Diaperene Baby Powder	Breon (E1030)
17	Dorothy Gray "Secret Of The Sea" Dusting Powder	
18	Emeraude Talcum Powder	Coty (355-4010)
19	English Leather	Mem
20	Faberge "Music" Dusting Powder	(2891)
21	Friendship Garden Dusting Powder	Shulton (3/27/72)
22	Friendship Garden Dusting Powder	Shulton (5/9/72)
23	Friendship Garden Dusting Powder	Shulton (7/13/72)

PLE O.	PRODUCT NAME	FURTHER IDENTIFICATION
4	Heaven Sent Aerosol Bath Powder Mist	Rubinstein
5	Heaven Sent Bath Powder	Rubinstein
16	Helen Pressl "Little Lady"	
17	Importa, Spain Mens' Talc	
28	Isis Floral Talcum Powder	
29	Johnson's Baby Powder	(028Q)
30	Johnson and Johnson Medicated Powder	(3612)
31	Koscot Beauty Dust--Oil of Mink	
32	Lanvin Arpege Dusting Powder	(1288)
33	Lanvin Arpege Powdered Mist	
34	Lanvin Arpege Talc	
35	Lewis Baby Powder	
36	Loves Fresh Lemon Glossy Powder	Manley & James
37	Macy's Scented Borated Talcum	
38	Macy's Talcum, Apple	(2K4)
39	Marcelle Dusting Powder, Hypo-Allergenic	
40	Mary Chess Perfumed Dusting Powder	
41	Mennen Baby Magic Powder	(B112)
42	Mennen Quinsana Foot Powder	(H202)
43	Merck Talc, Product No. 6460, Lot No. 6460)	(8039301)
44	Mexsana 2387-D Medicated Powder	Plough
45	Old Spice Body Talcum	Shulton
46	Persian Lilac Deluxe Dusting Powder	April Showers (LFN)
47	Persian Lilac Spray Bath Powder	April Showers (B200B)
48	Pond's Perfumed Talc Body Deodorant Dream Flower	(115B)
49	Prince Matchabelli Beloved Spray Powder	

MPLE NO.	PRODUCT NAME	FURTHER IDENTIFICATION
50	Quest Deodorant Powder	
51	Replique Spray Bath Powder	Parfums Raphael (004)
52	Riviana Foods - Italian Stearin Talc	For Rice
53	September Morn By Pond's	(19B)
54	Seven Winds After Bath Talc	DuBarry (021085)
55	U S P Talc	
56	Vaseline Intensive Care Baby Powder	(I 209)
57	Yves Saint Laurent Rive Gauche Spray Talc	
58	Z B T Baby Powder	(F1021)
59	Zeasorb Super Absorbent Medicated Powder	Stiefel
60	Ambush-Dana Dusting Powder	
61	April Showers	(9884)
62	Avon Unforgettable Perfumed Talc	
63	Beloved Perfumed Dusting Powder, Prince Matchabelli	
64	Coty Face Powder Rachel	
65	Desert Flower Spray Bath Powder	Shulton (F 1 BKI)
66	Emeraude Dusting Powder	Coty
67	Emeraude Spray Dusting Powder	Coty (1 AEY)
68	Fabergé Flambeau Deodorant Spray Powder	(37 WBF)
69	Jean Naté Spray Bath Powder	(1 N 247)
70	Jeris Talc, Flesh	
71	Jolie Madame Dusting Powder, Balmain	
72	Lady Esther Face Powder, Rachel	
73	Max Factor Face Powder, Rachelle	
74	Medicated Comfort Powder	Parke-Davis
75	OH! de London Talc	Yardley (498)

MPLE NO.	PRODUCT NAME	FURTHER IDENTIFICATION
76	To Know Me Is To Love Me - Tinkerbell	Tom Fields, Ltd.
77	Touch And Glow Face Powder, Creamy Peach	Revlon
78	Toujours Moi Bath Powder	Corday
79	Yardley April Violets	(4908)
80	Chantilly Dusting Powder	Houbigant (11F)
81	Cashmere Bouquet	
82	Jean Naté Talc	(on 345)
83	Mennen Shave Talc	(B 81)
84	Shower To Shower Body Powder	Johnson & Johnson (5507BG)
85	Pure Baby Powder, Dart Drug	(K 11C)
86	Pond's Dream Flower Perfumed Talc	(O 13D)
87	Almay Hypo-Allergenic Face Powder	
88	Constance Carroll, Bouquet Talc	
89	Djer-Kiss Talcum	Kerkoff
90	Flamingo Dusting Powder, Tussy	(L1047)
91	Lander Lilacs And Roses Talc	
92	Mavis Talcum	Vivaudou
93	Mavis Body Powder	Vivaudou
94	Tangee	Luft-Tangee
95	ZBT Baby Powder	(B0048)
96	Blanchard's Dusting Powder	
97	Born Wild Dusting Powder	Del Labs
98	Lander Gardenia And Sweet Pea Talc	
99	Lander Lilacs And Roses Deodorant Body Talc	
100	Miss Dior Dusting Powder	
101	Tai Winds Spray Talc	(Avon (DCC 1272 2-14-72,HWS)

