OC-69-35

MAY 1 1 1969

DEPARTMENT OF THE NAVY
NAVAL SHIP ENGINEERING CENTER, PHILADELPHIA DIVISION
PHILADELPHIA, PA. 19112

IN REPLY REFER TO
6764:MA:lal
9390(FA-287)
Ser 752

5 MAY 1969

Owens-Corning Fiber Glass Corporation
Toledo, Ohio 43601

Gentlemen:

Re: Proposed Insulating Materials for Naval Vessels

The serious hazards of asbestos have recently received widespread publicity and have generated a high level of interest concerning its use by the U. S. Navy as an insulating material. There are many varied uses of asbestos in the Navy but the most disturbing, from a health hazards viewpoint, is that for piping and boiler insulation and lagging. The chief hazard exists wherever there is a possibility of dust evolution during operations such as fabrication, installation and especially during rip-out.

In order to minimize the hazards associated with the use of asbestos and therefore reduce the possibility of deleterious effects to the workers, a comprehensive study has been initiated by the Naval Ship Engineering Center, Hyattsville, Md., to investigate the feasibility of substituting alternate materials for asbestos used as lagging, piping and boiler insulation. High temperature insulation, as used by the Navy, must be composed mainly of inorganic materials in order to endure temperatures above 200 F for extended periods. In addition, an acceptable insulation must exhibit the following characteristics:

1. Low heat conductivity.

2. Non-combustibility.

3. Lightweight.

4. Capability of easy molding and application.

5. Moisture repellency.

6. Non-corrosive, insoluble and chemically inert.

7. Composition, structure and characteristics must remain unchanged by temperature at which it is to be used.

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R. J. PELLEYMOUNTER, NOTARY PUBLIC
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8. Must be vermin proof.

9. The material and application costs should be economical.

10. The ideal insulation should be nontoxic and non-injurious to personnel during fabrication, installation, use, or rip-out.

11. Once installed, it should not cluster, become lumpy, disintegrate or build up in masses from vibration.

The Philadelphia Division of the Naval Ship Engineering Center has been assigned tasks to conduct a survey of suppliers of insulation to the Navy, to secure technical data literature, and to investigate medical research findings, safety manuals, and data on research being pursued by private industry intended to develop new or improved materials which may be suitable for replacements for asbestos for piping, felts and lagging. The cooperation and support of industry for this study is earnestly solicited by this activity since the health of the worker is the concern of management, labor and the government. Accordingly, the Navy is desirous of obtaining information on the following:

a. Are alternate non-asbestos containing materials available which may be used as thermal insulation pipe covering? The insulation must offer protection up to 750 F and be manufactured in cylindrical sections up to 3 feet long, and split in half lengthwise.

b. Are there any single layer or combination layered non-asbestos molded materials available which may be used as thermal insulation pipe covering forprotection from 750 to 1200 F?

c. What materials may be substituted for asbestos insulating felt (plain or water repellent) for use on valves or other irregular surfaces and which are suitable for a range from cold water temperature to 900 F?

d. What non-asbestos containing cloth materials may be used as a lagging jacket over thermal insulation, or as a wrapping on engine exhaust pipes, or for piping or tubing, or on the inner and outer surfaces of removable covers and on flanges and valves from -5 F to 1050 F?

e. What heat-resistant bonding materials may be substituted for asbestos insulation finishing cement over block insulation and irregular surfaces where powdering during rip-out has been a problem?

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f. What safety precautions to prevent inhalation of dust are observed during the manufacturing and processing of insulation materials?

g. What safety precautions are recommended during the installation and replacement of insulating materials to prevent the inhalation of asbestos fibers and dust?

h. To what extent or degree will material and installation costs be affected by the elimination or curtailment of the use of asbestos containing insulation?

Due to the urgency of this undertaking, it is requested that the above information be forwarded at your earliest convenience to Dr. M. Ammuth, the project engineer of this task, at the Naval Ship Engineering Center, Philadelphia Division, 6764, Philadelphia, Pa. 19112 (telephone number (215) 755-3922). Information submitted to the Philadelphia Division of the Naval Ship Engineering Center will be utilized by the Naval Ship Systems Command in promulgating a directive which will eliminate the use of materials and practices which are potentially hazardous to the health of insulation workers. This activity has been directed to complete the survey of insulation suppliers by 15 June 1969 to afford time for collation and personal contacts, if deemed necessary.

Please be assured that any product composition and formulae submitted in response to this survey will be held in strict confidence and will be viewed as a voluntary contribution to this perplexing problem to the insulation industry. It is understood that submission of information solicited by this activity will not obligate the government or its agencies in any manner whatsoever.

Very truly yours,

J. W. Murdock

J. W. MURDOCK
Head, Applied Physics Department

To L. W. Saxby - Toledo

From D. Bradshaw - San Francisco

May 29, 1969

ASBESTOS-FREE INSULATION

W. E. Munsey - Santa Clara
L. J. Brunel - San Francisco

The answers to the questions raised by the Department of the Navy are not easy to give as would be expected or the department would not have gone to industry requesting the information.

