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**A REPORT ON HEALTH ASPECTS
OF FIBROUS GLASS**

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FOREWORD

From time to time, since publication of its first bulletin in 1935, the Industrial Hygiene Foundation of America, Inc. (IHF) has issued medical reports on subjects of topical interest to its members.

IHF is a nonprofit research association of industries for the advancement of healthful working conditions and human relations in industry, and serves a unique function as the focal point for exchange of information on health problems allegedly arising from industries' operations, products and wastes.

The Foundation's ability is vested in individuals with highly specialized scientific, technical and professional backgrounds and experience in its member organizations as well as in its full-time staff, its standing committees, and expert panel of advisors. Its work is therefore supported by numerous individuals in hundreds of companies deeply committed to the advancement and fulfillment of the Foundation's mission.

At the invitation of IHF, Dr. Jon L. Konsen, Medical Director of Owens-Corning Fiberglas Corporation, Toledo, Ohio, assisted in the preparation of this bulletin in association with Dr. Paul Gross, Director of the Foundation's Research Laboratory, based on an extensive review of all available experimental and human data, published or in progress. The information contained herein is presented for the guidance of the members of IHF and all those in the fields of environmental and occupational health who should benefit from this documentation which gives evidence that fibrous glass is inert and non-injurious to health.

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INTRODUCTION

Fibrous glass is produced in two forms—as a wool-type product primarily for thermal and acoustical insulation and as a textile fiber for fabrics and strength-giving reinforcements.

Since its development in the early 1930's, fibrous glass has become one of society's most useful basic materials. Originally manufactured as a material for furnace filters and home insulation, fibrous glass now goes into more than 33,000 end products.

In addition to furnace filters and home insulation, major applications of wool-type fibrous glass today include acoustical ceilings, filters for purifying water and thermal insulation for pipe, air conditioning ducts, food cold storage systems and household refrigerators, ovens and other appliances. Major markets for textile fibrous glass are: curtains and draperies, bedspreads, table cloths, awnings, fire protective clothing and reinforcements for plastics, rubber and paper.

Interest in possible occupational and environmental health problems with fibrous glass goes back almost as far as the first development work on the material in 1931. In most cases, this interest has centered on possible effects from skin contact, inhalation and ingestion of small fibrous glass particles.

Results of medical research, including examinations of hundreds of persons who have worked in fibrous glass plants as long as 25 to 30 years, gives evidence that fibrous glass is inert and non-injurious to the individual's over-all health.

The purpose of this report is to review the findings of the most significant of these studies in an effort to clarify the health aspects of fibrous glass.

EFFECTS OF EXPOSURE TO FIBROUS GLASS

Obviously, continued exposure to excessive quantities of any dust or fumes should be avoided. However, dusts and fumes differ widely in their potential harm to human health. Some prove injurious in low atmospheric concentrations; others are harmless at high concentrations.

Skin irritation occasionally results from exposure to fibrous glass particles, but this irritation has proved to be superficial and transitory.

Fibrous glass manufacturers have always been interested in determining whether or not fibrous glass particles are injurious if inhaled or ingested. As a result, they have cooperated in many medical research studies conducted over the past three decades by medical scientists and physicians considered to be authorities in their medical specialties.

Based on existing medical evidence dating back to 1940 through to present, airborne fibrous glass is not a hazard to general health. Hundreds of fibrous glass workers have been exposed to higher-than-average concentrations of airborne glass particles virtually every working day for as long as 25 to 30 years without exhibiting any pattern of lung disease that can be attributed to exposure to fibrous glass.

MEDICAL RESEARCH STUDIES

Among the most significant of medical studies conducted to date on fibrous glass were the investigations in 1963 by George W. Wright, M.D., Head of the Medical Research Department of St. Luke's Hospital in Cleveland.

The study¹ is a review of periodic chest x-rays, medical records and job exposure histories of 1,401 employees at the largest and oldest fibrous glass manufacturing plant. None of these workers had been employed less than 10 years. Many were employed at the plant upwards of 25 years.

The report gives the purpose of the research in its opening sentence:

"The question to be explored is whether or not prolonged exposure of workers to an environment containing airborne fibrous glass coated with phenolic resin... is associated with a recognizable pattern of roentgenographic abnormality."

The report's summary states as follows:

"The effect, as revealed in the chest roentgenogram, of ten to twenty-five years of exposure in an environment containing airborne particles of fibrous glass has been studied. No unusual pattern of radiologic densities was observed.

"The frequency of various radiologic appearances known to occur in the general population was no higher in those with greatest exposure than in those with the least."

