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HEALTH ASPECTS OF FIBERGLAS MATERIALS

This brochure is prepared for distribution to plant physicians, industrial hygienists, safety engineers, and others interested in a documented summation of facts relating to the health aspects of Fiberglas materials.

OWENS-CORNING FIBERGLAS CORPORATION, TOLEDO, OHIO

1943

FIBERGLAS*—glass in the form of fine glass fibers which can be woven into fabrics, or fabricated into bats and boards—was first produced in the wool form in 1938. During the succeeding years, as finer and stronger fibers have been produced, and as new uses for them have been found, Fiberglas in both its wool and textile forms has become a basic material of American industry.

In the electrical and heat insulation fields, in the field of air filtration, and in other fields as well, Fiberglas is employed in many different ways and forms, for many different purposes. Because of its widespread use, and because it is a new material, it is to be expected that questions should arise from time to time concerning the possibility of health hazards in connection with its manufacture and handling.

Still another reason for such questions lies in the very fact that Fiberglas is glass. It is glass in an entirely new physical form. Its physical properties make it unrecognizable as glass by persons familiar with glass only as a hard, unbendable, transparent substance. Nevertheless, the complete transformation that Fiberglas has undergone is not always understood, and old connotations sometimes cling to the new material.

For sound business reasons, Owens-Corning Fiberglas Corporation—the manufacturer of Fiberglas—has always desired to find and present frank and complete answers to such questions. To this end it has encouraged and aided investigations by impartial medical experts. This publication, which presents the answers to the questions which have arisen, is largely based on their investigations.

NO HAZARD TO LUNGS

Gardner Investigation

Tests conducted by Dr. Leroy U. Gardner, Director of the Edward L. Trudeau Foundation for Research and Teaching in Tuberculosis, have demonstrated that Fiberglas has no injurious effect upon the lungs.

In the annual report of the Foundation's Saranac Laboratory, for the year 1940[1], the following statement appears:

> "The apparent lack of pulmonary damage from exposure to glass wool dust is being demonstrated by an inhalation experiment. For over a year animals have now been exposed to as high a concentration of this material as could be obtained, with no serious effect upon their lungs. The dust has been produced by breaking into short lengths the finest textile glass [Fiberglas] that is made, but none of the fibers that are floating in the air can be found in the lungs of the exposed animals. Their tendency, unlike that of asbestos, to form felt-like masses upon any object with which they come in contact, probably prevents their inhalation. Slight amounts of chronic inflammation similar to those observed with other harmless dusts, were resulted from accumulated particulate debris. These very fine, non-fibrous particles are the by-product of the violent beating used to break up the material."

In his 1941 report as director of the Trudeau Foundation[1], Dr. Gardner says:

> "Exposure to the dust of glass wool, a material commonly used to insulate buildings, involves no hazard for the lungs because this fibrous material is not inhalable."

Siebert Investigation

At the request of the attorney for the International Association of Heat and Frost Insulators and Asbestos Workers, Local Union No. 1, St. Louis, Dr. Walter J. Siebert conducted an investigation of possible health hazards in the manufacture and handling of Fiberglas.

Dr. Siebert is Pathologist and Director of Laboratories of the DePaul and Lutheran Hospitals, St. Louis. His investigation was made in the early summer of 1941. A full report was published in the January, 1942, issue of *Industrial Medicine*.[2]

The investigation covered a broad field. Study of the formulas employed in the manufacture and processing of Fiberglas products convinced Dr. Siebert that the chemical and physical characteristics of glass fibers are not of a kind from which serious industrial health problems would theoretically arise.

An exhaustive search of world medical literature for references to possible health hazards in the handling of Fiberglas failed to reveal references to any new or unusual occupational hazards in the handling of these products.

> "In view of the continually expanding market for Fiberglas products since 1938," Dr. Siebert says, "and in view of the promotion and advertising campaigns directed toward increasing their sale, the scarcity of references to the subject in the literature of science and medicine, and the lack of controversy or interest in the subject on the part of persons usually alert to possible industrial hazards, cannot be attributed to a lack of familiarity with the existence and use of the products. On the contrary, it warrants the conclusion that the handling of the products is attended by no unusual occupational hazard."

On the basis of his own observation, and dust counts made in the Owens-Corning Fiberglas Corporation's Newark, Ohio, factories, Dr. Siebert found that Fiberglas is remarkably free of the dust that characterizes certain products. This he attributes to the length of the fibers and the "pack strength" of

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*"Fiberglas" is the trade name (Reg. U.S. Pat. Off.) of glass manufactured in any fiber or filament form by Owens-Corning Fiberglas Corporation.

[1] *Annual Report of the Saranac Laboratory for the Study of Tuberculosis, of the Edward L. Trudeau Foundation, for the Year 1940.* Page 14.

