(412) 687-2100

INDUSTRIAL HYGIENE FOUNDATION OF AMERICA, INC.

5231 CENTRE AVENUE PITTSBURGH, PA. 15232

# PROGRESS REPORT NO. 4

on

# FIBROUS DUST STUDIES

for

Johns-Manville Corporation
Pittsburgh Corning Corporation
PPG Industries
Owens-Corning Fiberglas Corporation
Raybestos-Manhattan, Inc.

by

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# FIBROUS DUST STUDIES REPORT OF PROGRESS

## COVERING THE QUARTER ENDING DECEMBER, 1968

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Experimental studies on rats and hamsters injected intratracheally with fibrous dusts were described in our proposal dated June 1, 1966, and progress reports dated February, 1967; June, 1967; and June, 1968, respectively, have been submitted to sponsors.

Cumulative mortality among a total of 485 rats injected with the types of dust and in the dosages shown, is indicated in Table 1, in the format normally used in technical publications.

A different form of tabulation in the case of hamsters to show percent of mortality by dust type dosage and exposure duration has been developed. It differentiates between cumulative mortality versus sacrifice of survivors at the end of the 24-months exposure period, and indicates stage of progress of animals which remain under observation.

In addition to the above studies, work on fibrous dusts sponsored jointly with the Mellon Institute; University of Pittsburgh, Graduate School of Public Health; the Department of Health, Education, and Welfare, Occupational Health

Program; and in collaboration with the University of Cambridge (British Asbestos Council) have been undertaken. These were described previously in IHF Medical Series Bulletin, No. 11, "Asbestos Bioeffects Research For Industry." Progress has also been reported in papers before the Foundation's 31st and 32nd Annual Meetings and in publications ("Ferruginous Bodies in Human Lungs, Prevalence at Random Autopsies," M. D. Utidjian, P. Gross, and R. T. P. deTreville, Arch. Environ. Health 17:327-333, Sept. 1968; and "Pulmonary Ferruginous Bodies, Development in Response to Filamentous Dusts and a Method of Isolation and Concentration," P. Gross, R. T. P. deTreville, L. J. Cralley, J. M. G. Davis, Arch. Path. 85:539-546, May, 1968.)

In addition, the most current report of progress was given at the Foundation's Fibrous Dust Seminar on November 22, 1968, at Mellon Institute (Enclosure). A report of the proceedings is now in preparation and should appear in 1969; however, it may be of interest to record here that 100% of the cores of the 17 ferruginous bodies isolated by Dr. Michael D. Utidjian,* from the 100 autopsy specimens in the Foundation's Laboratory when subjected to electron diffraction by Mellon Institute, were shown not to be chrysotile asbestos. They are crystalline and it is not possible to rule out some complex form of asbestos. However, they do not appear similar to diffraction patterns obtained on known samples of amosite and crocidolite provided to IHF's Research Laboratory by Dr. James Leinweber, Johns-Manville Corporation, Research and Engineering Center, Manville, New Jersey.

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Further progress was reported by Dr. John M. G. Davis, Department of Pathology, Cambridge University, Cambridge, United Kingdom, who had presented earlier findings at the Foundation's 32nd Annual Meeting in 1967. It now appears that the precipitation of a matrix and subsequent impregnation by iron aound fibrous particles of respirable size is probably a function of scar tissue formation and availability of iron in the form of red blood cell hematin from capillaries. In dense scar tissue, every fiber was coated with a matrix (acid mucopolysaccharide) but few had the invasion by iron granules typical of ferruginous bodies.

As the Mellon Institute and U. S. Public Health Service support for the above studies is ending, a new proposal is being prepared by IHF for a more expanded study of fibers and ferruginous bodies from autopsied lungs. Obviously, the above results are on too small a population to allow us to reach any conclusions but they do represent an area of considerable challenge for further study in our Laboratory.