Another important study² made between 1956 and 1958 by Paul Gross, M.D.,

Research Professor, University of Pittsburgh, Graduate School of Public Health;

Senior Fellow, Mellon Institute; and Director of the IHF Research Laboratory,

Pittsburgh, Pa., was a laboratory animal study consisting of three parts:

1. determination of the pulmonary response resulting from exposure³ to high concentrations of respirable, airborne glass particles (hundreds of millions of particles per cubic foot) and the injection into the lungs of both coarse and fine glass particles to determine pulmonary response to the glass;*

* Respirable means sufficiently small to gain access to the deepest lung tissues, ordinarily 3μ or less in diameter, i.e., microscopic and submicroscopic sized particles. Fine particles used in this study were approximately 1μ in diameter. Coarse particles, put through a 325 mesh sieve (U.S. Standard No. 40) were 50μ or less in diameter with a few particles measuring as much as 400μ or 0.4 mm.

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2. to document the effects of the massive ingestion of ground glass of microscopic dimensions (laboratory animals were fed a diet containing 50% finely milled glass flakes for one year); and
3. to study the effects resulting from dusting the eyes of laboratory animals with finely milled glass dust and glass flakes.

Following are excerpts from Dr. Gross' summary and conclusions:

"No effect of glass dust and glass flakes was demonstrable upon the cornea or the conjunctiva of the eyes.

"No toxic or traumatic effect was demonstrable upon the gastrointestinal tract. There was only slight depression of the growth rate when rats ingested a diet containing as much ground glass (50%) as food. This depression was due entirely to a lower food intake.

"The pulmonary changes in guinea pigs exposed to fine glass dust for one year and those of rats either exposed to the same dust or given injections intratracheally with it were minimal in character and consisted only of small focal alveolar dust cell collections without fibrosis. . . Coarse glass dust injected into the lungs of rats behaved like inert foreign material. . . ."

Moreover, as recently as April, 1968, Dr. Gross reaffirmed the conclusions as follows:

"Based on all completed and in-progress experimental and human data of which we have knowledge, fibrous glass dust should be classified as 'inert', i. e., without demonstrable pathologic effect.

"There should be no adverse effects to health from inhalation of glass dust of respirable size, whether in pulverized or filamentous forms."

Two of the more recent investigations were reported in the July, 1967, issue of the Journal of Occupational Medicine. In one article⁴ Carey P. McCord, M. D., Professor Emeritus of the Institute of Industrial Health at

* From a memorandum to Robert T. P. deTreville, M. D. from Paul Gross, M. D. dated April 11, 1968.

the University of Michigan, Ann Arbor, Michigan, summarized his investigation of fibrous glass manufacture and technology with this statement:

"Fiber glass, like all common forms of glass, is a chemically inert substance. It possesses no known toxic properties. On a mechanical basis, spicules may abrade the skin leading to superficial and transitory irritation. Among fiber glass makers, particularly new workers who are most exposed, skin irritation occurs, but is not remarkable...."

In the second article,⁵ Ahmed N. M. Nasr, M. D., also of the Institute of Industrial Health at the University of Michigan, reviewed the world's literature covering health aspects of exposure to fibrous glass.

These excerpts from the report summarize Dr. Nasr's conclusions:

"As far as can be ascertained from a search of the American and European literature, available evidence indicates that fibrous glass is a relatively inert material with no fibrogenic or other significant toxic properties."

A study⁶ of human skin reaction to contact with fibrous glass was conducted in 1957 by Eldred R. Heisel, M. D., formerly Chief, Division of Dermatology, and John H. Mitchell, M. D., Clinical Professor and Head of the Division of Allergy, Ohio State University, Columbus, Ohio. This study included both patch and rubbing tests on two groups of human volunteers. One group of 50 white women had never been exposed to fibrous glass. The second group consisted of 92 persons who had been exposed to fibrous glass for periods ranging from less than one year to as long as 15 years.

Excerpts from the report's summary follow:

"... We were unable to induce sensitivity in the first group (e. g., 50 women) and no sensitization reactions were noted in the second group (e. g., 92 persons).

"Reactions were observed when finely cut fibers were applied to the skin. These varied directly with the size (diameter) of the fiber and were interpreted as being due to mechanical irritation...."

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SUMMARY

Medical investigations and scientific medical studies conducted by highly qualified specialists in skin and lung diseases have shown fibrous glass to be a biologically inert substance that produces no permanent injury to individuals exposed to it.

The documented evidence substantiating this conclusion includes investigation of the health of hundreds of fibrous glass workers who have been exposed to the material on a regular basis for as long as 25 to 30 years.

Medical publications on fibrous glass include other studies, investigations and literature reviews. Several of these are listed for information purposes.

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