

# MEMORANDUM

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

RAL  
7/31/73

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

SUBJECT: 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.

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EXHIBIT  
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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 considered 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 tremolite. 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, Ph.D.

Enclosures

FINAL REPORT

*Levin*

X-RAY POWDER DIFFRACTION ANALYSES OF COMMERCIAL COSMETIC POWDERS

| <u>Sample</u> | <u>Talc</u> | <u>Chlorite</u> | <u>Phlogo-<br/>pite</u> | <u>a-<br/>Quartz</u> | <u>Dolo-<br/>mite</u> | <u>Calcite</u> | <u>Trem-<br/>olite</u> | <u>Chryso-<br/>tile</u> | <u>Other<br/>Species</u> |
|---------------|-------------|-----------------|-------------------------|----------------------|-----------------------|----------------|------------------------|-------------------------|--------------------------|
| 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,<br>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,<br>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.                    |                          |

| <u>sample</u> | <u>Talc</u> | <u>Chlorite</u> | <u>Phlogo-<br/>pite</u> | <u>a-<br/>Quartz</u> | <u>Dolo-<br/>mite</u> | <u>Calcite</u> | <u>Trem-<br/>olite</u> | <u>Chryso-<br/>tile</u> | <u>Other<br/>Species</u> |
|---------------|-------------|-----------------|-------------------------|----------------------|-----------------------|----------------|------------------------|-------------------------|--------------------------|
| 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.                    |                          |

| <u>sample</u> | <u>Talc</u> | <u>Chlorite</u> | <u>Phlogo-<br/>pite</u> | <u>Quartz</u> | <u>Dolo-<br/>nite</u> | <u>Calcite</u> | <u>Trem-<br/>olite</u> | <u>Chryso-<br/>tile</u> | <u>Other<br/>Species</u> |
|---------------|-------------|-----------------|-------------------------|---------------|-----------------------|----------------|------------------------|-------------------------|--------------------------|
| 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,<br>Mica          |
| 99            | ca. 40%     | n.d.            | 3%                      | n.d.          | 6%                    | 2%             | n.d.                   | n.d.                    | Kaolin,<br>Mica          |
| 100           | ca. 80      | 10%             | 4%                      | n.d.          | 2%                    | n.d.           | n.d.                   | n.d.                    | ZnStear.                 |
| 101           | 63%         | 8%              | 3%                      | 7%            | 4%                    | n.d.           | 15%                    | n.d.                    |                          |
| 102           | 63%         | 2%              | n.d.                    | 3%            | 15%                   | n.d.           | 10%                    | 7%                      |                          |
| 103           | 93%         | 3%              | n.d.                    | n.d.          | 4%                    | n.d.           | n.d.                   | n.d.                    |                          |
| 104           | 91%         | 3%              | 1%                      | 2%            | 3%                    | n.d.           | n.d.                   | n.d.                    |                          |

| <u>sample</u> | <u>Talc</u> | <u>Chlorite</u> | <u>Phlogo-<br/>pite</u> | <u>Quartz</u> | <u>Dolo-<br/>mite</u> | <u>Calcite</u> | <u>Tram-<br/>olite</u> | <u>Chryse-<br/>tile</u> | <u>Other<br/>Species</u>      |
|---------------|-------------|-----------------|-------------------------|---------------|-----------------------|----------------|------------------------|-------------------------|-------------------------------|
| 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<br>Ac., 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.<br>MgCO <sub>3</sub> |
| 40            | ca. 85%     | n.d.            | n.d.                    | 2%            | 1%                    | n.d.           | n.d.                   | n.d.                    | ZnStear.<br>MgCO <sub>3</sub> |