Table 1

Mortality of Rats Injected
Intratracheally with Fibrous Dusts

| Fibrous Dust | Dose mg | No. of Rats | Cumulative Mortality Percentage | | | |
|---|---|---|---|---|---|---|
| | | | 6 mo. | 12 mo. | 18 mo. | 24 mo. |
| Glass (Gorski) | 3 x 3.5 | 15 | 7 | 73 | 100 | — |
| Glass (Refrasil) | 3 x 3.5 | 15 | 7 | 73 | 93 | 93 |
| Chrysotile (Elect. Precip.) | 3 x 3.5 | 15 | 13 | 53 | 73 | 100 |
| Synthetic Chrysotile (Mellon) | 3 x 15 | 15 | 20 | 33 | 47 | 53 |
| Synthetic Chrysotile and Benzopyrene | 3 x 15 | 15 | 7 | 27 | 40 | 80 |
| Synthetic Chrysotile and Nickel | 3 x 15 | 15 | 7 | 60 | 73 | 93 |
| Synthetic Chrysotile and Chromium | 3 x 15 | 15 | 7 | 27 | 40 | 100 |
| Glass and Phenol-Formaldehyde Binder | 3 x 3.5 | 15 | 80 | 87 | 87 | — |
| Glass (uncoated) | 3 x 3.5 | 15 | 13 | 67 | 80 | — |
| Glass and Phenol-Formaldehyde Binder | 3 x 3.5 | 15 | 27 | 67 | — | — |
| Brucite | 4 x 3.5 | 15 | 40 | 47 | 47 | — |
| Synthetic Chrysotile and Nickel | 3 x 15 | 10 | 30 | 40 | — | — |
| Synthetic Chrysotile and Chromium | 3 x 15 | 10 | 40 | 50 | — | — |
| Synthetic Chrysotile and Cobalt | 3 x 15 | 10 | 20 | 20 | — | — |
| Amorphous Magnesium Silicate and Nickel | 1 x 25 | 10 | 50 | 50 | — | — |
| Amorphous Magnesium Silicate | 3 x 25 | 10 | 10 | — | — | — |
| Synthetic Chrysotile and Manganese | 3 x 15 | 10 | 50 | 50 | — | — |
| Talc with low metal content | 1 x 25 | 25 | 44 | | | |
| Talc with high metal content | 1 x 25 | 25 | 40 | — | — | — |
| Brake Drum Dust | 2 x 10 | 10 | 0 | — | — | — |
| Synthetic Chrysotile (J-M) | 4 x 3.5 | 40 | 12 | 22 | — | — |
| Synthetic Chrysotile (J-M) and Nickel | 4 x 3.5 | 40 | 28 | 35 | — | — |
| Fiberfrax | 3 x 3.5 | 40 | 55 | 58 | 72 | — |
| Fiberfrax (Hammer milled) | 3 x 3.5 | 40 | 52 | 70 | 85 | — |
| Black Lake Chrysotile (Hammer mill) | 4 x 3.5 | 40 | 45 | 78 | 90 | — |
| TOTAL NUMBER RATS | | 485 | | | | |

* Survivors Sacrificed
** See Attached Sheet

## PERCENT MORTALITY—HAMSTERS

(Top row of figures signify number of animals)

