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Appendix 1

THE ASBESTOS MAGAZINE LETTERS OF 1935

This is a series of letters from the "Sumner Simpson papers" between the editor of the trade magazine *Asbestos*, the president of Raybestos-Manhattan (Simpson), and the top lawyer for Johns-Manville (Vandiver Brown). Sumner Simpson's note hand-written at the bottom of the letter from Brown reads: "Mr. Seigle will see Stover and tell him he does not want any publicity." Stover was the publisher of *Asbestos*. W.R. Seigle was a Johns-Manville Vice President.

"ASBESTOS"

Published by

SECRETARIAL SERVICE

16th Floor, Inquirer Bldg.
PHILADELPHIA, PA., U. S. A.

September 25, 1935.

Mr. Sumner Simpson, President,
Raybestos-Manhattan, Inc.,
Bridgeport, Conn.

Dear Sir:

You may recall that we have written you on several occasions concerning the publishing of information, or discussion of, asbestosis and the work which has been, and is being done, to eliminate or at least reduce it.

Always you have requested that for certain obvious reasons we publish nothing, and, naturally your wishes have been respected.

Possibly by this time, however, the reasons for your objection to publicity on this subject have been eliminated, and if so, we would like very much to review the whole matter in "ASBESTOS".

Our thought is that we could either prepare from data which we have in our files, or obtain from Mr. W. A. Godfrey of the Cape Asbestos Company, London, who is much interested in the subject, an article on the work done in England and then follow it with an article written by someone in your organization, as to the work done here.

We understand from Mr. Stover that your North Charleston plant, contains very complete dust control equipment and a description of such equipment, if you approve, would make a very interesting part of the article. Possibly even you could supply a photograph or two showing some part of this dust control equipment.

We await with much interest your reply. If there is no serious objection it would seem to be a most interesting subject for the pages of "ASBESTOS", and possibly a discussion of it in "ASBESTOS" along the right lines, would serve to combat some of the rather undesirable publicity given to it in current newspapers.

very truly yours,

"A S B E T O S"

W. A. Godfrey

Bridgeport, Conn.
Oct. 1, 1935

Mr. Vandiver Brown, Attorney,
Johns-Manville Corp.,
22 East 40th St.,
New York City.

My dear Mr. Brown:

Enclosed is a copy of a letter received from Miss Rossiter, of "Asbestos."

As I see it personally, we would be just as well off to say nothing about it until our survey is complete. I think the less said about asbestos, the better off we are, but at the same time, we cannot lose track of the fact that there have been a number of articles on asbestos dust control and asbestosis in the British trade magazines. The magazine "Asbestos" is in business to publish articles affecting the trade and they have been very decent about not re-printing the English articles.

I shall be pleased to have your opinion in the matter.

Very truly yours,

SS-G.

Enc.

President

Note: Due to the poor reproductive quality of the original copy of this letter, it appears here retyped in the original form and has been inserted on the original paper.—*Author*

Letter

— Johns-Manville — *Today*

TWENTY-TWO EAST FORTIETH STREET
NEW YORK, N. Y.



October 3, 1935

Mr. S. Simpson, President,
Raybestos-Manhattan, Inc.,
Bridgeport, Conn.

My dear Mr. Simpson:

I wish to acknowledge receipt of yours of October 1st enclosing copy of the September 25th letter from the editor of the magazine "ASBESTOS". I quite agree with you that our interests are best served by having asbestosis receive the minimum of publicity. Even if we should eventually decide to raise no objection to the publication of an article on asbestosis in the magazine in question, I think we should warn the editors to use American data on the subject rather than English. Dr. Lanza has frequently remarked, to me personally and in some of his papers, that the clinical picture presented in North American localities where there is an asbestos dust hazard is considerably milder than that reported in England and South Africa.

I believe the question raised by Miss Rossiter might well be considered at the committee meeting scheduled for next Tuesday, at which I understand both you and Mr. Judd will be present.

Very truly yours,

Vandiver Brown
Vandiver Brown
Attorney

VB:T

VB:T
VB:T will see Stover & tell him he can not handle publicity
SO 10/8/35

Appendix 2

"During a series of congressional hearings on asbestos last fall, the price of J-M's stock plunged about 20 percent, and it hasn't recovered."

Stephen Solomon, The Asbestos Fallout at Johns-Manville. *Fortune*, 196-206 (May, 1979).

In October of 1978, Congressman George Miller opened a series of hearings on the problem of asbestos disease. At this time, the "Sumner Simpson documents" produced in discovery by Raybestos-Manhattan, Inc. were discussed. Within one month, major news stories appeared in the *Los Angeles Times* (October 23, 1978) and the *Washington Post* (Nov. 12, 1978), which in turn were widely circulated in the U.S. press and in other countries. The price of Johns-Manville stock rapidly plunged from 34 to 24 dollars per share. Two days after the *Washington Post* story, Congressional hearings were held in Honolulu, Hawaii. There, Johns-Manville executives presented their interpretation of the Sumner Simpson Papers and advised the legislators on the subject of comprehensive, equitable, and uniform compensation for occupational diseases.

The testimony of J-M Executive Vice President Francis H. May offered his company's side of the story. His prepared statement is reprinted here in full. Dr. Paul Kotin, Senior Vice President for Health, Safety, and Environment, was not recorded as present at the hearings.