Without considerable research, which time does not permit, our answers are limited.

The answers are as follows:

(a) Foamglas
Fiberglas Multitemp (if revived)
How about a pipe covering molded from Fiberglas Intermediate Service Board wool to 750°F
In blanket form Eagle-Picher Alumafelt and Tablock
Standard Fiberglas pipe covering to 450°F

(b) No molded materials known to us.
E-P Tablock pipe covering in blanket form good to 1400°F.

(c) Tempmat and Ercomat to 1200°F (same product).
Fiberglas Marine High Temp. Insulation to 1200°F.
E-P Superglas Molded Felt to 1000°F
E-P Mineral Fiber Blankets to 1400°F

(d) Fiberglas cloths and tapes manufactured to meet either outside or hot side temperatures according to use.

(e) No finishing cement known which does not contain asbestos fibers.

(f) Dust collection systems and breathing masks.

(g) Specifically related to Navy work it is very impractical to install dust collection systems on board ship to protect all craft workers either when installing or removing insulation materials, and all men would have to wear proven masks when available to assure total protection of every man working on board.
The direction to go is to non asbestos materials.

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NO. 101-008 FOR IDENT.
R. J. PELLEYMOUNTER, NOTARY PUBLIC
11-16-81

L. W. Saxby

(h) It appears that it should be possible to go to non asbestos insulation systems at about present costs. Some allowances may have to be made for appearance or damage resistance, but this would be minor in the achievement of the objective.
This is based on the availability of a non asbestos calcium silicate pipe covering and finishing cement.

This is the time to perfect a coated Fiberglas textile fiber resistant to the base chemical conditions found in calcium silicates for use as the reinforcement in Kaylo.

Let's get rid of asbestos in the insulation industry and we can then get rid of other costly problems which are beginning to develop. This should be our number one research program at this time, as we now have the cause for this important action.

DB:kw

Environmental Sciences Laboratory

of The City University of New York

INSULATION HYGIENE PROGRESS REPORTS

FROM THE INSULATION INDUSTRY HYGIENE RESEARCH PROGRAM

Irving J. Selikoff, M.D., Program Director

Vol. 2, No. 1 Spring 1971

SPECIAL ISSUE

This issue of *Insulation Hygiene Progress Reports* contains a report given by Mr. Donald Bradshaw to the 1970 Annual meeting of the National Insulation Contractors Association at Dallas, Texas. It begins in the next column.

In his call for "good housekeeping for good health", Mr. Bradshaw enumerated responsibilities of insulation contractors, general contractors or owners, government authorities, unions, workmen, and manufacturers in the drive to achieve work safety.

What Progress Has Been Made

As he is Chairman of the Health and Safety Committee of N.I.C.A., his remarks take on special significance. They illustrate how far the insulation industry has progressed since the first publication of the health hazards of asbestos insulation workers in 1964 by Dr. Irving J. Selikoff, and since the beginning of the Insulation industry Hygiene Research Program two years ago.

Safety Practices

The talk, which is illustrated by IIHRP photographs, well summarizes many of the safety practices developed by the IIHRP and others. We look forward to having those practices already developed become standard on all job sites, and to finding appropriate solutions for those problems still remaining.

AND NEXT:

The next issue of Insulation Hygiene Progress Reports will discuss, among other items, the precautions to be taken in the use of fibrous glass products and the potential hazards associated with volatile adhesives used in insulation work.

Insulation Contractors Call for "Good Housekeeping"

By Donald Bradshaw

What do we mean by "good housekeeping" as it applies to our industry —the insulation contracting industry —in the context of the theme of this annual meeting? It means the dedicated practice of handling all materials we use so as to minimize and ultimately eliminate all hazards to human health.

What hazards do we face? Already this morning we have been addressed on the human body and its anatomical aspects which can be affected adversely by the use of specific materials common to our industry. How, therefore, can we adapt ourselves to the handling of our materials in a safe and acceptable manner?

Almost thirty years ago the United States was faced with the large-scale development of radio-active fissionable materials, and the handling of these materials required housekeeping methods and safeguards almost beyond comprehension prior to that time. It was done and done successfully because it *had* to be done successfully or the consequences would have been swift and severe.

A Practical Perspective

Over the past two to three years housekeeping in our industry has taken on a very new and significant meaning to us as we have become aware of the magnitude of certain occupational health hazards. At this point we are striving to maintain a practical perspective on the performance of our work while we actively move forward to reduce and eliminate, where possible, the causes of the occupational health hazards.

What, then, is good housekeeping? It is the removal of those causes. Since, at this time, the source causes are an inherent part of the materials we use in our industry, we must exert our best practical efforts towards controlling the use of the materials so as,

Mr. Donald Bradshaw, Chairman of the Health and Safety Committee of the National Insulation Contractors Association. He is also North California District Manager of the Supply and Contracting Division of the Owens-Corning Fiberglas Corporation, San Francisco, California.

to make the working environment as health-safe as possible.