[2] Siebert, Walter J., M.D., "Health Hazards Found Investigation," *Industrial Medicine*, Vol. XI, No. 1, pp. 6-8, January, 1942.

the material due to the fact that the glass fibers break cleanly, rather than shatter when they are sawed, chopped or cut during production or fabricating operations.

Dr. Siebert examined several hundred stereoscopic x-ray plates of the chests of employees in the Newark factories. These were selected at random by Dr. Siebert from the file of some 1500 plates taken since the company, in 1939, instituted the policy of making x-ray plates of the chests of all Newark employees.

Among the plates selected for special inspection were those of employees working in the batch house where the raw materials are handled. Beginning in May 1939, serial stereoscopic chest films had been made of the 15 men who were engaged in mixing the ingredients of the batch at the time of the investigation, or who had worked in the batch house—the only place where exposure to free silica is encountered. A repeat examination of all men was made in June 1941.

> "In no case," Dr. Siebert reports, "was there any radiographic evidence of pulmonary disease."

Three cases of silicosis contracted before employment by Owens-Corning had been discovered by the company. None of these men had ever been employed in the batch house, but their employment does require the handling of Fiberglas products. It is the policy of the company neither to refuse employment to, nor discharge, any man for whom safe employment can be found. The following summarizes the case histories of these three workers.

Case No. 1 worked for another company as a molder from 1924 to 1929, and roentgenograms of the chest were made in 1929 because of the presence of tuberculosis in his family. Chest plates were again made in 1936 because of suspicion of silicosis. He was first employed by Owens-Corning on June 6, 1940.

Case No. 2 was employed as a bottle blower and machine operator from 1901 to 1930. He was first employed by Owens-Corning on March 26, 1941. Silicosis was diagnosed following an x-ray of the chest made on May 12, 1941.

Case No. 3 worked for 12 years as a molder before entering the employ of Owens-Corning Fiberglas Corporation on October 25, 1939. Silicosis was diagnosed following an x-ray of the chest on November 1, 1940.

> "In each of these silicosis cases," Dr. Siebert says in his report, "there is a sufficient causative factor in the man's previous employment history or other circumstances, and the evidence is entirely inadequate to indicate that the condition of any one of these three men should be attributed to any silicosis hazard encountered in handling Fiberglas, even assuming such a hazard to exist."

Records of disability and absenteeism filed in the office of the plant physician of the Newark factories were examined by Dr. Siebert, and revealed no unusual incidence of respiratory infections among Owens-Corning employees. Statements furnished to Dr. Siebert by Newark physicians whose practices are limited to eye, ear, nose and throat diseases, and who are in no way associated with Owens-Corning, indicate that these specialists notice no unusual incidence of respiratory disturbances among their private patients employed by the company, as compared with their private patients who are not employees.

A letter to Dr. Siebert from the Claims Referee of the Industrial Commission of Ohio, dated June 17, 1941—when the manufacture of Fiberglas products had been carried on over a period of nine years in Ohio—states that no claim for workers' compensation has ever been filed in the State on the basis of a disease of the upper respiratory tract caused by the alleged inhalation of Fiberglas particles. The letter reads, in part, as follows:

> "For your information we recognize diseases of the respiratory tract as compensable occupational diseases, such as silicosis, asbestosis, anthracosis and siderosis. As a matter of fact there is a provision under the law to recognize any disease of this type which is caused by the [illegible]
>
> "We endeavor to keep a complete statistical record in the Department of Safety and Hygiene of all cases of this type. I have made a thorough check with this department, and to date we have never had a claim filed for a disease of the upper respiratory tract caused by the [illegible] Fiberglas particles."

Summing up, Dr. Siebert says in his report:

> "In submitting his best judgment, based on his professional interpretation of all [illegible] examined in the course of the investigation, the author [Dr. Siebert] finds that there is no silicosis, fibrosis or dust hazard connected with working with Fiberglas."

Respirators Not Mandatory

On May 5, 1942, the Chief of the Bureau of Industrial Hygiene of the National Institute of Health, wrote a letter to the medical officer in charge of the U. S. Marine Hospital, Boston, concerning the wearing of respirators by workers engaged in handling Fiberglas.

The letter reads, in part, as follows:[1]

> "As Fiberglas has not, to my knowledge, been incriminated as causing fibrotic or other disease of the lungs, the mandatory use of respirators would not appear justified. It is considered good hygienic practice, however, to provide respirators for workers exposed temporarily to excessive quantities of any kind of dust, or to workers who are sensitive to certain dusts and need personal respiratory protection."

Navy Memorandum

Although no specific cases of injury in connection with the installation of fibrous glass [Fiberglas] insulation in ships had ever been reported, the Navy Department Bureau of Ships requested the Navy Department Bureau of Medicine and Surgery to make an investigation and recommendations.

After reference of the matter to the Division of Industrial Hygiene of the National Institute of Health, the Bureau of Ships and the Bureau of Medicine and Surgery sent a memorandum, dated December 30, 1942, to the Commandants of all Naval Districts; the Commandants of all Navy Yards; all Supervisors of Shipbuilding, USN; the Commanding

[1] Issued by permission of J. C. Townsend, M.D., Chief, Division of Industrial Hygiene, U.S. Public Health Service.