(Source: *Asbestos-Related Occupational Diseases*. Hearings before the Subcommittee on Compensation, Health and Safety,

U.S. House of Representatives Committee on Education and Labor, conducted November 14, 1978. U.S. Gov't. Printing Ofc. Washington, pp. 637-646, 1979).

PREPARED STATEMENT OF FRANCIS H. MAY, EXECUTIVE VICE
PRESIDENT, JOHNS-MANVILLE CORP.

Mr. Chairman, members of the subcommittee, my name is Francis H. May, I am executive vice-president of Johns-Manville Corporation, headquartered in Denver, Colorado. With me this morning are G. Earl Parker, vice-president, General counsel and secretary; Dennis H. Markusson, associate general counsel; and John D. Autry, director of public affairs.

We are pleased to be here today as the subcommittee continues its important work in addressing the issue of asbestos-related occupational disease, and most importantly compensation for occupational illness.

For the past several years our company has been involved in the litigation of asbestos disease related product liability lawsuits. From this experience I think we have gained some insight into the complex nature of the issues presented, the viability of existing methods for addressing these issues, and the present need for innovative measures. It is to these areas that I shall direct my primary remarks this morning.

Following my remarks Mr. Parker will discuss some considerations in legislative approaches to provide uniform, comprehensive and equitable compensation for occupational illness.

Before proceeding further I must first address the growing propensity of some to try legal issues in non-judicial forums. While I personally deplore the practice of law by press conference, the issuance of half statements and the calculated use of selected facts—these practices, upon reflection, serve to graphically demonstrate the inability to adequately resolve the complex issues in asbestos products liability cases within the traditional judicial structure.

While I am mindful of Representative Heftel's statement that these hearings are not intended to fix fault or blame—public accusations have been made and a response is appropriate. In recent hearings before this subcommittee attorneys for various plaintiffs made some rather rash statements, and I am sorry to

say some of them seem to have been accepted all too quickly at face value.

There seem to have been three basic theses in what I will call the San Francisco accusations:

1. That early knowledge of the biological effects of asbestos in mining, milling and manufacturing operations equates to knowledge that asbestos-containing insulation products could present a hazard.

2. That industry and specifically Johns-Manville failed to respond in a reasonable and responsible manner to developing medical and scientific information.

3. That there existed some conspiracy to manipulate and suppress and that it is somehow related to present litigation.

These theses are categorically false.

While it would be unwarranted for me to comment in these proceedings on every conceivable evidentiary fact I would like to bring some perspective to these accusations.

KNOWLEDGE OF A HAZARD

The issue is not whether asbestos exposure under certain conditions can constitute a possible health hazard. On this there is no longer debate. Nor is the issue the existence in the 1920s and 1930s of medical and scientific information relative to asbestosis among workers exposed to continual and high concentrations of asbestos fiber in mines, mills and manufacturing plants.

The paramount issue in virtually all the litigation including shipyard cases is: When was there adequate medical and scientific knowledge of a possible hazard to workers outside the mines, mills and factories using already manufactured products, notable insulation products containing small amounts of asbestos, to constitute a basis for action? In other words, the issue is reasonable foreseeability.

There was a conscious effort in the material submitted at the San Francisco hearings to imply that by 1930 there existed an abundance of knowledge of a potential health hazard from asbestos. This simply is not true. By 1930 there were but a

handful of so-called asbestosis cases reported in the English literature, all from asbestos textile plants.

Indeed, it was not until 1927 that Dr. Cooke in England, reporting on one single case involving a textile worker, coined the term "asbestosis" to describe a type of fibrotic occupational disease.^{1,2}

However, by 1930 and based in large part upon the world's first large scale survey undertaken by Dr. Merewether asbestosis was being found with some frequency in the asbestos textile mills of England.³

The first major medical work in the United States was the study of asbestos textile factories by Dr. Anthony Lanza which was published by the United States Public Health Service in 1935.⁴ This publication was the culmination of research in this country sponsored not by the Public Health Service, but by Johns-Manville and Raybestos-Manhattan. As this article has become a matter of some contention I will remark on it in detail in a few moments.

In 1938 the Public Health Service did another study of the asbestos textile industry, and took a step which was to dramatically impact on asbestos-related occupational disease issues for the next 25 years. The 1938 Dreessen Study established a recommended standard or threshold limit value for asbestos dust exposure of 5 million particles per cubic foot, eight hours per day, forty hours per week for a working lifetime as a safe level of exposure.⁵

It is to be noted that throughout the literature of this period there prevailed in the medical and scientific community a feeling that asbestosis was a limited problem, and that if the dust levels in the factories could be reduced the problem of asbestosis would disappear.⁶

In 1946 the First Epidemiological Study of Insulation Applicators (as opposed to mine, mill or factory workers) was published by Fleischer-Drinker, et al.⁷ The study was done in shipyards, and was undertaken on behalf of the Navy. Two significant findings came out of that report; first, that the measured exposures to asbestos dust for the insulation workers were with one exception below what the U.S. Public Health Service/Dreessen, article had established as a "safe level" (5

MPPCF standard) and, second, that pipecovering was deemed to be not a hazardous occupation. That insulation worker exposures were generally below the U.S. Public Health Service standard is a fact subsequently documented by other investigators.⁸

It is appropriate to reflect for a moment on this state of the medical art in the United States in 1946 with reference to insulation workers. At this time we were faced with a U.S. Public Health service standard of 5 MPPCF; actual measured exposures well below that "safe level," and an epidemiological study concluding that insulation work was not a hazardous occupation. Was there, then, in 1946 any basis for action on the grounds that asbestos-containing insulation products constituted an occupational hazard to workers? I think not. This conclusion seems eminently justified by the fact that there were no cries to the contrary from Government, labor, medicine, or academia.