Recently we have seen the imposition of rigid controls in New York city on the application of structural fireproofing protection containing health-hazardous materials. How do such controls relate to everyday practices in our industry where some similar materials are used in a different way?

RESPONSIBILITIES OF INSULATION CONTRACTORS

We are all quick to defend our individual positions as contractors but are we really taking the necessary practical steps of good housekeeping now so obviously necessary in our industry for the health safety of our men and also all other persons at the jobsite or in the shop?

We have two major areas of health

(Continued on second page)

Deposition

EXHIBIT NO. 101-003 FOR IDENT.

R. J. PELLEYMOUNTER, NOTARY PUBLIC

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Insulation Hygiene Progress Reports

Vol. 3, No. 1 Spring 1971

from the

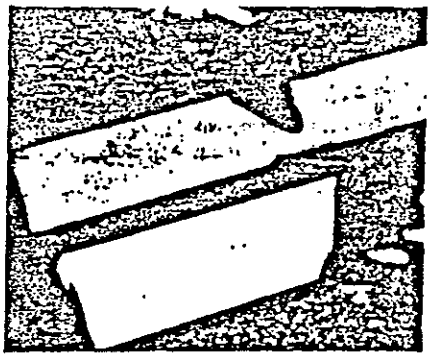
Insulation Industry Hygiene Research Program

Editor: W. J. Nicholson, Ph.D., Published at the Environmental Sciences Laboratory (Irving J. Selikoff, M.D., Director), Mount Sinai School of Medicine of the City University of New York, New York, N.Y. 10029

PURPOSES OF THE INSULATION INDUSTRY HYGIENE RESEARCH PROGRAM

1. To develop improved methods for minimizing exposure of insulation workers to dusts and fumes encountered in their work.

2. To disseminate knowledge of these improved methods of dust control wherever they may be applied advantageously and to offer cooperation, advice and assistance toward their universal adoption.



Vinyl-coated calcium silicate insulation, developed in cooperation with the IIHRP, greatly reduces dust generated during shipment and in subsequent handling by workers.

Five Groups Each Have Their Responsibilities

(Continued from first page)

protection to control:

1. The inhalation of known hazardous insulation material dusts which lead to respiratory tract and lung congestion and disease; and
2. The inhalation of vapors or absorption through the skin of liquids which are harmful to health, and which are found today in a number of adhesives and some surface finishes.

Our responsibility is to:

1. Organize the performance of the work so that the best available practical health safety can be followed;
2. Provide the facilities and equipment which will minimize and, where possible, eliminate, the presence of harmful dusts;
3. Avoid the use of known highly toxic materials in favor of safe ones when available, or ones with the lowest toxicity;
4. Educate our field and shop men in the most effective use of facilities and equipment so as to afford maximum protection for themselves, and see that they are used correctly;
5. Select materials and methods which provide the maximum safety when being applied.
6. Promote the development and use of health-safe materials throughout our industry; and
7. Support the apprentice training programs in the teaching of good housekeeping practices for the health-safe handling of all industry materials.

How should we implement our responsibility?

The Dust Problem

First of all, the harmful dust problem. Let us start in the shop.

See that all materials of a harmful nature are handled so as to control all dust. Some materials are now being coated to reduce dusting in handling. Use a large commercial vacuum cleaner with disposable filter bags to sweep up all powdered or crumpled material.

When bags of insulating cements are broken, carefully repackage them in plastic bags and vacuum up all spilled material.

Where shop fabrication occurs see that your men wear approved masks —U.S. Bureau of Mines or better— and be sure that an adequate and effective dust collection system is used which discharges the material into bags which can be sealed for disposal.

Improved Saws

A new mask is expected to be available by the end of 1970 with a filter medium developed by Johns-Manville and Mount Sinai, and the face piece engineering by Wilson, Welsh, and others.

Keep alert to improved saws which reduce dust. Have disposable bags suspended from frames and deposit scrap and waste material into these bags which must be sealed before disposal. Store fabricated material in lined cartons or containers before shipment so as to contain the dust.

All this seems like a massive undertaking but when you think it through

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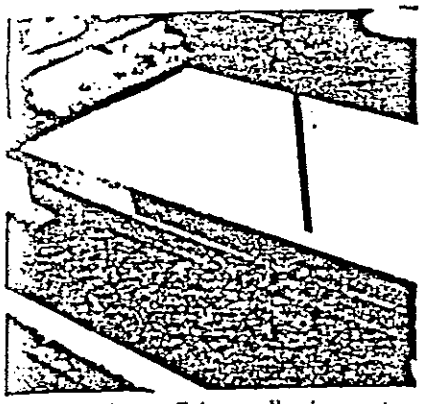
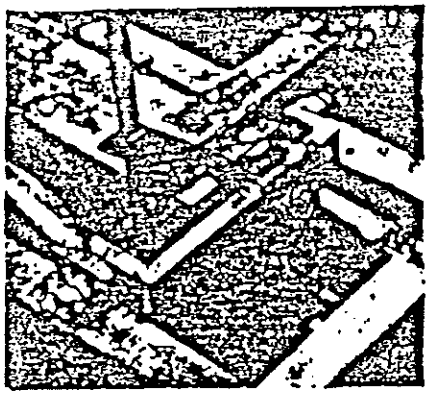
An efficient vacuum cleaner used to clean up fallen material can greatly reduce airborne dust levels.