Officers of all tenders and repair ships; and all Industrial Managers, USN.

This memorandum[5] contained the following statements:

> "Because of the physical characteristics of glass wool the hazard-producing damage to the human lung is practically nil.
>
> "No cases of silicosis or other disabling changes in the lung have been brought to the attention of the Division of Industrial Hygiene of the National Institute of Health in association with the handling of glass wool or glass fibers.
>
> "It is concluded from observations, investigations and available literature that there is no appreciable health hazard associated with the handling of fibrous glass and slag wool in the blanket or board form."

Aetna Casualty Statement

The Aetna Casualty and Surety Company underwrites insurance covering any ill effects upon the health of Owens-Corning employees caused by the handling of Fiberglas products.

A letter, dated June 21, 1941, written by the manager of the insurance company's Engineering and Inspection Department, to the company's general agent in Toledo, reads in part as follows:

> "... Relative to the use of Fiberglas, rock wool, or slag wool, I have discussed this matter very thoroughly with our Medical Department insofar as it applies to the installation of glass wool and its relation to silicosis, and I know of no better answer to give you than their direct statement:
>
> "'We may definitely state that this is not possible, based upon the established fact that silicates of which glass wool is composed will not produce silicosis or a similar condition.
>
> "'Free silica, which when inhaled in sufficient quantity will produce silicosis, is one of the ingredients of many varieties of glass. However, in the manufacturing process, the free silica chemically unites with other substances, leading to the production of silicates, and glass is a solid solution of these various silicates produced by the fusion of free silica with metallic oxides. Glass wool consists of glass in the form of very fine strands.'"

EFFECTS ON THE SKIN

From time to time newly employed workers, unaccustomed to handling Fiberglas materials, have experienced a mechanical irritation of the skin. The period of discomfort has seldom exceeded a few days.

Manufacturing experience indicates that such irritation is minimized and the period of discomfort lessened when it occurs if workers wear clothing loose at the neck and wrists and use plenty of warm water and soap when the day's work is done. The United States Public Health Service has suggested use of a soap containing a wetting agent. Such a soap is Lan-O-Kleen (cornmeal impregnated with lanolin), a hand cleaner manufactured by the West Disinfecting Company that is widely used in industry to remove particles that cling to the skin.

The Owens-Corning physician in charge of the medical dispensary at the company's plants and laboratories in Newark, Ohio, writes[6] as follows:

> "Occasionally, new employees suffer a mechanical irritation of the skin for a few days at the start of the job. For relief from this irritation during the stage when they are becoming accustomed to handling the products, I recommend that they apply as a soothing agent calamine lotion containing one per cent phenol, a preparation that may be obtained at any corner drug store without a physician's prescription ... the irritation disappears within a few days, the new workers apparently become immunized against the action of the fibers, and they suffer no further discomfort."

Soap and water has proved most effective in removing particles of fibers, whether of glass or any other material, from the skin. The company has found that there is seldom, if ever, need of gloves, armlets or other protective clothing. In their absence, there is less likelihood that fiber particles will be rubbed into the skin

Siebert Investigation

Study of this occasional irritating effect upon the skin comprised a phase of the investigation undertaken by Dr. Siebert on behalf of St. Louis Local No. 1 of the Heat and Frost Insulators and Asbestos Workers. (See page 2).

An examination of the wrists, arms, ankles, necks, eyes, shoulders and waists of approximately two hundred employees in the Newark Fiberglas factories was made by Dr. Siebert. These workers were employed on production lines and on fabricating operations, cutting, sawing, shaping, transporting and packaging glass thermal insulating wool, both bonded and unbonded.

No case of eye irritation or conjunctivitis was discovered during this inspection. Evidence of significant skin irritation was shown by only one worker, a man who had begun work in the plant four days before. Two biopsy specimens of skin were removed from the arm of this newly-employed worker.

Serial microscopic sections of this tissue examined by Dr. Siebert showed a mild degree of capillary dilatation in the corium of the skin. In addition, there were a few scattered lymphocytes around several of the dilated capillaries. The epidermis was entirely normal. No glass particles were found. Dr. Siebert reported no evidence of fibrosis, bacterial infection, allergy or hyperkeratosis.

Several of the serial sections revealed a small amount of a brownish pigment in the corium which showed no inflammatory reaction around it.

> "It is assumed," says Dr. Siebert, "that this pigment is bakelite, one of the substances used as a binder for the glass fibers. The fact that there was no foreign body reaction around this indicates that this material is an inert substance, and that it does not produce either a foreign body reaction or a fibrosis. The extremely mild inflammatory reaction in the corium of the skin would result from any slight mechanical irritation."