The popular rhetoric now is to assert that the 5 MPPCF standard and the Fleischer-Drinker Report were wrong. Of course they were wrong, but when was this error discovered—certainly not until the landmark 1960s work of Dr. Irving J. Selikoff, a physician well known to this subcommittee.⁹ It will be of interest to this subcommittee that in the American Medical Literature there is not a single criticism of the Fleischer-Drinker conclusions or the 5 MPPCF standard until Dr. Selikoff's work.

While attempts are made by learned advocates to extrapolate mining, milling, and manufacturing data and apply it to the insulation workers who are the subject of most present lawsuits, the facts simply do not support such an extrapolation. Two quotes from Dr. Selikoff's writings eloquently place the development of knowledge of any insulation worker hazard in proper perspective.

In 1965 he wrote: "We may conclude that asbestosis and its complications are significant hazards among insulation workers in the United States at this time."¹⁰

In 1970 he concluded: "In the asbestos mining and manufacturing industry, the risk of heavy exposure to the occupational dusts had been recognized for some years. And this primary

industry has understood the need to install ventilation systems and other dust control devices to reduce the hazard. Experience had indicated that reduction of dust levels and exposures could result in greatly improved health experience among asbestos factory workers. But the extrapolation of that experience to another classification of workers—specifically those who fabricate and install insulating materials—was a more sophisticated task for clinical medicine and epidemiology."¹¹

While I have generally tracked the medical literature with respect of asbestosis the situation is virtually the same as to cancer. Early isolated case reports of lung cancer in association with asbestosis in factory workers were followed by years of uncertainty and scientific disagreement. The 1960s brought general agreement that there was an excess of lung cancer among those workers exposed to asbestos including insulation workers. However, this association has been complicated by the fact that almost all cases of asbestos worker lung cancer involve cigarette smokers, and there remain honest differences as to whether cigarette smoking is the determinant or the modifier of the lung cancer. As to mesothelioma there is no serious difference of agreement that this rare tumor was first associated with asbestos exposure by Dr. Wagner's South African studies published in 1960, and that by the mid-1960s it too had been associated with insulation workers by Dr. Selikoff.^{12,13}

This brief review hopefully will serve to give the subcommittee some feel for the "foreseeability-of-hazard" issue which is at the heart of most of the past and pending litigation.

This admittedly brief review is not intended to be all inclusive. It does not, for example, attempt to deal with the complex matter of individual case reports, and their effect on the state of the medical art. My purpose in presenting this review is to give the subcommittee some perspective with respect to the medical literature, the concepts of dose, the pitfalls of attempted extrapolations. Only in this way can the subcommittee appreciate and evaluate the complexity of the foreseeability-of-hazard issue which is at the very heart of most of the past and pending litigation, and the continued futility of attempting to deal equitably and effectively with this issue within existing judicial structures.

FAILURE TO ACT

The second San Francisco thesis is the inference that Johns-Manville failed to respond to the medical and scientific information of possible asbestos exposure hazards. This subcommittee and its media audience were led to believe that nothing was done, and that lives were sacrificed for profits. While such invective makes for good copy and a rousing jury argument—it—simply is not true.

Johns-Manville's long history of commitment to the resolution of asbestos-related occupational disease problems is unparalleled in industry, labor or government. It is that commitment that brings us here this morning.

Let's turn to some specifics. As you will recall from my earlier testimony, by 1930 the British Medical Literature was suggesting a possible occupational disease hazard of asbestosis in asbestos textile factories. Did Johns-Manville respond? It did indeed. In conjunction with Raybestos-Manhattan Corporation, Johns-Manville commissioned the Metropolitan Life Insurance Company to commence a survey to ascertain the existence of any asbestos disease hazards in North American mining, milling and manufacturing operations. The scope of the Johns-Manville response is eloquently conceded by an adversary, Robert E. Sweeney, Esq., who represents many insulation workers in lawsuits throughout the United States writing in the October 1978 issue of *Trial* magazine he states:

"Alerted by the work of medical and scientific investigators throughout the world, the asbestos industry, led by Johns-Manville, commissioned the Metropolitan Life Insurance Company in the early 1930s to investigate and determine the relationship of asbestos exposure to the high rate of pulmonary disease encountered among workers in the asbestos mines and factories.

These studies were conducted under the leadership of the medical director of the Metropolitan Life Insurance Company, Dr. Anthony J. Lanza.

The project ran from October 1929 to January 1931. It included study of dust conditions in asbestos mines and mills in Canada and the United States.

Physical examination of asbestos workers included X-rays, films, and studies of dust exhaust systems.

The conclusion of the industry's own research proved that prolonged exposure to asbestos dust caused pulmonary fibrosis and that cases of definite cardiac enlargement were frequently found to be associated with asbestosis.