The use of an efficient collection system attached to table saws reduces dust. See Vol. 1, No. 4 of *Progress Reports* for results of band saw dust collector trials.



A high-velocity collection port located under the bed of a saw. Air velocities as high as 10,000 feet per minute can be generated to collect loose asbestos dust.

Cements Must Be Mixed Under Dust-Controlled Conditions

(Continued from second page)

and follow it out, it is just good housekeeping by any method of measuring, coupled with necessary health protection.

The same fabrication procedures as outlined for the shop fabrication should be followed. Today we are improving high velocity dust collecting equipment which can contribute most significantly to the control and elimination of dust, and such equipment is being adapted to field fabrication saws.

The fabrication shop should be enclosed either in a building or in an enclosure of polyethylene so as to prevent the wind from scouring all the dust out of the shop and depositing it over the jobsite area. Bagging of dust and scrap is necessary, as in the shop, and approved masks must be worn by all people working in the shop area.

All possible fabrication of harmful dust-producing materials should be carried out in the jobsite fabrication area, and the floor and fabrication tables should be vacuum cleaned frequently.

In The Bag Mixing

The mixing of cements should be done under dust-controlled conditions, or the new "in the bag" mixing method used.

The removal of old insulation requires special attention, and should be done with the care necessary to contain the dust and scrap material throughout the process.

Hazardous cloths should be cut, not torn.

What about the point of application fabrication which often requires the sawing and shaping of material for closure pieces or special configurations?

Blowing in the Wind

This is where our good housekeeping falls apart on certain types of work. Way up on the sixth level of a power plant or 120 feet up in the air on a refinery tower, the exposure to our man may not be too great if the wind is blowing away from him, but with the aid of the wind we neatly deposit a fine blanket of material over a wide area.

To make templates of complex shapes to be sent to the fab shop is a lengthy and costly process, so we must devise portable compact enclosed work booths with bagging facilities for dust and scrap and contain all such work at these points. Power saws are now being developed with self-contained dust collectors.

Change facilities on jobs enable the men to change clothes at the start and end of work and, with the improvements being made in throw-away clothing, we are approaching the time of slipover covers which will keep the dust out of the working clothing.

Toxic Vapors, Liquids

Practices of beating dust-forming insulation into place and sinking tie wires into the insulation should be discontinued. Contractors should instruct their men to wear masks whenever hazardous insulation material dust is in the air. A contractor may be found negligent if this is not required.

In the area of toxic vapors or liquids the potential health problems are more easily protected by the selection of materials presenting little or no hazard. Where toxic materials must be used, they should be applied with good ventilation and the men, in confined spaces, should be provided with low-pressure air face masks.

Rubber gloves should be worn at all times. Containers should always be kept closed when not in use.

The responsibilities of the contractor in the area of industry health protection, and the steps he must take in discharging them, result from the position of certain materials he uses in the performance of his work. It is very apparent that should it become possible to remove the causes in the materials we use, then our good housekeeping and working practices can be modified extensively.

OWNERS' RESPONSIBILITIES

In the sense that we are considering the occupational health of our industry, the general contractor's or owner's responsibility is basically one of an understanding of our housekeeping objectives and the reasons for them. He must cooperate with us in the actions we must take in providing us with the necessary working areas, and if essential, remove other crafts from our working area for specific periods of time.

He should not impose any restraints on the performance of our work which would prevent the economical installation of the material.

GOVERNMENT AUTHORITIES' RESPONSIBILITIES

Here we look at all levels of gov-

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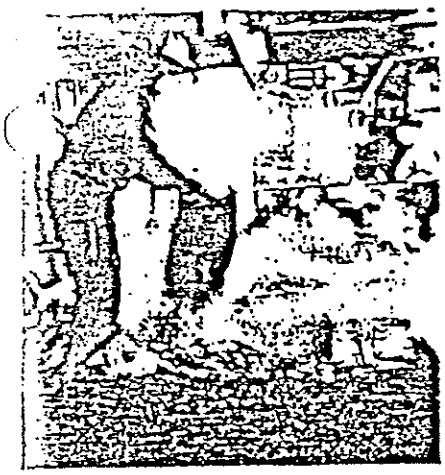
Asbestos workers of Local 91 field testing new disposable respirators of Minnesota Mining and Manufacturing Co. in an amosite pad shop.



Large amounts of dust generated during conventional cement mixing expose asbestos workers and spread throughout the site.

The mixing of asbestos cement in a plastic bag during IIHRP trials.

A Man Should Take Care of Himself —and Others

expect he will prudently lead the way.

What do we mean by prudent? Well, we cannot make every jobsite a "clean room", but we cannot expect a man to over-expose himself unnecessarily to harmful dusts either by his own action or because of lack of equipment.