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[5] Reported in The Philadelphia Navy Yard Beacon, Vol. II, No. 16 (February 6, 1942). S. L. References: BUSHIPS 330—[illegible] (3436) EN28/A3-1) and BUMED P3/[illegible]. Final statement of the memorandum: "It is requested that the foregoing be brought to the attention of all persons having cognizance of or interest in the handling and installation of the subject material."

[6] In a letter dated June 20, 1941, from R. A. Campbell, M.D. to Dr. Walter J. Siebert. The letter is Exhibit 23 in Dr. Siebert's Fiberglas Health Hazard Investigation.

Dr. Siebert summarizes his conclusions regarding this phase of his investigation in the following words:

> "The author [Dr. Siebert] believes the following generalization is warranted by the evidence: Contact with glass wool may cause ephemeral discomfort among workers inexperienced in handling the material. The skin irritation, however, cannot be regarded as a progressive dermatitis, for it is non-toxic and usually disappears in a few days. In extremely rare instances, where a worker may be predisposed to secondary effects of mechanical skin irritation because of lymphatic edema, allergy or the presence of foci of infection elsewhere in the body and otherwise protected from the effects of mechanical irritation, lesions may persist. But these cases are exceptional with such reality that they do not justify incriminating glass fiber as a causative factor."

Sulzberger-Baer Investigation During the spring and summer of 1942, Dr. Marion B. Sulzberger, Assistant Clinical Professor of Dermatology and Syphilology, New York Post Graduate Medical School, and Dr. Rudolf L. Baer, Junior Assistant Dermatologist and Syphilogist, New York Post Graduate Hospital, carried out an experimental investigation of the effects of Fiberglas on the skin of laboratory animals and human volunteers. A report of their investigation was published in the October 1942, issue of *Industrial Medicine*.[7]

The laboratory animals used were rabbits and guinea pigs. Depilated sites on the animals were rubbed almost daily, except Sundays and several Saturdays, over a period of a month, with Fiberglas materials in both their wool-like and textile forms. Ten human subjects were rubbed daily, except Sundays, with the same materials, for periods ranging from seven to nineteen days.

Histological examination of the reaction sites in animals and human subjects showed evidence of a superficial inflammatory process. The histologic sections did not show any evidence of permanent damage, and the epidermis was generally found to be intact and undisturbed in its continuity.

Special methods of fixation which were designed to retain clinically visible glass spicules sticking into the skin, were used in the attempt to demonstrate these spicules in the histologic section. However, in none of the many slides examined could the glass spicules be seen.

> "This," Dr. Sulzberger and Dr. Baer say, "together with the fact that no disturbance in the continuity of the horny layer of the epidermis was seen, suggests that the spicules which were seen clinically after the rubbings, were only very superficially embedded. No foreign-body reaction was seen in any of the sections examined, thus demonstrating that no fragments of the various materials used in these experiments had penetrated into the deeper layers of the skin."

Summarizing the results of the investigation, Dr. Sulzberger and Dr. Baer say:

> "All of the reactions observed were of a transitory and superficial nature. The only part of the reactions which persisted for more than a few days were slight thickening and brownish pigmentation of the skin. The latter were sometimes apparent for several weeks. No reactions or symptoms outside the rubbed skin areas were observed at any time during the experiments.
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> "The pieces of material which were most sticking into the skin after rubbings with Fiberglas in its wool-like form appeared to be very superficially embedded. This observation was borne out by the fact that ordinary washing with water easily removed a large part of the spicules remaining in the skin after rubbing.
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> "No definite sensitization to any of the materials could be demonstrated. In a few subjects there were a few mild and evanescent reactions to several of the materials, but it appeared very questionable whether these reactions were based on specific sensitization."

Navy Memorandum The Navy Department Bureau of Ships and Bureau of Medicine and Surgery investigation of possible health hazards in connection with the installation of Fiberglas insulation in ships (see page 3), discussed the effects of Fiberglas upon the skin.

The section of the memorandum summarizing results of the investigation (dated December 30, 1942), which refers to skin effects, reads as follows:

> "The irritation of the skin from contact with glass fibers is of a purely transitory and superficial nature. Only the immediate skin areas in contact with or rubbed with glass wool are slightly irritated, accompanied by a slight thickening of the skin, lasting at most for a few days. Minute pieces sticking to the skin and appearing to be superficially embedded are readily removed by ordinary washing with water."