The study recommended that the industry face seriously the problem of dust control in asbestos plants and sponsor studies on known cases of asbestosis."¹⁴

Based upon the limited medical and scientific information available in the 1929 to 1930 period one may ask whether this was a responsible and responsive course of action for two corporations to take, and I think the answer is obviously in the affirmative. At this juncture, in 1930, no action on this subject had been undertaken by any agency of the Federal Government. Several more years would pass before the Government first acted.

Johns-Manville undertook immediate and concerted efforts to implement dust control procedures at its mines, mills and manufacturing facilities, and the company has been an acknowledged leader in the development of dust control devices. Since appropriate dust control devices were not available in the marketplace, the company undertook development of in-house dust control engineering expertise and design of dust control devices. Unique applications of fabric filters, as the most effective asbestos dust control device, and which today are universally used, were developed by Johns-Manville.¹⁵

To give the subcommittee a brief example of the extent of the company's major commitment, I did a quick historical survey of dust control installations at three Johns-Manville manufacturing facilities. I learned that between 1931 and 1970 approximately 160 major dust control devices were installed at just 3 plants. I stopped my survey at 1970 as I wanted to cover a period when there were no mandatory governmental standards or requirements. In other words, these are 160 voluntary projects. As an aside one might ask where the public health agencies of the Government were during this 30-year period.

In terms of money expended for dust control equipment in Johns-Manville plants, it is conservatively estimated that

between 1931 and 1970 \$25 to \$30 million was spent. If viewed in terms of 1978 dollars this sum would no doubt be four or five times that amount.

In addition to dust control equipment the company has had safety meeting respirator and employee physical examination programs in effect for several decades. (sic)

These programs continue to the present time, and today's worker receives ever increasing amounts of asbestos and health literature.

Because of the dramatic effects of cigarette smoking among individuals occupationally exposed to asbestos Johns-Manville has banned smoking at all asbestos using locations, although this is not required by existing Federal standards. It is noteworthy that unions have forced litigation opposing implementation of this policy at two locations.

With respect to asbestos-containing thermal insulation products, Johns-Manville undertook a voluntary labeling program in September of 1964 contemporaneous with the Selikoff revelations that the 5 MPPCF Public Health Service recommended standard was not a safe exposure level, and that a hazard did in fact exist. Johns-Manville led the industry in caution labeling, and led the Federal Government by 6 years (sic) as it was not until July 1972 that a Federal standard for labeling became effective.

There is an interesting contrast between Johns-Manville labels from 1964 to 1972 and the Federal label mandated in 1972 and still in use today:

Caution—This product contains asbestos fiber.

Inhalation of asbestos in excessive quantities over long periods of time may be harmful.

If dust is created when this product is handled, avoid breathing the dust.

If adequate ventilation control is not possible, wear respirators approved by the U.S. Bureau of Mines for pneumoconiosis-producing dusts. (1964-70 J-M Label.)

Caution—This product contains asbestos fiber.

Avoid breathing the dust. Inhalation of asbestos in excessive quantities over long periods of time may be harmful.

If dust is created when this product is handled, use proper protection.

If proper dust control cannot be provided, respirators approved by the U.S. Bureau of Mines for protection against pneumoconiosis-producing dusts should be worn. (1970-72 J-M Label.)

Caution—Contains asbestos fiber avoid creating dust. Breathing asbestos dust may cause bodily harm. (1972 to present, Federal OSHA label.)

I think even the most biased observer would concede that Johns-Manville label voluntarily implementary (sic) in 1964 is far superior to present Federal requirements.

In addition to the warning labels the record is clear that Johns-Manville undertook a variety of other affirmative measures in the 1960s:

1. Seminars were conducted for insulation contractors to explain possible hazards and safe handling techniques.

2. In cooperation with the National Insulation Manufacturers Association and the National Insulation Contractors Association a booklet entitled "Recommended Safe Practices for Handling and Applying Thermal Insulation Products Containing Asbestos" was prepared and circulated to insulation contractors throughout the United States.

3. In cooperation with Mount Sinai Hospital, Dr. Selikoff and the Asbestos Workers Union the "Insulation Industry Hygiene Research Program" was formed. Activities of this organization resulted in material on asbestos and health and safe work practices going directly to the homes of insulation workers in the form of "green sheets" which were inserted in the union magazine.

4. Substitute thermal insulation products were developed and by 1973 the company ceased production of asbestos-containing insulation materials with the exception of a few accessory items.

In the area of medical research Johns-Manville's extensive support of medical research on the biological effects of asbestos has continued on an ever increasing scale since 1929. (An appendix outlining the numerous projects is attached hereto.)

There was some effort at the San Francisco hearing to cast in a negative light the company's payment of workers' compensa-

tion claims to factory workers with asbestos-related illnesses. Johns-Manville has indeed paid workers' compensation to factory workers on asbestos claims. To my knowledge no bona fide claim has ever been contested. In fact, there have been instances where the company has waived available statute of limitations defenses, and allowed the claim.

Johns-Manville's record of voluntary commitment to the resolution of asbestos-related occupational disease problems is clear. Johns-Manville did respond to medical and scientific knowledge in a prompt, reasonable and responsible fashion.

CONSPIRACY

In recent weeks much attention has been focused on some very old correspondence between employees of Johns-Manville and Raybestos-Manhattan. Indeed, this correspondence set much of the tone for this subcommittee's San Francisco hearings. It is a tribute to the plaintiffs' lawyers that they have been able to make so much of so little.