MPLE NO.	PRODUCT NAME	FURTHER IDENTIFICATION
02	Tosca Dusting Powder	
03	Coty L'Aimant Talcum Powder	(1JJ)
04	Coty Emeraude Talcum Powder	(01A)
05	Coty L'Aimant Dusting Powder	(1M)
06	Coty Imprévu Dusting Powder	(1DE)
07	Coty Muguet des Bois Dusting Powder	(2DO)
08	Revlon Intimate Perfumed Bath Powder	(241)
109	Jean Naté Bath Powder	Lanvin - Charles of the Ritz (2137)
110	Jean Naté Spray Bath Powder	Lanvin - Charles of the Ritz (2103)
111	Old Spice Body Talc	Shulton, Inc. (MFO)
112	Dr. Scholl's Foot Powder	(20517)
113	Faberge Xanadu Luxury Bath Powder Spray	(Y1)
114	Faberge Zizanie de Fragonard	(2132) Ref. 61159-019
115	Faberge Tigress Bath Powder	Ref. 2052-003
116	Faberge Woodhue for Men	Ref. 5027 (0252)
117	Faberge Brut for Men Shower Buff All-Over Body Powder	Ref. 5400
118	Faberge Talc	(raw material: from France)
119	Faberge Aphrodesia Bath Powder	Ref. 2052 (2172)
120	Faberge Straw Hat Bath Powder	
121	Faberge Aphrodesia for Men Shower Buff	Ref. 5027
122	Faberge Xanadu de Luxe Bath Powder	Ref. 1244-028 (2342)
123	Faberge Woodhue Bath Powder	Ref. 2052-002
124	Faberge Music Dusting Powder	Ref. 0714-018 (3121)
125	Faberge Flambeau Bath Powder	Ref. 2052 (3471)

AMPLE NO.	PRODUCT NAME	FURTHER IDENTIFICATION
126	Mennen Baby Magic	
127	Walgreen's Crib Age	
128	Caldesene Medicated Powder	
129	Desiten	
130	Vaseline Intensive Care	
131	Johnson and Johnson Medicated Powder	
132	Johnson Baby Powder	
133	Johnson's Baby Powder	(108T)
134	Johnson's Baby Powder	(109T)
135	Johnson and Johnson Medicated Powder	(0452K)
136	Johnson and Johnson Shower to Shower Body Powder	(C 512Z)
137	Johnson and Johnson Shower to Shower Body Powder	(0709X1)
138	Johnson and Johnson Shower to Shower Body Powder	(0872K)
139	Avon Brocade Spray	(31602)
140	Avon Bird of Paradise Spray	(B1652)
141	Avon Tai Winds Spray Talc	(4065)
142	Mennen Bath Talc	(A308)
143	Pin-Zow Talque	Perfection Beauty Products, Inc., Pearl River, N.Y.
144	Overton's "High-Brown" Face Powder	
145	Softee Face Powder	
146	Westport Face Powder	
147	Hazel Bishop Pressed Powder	
148	Lady Wayne Face Powder	
149	Solitaire Cake Makeup	
150	Dreamglo Pressed Powder	

MPLE NO.	PRODUCT NAME	FURTHER IDENTIFICATION
151	Early American Old Spice Talcum Powder	
152	Corsage Dusting Powder	Lander
153	Ammens Powder, Medicated	
154	Bismoline Medicated Powder	
155	Rite Aid Pure Baby Powder	
156	Warner Pure Baby Powder	
157	Mavis Imported Talcum	
158	Avon Brocade Perfumed Talc	
159	Avon Blue Lotus Perfumed Talc	
160	Avon Beauty Dust Refill - Charisma	
161	Avon Elusive Beauty Dust Refill	
162	Avon Regence Perfumed Talc	
163	Pinaud Clubman Talc	
164	Grand Union Baby Powder	(101672)
165	Cashmere Bouquet	(4212DX) (Supplied by Mfgr.)
166	Almay Face Powder, Soft Beige	(List No. 719, Lot 201, Supplied by Mfgr.)
167	Tawny Tone Body Talc From Black Heritage	(Beauty Mustus, Inc. Greenwich, Conn.)
168	Colgate Tooth Powder	
169	Dr. Lyon's Tooth Powder	
170	"C" Bouquet Talc.	(Winarick, Inc. Distr. by F. W. Woolworth)(2662)
171	Tangee Dusting Powder	(George W. Luft Co.)(2762)
172	Jeris Talc	(Winarick) (2732)
173	Corsage Dusting Powder	(Lander Co.)
174	Lander Gardenia & Sweet Pea Deodorant Body Talc	

AMPLE NO.	PRODUCT NAME	FURTHER IDENTIFICATION
175	Lander Baby Powder	
176	Lander Lilac & Roses Body Talc	
177	Beloved Perfumed Dusting Powder	Prince Matchabelli (235A)
178	Jean Naté Talc No. 60	(2264)
179	Jean Naté Spray Bath Powder	(2101)
180	Tinkerbell Body Talc	(Tom Fields, Ltd., Div. of MEM)
181	Yardley Sigh Shadow Brush-On Eye Shadow	Ref. No. 721
182	Max Factor Face Powder, Rachelle	(Supplied by Mfgr.)
183	Tweed Bath Powder, Lentheric	(Yardley)(44)
184	Yardley Next to Nature Sheer Pressed Powder	(A2)
185	Yardley April Violets Dusting Powder	(162)
186	Yardley Red Roses Dusting Powder	(165)
187	Yardley Springflowers Talc	(260)
188	Yardley White Lavender Talc	(271)
189	Yardley Red Roses Talc	(214)
190	April Showers Deodorant Talc	Ref. No. 9882
191	Chantilly Houbigant Dusting Powder	(2JBB)
192	Tinkerbell Dusting Powder	(Tom Fields, Ltd.)
193	Tinkerbell Powder Mitt	(Tom Fields, Ltd.)
194	Tinkerbell Dusting Powder	(Tom Fields, Ltd.)
195	Tinkerbell Body Talc	(Tom Fields, Ltd.)