R. F. CARTER - PITTSBURGH

FROM GEORGE H. FARRAH
ENVIRONMENTAL HEALTH LABORATORY
ALCOA TECHNICAL CENTER
ALCOA CENTER

TO MEMORANDUM

March 26, 1973

RE: PHOTOMICROGRAPHS OF ASBESTOS FIBERS

The Occupational Safety and Health Administration (OSHA) now requires at least semi-annual surveillance of industrial exposures to asbestos fibers. Since the specified method of compliance testing is new to most of us, there has been uncertainty as to the appearance of asbestos fibers when examined by phase contrast illumination at 400-450x magnification. For this reason we have taken photomicrographs of specimens of fibers, collected and mounted by the prescribed techniques, for distribution to those who have raised the question: "What are we to look for in these samples?"

From the many photomicrographs of asbestos that were taken in the Environmental Health Laboratory by Mr. Robert Geiger, three were selected as being reasonably typical in appearance. A fourth print shows a few short fragments of Pyrex glass fiber as seen under the same conditions.

Print No. 1 is a representative field showing material collected during the machining of Molten Metal Marinite, in which the fibrous material is Amosite asbestos. There are other, irregular particles present, but only the straight, slender fibers are to be counted. Of these, only fibers whose length is at least three times their diameter, and whose length is greater than 5 micrometers (μm, or "microns" in older terminology) are to be counted. Calibration of our microscope's optical system at 450x gave a value of about 5 μm as the diameter of No. 5 circle, seen above the Porton grid. (This is a fortuitous situation; numbers of the circles and black dots are only ratios in terms of "D-units", where $D = \sqrt{2^N}$, and have no fixed values until the optical system is calibrated.) The counting field, defined by a Porton reticle grid, is the left half of the large rectangle. It measures roughly 1 in. x 1 in. in the print and is subdivided into 6 rectangles. Only fibers within that square are to be counted. A fiber on the outside boundary line is counted only if more than half of its length extends inside the line. Since fibers do not all lie in the same plane, it is helpful to focus up and down as each field is scanned. Under these rules, I would count 4 fibers in the print of this field: 2 in upper right (bright yellow lines), 1 in right middle (narrow black line), and 1 in left middle rectangle (short black line in lower-right quadrant).

Print No. 2, another field of the same specimen as Print No. 1, shows a clump of fibers and other particles. In this print, approximately 22 countable fibers - both bright and dark - can be seen. Racking the fine-focus control up and down would probably bring others into view and raise the count. However, any field containing more than 20 fibers should be rejected and another field taken as recommended by the NIOSH Criteria Document on asbestos. Smaller groups of fibers may be countable and this will be left to the judgement of the operator.

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Print No. 3 is a specimen of Chrysotile asbestos collected from a dust cloud of "Asbestos Shorts". This material shows some curled fibers, whereas the Amosite fibers that I have examined have always been straight and generally slender. This specimen was collected from a laboratory-generated dust cloud and represents a very heavy concentration. However, in this field, only about 8 fibers are countable under the NIOSH criteria.

Print No. 4 indicates that the glass fiber (Pyrex) which we examined is not likely to be confused with asbestos fiber because of the latter's smaller dimensions. This was also true of quartz fibers which we examined. There are, of course, other types of glass wool which are of much smaller diameter (e.g. "Swedish Wool"), used in special applications, and which could be mistaken for asbestos. It is unlikely that this type glass fiber will be encountered in our plant operations.