| <u>Sample</u> | <u>Talc</u> | <u>Chlorite</u> | <u>Phlogopite</u> | <u>Quartz</u> | <u>Dolomite</u> | <u>Calcite</u> | <u>Tremolite</u> | <u>Chrysotile</u> | <u>Other Species</u>          |
|---------------|-------------|-----------------|-------------------|---------------|-----------------|----------------|------------------|-------------------|-------------------------------|
| 141           | 80%         | n.d.            | n.d.              | 2%            | 1%              | n.d.           | n.d.             | n.d.              | ZnStear,<br>MgCO <sub>3</sub> |
| 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.<br>Kaolin            |
| 145           | ca.70%      | 3%              | n.d.              | n.d.          | 3%              | n.d.           | n.d.             | 2%                | ZnStear.<br>Kaolin,<br>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<br>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,<br>Mica               |

| <u>Sample</u> | <u>Talc</u> | <u>Chlorite</u> | <u>Phlogo-<br/>nite</u> | <u>Quartz</u> | <u>Dolo-<br/>mite</u> | <u>Calcite</u> | <u>Trem-<br/>olite</u> | <u>Chryso-<br/>tile</u> | <u>Other<br/>Species</u> |
|---------------|-------------|-----------------|-------------------------|---------------|-----------------------|----------------|------------------------|-------------------------|--------------------------|
| 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 Å (at 7.3 Å); 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 Å and 3.59 to 3.65 Å, (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 250X 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  $\text{MgC}_2\text{O}_3$ , 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 Å to that of an internal standard. The best internal standard

is calcium oxalate monohydrate (peak at 5.83 Å).

4. The quantitative results are conditioned by the fact that segregation effects in talc powders are considerable; the analytical method gives a reproducibility of  $\pm 2$  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.

*S. J. Levin*

TABLE II

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

| SAMPLE NO. | RESULTS                         |                                          |                                            |
|------------|---------------------------------|------------------------------------------|--------------------------------------------|
|            | N. Y. U.<br>(X-RAY DIFFRACTION) | FDA <sup>a</sup><br>(OPTICAL MICROSCOPY) | PFIZER <sup>b</sup><br>(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         | -- <sup>c</sup>                 |                                          |                                            |
| 17         | n.d.                            |                                          |                                            |
| 18         | n.d.                            |                                          |                                            |
| 19         | n.d.                            |                                          |                                            |
| 20         | n.d.                            |                                          |                                            |
| 21         | n.d.                            |                                          |                                            |
| 22         | n.d.                            |                                          |                                            |

| SAMPLE NO. | RESULTS                         |                             |                               |
|------------|---------------------------------|-----------------------------|-------------------------------|
|            | N. Y. U.<br>(X-RAY DIFFRACTION) | FDA<br>(OPTICAL MICROSCOPY) | PFIZER<br>(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.<br>(X-RAY DIFFRACTION) | FDA<br>(OPTICAL MICROSCOPY) | PFIZER<br>(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.<br>(X-RAY DIFFRACTION) | FDA<br>(OPTICAL MICROSCOPY) | PFIZER<br>(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.<br>(X-RAY DIFFRACTION) | FDA<br>(OPTICAL MICROSCOPY) | PFIZER<br>(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.<br>(X-RAY DIFFRACTION) | FDA<br>(OPTICAL MICROSCOPY) | PFIZER<br>(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.<br>(X-RAY DIFFRACTION) | FDA<br>(OPTICAL MICROSCOPY) | PFIZER<br>(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.<br>(X-RAY DIFFRACTION) | FDA<br>(OPTICAL MICROSCOPY) | PFIZER<br>(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.

TABLE III

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

| SAMPLE<br>NO. | RESULTS                   |                     |                                      |                                     |                  |
|---------------|---------------------------|---------------------|--------------------------------------|-------------------------------------|------------------|
|               | N. Y. U.<br>(X-RAY DIFF.) | FDA<br>(OPT. MICR.) | PFIZER <sup>a</sup><br>(X-RAY DIFF.) | COLUMBIA<br>SCIENTIFIC <sup>b</sup> | HPB <sup>c</sup> |
| 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.                      |                     |                                      |                                     |                  |

