506

January 3, 1950

Mr. W.C. Hazard
Division of Industrial Hygiene
Owens-Illinois Glass Company
Toledo, Ohio

Dear Bill:

A sample of dust collected during the loading of Kaylo into cars was separated by sedimentation into two size fractions at the 5-micron level. The fraction consisting of particles smaller than five microns was submitted for x-ray diffraction analysis to determine (a) whether quartz is present and if so, to what extent, and (b) to determine the amount of asbestos present in the dust.

Results

The report from the Chemical Physics Department on this sample (our No. 873) is as follows:

> "The diffraction pattern is of fair quality but somewhat faint, indicating the sample to contain an appreciable non-crystalline fraction. The major crystalline component is β- $CaO \cdot SiO_2$ and there is a minor amount of $CaCO_3$. Quartz is not detected, and if present must not constitute over two per cent of the sample. A number of lines remain unexplained, two of considerable strength. They are not due to chrysotile asbestos nor to other varieties of asbestos for which data are immediately available. However, the data on asbestos are not highly reliable or complete. Furthermore, the asbestos minerals as a group give poor quality diffraction patterns and are not readily identifiable by x-ray diffraction means alone. It therefore is likely that these unidentified lines are not due to asbestos."

This report gave us the answer concerning quartz but left us in doubt about the presence of asbestos. In an effort to resolve this question, and being especially anxious to account for the unexplained strong lines in the pattern, we requested samples of the ingredients which went into the particular batch of Kaylo from which the dust sample was obtained. These were received and three additional diffraction patterns were prepared.

M-506

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Kenite and Clay were used for the x-ray work exactly as received; the asbestos sample was finely ground in a mortar. A statement of results from the Chemical Physics Department on these three samples is as follows:

"Further patterns prepared:

(1) Asbestos used in the plant: Pattern consists almost entirely of quartz lines, indicating 10 - 15% to be present. Only three lines of appreciable strength remain, and these do not check available asbestos data. Two of the asbestos lines could be superposed on the No. 873 pattern but the third one is in a clear position and is not seen.

(2) Kenite (an ingredient used in the present lot of product): Material is very largely amorphous. There is a faint clay-like pattern which is of too diffuse quality to be picked up in a mixture with other materials as in Sample No. 873.

(3) Clay (ingredient in present product): Material gives a good kaolinite clay pattern. Should be detected in mixture in concentration down to 10%. Not found in No. 873."

The Chemical Physics Department advises us that a further effort to obtain a satisfactory diffraction pattern from the sample of asbestos will amount to a major research venture without good prospects for success. We think this phase of the investigation should be dropped.

Proposed Use of Electron Microscope

X-ray diffraction study appears to be incapable at the present time of answering the question of whether asbestos is present in appreciable amount in the fine dust from loading Kaylo slabs into box cars. A Foundation project for the Asbestos Textile Institute several years ago resulted in a demonstration that useful information about particle size and dispersion of asbestos dust can be obtained from electron microscope photographs of a carefully collected deposit of the air-borne dust.

Briefly, the technique of collection consists of mounting a thin grid coated with collodion within the collecting tube of an electrostatic precipitator to permit dust to collect on the grid after it has passed through the several turns of a glass spiral, the interior surface of which has been coated with a film of adhesive. The spiral serves to eliminate the larger particles from deposition on the grid.

Photographs of the deposit will show qualitatively whether or not asbestos is present in the dust as discrete, small particles, either as single fibers or as small bundles of fibers.

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It is proposed that the Foundation provide spirals and mounted grids in electrostatic precipitator tubes for the collection of the samples in the plant. When these are returned with the desired samples, the Foundation can make the electron microscope studies and interpretation of the resulting photographs. Enclosed are reproductions of sample photographs of asbestos dust obtained in the manner described above.

Results From Greater Than 5-Micron Fraction

Examination of the greater than 5-micron fraction of sample No. 873 showed an x-ray diffraction pattern very much similar to that of the fine fraction. The outstanding difference was the presence of strong quartz lines. Analysis shows quartz to be present to the extent of 10 per cent. The quartz lines show a pebbling which is characteristic of coarse particles, estimated greater than 50 microns.

The two distinct but unexplained lines of the fine fraction are present again in the pattern of the coarse fraction. By their spacing they are thought to be caused by a large and complex crystalline structure, probably a highly hydrated complex silicate as seen elsewhere in some clay patterns.

A statement of charges for this work is enclosed.

We shall be glad to discuss with you these results and our proposal for the electron microscope studies, either by correspondence or conversation.

With best regards,

Sincerely,

JFM:W
Enc.

James F. Morgan
Chemist

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Approved _____ Date _____

MELLON INSTITUTE OF INDUSTRIAL RESEARCH

DEPARTMENT OF RESEARCH IN CHEMICAL PHYSICS

Fellow: Mr. J. F. Morgan — Fellowship No. 2

Project: Dust Analysis: Owens-Illinois Glass Company

Project No.: 127-X

Date of Report: January 4, 1950

NATURE OF REPORT: Preliminary ____ Progress ____ Final XXXX

Sample No. 575 < 1 μ (Film P970).

The diffraction pattern is of fair quality but somewhat faint, indicating the sample to contain an appreciable non-crystalline fraction. The major crystalline component is β-$CaO \cdot SiO_2$ and there is a minor amount of $CaCO_3$. Quartz is not detected and, if present, must not constitute more than about 2% of the sample.

A number of lines remain unexplained, two of considerable strength. They are not due to chrysotile asbestos nor to other varieties of asbestos for which data are immediately available. However, the diffraction data on asbestos are not highly reliable or complete. Furthermore, the asbestos minerals give poor quality powder diffraction patterns and are not readily identifiable by x-ray diffraction means alone.

Sample No. 573 > 1 μ (Film P997).

The pattern is the same as the above except that the lines of quartz appear. Spectrometer analysis shows the quartz content to be 10%. The spottiness of the quartz lines shows that a considerable fraction of it is rather coarse, mean particulate dimension perhaps 50-100 microns. As in the < 1 μ fraction, the major constituent is β-$CaO \cdot SiO_2$ and a minor amount of $CaCO_3$ is present.

Patterns of Raw Materials:

Asbestos (Film P931) -- The pattern observed is due almost entirely to quartz, which constitutes about 10-15% of the material. Only three lines of appreciable strength remain, and they do not check the available asbestos data.

Kaolin (Film P962) -- The material is largely amorphous. It gives a faint clay-like pattern which is too diffuse in nature to be observed in a mixture with the patterns of other materials, as in Sample 575.

Clay (Film P957) -- The material is predominantly kaolinite and gives a good diffraction pattern. It should be possible to detect it in concentrations down to about 10%, but it was not observed in Sample 575.

Lucas E. Alexander

SENIOR FELLOW

L. E. Alexander:mlc

FORM III

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