EXHIBIT II

JOHNS-MANVILLE RESEARCH AND ENGINEERING CENTER

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Report No. E414-6

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Title: LACK OF FOOD CONTAMINATION BY CONTACT WITH PAPER DUE TO SHIPPING

SUMMARY

The purpose of this study was first, to determine the severity of the effects of transportation on the contents of food and drug packages and second, to determine the relevance of using an artificial test to simulate the effects of actual shipping conditions. Specifically, the study was to determine whether actual shipping would cause sufficient abrasion to the containers to cause migration of part of the paper into the contents of food packages.

This study established that tremolite contained in talc used in food paper packaging does not migrate to any food substances during normal commercial shipment and handling.

Test containers of salt lined with tremolitic talc-containing paper shipped by truck from Denver to New Jersey and back caused no breakdown in the integrity of the paper and no migration of the tremolite or any other ingredient of the paper. Additionally, food packaged in tremolitic talc-containing paper purchased at a local supermarket showed no evidence of tremolite migration due to paper breakdown. This was so even though foods were chosen which were likely to have been shipped long distances and were likely to be abrasive.

It was established by the data reported in Report No. E414-2 that migration of tremolite from food packaging paper to food can only occur if some partial breakdown of the paper occurs. Migration does not occur unless the integrity of the paper is at least partially destroyed and then all of the components of the paper will migrate (be released) in the same proportion as they exist in the paper (no selective migration). This conclusion was verified by the "Scuff Test" reported in Report No. E414-2, which was questioned as possibly being more severe than actual commercial shipping conditions.

This present report establishes that the conditions established in the "Scuff Test" are indeed much more severe than actual commercial shipping conditions. Actual shipping conditions result in no migration, at least to reliable levels of identification by transmission electron microscopy, optical (petrographic) microscopy, and weight determinations.

Contents: Summary, Discussion, Conclusions, Recommendations, and Appendix.

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DISCUSSION

Introduction

Initial studies on tremolite migration from paper manufactured with tremolitic talc established that migration will only occur with partial destruction of the integrity of the paper which is in contact with the food. Without some destruction of the paper, no measurable migration occurs, i.e., there is no selective migration initiated by the abnormally severe "shaking" or "scuffing" of the packages' contents. To simulate this action, an artificial "Scuff Test" was employed which deliberately caused paper destruction. This enabled us to analyze the mechanism of migration.

The purpose of the present study was to determine the relevance of this artificial test to actual shipping conditions, as well as evaluate the severity of actual transportation. To accomplish this, specially prepared containers were sent by REA truck from Denver to Manville, New Jersey and back to Denver, a round trip of approximately 72 hours and 4,000 miles of constant truck travel. In addition, actual food commodities were purchased at a supermarket for the purpose of analyzing them for possible tremolite migration.

Actually Shipped "Controlled" Samples

Four paper lined, salt containing jars were sent by truck on their 72-hour journey. These lined jars were prepared in identical fashion to the test jars used in the artificial "Scuff Test". Four different test papers were employed, each specifically chosen because it contained tremolitic talc (they ranged from 0.25-1.0 percent talc). Two hundred grams of technical grade salt served as the food medium in each of the lined jars. Evaluation of the salt samples after shipment consisted of: (1) determining the weight of the abraded material from the paper, if any, (2) inspection for cellulose fibers, talc, tremolite, and chrysotile, by petrographic analysis, and (3) inspection for talc and asbestiform materials by Transmission Electron Microscopy (TEM). These analyses were conducted in the same fashion as were the samples that were tested by the artificial "Scuff Test" reported in Report No. E414-2, with the exception of additional analyses by TEM in the present test after no migration was detected by petrographic analysis.

In examining these samples, an effort was made to concentrate on the detection of the presence of talc since the previous studies showed no selective migration. Therefore, it can be presumed that if no talc is detected in the residue, then there would be no tremolite (on a weight basis, there should be 95 unit weights of talc for every 5 unit weights of tremolite in this particular talc). This technique was used as conservative means of

detecting the presence or absence of tremolite. To serve as check, thorough scanning was made for tremolite, even though its presence might be beyond the levels of detection with practically insignificant amounts of paper breakdown.

The overall analyses indicated that no migration was found. Thus, the actual shipping route of 72 hours of constant road travel did not create conditions severe enough to cause appreciable destruction of the paper liners. Petrographic analysis of all four test samples revealed only a possible trace of talc and no evidence of the presence of any chrysotile or tremolite fibers due to migration.