A man is obligated to take practical care of himself, to educate himself in health protection, and, through good housekeeping practices, protect all other men at the jobsite.

The Individual Worker Must Prudently Lead The Way

(Continued from third page)

ernmental authority, from city to federal, and ask ourselves: Are we going to let government agencies control our business in the field, or are we going to control it ourselves?

We have seen rather sudden and drastic local controls imposed on the structural fireproofing industry in New York city because the industry itself was not organized to take appropriate preventive measures. Legislation in the Health & Safety Construction Act and the Walsh-Healey addendum on material specification sheets faces us at the federal level.

The Daniels bill, if passed, will be much stiffer than the Walsh-Healey bill.

Worthwhile Progress

Are we, as an industry, capable of organizing ourselves before the governmental agencies do it for us? In my opinion, we are making some really worthwhile progress, but we still have quite a lot to accomplish.

We have a common body throughout our industry and that is the international Union. Through this body unity and uniformity of action is possible. Such actions must be responsive to our industry's needs and costs and must be well conceived.

If we ourselves default in our responsibilities then surely the governmental agencies will quickly assume our responsibilities. In summary, we are saying that the government should do only what we ourselves, union and contractor, are unable to do.

I have already touched on the role the International Union can play in promoting singleness of action throughout the nation, but the responsibilities of the Union, both at the International and Local levels, extend into several other areas.

UNIONS' RESPONSIBILITIES

1. To promote the understanding and acceptance of good housekeeping occupational health concepts at the membership level;
2. To stimulate the membership to follow good practical safeguards necessary in the industry;
3. To represent the industry in unity with the contractors at the area level whenever there are inquiries or investigations into the health hazards of our industry, and not take unilateral action which could hurt the industry; and
4. To support regular health examinations for the membership and to sustain a continuing awareness of good housekeeping procedures.

INDIVIDUAL WORKERS' OBLIGATIONS

Without the effective involvement of the individual worker, we cannot achieve occupational health good housekeeping. In fact, we hope and

MANUFACTURERS' RESPONSIBILITIES

All of us can quickly see that good housekeeping in the field and shop has a price tag to the insulation contracting industry: and the cost of this tag could be increased considerably by future possible legislation. To remove the causes is to cancel the price tag and we, as a contracting industry, should give every support to the development and use of non-hazardous materials.

This price tag is not a two cents per hour contribution to support an occupational health program. It is the cost effect of carrying out good housekeeping practices in the field, the impact of which is no small matter.

Good housekeeping? Yes!

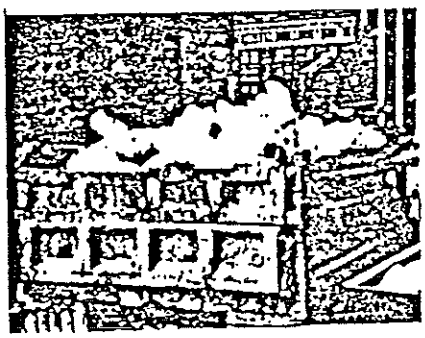
Why? Good health is good sense.

Where? Everywhere.

When? Now.

How? By the methods outlined and to be developed.

Thank you gentlemen.



Bagging of waste material prevents asbestos dust dissemination about the job site and into the general community.