| Months of Exposure after Injection | 12 Aluminum Silicate | 12 Ground Fiber Glass (ex Gerrit) | 12 Talcum Powder | 22 Heated And Treated Ppt Washings | 12 Silicon Carbide Whiskers | 12 Fibrous Glass No Binder Refrasil A-100 | 12 Synthetic Crysotile (1-PR-75) | 12 Grace 7169C | 12 Grace 7165C | 10 Grace 7165B | 12 Crysotile Ppt Washings | 12 Attapulgite | 12 Sillimonite | 12 Johnson's Baby Talc | 12 Dust from Brake Drum | 12 Beneficiated Attapulgite | 24 Filamentous Glass With Phenol Binder | 12 Uncoated Fiber (Ball Milled, 2 hours) | 12 Fiber Glass with Phenol Binder (Ball Milled, 2 hours) | 12 Ground Brucite | 12 Brucite Fiber | 12 Fiber Glass with Textile Binder (Ball Milled, 2 hours) | 10 Microquarts (Acid Leached) | 10 Microquarts with High Ni Salt | 10 Microquarts Ni Salt | 30 Untreated Controls |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | | * | | * | * | * | * | | * | | | * | * | * | | | | | | | | | | | | | 80 |
| | | 92 | | 91 | 92 | 92 | 92 | | 92 | 100 | | 92 | 83 | 58 | | 100 | | | | | | | | | | | 63 |
| 22 | | 92 | | 91 | 92 | 75 | 83 | | 92 | 90 | | 75 | 83 | 58 | | 83 | | | | | | | | | | | 63 |
| | | 92 | 100 | 91 | 92 | 67 | 75 | | 92 | 70 | | 75 | 58 | 58 | | 83 | | | | | | | | | | | 57 |
| 20 | 100 | 92 | 75 | 91 | 75 | 67 | 58 | | 92 | 70 | 100 | 75 | 50 | 58 | | 83 | 79 | | | | | | | | | | 50 |
| | 92 | 75 | 50 | 91 | 58 | 58 | 42 | | 92 | 70 | 92 | 33 | 50 | 50 | * | 83 | 79 | | | | | | | | | | 37 |
| 18 | 92 | 75 | 42 | 86 | 50 | 50 | 33 | | 83 | 70 | 75 | 33 | 50 | 33 | 50 | 50 | 75 | 58 | 25 | | | | | | | | 37 |
| | 67 | 75 | 42 | 82 | 50 | 42 | 25 | | 83 | 60 | 67 | 33 | 50 | 25 | 50 | 33 | 71 | 58 | 25 | 17 | 92 | | | | | | 33 |
| 16 | 58 | 67 | 42 | 77 | 50 | 33 | 25 | | 83 | 50 | 58 | 25 | 33 | 25 | 50 | 25 | 71 | 50 | 17 | 8 | 92 | | | | | | 23 |
| | 58 | 58 | 33 | 77 | 42 | 25 | 17 | 100 | 83 | 40 | 58 | 17 | 17 | 25 | 50 | 17 | 71 | 50 | 8 | 8 | 83 | | | | | | 23 |
| 14 | 58 | 58 | 33 | 77 | 25 | 25 | 17 | 92 | 67 | 40 | 50 | 17 | 17 | 25 | 42 | 17 | 67 | 50 | 8 | 0 | 75 | | | | | | 20 |
| | 50 | 58 | 33 | 73 | 25 | 25 | 17 | 92 | 58 | 40 | 42 | 17 | 8 | 25 | 33 | 17 | 67 | 50 | 8 | 0 | 75 | 0 | | | | | 13 |
| 12 | 50 | 50 | 33 | 73 | 17 | 25 | 17 | 92 | 50 | 40 | 33 | 17 | 8 | 25 | 33 | 17 | 67 | 50 | 0 | 0 | 58 | 0 | | | | | 10 |
| | 50 | 50 | 33 | 73 | 17 | 25 | 17 | 92 | 50 | 30 | 33 | 17 | 8 | 25 | 25 | 17 | 62 | 42 | 0 | 0 | 42 | 0 | | | | | 7 |
| 10 | 50 | 42 | 33 | 68 | 17 | 25 | 17 | 92 | 50 | 30 | 33 | 17 | 8 | 25 | 25 | 17 | 62 | 33 | 0 | 0 | 42 | 0 | | | | | 7 |
| | 17 | 42 | 33 | 68 | 17 | 25 | 17 | 92 | 50 | 30 | 33 | 17 | 8 | 25 | 25 | 17 | 62 | 33 | 0 | 0 | 42 | 0 | 40 | 40 | 40 | 7 | |
| 8 | 17 | 33 | 25 | 68 | 17 | 25 | 17 | 92 | 50 | 30 | 33 | 17 | 8 | 25 | 25 | 8 | 62 | 33 | 0 | 0 | 25 | 0 | 30 | 40 | 40 | 3 | |
| | 17 | 25 | 25 | 64 | 17 | 25 | 17 | 92 | 50 | 20 | 25 | 17 | 8 | 25 | 0 | 8 | 62 | 33 | 0 | 0 | 25 | 0 | 30 | 40 | 40 | 3 | |
| 6 | 17 | 25 | 25 | 59 | 8 | 25 | 17 | 92 | 50 | 20 | 17 | 17 | 8 | 25 | 0 | 8 | 58 | 33 | 0 | 0 | 25 | 0 | 30 | 30 | 40 | 0 | |
| | 8 | 17 | 17 | 59 | 0 | 8 | 17 | 92 | 50 | 20 | 0 | 17 | 8 | 17 | 0 | 8 | 58 | 17 | 0 | 0 | 25 | 0 | 0 | 0 | 20 | 0 | |
| 4 | 8 | 17 | 17 | 54 | 0 | 8 | 8 | 92 | 50 | 10 | 0 | 17 | 8 | 17 | 0 | 8 | 58 | 17 | 0 | 0 | 25 | 0 | 0 | 0 | 20 | 0 | |
| | 8 | 17 | 17 | 54 | 0 | 8 | 8 | 92 | 50 | 10 | 0 | 17 | 8 | 17 | 0 | 8 | 58 | 17 | 0 | 0 | 17 | 0 | 0 | 0 | 20 | 0 | |
| 2 | 0 | 8 | 8 | 45 | 0 | 8 | 8 | 92 | 50 | 10 | 0 | 17 | 8 | 17 | 0 | 8 | 58 | 17 | 0 | 0 | 8 | 0 | 0 | 0 | 20 | 0 | |
| | 0 | 8 | 8 | 45 | 0 | 0 | 0 | 83 | 50 | 0 | 0 | 0 | 8 | 8 | 0 | 0 | 58 | 17 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | |
| ** | A | A | A | A | A | A | A | B | C | B | A | A | A | A | A | A | D | A | A | A | E | A | F | F | F | F | |

## Attachment to Table, Percent Mortality—Hamsters

The following dosages were used:

A = 3 x 3.5 mg

B = 1 x 3.5 mg

C = 1 x 1.75 mg

D = (two dosages were used)

12 = 1 x 3.5 mg
12 = 2 x 1.75 mg

E = (two dosages were used)

4 = 3 x 3.5 mg
8 = 6 x 1.75 mg

F = 2 x 12.5 mg