Schwartz-Botvinick Report In an investigation of skin hazards in the manufacture of glass fiber insulating materials and glass fiber textiles, Dr. Louis Schwartz, medical director, and Dr. Isadore Botvinick, P.A. Surgeon of the Division of Industrial Health, National Institute of Health, United States Public Health Service, reported the following:[8]

> "The hazards to workmen using glass wool products for insulation and for other purposes are those due to abrasions by slugs in the glass wool. A few may develop allergic dermatitis from contact with improperly cured binders. If such workers wear leather gloves, impervious sleeves, and aprons, they will be afforded adequate protection against these hazards.
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> "Workers handling glass fiber in textile manufacturing may develop dermatitis from the mechanical cutting action of the fibers on the skin, and a small percentage of them may develop an allergic dermatitis from the [illegible] irritation of the arms, neck, chest, and other parts of the body may be prevented by wearing impervious sleeves and aprons. Irritation of the nasal mucosa may be prevented by inserting a bland grease into the nostrils two or three times a day.
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> "According to an official of the company, the incidence of dermatitis at the [illegible] plant was low, being in the order of 1% of the employees employed. No compensation cases had developed, indicating that the dermatitis is not severe. Some new employees experience sensitivity to handling the glass fibers for a few days and may wear gloves or protective clothing at first, but an immunity seems to develop

[7] Sulzberger, Marion B., M.D., and Baer, Rudolf L., M.D., "Effects of Fiberglas on Animal and Human Skin," *Industrial Medicine*, Vol. XI, No. 10, pp. 635-638, October, 1942.

[8] Schwartz, Louis, and Botvinick, Isadore, "Skin Hazards in the Manufacture of Glass Wool and Thread" in *Industrial Medicine*, Vol. XII, No. 3 (March 1943), pp. 240-244.

quickly so that the great majority of experienced workers prefer to work without gloves or special clothing. Exceptions are found among employees handling hot equipment, coarse filter fibers, metal lath, and other collateral materials of like nature. In the principal wool and textile departments, workers, according to management experience, report greater discomfort from gloves and protective clothing than from the material with which they work."

GENERAL HEALTH EFFECTS

No claim for workers' compensation based on a pulmonary industrial disease or disability resulting from an occupational skin disorder attributable to Fiberglas as differentiated from other materials, has ever been validated in the State of Ohio, where manufacture has been centered since 1932. The number of employees in the Ohio Fiberglas factories has risen from about 20 in 1932 to several thousand, whose total exposure aggregates millions of man hours. In addition, exposure in Ohio includes several thousand employees in the factories of refrigerator and range manufacturers where Fiberglas insulating materials have been handled on assembly lines.

Compensation Assessment Low Ohio's workers' compensation rates (assessed against the employer per $100 of payroll) for men and women engaged in the manufacture and handling of Fiberglas are lower than for workers in comparable industries, as is shown by the following figures, which are recorded as Exhibit 11 in Dr. Siebert's report:

Fiberglas textile employees	66c
Fiberglas insulating wool employees	95c
Asbestos manufacturing	$1.00
Rubber manufacturing	$1.00
Fiber goods manufacturing	$1.10
Carbonate of magnesia manufacturing	$1.10
Building Material dealers' employees	$1.20
Clay products manufacturing	$1.60
Paper manufacturing	$1.60
Wood pulp mills	$2.00

Health Record Excellent The health of Fiberglas workers is regarded as better than average by the Aetna Life Insurance Company, which underwrites group insurance (life, disability, sickness and hospitalization) for employees of Owens-Corning Fiberglas Corporation. In a letter to an Owens-Corning executive, dated June 11, 1941, Aetna's Toledo general agent wrote, in part, as follows:

"The health of your employees has been better than average. This is evidenced by the fact that we now have in effect a 38% reduction in rate (from standard) on both the sickness and hospitalization insurance carried by your employees. This is the result of nearly four full years' exposure, and develops a rate lower than any similar industry that we have insured . . .

"There is in effect a permanent and total disability feature in connection with your life insurance, and as yet there has been only one claim from an employee, and this was due to a non-occupational accident, far removed from the course of his occupation or from any health hazard in his occupation.

"As further evidence, our Casualty Company carries, what is known as, Products Liability at an extremely low rate, and no claim has ever been presented, indicating, of course, that there is no hazard in the use of Fiberglas or any of its products."

Surgical Uses Of Fiberglas Several surgical uses of Fiberglas described in recent medical literature are of interest as demonstrating the fact that glass is an inert, non-toxic substance which produces no harmful effects on human tissues.

The use of a strand of Fiberglas yarn as a tracer thread that makes it possible to detect the presence of a surgical sponge if left in a wound during an operation, is described by Captain Edward F. Lewison[9], Medical Corps, United States Army, who says:

"... I undertook to find a safe surgical sponge—one that would cast a permanent X-ray shadow and, thus, could be readily detected by an X-ray film ... It was not until the recent development of fiberglas thread that a practical and apparently ideal solution to the problem was found.

"... this specially prepared fiberglas yarn was found to embody the following qualities:

1 Marked radio-activity
2 Minimum tissue reaction
3 Chemical inactivity
4 Physical properties of pliability, delicacy and appearance resembling a fine silk thread
5 Reasonable cost of production

"Like glass, which is the basic constituent of its composition, this thread is chemically, physically, and biologically inert, yet unlike glass it is a thread of exceptional strength, soft texture, and remarkable plasticity . . .