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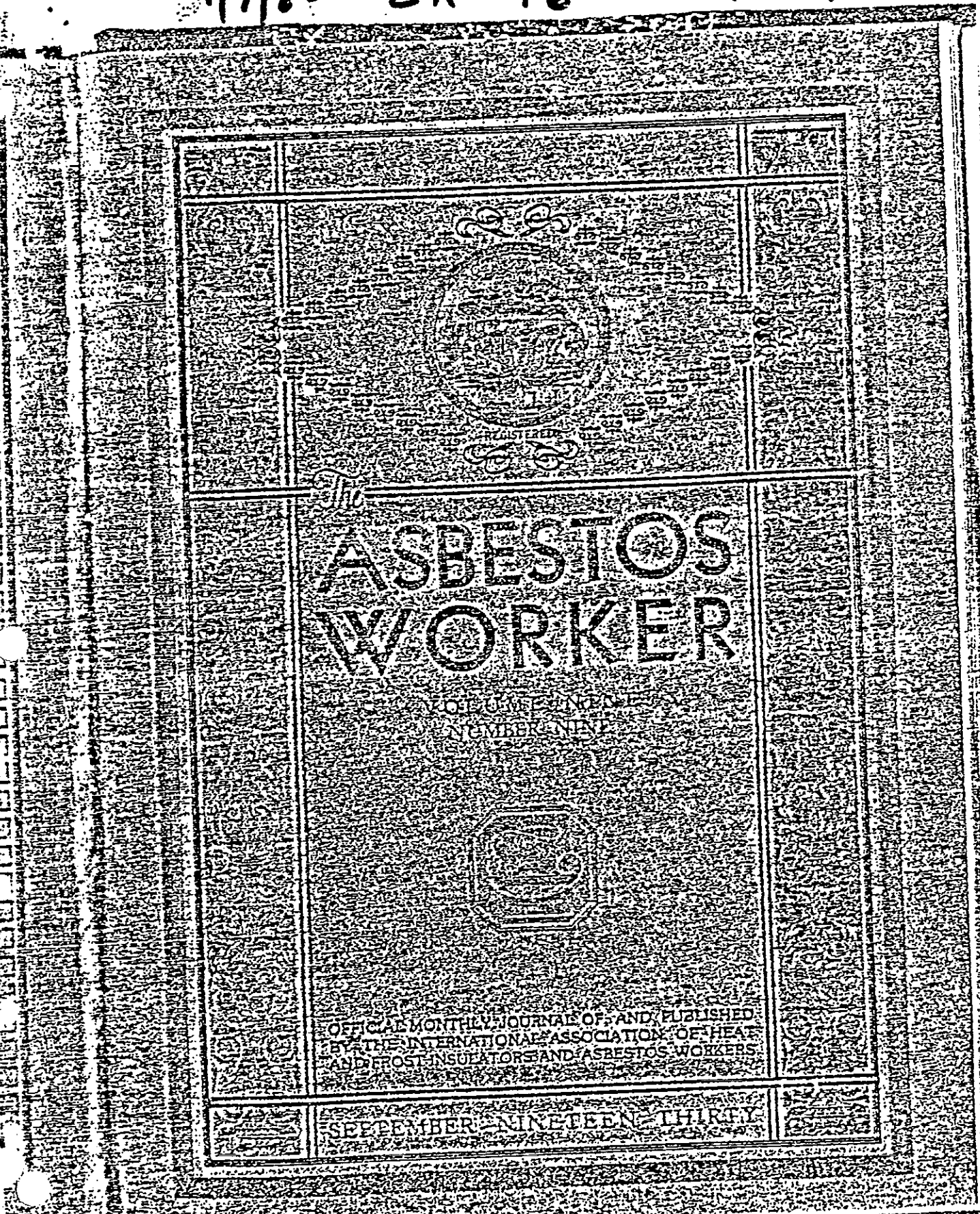

The "Pulmonary Asbestosis" Menace

The increasing use of a very necessary product has created a new occupational hazard, that must be taken into account by Asbestos Worker.

THE steadily increasing use of asbestos in industrial processes has created a new occupational risk and added to the list of industrial lung affections a new form of chronic pulmonary fibrosis. An account of the conditions under which the asbestos-containing rock is mined or quarried and the raw asbestos converted into finished material, together with the results of exposure to these processes, is given by Sir Thomas Oliver in a recent article.

Asbestos, which possesses both mineral and vegetable characteristics, is found in many parts of the world, in rock to which the fine silk-like asbestos fibers are adherent, the types of asbestos in greatest demand for industrial purposes being found in Italy, Russia, Canada, and South Africa. Although the asbestos fibers appear light and fleecy, they are as dense and heavy as the rock itself. In spite of this fact, however, the material can be spun into fine thread, into coarse cord, woven into cloth, or so compressed as to form solid blocks. The chemical analysis shows that the main constituents of the asbestos are magnesia, silica, and oxide of iron, with traces of sodium, potassium, and aluminum. The Italian and Canadian asbestos contains mainly magnesia and silica with only 3 and 5.75 per cent of oxide of iron, respectively, while the South African asbestos contains 40 per cent of oxide of iron and only 2 per cent of magnesia. The proportion of silica in the three kinds of asbestos ranges from 41 to 50 per cent.

In a visit by the writer to the asbestos quarries in Thetford, Canada, it was found that the quarries were deep and the work of mining, therefore, hazardous but that there was comparatively little dust evolved even in the crushing mills until the processes of milling and screening were reached, when there was considerable dust produced. Other processes in cleaning the asbestos fibers from rock, in separating the long fibers from the short, and in carding and spinning and weaving were all found to be productive of dust.

Doctor Oliver reports the results of the examination of English workers who had been engaged for many years in the manufacture of asbestos products. A woman aged 61 who had been employed in an asbestos factory for 25 years, with few intermissions, showed the effects of the dust exposure in the altered respiratory sounds, a respiratory capacity of only 1 inch, pulse rate of 90 and respirations of 22 per minute. A daughter of this woman, who had been an asbestos worker for 16 years, had a dry cough, slight dyspnea, slight dullness over the base of each lung, and deficiency of the respiratory murmur with fine crepitating râles heard over the bases. In both of these cases the yellow foreign bodies found in the lungs or in the sputum, which are characteristic features of asbestosis, were demonstrated. These foreign

bodies are described by Doctor Oliver as varying in tint from a faint yellowish green color through golden yellow to a deep brown.

Anatomical examination of the lungs of persons who had been subjected to the inhalation of asbestos dust for several years showed "well-marked diffuse interstitial pneumonia with chronic bronchitis and emphysema; well-marked anthracosis; in some a pronounced tuberculous condition with chronic phthisis" as well as the type of foreign bodies, already referred to, in the alveoli, bronchi, bronchioles, and the interstitial fibrotic areas.