In any objective consideration of this correspondence two factors become paramount, first, the age of the documents, and, second, the nature of the problem being addressed.

The correspondence at issue is more than 40 years old, and was written at a time when the world's body of knowledge concerning possible asbestos-related health problems was in its infancy. It was written at a time when legitimate questions far outnumbered available answers; at a time when any potential hazard from asbestos was thought to be mild compared to other problems such as silicosis; at a time when it was thought any problem was confined to mines, mills and manufacturing plants, and would be readily solved with some additional dust control. An objective review of the entire body of documents confirms these facts, and further indicates consistency with the then state of medical and scientific knowledge. It is inconceivable that reasonable persons would base today's crucial policy judgments on these ancient letters.

The fact that the health issues addressed in this correspondence are entirely different from those in most of the present litigation has been conveniently ignored. Simply stated the

correspondence had nothing whatsoever to do with asbestos-containing insulation materials or insulation applicators.

The correspondence relates to possible hazards in mines, mills and manufacturing plants to which Johns-Manville then and thereafter responded with leadership. As indicated in my earlier comments, in the 1930s asbestos-containing insulation materials were not known to present a problem to insulation applicators. Just as Dr. Selikoff has indicated that the mine, mill and factory experience cannot be extrapolated to the insulation worker experience, likewise correspondence relative to factory situations cannot be extrapolated to present cases involving exposure to insulation products.¹⁶

Some specifics: A document ingored by the plaintiff's attorneys is the minutes of a meeting on January 5, 1934 wherein a decision was made by Johns-Manville and Raybestos-Manhattan to "Have the Metropolitan Life Insurance Company bring up to date the survey with respect to dust conditions in their respective factories." Is this an irresponsible course of conduct? Quite to the contrary, and remember too that at this time the Federal Government had still done nothing.

The Januray 5, 1934 minutes go on: "The policy of the two companies concerned is that they desire through the operation of this committee and the resulting investigations to obtain, each for itself, the best practice possible for the elimination of dust and the protection of employees."

Subsequent 1934 correspondence confirms the employment of Otto L. Binder to do dust counts, and the purchase of X-ray equipment. Again, hardly irresponsible conduct.

We come now to the review of the galley proofs of Dr. Lanza's 1935 article. This is a significant item because it has generated accusations that Johns-Manville and Raybestos-Manhattan somehow manipulated, dictated and even impeded the development of medical and scientific knowledge in the United States. An examination of facts quickly and vividly uncovers the shallowness and inaccuracy of such accusations:

1. V. Brown to Dr. Lanza, December 10, 1934:

- (a) Brown indicates two clerical points where material from the original report was not picked up in galley proofs. This

certainly is not a manipulation of Dr. Lanza's independent conclusions;

(b) The remainder of Brown's comments also relate to clerical omissions or questions of clarity;

(c) Nowhere does Brown suggest substantive alterations.

2. Hobart to Brown, December 15, 1934. Hobart was an attorney in private practice, who apparently was asked to review and comment on the Lanza article:

(a) Hobart suggests deletion of the sentence: "It might well be assumed that similar variables would influence the occurrence of asbestosis." That sentence was not deleted from the article as published.

(b) Hobart refers to the defense of lawsuits. This is a reference to actions arising out of the Manville, N.J. plant at a time before asbestos occupational disease claims were covered in New Jersey by Workers' Compensation.¹⁷

(c) Hobart next suggested that some material appear in the body of the article rather than in a footnote. In the published article the material remained as a footnote on page 3.

(d) Hobart next suggested deletion of the words: "Was unnecessarily dusty" from a portion of the report with reference to a description of plant E. In reviewing the actual Lanza article it does appear that in the section on dust studies there is no reference to the words "was unnecessarily dusty." However, on page 5 and the top of page 6 of the actual Lanza article it is indicated that at plant E there was excessive dust. Accordingly, it can hardly be argued that the deletion of the words "was unnecessarily dusty" changes in any way the scientific import of the Lanza study.

(e) As did Brown, Hobart points out that the galley omits from conclusion 1 the sentence "Clinically, from this study, it (asbestosis) appears to be of a type milder than silicosis"; which had appeared in the original report. Hobart does add that such an addition should be made to the conclusions only, "If the doctors are satisfied that such is the facts." These are hardly the words of a manipulator of medical science.

(f) With respect to conclusion No. 5 Hobart points out that the galley indicated that asbestosis did not add to the mortality in

tuberculosis cases, and that such an inference did not seem justified. Dr. Lanza did reword his conclusions so as not to negate the hazard to individuals with tuberculosis. This certainly is clear evidence of openness, objectivity and honesty in the review of the Lanza article.

(g) Hobart criticizes conclusion No. 6 and a reference and inference concerning granite dust, and in the final article we see that Hobart's suggestions were adopted by Lanza. However, this is not a departure from a sound scientific conclusion. It appears that all Hobart was seeking was to avoid an unnecessary parallel being drawn between asbestos and granite dust.

(h) With respect to recommendation No. 4 Hobart asks to have inserted the word "possible" as to future studies of the "possible" effects of asbestosis on the heart and circulation. It is interesting to note that in item No. 4 of Dr. Lanza's recommendations set forth on page 11 of the actual report that Dr. Lanza obviously rejected this suggestion as the word "possible" does not appear prior to the word "effects."