Upon comparing these results to the artificial "Scuff Test" that was run for only 24 hours, it is evident that the artificial test causes conditions which are overwhelmingly more severe than actual commercial transportation. As an example, the results of one particular paper sample that was run in both the artificial and actual tests are compared in this tabulation.

Comparison of Artificial and Actual Shipping Test Results
Petrographic Evaluation
Paper Sample RS-73242-2

	Number of Talc Particles	Number of Chrysotile Fibers	Number of Tremolite Fibers	Duration
Artificial Test	52,500	0	2,002	24 hours
Actual Test	possible trace	not detected	not detected	72 hours

In addition to examining the shipped salt samples by petrographic methods, they were also examined by TEM (8000X). The fields were selected at random after considerable scanning specifically looking for talc and tremolite. Thirteen plates were made in those cases where scanning indicated the possible presence of talc of tremolite. The results from examination of these 13 plates showed the possibility of only one talc particle and also the possibility of only one tremolite fiber. In addition, no fibers of any kind longer than 5 microns could be detected. Tables 1 and 2 in the Appendix have the complete examination results in tabular form.

This complete and thorough analysis of these shipped samples establishes that normal transportation does not create a severe enough environment to even allow salt (which is one of the most abrasive food materials packaged) to cause appreciable destruction of its containers. Thus, under actual commercial conditions, migration of tremolitic talc caused by paper breakdown due to shipping and handling is highly unlikely.

Evaluation of Food Products

Five food items were purchased at a local supermarket for the purpose of analyzing them for the presence of tremolitic talc in the paper packaging and the possibility of any migration from those papers. Items that had been transported the longest distances as well as those foods that would be particularly abrasive were specifically chosen. The food items selected were macaroni, rice, salt, corn flakes, and dry, non-fat milk.

The petrographic analysis of these food items indicated absolutely no migration of tremolite fibers. The food containers were analyzed by X-ray diffraction, and petrographic methods to identify if the paper packaging contained talc and tremolite. Table 3 reports the results of these analyses. Petrographic examination revealed no talc in four of the five contents, with only the possibility of a trace in the Morton's Salt. Examination of the Morton's Salt was extremely difficult because one of its additives, sodium silico aluminate (a crystalline material still present after ashing), interfered with the optical examination. Subsequent examination showed no tremolite or chrysotile fibers present in any of these foods. These results are located in Table 4 in the Appendix.

TEM examination of the ashed food samples also revealed no tremolite fibers. Several small chrysotile and talc particles were detected, but all were sub-optical in size. Each ashed food item underwent a thorough examination of at least 20 fields by the TEM, each field 80 microns square. These results are located in Table 5.

CONCLUSIONS

1. Analysis of salt test samples which endured approximately 3 days of constant road travel showed no evidence of appreciable breakdown in the integrity of the paper liners and no migration of tremolite fibers, although the test papers were known to contain tremolitic talc in the range of 0.25 to 1.0 percent.

2. Analysis of actual food commodities purchased at a supermarket also showed no evidence of appreciable breakdown in the integrity of the packaging paper and absolutely no migration of tremolite fibers, even though three of the paper containers were known to contain tremolitic talc.

3. These studies support the conclusion arrived at in Report No. E414-2: Regardless of the composition of the paper (container), migration will not occur unless severe enough conditions cause the container's contents to scuff and abrade the inside lining enough to cause paper breakdown.

4. It seems evident that actual conditions of transportation do not create a severe enough environment for paper breakdown to occur; thus, migration from paper is highly unlikely.

5. The artificial Scuff Test, as used in Report No. E414-2, was found to be appreciably more severe than actual commercial shipping conditions.

RECOMMENDATIONS

1. It is recommended that an artificial Scuff Test should not be used to simulate actual transportation for food packaging migration studies because it produces results not comparable to actual commercial shipment.

APPENDIX
Table 1

RESULTS OF PETROGRAPHIC EXAMINATION OF RESIDUES FROM SHIPPED TEST SAMPLES[5]

Sample No.	Actual Talc Content of Paper[1] (percent)	Talc Particles Per Membrane[2]	Chrysotile Per Membrane	Tremolite Per Membrane
RS 73242-1	0.35%	possible trace	not detected	possible trace[4]
RS 73242-2	1.0 %	possible trace	not detected	not detected
RS 73242-6	0.60%	possible trace	not detected	not detected
RS 73242-7	0.25%	possible trace	not detected	not detected

1. Talc content determined by X-ray diffraction.

2. The entire contents of the test samples were dissolved in filtered water and filtered through a 0.8 micron membrane. Therefore, only insoluble impurities present in the contents were collected on the membrane.