## RESULTS

| AMPLE<br>NO. | N. Y. U.<br>(X-RAY DIFF.) | FDA<br>(OPT. MICR.) | PFIZER <sup>a</sup><br>(X-RAY DIFF.) | COLUMBIA<br>SCIENTIFIC <sup>b</sup> | HPB <sup>c</sup> |
|--------------|---------------------------|---------------------|--------------------------------------|-------------------------------------|------------------|
| 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.                     |                     |                                      |                                     |                  |

## RESULTS

| SAMPLE NO. | N. Y. U.<br>(X-RAY DIFF.) | FDA<br>(OPT. MICR.) | PFIZER <sup>a</sup><br>(X-RAY DIFF.) | COLUMBIA<br>SCIENTIFIC <sup>b</sup> | HPB <sup>c</sup> |
|------------|---------------------------|---------------------|--------------------------------------|-------------------------------------|------------------|
| 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.               |                                      |                                     |                  |

## RESULTS

| SAMPLE NO. | N. Y. U.<br>(X-RAY DIFF.) | FDA<br>(OPT. MICR.)               | PFIZER <sup>a</sup><br>(X-RAY DIFF.) | COLUMBIA<br>SCIENTIFIC <sup>b</sup> | HPB <sup>c</sup> |
|------------|---------------------------|-----------------------------------|--------------------------------------|-------------------------------------|------------------|
| 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<br>talc grains       |                                      |                                     |                  |
| 91         | 5%                        |                                   |                                      |                                     |                  |
| 92         | 5%                        | possible, in<br>talc grains       |                                      |                                     |                  |
| 93         | 4%                        |                                   |                                      |                                     |                  |
| 94         | ?                         | much<br>antigorite <sup>d</sup> ? | n.d.                                 | inconclusive                        |                  |
| 95         | 3%                        |                                   |                                      |                                     |                  |
| 96         | 10%                       | possible, in<br>talc grains       | n.d.                                 | inconclusive                        | <0.1%            |
| 97         | 15%                       | moderate<br>antigorite?           | n.d.                                 | inconclusive                        |                  |

## RESULTS

| AMPLE<br>NO. | N. Y. U.<br>(X-RAY DIFF.) | FDA<br>(OPT. MICR.)         | PFIZER <sup>a</sup><br>(X-RAY DIFF.) | COLUMBIA<br>SCIENTIFIC <sup>b</sup> | HPB <sup>c</sup> |
|--------------|---------------------------|-----------------------------|--------------------------------------|-------------------------------------|------------------|
| 98           | n. d.                     |                             |                                      |                                     |                  |
| 99           | n. d.                     | n. d.                       |                                      |                                     |                  |
| 100          | n. d.                     | possible, in<br>talc grains |                                      |                                     |                  |
| 101          | n. d.                     | much<br>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          | ?                         |                             |                                      |                                     |                  |

## RESULTS

| AMPLE<br>NO. | N. Y. U.<br>(X-RAY DIFF.) | FDA<br>(OPT. MICR.) | PFIZER <sup>a</sup><br>(X-RAY DIFF.) | COLUMBIA<br>SCIENTIFIC <sup>b</sup> | HPB <sup>c</sup> |
|--------------|---------------------------|---------------------|--------------------------------------|-------------------------------------|------------------|
| 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.               |                                      |                                     |                  |

## RESULTS

| AMPLE<br>NO. | N. Y. U.<br>(X-RAY DIFF.) | FDA<br>(OPT. MICR.)         | PFIZER <sup>a</sup><br>(X-RAY DIFF.) | COLUMBIA<br>SCIENTIFIC <sup>b</sup> | HPB <sup>c</sup> |
|--------------|---------------------------|-----------------------------|--------------------------------------|-------------------------------------|------------------|
| 149          | ?                         | n. d.                       |                                      |                                     |                  |
| 150          | n. d.                     |                             |                                      |                                     |                  |
| 151          | n. d.                     |                             |                                      |                                     |                  |
| 152          | n. d.                     | n. d.                       |                                      |                                     |                  |
| 153          | n. d.                     |                             |                                      |                                     |                  |
| 154          | n. d.                     | n. d.                       | 0.1% <sup>e</sup>                    | 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<br>talc grains |                                      |                                     |                  |
| 165          | ?                         |                             |                                      |                                     |                  |
| 166          | ?                         |                             |                                      |                                     |                  |
| 167          | n. d.                     |                             |                                      |                                     |                  |
| 168          | --                        |                             |                                      |                                     |                  |
| 169          | --                        |                             |                                      |                                     |                  |
| 170          | 8%                        |                             |                                      |                                     |                  |
| 171          | n. d.                     |                             |                                      |                                     |                  |
| 172          | n. d.                     |                             |                                      |                                     |                  |
| 173          | ?                         |                             |                                      |                                     |                  |
| 174          | n. d.                     |                             |                                      |                                     |                  |