3. Brown and Judd, December 18, 1934. Brown transmits a copy of the galley proofs of the Lanza article to Raybestos-Manhattan.

4. Brown to Lanza, December 21, 1934. Brown returns the galley proofs to Dr. Lanza together with Mr. Hobart's comments. The following is found in this letter:

"I trust that you will give his comments and suggestions, as well as those mentioned in my letter of December 10th, your most serious consideration. I am sure that you understand fully that no one in our organization is suggesting for a moment that you alter by one jot or tittle any scientific facts or inevitable conclusions revealed or justified by your preliminary survey. All we ask is that all of the favorable aspects of the survey be included and that none of the unfavorable be unintentionally pictured in darker tones than the circumstances justify."

5. Brown to Judd, December 24, 1934. A letter indicating that Hobart and Brown had "together canvassed fairly thoroughly the points in the proof to which we could justifiably suggest additions, omissions, or changes in phraseology that will be beneficial from the industry viewpoint. The use of the word "justifiable" is certainly consistent with Brown's letter to Lanza

of December 21, 1934, and the entire objective review of the Lanza article.

This then is the entire record of the review of the Lanza article by Raybestos-Manhattan and Johns-Manville. The article was then published by the U.S. Public Health Service, and subject to that Agency's critical review.

Some additional observations are in order with respect to the Lanza article. If Johns-Manville and Raybestos-Manhattan are deemed to have been conspirators, manipulators and suppressors in the 1930s, then they were poor ones, for who interested in suppression or manipulation would promote a study to be published by the U.S. Public Health Service and which recommended:

1. That the industry seriously face the problem of dust control in asbestos plants.

2. That new employees be examined physically, including X-ray examination of the chest, and rejected for employment if they show tuberculosis or pneumoconiosis.

3. That employees be examined physically, preferably every year, but at least every 2 years, this examination to include an X-ray examination of the chest.

4. That the industry sponsor studies on known cases of asbestosis, as well as studies on effects of asbestosis on the heart and circulation.¹⁸

It would further be a poor suppressor who would have Dr. Lanza in the course of his study work with 11 other physicians including a physician of the U.S. Public Health Service.¹⁸

Finally, as indicated earlier, all of the recommendations of Dr. Lanza were implemented by Johns-Manville.

I realize my comments with respect to the Lanza article have been quite long and detailed, but it is only through this type of detailed review that the falsity of the quick accusation and self-serving conclusion can be revealed.

There have been other unwarranted and exaggerated statements concerning this correspondence. Clearly, it would neither be possible nor appropriate for me to address each such contention or allegation in this forum. Generally this material can be summarized as indicating a continuing concern and involvement in research as to the possible biological effects of asbestos.

Almost all of the correspondence in 1936 and subsequent years relates to industry financed studies undertaken by Dr. Leroy Gardner at the Saranac Laboratories. The correspondence confirms Johns-Manville and Raybestos-Manhattan as taking the lead in the financing of such research, and ultimately obtaining contributions from several other companies.

Rather than speculate further on the import of these statements or strain to apply them to today's issues, I prefer to deal with the truly relevant facts.

I do know that the entire record makes it abundantly clear that Johns-Manville and Raybestos-Manhattan went forward with the first medical research done in this country; I do know that such research was published for all the world to see in the public health reports of the U.S. Public Health Service; I do know that industry continued to finance research; I do know that the findings of such research were consistent with other developing medical information; I do know that these actions were voluntary; I do know that industry's efforts antedated by several years any action by the Federal Government; I do know that Johns-Manville was promoting and has continued to promote basic medical research; and I do know that but for industry's efforts, which I suspect were unparalleled in the 1930s, the state of medical knowledge in this country would have lagged for years. I don't understand the contention that manipulation and suppression and total lack of concern for individuals were basic motives of the industry. If that were so why did industry bother to do anything at all? And yet, the record is clear this was not the path chosen.

I would like to turn now to the basic issue faced by this subcommittee: Whether there is a need for legislative action to provide compensation for occupational disease, and in particular, asbestos-related occupational disease.

In seeking an objective resolution of this issue there are several preliminary questions which must first be answered.

Is the assurance of fair compensation for occupational disease a desirable and necessary social objective? Johns-Manville president, John A. McKinney, clearly answered this question in his testimony before the Senate Committee on Human Resources on S. 3060 stating: "Comprehensive, equitable, and

uniform compensation for occupational disease is a worthy and proper social goal. On this there can be no debate."¹¹

The next question to be answered is whether such a goal can be achieved with existing systems, remedies and mechanisms. From my personal experience I tell you in all sincerity, that absent innovative and decisive action, compensation for asbestos-related occupational disease under present structures will never be comprehensive, equitable, or uniform.

At present there are but two means of compensation for occupational disease: Workers' compensation and the products liability lawsuit. At your recent hearings in San Francisco you heard testimony on the inadequacies of workers' compensation. Suffice it to say that at present there are wide disparities in the amount and duration of workers' compensation payments, and in many instances both are woefully inadequate.

Turning to the occupational disease product liability lawsuit, it must be understood at the outset that exposure, disease and casual relationship do not equate to liability, or culpability or fault in the world of civil products liability law. Lack of understanding of this basic fact has created great frustration in the minds of many in consideration of the problems of compensation for occupational disease.