3. Three fibers present ranging in length from 300 to 480 microns, but have to be considered as outside contamination, as talc is commercially ground so fine as to prohibit the presence of chrysotile fibers of such a length.

4. Based on the total examination of one 10 mm field, only one tremolite fiber was detected. This could have resulted from contamination from unknown source.

5. These analyses were based on the examination of at least 100 fields of view per sample at 500X magnification.

Possible Trace should be divided into 2 terms:

Possible - optical properties indicate the presence of a particulate mineral, possibly talc.

Trace - if there, the above is present in a trace amount.

APPENDIX
Table 2

EXAMINATION OF SHIPPED TEST SAMPLE RESIDUES
BY TRANSMISSION ELECTRON MICROSCOPY

Sample No.	8000X - TEM Plate Number	Talc	Tremolite
RS 73242-1	2216A	0	None
	2216B	0	None
	2216C	0	None
	2216D	0	None
RS 73242-2	2217A	0	None
	2217B	0	1 possible, 5 micron long
	2217C	0	None
RS 73242-6	2218A	0	None
	2218B	0	None
	2218C	possibly 1	None
RS 73242-7	2219A	0	None
	2219B	0	None
	2219C	0	None

1. Samples ashed at 800°F for 16 hours.

2. Entire samples were scanned looking specifically for talc and tremolite.

3. Fields were selected at random.

4. No fibers of any kind detected longer than 5 microns.

Examination performed by V. E. Wolkodoff

APPENDIX
Table 3

PETROGRAPHIC EXAMINATION OF ASHED FOOD CONTAINERS
Optical Examination for Chrysotile and Tremolite at 500X

Sample	Chrysotile	Tremolite
4385-35-1	ND	present
4385-35-2	ND	ND
4385-35-4	ND	ND
4385-35-5	ND	present
4385-35-8	ND	present

APPENDIX
Table 4

ASHED FOOD MATERIALS EXAMINED PETROGRAPHICALLY
FOR TALC AND ASBESTIFORM MINERALS

Commodity	% Talc in Container	% of Total Package Contents Examined	Presence of Tremolite in Container[2]	Talc Detected in Food Contents	Tremolite and Chrysotile in Food Contents
Macaroni	0.23%	31.67%	Positively Identified	Not Detected	Not Detected
Dry non-fat milk	0.84%	23.14%	Not Detected	Results Inconclusive	Not Detected
Quick Rice	0.25%	10.77%	Not Detected	Not Detected	Not Detected
Corn Flakes	0.05%	6.41%	Positively Identified	Not Detected	Not Detected
Morton's Salt[1]	1.26%	13.55%	Positively Identified	Possible Trace	Not Detected

1. 85 g dissolved on millipore membrane before ashing.

2. Examined by petrographic analysis. Conclusions based on at least 100 fields of view.

NOTE: All food materials ashed at 800°F in air atmosphere for 7 days. To remove all carbonaccous material, except for Morton's salt, a higher temperature may be required, but optical properties would change.

Comments from Petrographer: The ash from dry milk was extremely difficult to read and the results are inconclusive. An extremely small amount of the crystalline materials in ashed Morton's Salt has been identified as talc and the percentage is officially listed as a possible trace.

Examination performed by V. E. Wolkodoff.

APPENDIX
Table 5

TRANSMISSION ELECTRON MICROSCOPY EXAMINATION OF FOOD CONTENTS
(ASHED)

Sample No.	Description	% of Total Package Contents Examined	TEM Plate No.	Talc	Chrysotile	Tremolite
4385-35-1F	Macaroni Ash	31.67%	2234A	ND	2 < 1 micron	ND
			B	ND	ND	ND
			C	ND	ND	ND
4385-35-2F	Dry Milk Ash	23.14%	2235A	ND	ND	ND
			B	ND	ND	ND
			C	ND	ND	ND
4385-35-4F	Ashed Rice	10.77%	2236A	ND	2, one > 1 micron	ND
			B	ND	1 clump	ND
			C	2 particles	.1 < 1 micron	ND
4385-35-5F	Ashed Corn Flakes	6.41%	2237A	ND	ND	ND
			B	ND	ND	ND
			C	ND	ND	ND
4385-35-8F	Morton Salt Ash	13.55%	2238A	1 particle	ND	ND
			B	1 particle	ND	ND
			C	ND	ND	ND