"It was, therefore, almost inevitable that the hidden aptitudes of a specially prepared radio-opaque fiberglas yarn should be discerned and a thread developed which was permanently impenetrable to the X-ray and perfectly harmless to body tissue as well.

"... no more than one opaque thread per sponge is required. This reduces the cost of production and thereby enhances the practical virtues and expediency of this type of safe surgical gauze . .

"The essential characteristics of a sponge as defined by the American College of Surgeons are as follows

1 Ability to absorb the greatest quantity in the shortest time
2 Ease of sterilization
3 Freedom from loose threads
4 Uniformity
5 Softness, to prevent trauma
6 Freedom from foreign substances

"... With the innovation of 'rayable' surgical gauze these general standards remain unaltered Radio-opaque thread is soft, sterilizes readily, and as a single strand could hardly change the absorbent quality of a sponge or pad. If characteristic (6), in the classification of the American College of Surgeons, 'Freedom from foreign substances,' is construed as meaning freedom from harmful, and toxic foreign substances, then this benign fiberglas yarn qualifies within the interpretation of this essential characteristic."

Dr. Roy Philip Scholz and Dr. Philip S. Mountjoy[10] describe the use of Fiberglas thread as a suture material employed to sew surgical wounds.

The authors of the article write:

"... Because Fiberglas is inert and non-reacting

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[9] Lewison, Edward F., Captain, Medical Corps, United States Army. "Sterile Gauze as a Factor of Safety in Surgical Operations." *Bulletin of the American College of Surgeons*, Vol. XXVII, No. 1, pp. 39-40, January, 1942.

[10] Scholz, Roy Philip, M.D., and Mountjoy, Philip S., M.D., "Fiberglas Sutures Material." *American Journal of Surgery*, Vol. LVI, No. 3, pp. 479-[illegible], June, 1942.

in the tissues and practically insoluble, it does not cause circulation, edema, or cell proliferation; and it in no wise interferes with wound healing . . .

" . . . It is not affected by tissue fluids, enzymatic action, or action of chemicals; neither does it produce toxins or allergic reactions. The fact that each fiber is an extremely fine, solid filament of pure glass, makes it non-absorbent, and in view of its being a non-irritant, it does not call forth tissue fluids which would harbor germ life."

A third surgical use of Fiberglas deserves mention because of the part it is playing in helping to save the lives of men of the fighting services who are wounded in battle.[1] From all the war fronts comes word that blood plasma transfusions are proving to be one of the greatest single factors in radically reducing the number of wounded who succumb to their wounds in this, as compared to other wars.

A small strip of tape, woven of glass fibers, is used as a filter in the tubing of the light, portable apparatus used to give the transfusions—frequently just behind the front lines. Through this strip of Fiberglas tape all the plasma fluid passes on the way from the plasma bottle to the wounded man's veins.

The Fiberglas tape is used as the filter because the tape can be sterilized for repeated use, because it requires no bulky housing, because the weave is close enough to strain out any undissolved particles the fluid may contain, and because, being glass, the fibers do not swell when wet, thus offering no impediment to the free passage of the fluid.

[1]"New Type Plasma Filter Will Aid in Prevention of Fatal Wound Shock" in *Surgical Business*, Sept., 1942, pp. 20-21.

PHYSICAL AND CHEMICAL PROPERTIES

The raw materials of which Fiberglas is made are selected sands and mineral oxides. The result of the fusion of these materials is true glass, which is then processed into a radically new form.

Chemically, Fiberglas is similar to other forms of mineral wool. It can properly be classified as a new, refined form of mineral wool. The fact that other forms of mineral wool (rock wool and slag wool) have been used for many years, in itself strongly suggests [illegible] in the inherent chemical and physical characteristics of Fiberglas that is likely to introduce any serious occupational hazard.

Fiberglas contains no free silica; no free sodium silicate. No carcinogenic hydrocarbons or other hydrocarbons can be present because of the extremely high temperatures employed in fusing the raw materials. No harmful fumes can be given off, since no substances are present which will volatilize within the recommended service ranges.

HEALTH ASPECTS OF FIBERGLAS MATERIALS

ANNOTATED BIBLIOGRAPHY

LUNGS AND RESPIRATORY TRACT

Gardner, Leroy U., M.D., *Annual Report of The Saranac Laboratory for the Study of Tuberculosis of the Edward L. Trudeau Foundation for the Year 1940*, p. 11.

Dr. Gardner reports that the apparent lack of pulmonary damage from exposure to glass wool dust is being demonstrated by an inhalation experiment.

Gardner, Leroy U., M.D., "Report of the Director of The Trudeau Foundation—1941" in *The Fifty-Seventh Annual Medical Report of the Trudeau Sanatorium and the Thirty-Seventh Medical Supplement for the Year ending September 30, 1941, together with the Twenty-Fifth Collection of the Studies of the Edward L. Trudeau Foundation for Research and Teaching in Tuberculosis.*

On the last page, Dr. Gardner reports that work carried on at the Saranac Laboratories in 1941 has demonstrated that exposure to dust of glass wool involves no hazard for the lungs because the fibrous material is not inhalable.