In the products liability lawsuit, for there to be a recovery there must be a determination of liability, culpability, or, if you will, fault. It is an adversary situation, and we must recognize that as presently constituted the American civil adversary system has deliberately chosen to resolve contested matters by the clash of mutually inconsistent and divergent viewpoints. Unfortunately, such a system only frustrates our socially desirable goal of comprehensive, equitable and uniform compensation for occupational disease.

The fly in the ointment is the matter of fault. In the typical case involving an insulation worker with asbestosis the jury must ultimately resolve two issues. First, at what point in time was a hazard to the insulation worker reasonably foreseeable, thus giving rise to duty to warn? Second, after any such duty arose, were reasonable steps taken toward its satisfaction?

Resolution of these issues, particularly the former, in an asbestos-related occupational disease case is a highly complex

exercise. Unlike other types of products liability cases where there is physical evidence such as a broken casting or a ruptured tire to serve as a focal point, in the asbestos case the evidence is far more esoteric. From the body of medical and scientific literature determination must be made as to when on a reasonable basis there was or should have been knowledge of a hazard to insulation workers. It is an exercise in hindsight.

As the subcommittee will appreciate from my earlier testimony, and other testimony received, the interpretation of the state of the medical art has become in the truest sense of the American adversary system a clash of mutually inconsistent and divergent viewpoints. The clearest evidence that legitimate but divergent viewpoints exist is the fact that each case is individually handled by the courts, and that juries do indeed reach different results. In some cases the plaintiffs prevail while in others the verdict favors the defendants. While such a state of affairs might well be consistent with American judicial tradition we must ask if it is achieving anything toward attainment of the goal of comprehensive, equitable, and uniform compensation for occupational disease.

For so long as liability and fault are the cornerstones upon which attempts to resolve the issue of compensation for occupational disease are based, there will, in fact, be no resolution.

Mr. McKinney in his testimony on S.3060, to which I referred earlier, outlined many specific shortcomings of the present product liability system for fairly and equitably dealing with the issue of compensation for occupational disease. That testimony has previously been submitted to this subcommittee, and therefore I will not reiterate the points raised in that testimony. I do urge the subcommittee to consider carefully Mr. McKinney's testimony.

I want to turn briefly to what I will call a concept of collective responsibility. I emphasize collective responsibility—not collective liability or fault. Any equitable resolution of the issue of compensation for occupational disease must include all who, as a matter of basic realities and fairness, are involved. Due to factors such as the insulation from suit provided by workers' compensation laws and variations in state law on contribution,

indemnification and joinder, all parties to the equation are not included in present proceedings. For example:

1. What of the employer and his responsibility for health and safety considerations in the workplace of his employees? This is a particularly troublesome question in insulation worker cases where subsequent to knowledge, warnings, and instructions, working conditions with respect to asbestos exposure remained, at best, marginal. Should a product manufacturer rather than the employer be responsible for occupational disease attributable to deficient working conditions? From early discovery in shipyard cases it appears that this may be a particularly acute problem in naval shipyards.

2. What of the Federal government and its public health responsibility? The history of the Government's attention to asbestos-related health issues is one of noninvolvement, erroneous standards, and a constant lagging behind industry and academia.

3. What of other contributing factors to occupational health burdens such as cigarette smoking?

Within a framework of collective responsibility all should share in the comprehensive, equitable and uniform compensation for occupational disease.

The problems of compensation for asbestos-related occupational disease under existing systems are clear. Returning to the original question raised, I submit to the subcommittee that a goal of comprehensive, equitable and uniform compensation for asbestos-related occupational disease cannot be achieved within existing structures, and that legislation is required.

The issues presented at these hearings merit the subcommittee's most serious attention. A great deal rests on your decisions. Personally, I am fearful that if we fail to join together to take dramatic and innovative action the number of lawsuits will continue to grow, millions of dollars will be spent for attorney's fees, court costs and expert witnesses, court backlogs will grow, inconsistent results will continue, and in future years we will look back and regret our failure to resolve the basic question of comprehensive, equitable and uniform compensation for occupational disease. This subcommittee has the opportunity to

take innovative, progressive, and effective action. The status quo is no longer acceptable.

¹ Cooke, W.E., "Pulmonary Asbestosis," *British Journal of Medicine* (sic), Vol. II, pp. 1024-25.

² It is to be noted that the document entitled "Asbestos, Chronological Highlights" are submitted to the subcommittee in San Francisco is replete with errors. For example, dates are erroneous, the numbers of cases are misstated, and the document implies the existence of workers' compensation laws specifically addressing asbestosis up to 13 years before the term asbestosis was coined.

³ Merewether, E.R.A., *Report on Effects of Asbestos Dust on the Lungs and Dust Suppression in the Asbestos Industry*, H.M. Stationery Office (1930).

⁴ Lanza, A.J., McConnell, W.J. and Fehnel, J.W., "Effects of the Inhalation of Asbestos Dust on the Lungs of Asbestos Workers," *Public Health Reports*, Vol. 50. pp. 1-12 (1935).

⁵ Dreessen, W.C., et al., "A Study of Asbestosis in the Asbestos Textile Industry," *Public Health Bulletin* No. 241, (1938).

⁶ Dreessen, *ibid.*, Merewether, *supra.*, (1930); Lanza, *supra.*, (1935).