## RESULTS

| SAMPLE NO. | N. Y. U.<br>(X-RAY DIFF.) | FDA<br>(OPT. MICR.) | PFIZER <sup>a</sup><br>(X-RAY Diff.) | COLUMBIA<br>SCIENTIFIC <sup>b</sup> | HPB <sup>c</sup> |
|------------|---------------------------|---------------------|--------------------------------------|-------------------------------------|------------------|
| 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:

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

TABLE IV

## KEY TO SAMPLE NUMBERS OF COSMETIC TALCUM-TYPE POWDERS

| <u>SAMPLE NO.</u> | <u>PRODUCT NAME</u>                             | <u>FURTHER IDENTIFICATION</u> |
|-------------------|-------------------------------------------------|-------------------------------|
| 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                | Diaparene 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<br>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<br>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<br>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<br>NO. | PRODUCT NAME                                | FURTHER IDENTIFICATION       |
|-------------|---------------------------------------------|------------------------------|
| 76          | To Know Me Is To Love Me - Tinkerbelle      | 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) |

| <u>FILE NO.</u> | <u>PRODUCT NAME</u>                                      | <u>FURTHER IDENTIFICATION</u>          |
|-----------------|----------------------------------------------------------|----------------------------------------|
| 32              | Tosca Dusting Powder                                     |                                        |
| 33              | Coty L'Aimant Talcum Powder                              | (1JJ)                                  |
| 34              | Coty Emeraude Talcum Powder                              | (01A)                                  |
| 35              | Coty L'Aimant Dusting Powder                             | (1M)                                   |
| 36              | Coty Imprévu Dusting Powder                              | (1DE)                                  |
| 37              | Coty Muguet des Bois Dusting Powder                      | (2DO)                                  |
| 38              | Revlon Intimate Perfumed Bath Powder                     | (241)                                  |
| 109             | Jean Naté Bath Powder                                    | Lanvin - Charles of the Ritz<br>(2137) |
| 110             | Jean Naté Spray Bath Powder                              | Lanvin - Charles of the Ritz<br>(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<br>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)                       |

| <u>SAMPLE</u><br><u>NO.</u> | <u>PRODUCT NAME</u>                              | <u>FURTHER IDENTIFICATION</u>                          |
|-----------------------------|--------------------------------------------------|--------------------------------------------------------|
| 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,<br>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<br>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 Régence 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,<br>Supplied by Mfgr.)       |
| 167         | Tawny Tone Body Talc From Black Heritage        | (Beauty Mustus, Inc.<br>Greenwich, Conn.)           |
| 168         | Colgate Tooth Powder                            |                                                     |
| 169         | Dr. Lyon's Tooth Powder                         |                                                     |
| 170         | "C" Bouquet Talc.                               | (Winarick, Inc. Distr. by<br>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<br>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          | Tinkerbelle Body Talc                       | (Tom Fields, Ltd.,<br>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, Lenthéric                | (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          | Tinkerbelle Dusting Powder                  | (Tom Fields, Ltd.)                 |
| 193          | Tinkerbelle Powder Mitt                     | (Tom Fields, Ltd.)                 |
| 194          | Tinkerbelle Dusting Powder                  | (Tom Fields, Ltd.)                 |
| 195          | Tinkerbelle Body Talc                       | (Tom Fields, Ltd.)                 |