"Researches of Mellon Institute 1940-41" in *News Edition, American Chemical Society*, Vol. XIX, No. 7 (April 10, 1941), p. 402.

Dr. Gardner's research is reported as follows: "We have been studying the effect of inhaled glass wool. Apparently even the finest textile glass can up as an atmospheric dust is not inhaled in appreciable concentrations and does not produce any dangerous effects upon the lung."

"Fibrous Glass Insulation Not Harmful" in *The Philadelphia Navy Yard Beacon*, Vol. II, No. 15 (February 5, 1943), p. 2.

This article reports conclusions based on an investigation by the Bureau of Ships and the Bureau of Medicine and Surgery of the Navy Department. Final statement: "It is concluded from observations, investigations and available literature that there is no appreciable health hazard associated with the handling of fibrous glass and slag wool in the blanket or board form."

Entitled "Fibrous Glass Insulation: Health Aspects of," a report of the investigation is contained in a memorandum dated September 30, 1942 which is indexed as BUSHIPS S38-1 (3630) EN28/A2-11 and BUMED F3/S38-1 (109).

SKIN

Sulzberger, Marion B., M.D., and Baer, Rudolf L., M.D., with the technical assistance of Lowenberg, Clara, M.S., and Menzel, Hildegard, B.S., "The Effects of Fiberglas on Animal and Human Skin—Experimental Investigation" in *Industrial Medicine*, Vol. XI, No. 10 (October, 1942), pp. 482-484.

Report of clinical investigation of effects of glass fibers on the skin, in which the authors find: "All of the reactions observed were of a transitory and superficial nature."

Abstract of article by Dr. Sulzberger and Dr. Baer, cited above, appears in *Industrial Hygiene Digest*, Vol. VII, No. 2 (February, 1943), p. 7.

Schwartz, Louis, Medical Director, and Botvinick, Isadore, P.A. Surgeon, Division of Industrial Hygiene, National Institute of Health, United States Public Health Service, "Skin Hazards in the Manufacture of Glass Wool and Thread" in *Industrial Medicine*, Vol. XII, No. 3 (March, 1943), pp. 142-144.

GENERAL HEALTH

Siebert, Walter J., M.D., "Fiberglas Health Hazard Investigation" in *Industrial Medicine*, Vol. XI, No. 1 (January, 1942), pp. 6-9.

Report on investigation to determine whether manufacture or handling of Fiberglas involves any unusual occupational hazards.

Abstract of Dr. Siebert's article cited above appears in *Industrial Hygiene Digest*, Vol. VI, No. 2 (February, 1942), p. 9.

"Equipment With Dust-Stop Filter Acceptable" in *Journal of the American Medical Association*, Vol. CXVII, No. 11 (September 13, 1941), p. 938.

Description of units placed in window frame equipped with Fiberglas air filter to remove pollen from air entering room. Often called to hay fever clinics.

W. G. Hazard, P.A. Industrial Hygiene Engineer (R), U.S.P.H.S., "Summary of Remarks on Health Aspects of Fiberglas Materials." Excerpt from the Proceedings of the Rhode Island Industrial Health Institute, May 10, 1943. 4 pages. Copies available on request to Division of Industrial Hygiene, R.I. Dept. of Health, Providence.

The manuscript concludes:

"The job of the industrial hygienist is to show manufacturers how they can use all manner of materials without injury to any worker. In the case of Fiberglas, the danger is not real but imaginary. The following points might well be discussed with employees when they are hired, and periodically afterwards:

1. Breathing glass fiber dust is not harmful to the lungs.
2. Irritation of the skin is temporary, superficial, and not progressive.
3. No special personal protective devices or clothing need be worn, except that in overhead applications of glass fiber, goggles are often desirable to protect against falling bodies.
4. Frequent washing and a daily shower with soap and warm water will readily remove most of the small fibers clinging to the skin and will reduce any 'itching'."

"Hazards Reduced War Effort" in *Safety Engineering*, Vol. LXXXIV, No. 1 (July, 1942), pp. 26-27.

Use of Fiberglas for thermal insulation, sound absorption and light reflection in two Southern bomber assembly plants described as being instrumental in eliminating occupational hazards.

"Fire-Safe Air Conditioning" in *Buildings and Building Management* (October, 1941), pp. 33-34.

Fire-safety factors which should be considered in installing air conditioning equipment. Use of Fiberglas air filters minimizes smoke loss in department store fire.

FIBERGLAS IN SURGERY

Lowrance, Edward F., M.D., Captain, MC, "Repable Gauze. Development of a Radiopaque, Threaded Gauze Surgical Sponge," in *Annals of Surgery*, Vol. CXVI, No. 2 (August, 1942), pp. 311-314.