There is decided differentiation between the appearance of the lungs of workers exposed to silica dust and those exposed to asbestos dust. An investigation by a member of the South African Institute for Medical Research, quoted by Doctor Oliver, has described the pathological lesions found in the lungs of four natives who had been working in an asbestos mine in Southern Rhodesia. He states that "while the pulmonary fibrosis is patchy and is mainly related to the vascular system and bronchi, with here and there lymphocytic accumulations, there is 'no resemblance to the orderly whorled arrangement and sharp definition of the silicotic nodule'; nor evidence of it in some of the cases of tuberculosis, which when present had evidently been sequential to the fibrosis."

A report on pulmonary asbestosis by Dr. E. R. A. Merewether and C. W. Price, respectively, medical and engineering inspectors of factories in Great Britain, is reviewed in the editorial columns of The Lancet, April 19, 1930. The investigation on which this report is based was made during 1928 and 1929 as a result of the discovery of nontuberculous fibrosis in the lungs of an asbestos worker of sufficient severity to require hospital treatment.

In this study only workers who were using more or less pure asbestos were included, so as to rule out any complicating factors caused by other dusty substances. It was estimated that about 2,200 workers were employed in England in these processes. Physical examinations were given to 363 workers, or 16.5 per cent of the estimated total workers in the industry. A certain degree of selection was exercised in the examination, as only newcomers and long-time workers were chosen. Of the men examined, all but one were at work on the day of examination. In 95 cases, or 26.2 per cent, there was a diffuse fibrosis which was attributable to the inhalation of dust, while in 21 cases there were precursory symptoms of the disease. In 133 cases radiograms were made, 62 of which showed definite diffuse fibrosis, while 25 were suggestive of fibrosis. As the whole body of workers were not examined it is pointed out that it would be unfair to assume that roughly 1 in 4 asbestos workers have fibrosis, especially as a large proportion of the men examined had been five years or more in the industry. The examinations showed that there were no cases of fibrosis among workers who had been employed less than four years, while there were 36 cases among those with employment of 5 to 9 years, 27 cases among those employed 10 to 14 years, 15 among those employed 15 to 19 years, and 17 cases among those employed over 20 years. The largest number of cases was found between the ages of 30 and 50 but it is considered that length of exposure rather than age is the important factor in the development of the disease. While it was difficult to relate the incidence of asbestosis to the occupation, owing to the fact that frequently many processes are housed in one room and workers are transferred from one process to another, there was found to be a lower incidence and probably a later onset among the spinners as a group than among those who crush, card, or weave the asbestos. There was no evidence produced to show that one variety of asbestos is more capable of producing fibrosis than an-

other, the degree of concentration of the dust and length of exposure being the important factors. It appears that disablement from the disease is even more delayed than in the case of silicosis, the affected worker often continuing at work with occasional breakdowns from bronchitis until he is aware of shortness of breath upon exertion. This is attributed both to the character of the disease and the fact that the work as a rule is not strenuous. In some cases there is a period of invalidism before death, while in others broncho-pneumonia or other acute affection may supervene while the man is still at work.

The report records 10 cases up to the end of 1929 in which an advanced degree of asbestosis without tuberculosis was the primary cause of death, verified in nine cases by post-mortem examinations. The length of exposure varied in these cases from 9 to 24 years. The rate of progress of the disease varies. In cases in which there is continued exposure to high concentrations of the dust the fibrosis may be fully developed in from 7 to 9 years, while with milder degrees of exposure it may take from 15 to 25 years to develop fully. The data, so far, show no special liability to pulmonary tuberculosis among asbestos workers.

The report points out that special exhaust ventilation is necessary to remove dust in these industries especially in the processes of spinning and weaving. The recommendations in the report include the application of efficient localized exhaust ventilation at dust-producing points; the substitution of inclosed mechanical methods for hand conveyance and for dusty handwork generally; the effective inclosure of dust-producing machines and plant; and the substitution of wet methods for dry. It is considered that young persons should not be employed on specially dusty work.—*Monthly Labor Review.*

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The "Pulmonary Asbestosis" Menace

The increasing use of a very necessary product has created a new occupational hazard, that must be taken into account by Asbestos Worker.

THE steadily increasing use of asbestos in industrial processes has created a new occupational risk and added to the list of industrial lung affections a new form of chronic pulmonary fibrosis. An account of the conditions under which the asbestos-containing rock is mined or quarried and the raw asbestos converted into finished material, together with the results of exposure to these processes, is given by Sir Thomas Oliver in a recent article.

Asbestos, which possesses both mineral and vegetable characteristics, is found in many parts of the world, in rock to which the fine silk-like asbestos fibers are adherent, the types of asbestos in greatest demand for industrial purposes being found in Italy, Russia, Canada, and South Africa. Although the asbestos fibers appear light and fleecy, they are as dense and heavy as the rock itself. In spite of this fact, however, the material can be spun into fine thread, into coarse cord, woven into cloth, or so compressed as to form solid blocks. The chemical analysis shows that the main constituents of the asbestos are magnesia, silica, and oxide of iron, with traces of sodium, potassium, and aluminum. The Italian and Canadian asbestos contains mainly magnesia and silica with only 3 and 5.75 per cent of oxide of iron, respectively, while the South African asbestos contains 40 per cent of oxide of iron and only 2 per cent of magnesia. The proportion of silica in the three kinds of asbestos ranges from 41 to 50 per cent.