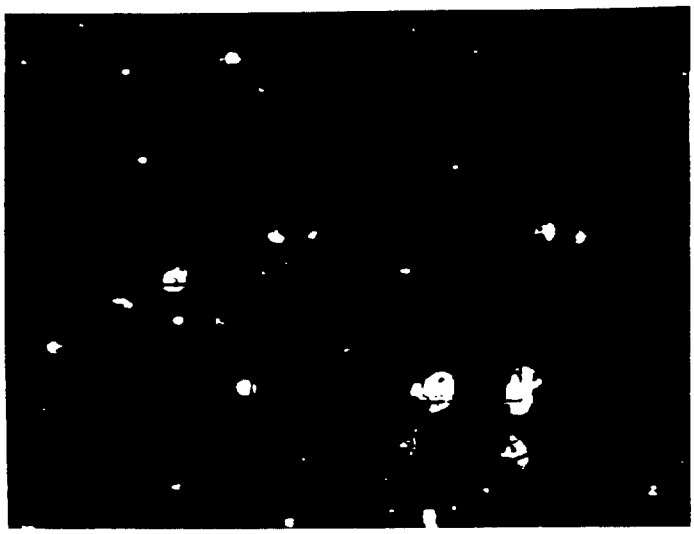
The comments given above represent our interpretation of the NIOSH procedure. Furthermore, fiber counting is a subjective procedure so that two or more persons, evaluating the same specimen (and even counting the same field) may well report slightly different counts. However, by counting a minimum of 100 fibers or 100 fields (whichever occurs first, but in no case fewer than 20 fields), a statistically acceptable value should result.

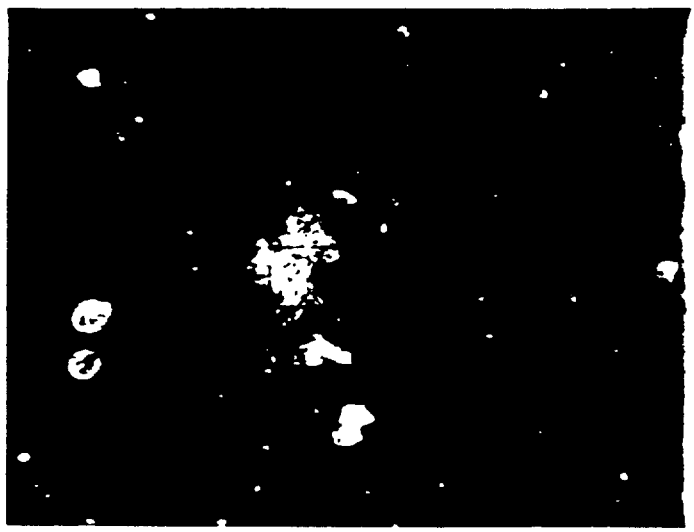
It is hoped that these prints and comments may be of some help to those who are getting started in this activity. If other questions concerning asbestos fiber surveillance arise, do not hesitate to call.

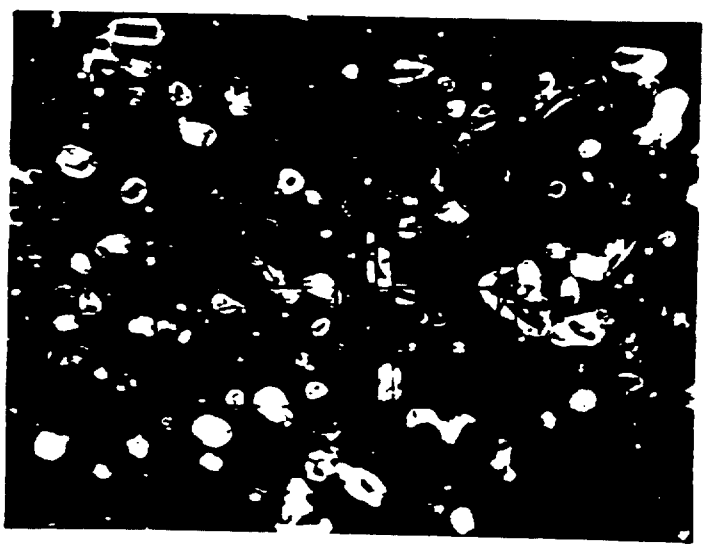
GEORGE H. FARRAH
GHF:ES

Attachments: four

cc: T.B.Bonney - Pittsburgh
R.P.Carter - Pittsburgh
Richard Curphey - Badin
Stephen Nance - Warrick
Stephen McGhee - Tennessee
James A. Thompson - Wenatchee
Lewis L.Haisch - Vancouver
Clair Artz - Cressona
K.W.Williams - Davenport
W.S.Barr - Massena
A.G.Clayton - Rockdale









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