Dr. Lowrance suggests that in the manufacture of all surgical gauze that is to be used in the operating room, a single strand of lead "Fiberglas" thread might be incorporated into the gauze mesh, or so placed in prepared pads, sponges and gauze drain filler, that "lost" sponges can be more readily recovered by roentgenographic identification.

Lowrance, Capt. Edward F., M.C. United States Army, "Radio-Opaque Thread — A Guide to the 'Lost' Sponge" in *Modern Hospital*, Vol. LVIII, No. 4 (April, 1942), pp. 67-68.

Report on use of a strand of Fiberglas yarn as a tracer thread in surgical sponges.

Lowrance, Edward F., M.D., "A Safe Surgical Sponge" in *Surgery, Gynecology and Obstetrics*, Vol. LXIX (November, 1939), pp. 690-695.

Dr. Lowrance reports experimental work leading to development of a radiopaque, fibrous glass thread placed in surgical sponges.

Lowrance, Edward F., Captain, Medical Corps, United States Army, "Repable Gauze As a Factor of Safety in Surgical Operations" in *Bulletin of the American College of Surgeons*, Vol. XXVII, No. 1 (January, 1942), pp. 39-40.

Report on use of a strand of Fiberglas yarn in a tracer thread in surgical sponges. Writes Dr. Lowrance: "Like glass, which is the basic constituent of its components, this [Fiberglas] thread is chemically, physically, and biologically inert, yet unlike glass it is a thread of exceptional strength, softness, and remarkable pliability . . . It was, therefore, almost inevitable that the hidden qualities of a specially prepared radio-opaque Fiberglas yarn should be discovered and a thread developed which was permanently impenetrable to the X-ray and perfectly harmless to body tissue as well."

Sabato, Roy Phillip, M.D., and Menninger, Philip B., M.D., "Fiberglas Suture Material" in *American Journal of Surgery*, Vol. LVI, No. 3 (June, 1942), pp. 600-[illegible].

Report on experimental use of Fiberglas sutures in animal and human surgery. Dr. Sabato and Dr. Menninger write: ". . . Because Fiberglas is inert and non-reactive in the tissues, and practically insoluble, it does not cause exudation, edema, or cell infiltration, and it in no wise interferes with [illegible] . . . It is not affected by tissue [illegible] fluids, excessive acidity, or excess of [illegible] neither does it produce toxic or allergic reaction. The fact that each fiber is an extremely fine, continuous filament of pure glass, makes it non-absorbent, and in view of its being a non-irritant, it does not soak up tissue fluids which would harbor germ life."

[illegible] in *Newsweek*, Vol. XIX, No. 24 (June 15, 1942), pp. 42-43.

Experimental use of Fiberglas sutures in animal and human surgery.

"New Type Plasma Filter Will Aid in Prevention of Fatal Wound Shock" in *Surgical Business*, Vol. V, No. 5 (May, 1942), pp. 20-21.

Fiberglas tape used as filter in blood plasma transfusion apparatus.

Lock, J. Vernon, M.D., "An Electric Bone Saw and Drill" in *The American Journal of Surgery*, New Series, Vol. LIV, No. 2 (November, 1941), pp. [illegible].

Dr. Lock reports the use of fibrous glass insulation in the construction of an electric motor employed to power a drill used in bone surgery.

HANDLING CHARACTERISTICS

Rogers, Tyler Stewart, "Safe Practice in the Manufacture and Uses of Fiberglas," issued as *Safe Practice Bulletin No. 18* (February, 1940), in the Occupational Disease Prevention Series published at Harrisburg by the Pennsylvania Department of Labor and Industry.

Mr. Rogers reports: "Fiberglas is cleaner, holds together better, contains less 'dust' and foreign materials than the common rock wool and slag wool insulations used for over fifty years . . . Fiberglas employees have compiled an outstanding health record covering millions of man hours of handling Fiberglas products."

McIlvain, E. R., M.D., "Insulation in Screen-Hood [illegible] Trains," issued as *Safe Practice Bulletin No. 3* [illegible] in the Occupational Disease Prevention Series published at Harrisburg by the Pennsylvania Department of Labor and Industry.

Dr. McIlvain reports: "Fiberglas provides the qualities generally sought in an insulation product in [illegible] and in addition has proven safe for handling purposes by our workmen."

"How Workmen Handle Fiberglas Thermal Insulation [illegible]," issued as *Fiberglas Standards* [illegible], published by Owens-Corning Fiberglas Corporation.

[illegible], Major, A. U. S., "Use of Fibrous [illegible] by the Army and Navy," in [illegible] Technical Publication Vol. VII, No. 3 [illegible] Industrial Minerals [illegible] No. 1600 (Class B, Industrial Minerals [illegible]), pp. 1-16.

This is a reprint of an address [illegible] in New York City on [illegible] before a joint session of the [illegible] Economic Conference and the [illegible] Division of the American Institute of Mining and [illegible] Engineers. The article contains a [illegible] performance description of manufacturing [illegible].