In a visit by the writer to the asbestos quarries in Thetford, Canada, it was found that the quarries were deep and the work of mining, therefore, hazardous but that there was comparatively little dust evolved even in the crushing mills until the processes of milling and screening were reached, when there was considerable dust produced. Other processes in cleaning the asbestos fibers from rock, in separating the long fibers from the short, and in carding and spinning and weaving were all found to be productive of dust.

Doctor Oliver reports the results of the examination of English workers who had been engaged for many years in the manufacture of asbestos products. A woman aged 61 who had been employed in an asbestos factory for 25 years, with few intermissions, showed the effects of the dust exposure in the altered respiratory sounds, a respiratory capacity of only 1 inch, pulse rate of 90 and respirations of 22 per minute. A daughter of this woman, who had been an asbestos worker for 16 years, had a dry cough, slight dyspnea, slight dullness over the base of each lung, and deficiency of the respiratory murmur with fine crepitating râles heard over the bases. In both of these cases the yellow foreign bodies found in the lungs or in the sputum, which are characteristic features of asbestosis, were demonstrated. These foreign

bodies are described by Doctor Oliver as varying in tint from a faint yellowish green color through golden yellow to a deep brown.

Anatomical examination of the lungs of persons who had been subjected to the inhalation of asbestos dust for several years showed "well-marked diffuse interstitial pneumonia with chronic bronchitis and emphysema; well-marked anthracosis; in some a pronounced tuberculous condition with chronic phthisis" as well as the type of foreign bodies, already referred to, in the alveoli, bronchi, bronchioles, and the interstitial fibrotic areas.

There is decided differentiation between the appearance of the lungs of workers exposed to silica dust and those exposed to asbestos dust. An investigation by a member of the South African Institute for Medical Research, quoted by Doctor Oliver, has described the pathological lesions found in the lungs of four natives who had been working in an asbestos mine in Southern Rhodesia. He states that "while the pulmonary fibrosis is patchy and is mainly related to the vascular system and bronchi, with here and there lymphocytic accumulations, there is 'no resemblance to the orderly whorled arrangement and sharp definition of the silicotic nodule'; nor evidence of it in some of the cases of tuberculosis, which when present had evidently been sequential to the fibrosis."

A report on pulmonary asbestosis by Dr. E. R. A. Merewether and C. W. Price, respectively, medical and engineering inspectors of factories in Great Britain, is reviewed in the editorial columns of The Lancet, April 19, 1930. The investigation on which this report is based was made during 1928 and 1929 as a result of the discovery of nontuberculous fibrosis in the lungs of an asbestos worker of sufficient severity to require hospital treatment.

In this study only workers who were using more or less pure asbestos were included, so as to rule out any complicating factors caused by other dusty substances. It was estimated that about 2,200 workers were employed in England in these processes. Physical examinations were given to 363 workers, or 16.5 per cent of the estimated total workers in the industry. A certain degree of selection was exercised in the examination, as only newcomers and long-time workers were chosen. Of the men examined, all but one were at work on the day of examination. In 95 cases, or 26.2 per cent, there was a diffuse fibrosis which was attributable to the inhalation of dust, while in 21 cases there were precursory symptoms of the disease. In 133 cases radiograms were made, 62 of which showed definite diffuse fibrosis, while 25 were suggestive of fibrosis. As the whole body of workers were not examined it is pointed out that it would be unfair to assume that roughly 1 in 4 asbestos workers have fibrosis, especially as a large proportion of the men examined had been five years or more in the industry. The examinations showed that there were no cases of fibrosis among workers who had been employed less than four years, while there were 36 cases among those with employment of 5 to 9 years, 27 cases among those employed 10 to 14 years, 15 among those employed 15 to 19 years, and 17 cases among those employed over 20 years. The largest number of cases was found between the ages of 30 and 50 but it is considered that length of exposure rather than age is the important factor in the development of the disease. While it was difficult to relate the incidence of asbestosis to the occupation, owing to the fact that frequently many processes are housed in one room and workers are transferred from one process to another, there was found to be a lower incidence and probably a later onset among the spinners as a group than among those who crush, card, or weave the asbestos. There was no evidence produced to show that one variety of asbestos is more capable of producing fibrosis than an-

other, the degree of concentration of the dust and length of exposure being the important factors. It appears that disablement from the disease is even more delayed than in the case of silicosis, the affected worker often continuing at work with occasional breakdowns from bronchitis until he is aware of shortness of breath upon exertion. This is attributed both to the character of the disease and the fact that the work as a rule is not strenuous. In some cases there is a period of invalidism before death, while in others broncho-pneumonia or other acute affection may supervene while the man is still at work.

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