⁷ Fleischer, Walter E., Viles, Jr., Frederick, J., Gade, Robert L. And Drinker, Philip, "A Health Survey of Pipe Covering Operations in Constructing Naval Vessels", *Journal of Industrial Hygiene and Toxicology*, January 1946.

⁸ Selikoff, I., *infra.*, at pg. 142.

⁹ Selikoff, I.J., "The Occurrence of Asbestosis Among Insulation Workers in the United States." *Annals New York Academy of Sciences*, 1965.

¹⁰ *Ibid.*, 1965.

¹¹ Selikoff, I.J., "Partnership for Prevention—The Insulation Industry Hygiene Research Program," *Industrial Medicine*, Vol. 39, No. 4, April 1970.

¹² Wagner, J.C. Sleggs, C.A. and Marchand, Paul, "Diffuse Pleural Mesothelioma and Asbestos Exposure in the North Western Cape Province," *British Journal of Industrial Medicine*, 1960, 17, 260.

¹³ Selikoff, I.J., Churg, J. and Hammond, E.C., "Asbestos Exposure and Neoplasia," *Journal American Medical Association*, April 1964.

Selikoff, I.J., Churg, J. And Hammond, E.C., "Relation Between Exposure to Asbestos and Mesothelioma," *the New England Journal of Medicine*, March 1965.

¹⁴ Sweeney, Robert E., "The Asbestosis Time Bomb," *Trial*. October 1978, p. 17. It is to be noted that the cases of disease to which Mr. Sweeney makes reference were in the asbestos textile industry, and among individuals who had experienced long periods of continually heavy exposure to 100 percent raw asbestos fiber.

¹⁵ The world's largest fabric filter is maintained at Johns-Manville's Jeffery Mine in Asbestos, Quebec.

¹⁶ Selikoff, I.J., "Partnership for Prevention—The Insulation Industry Hygiene Research Program," *supra*.

¹⁷ A settlement of this type claim is referred to in the minutes of a 1933 meeting of the board of directors of Johns-Manville.

¹⁸ Lanza, *supra*., p. 6, 11.

Appendix 3

There are many examples in this book of the suppression of findings and opinions by health professionals. However, the scientific journals are sometimes also open to criticism for the way they choose what to publish. Conspicuous in this regard is the *Journal of Occupational Medicine*, the "official publication" of the American Occupational Medical Association (AOMA). The author's effort to get this journal to publish a letter on the threat of asbestos in drinking water is illustrative.

(Here follow full texts of letter from BC to JOM 6-13-83 and JOM reply 9-27-83)

June 13, 1983
For Publication

to the *Journal of Occupational Medicine*

Dear Editor:

In response to an inquiry (Occupational Medicine Forum, *JOM* 25: 361, May, 1983) on the health effects of ingested asbestos, the AOMA Committee on Occupational Medical Practice offered the opinion, "there is little evidence to support a health risk problem from asbestos fibers in drinking water."

This opinion is very open to dispute in light of current scientific knowledge. Asbestos is a universally recognized

carcinogen, and numerous studies show excessive rates of gastrointestinal cancer and other cancers among workers occupationally exposed to inhaled asbestos. There is little or no basis for expecting that asbestos fibers' carcinogenic properties are altered by taking a ride up the mucociliary escalator and then being swallowed. What basis then could there be for thinking the asbestos fibers are less of a digestive cancer threat if directly swallowed in drinking water than if swallowed after clearance from the lung?

If we accept the idea that one route of swallowed fiber can be presumed an equal GI cancer threat to the other, then we can make estimates of risk as a function of dose. What dose of swallowed asbestos fibers does it take to constitute a "health risk problem"? Here the AOMA Committee may have a different perspective than others in public health concerned with environmental cancer risks to which tens of millions are constantly exposed. What might be an unnoticeably small excess risk for several thousand workers occupationally exposed could still be a major public health threat when the number exposed to the same risk is 10,000 times as great.

The expert panel of the International Agency for Research on Cancer concluded in its 1977 Monograph on asbestos, "At present, it is not possible to assess whether there is a level of exposure in humans below which an increased risk of cancer would not occur." More recently, it has been noted that at least four epidemiological studies of asbestos workers demonstrated a linear dose-response relationship with no evidence of a threshold below which disease does not appear (W.J. Nicholson. *Criteria Document for Swedish Occupational Standards: Asbestos and Inorganic Fibers*, 1981).

Asbestos is widely present at levels exceeding 10 million fibers per liter in U.S. drinking water supplies. And there is every reason to expect that this problem is getting worse, not better. Using EPA dose-response estimates, Millette and his co-workers have calculated that 1,000 cancer deaths per year in the U.S. may be caused by asbestos in drinking water.

The AOMA Committee cited Dr. Millette as an authority on this subject. Readers who examine the paper by him and his co-workers, entitled "The Need to Control Asbestos Fibers In

Potable Water Supply Systems" (*Sci. Total Environment* 18: 91-102, 1981) may come away with a very different opinion from that offered by the Committee. Dr. Millette would no doubt regard it as a public service to provide copies of this paper to interested readers (address in *JOM op. cit.*).

Sincerely yours,
Barry I. Castleman

* * *

September 27, 1983

Dear Mr. Castleman:

Your letter-to-the-editor of June 13 was referred to the AOMA Committee on Occupational Medical Practice. After due consideration, the Committee concluded that perhaps its response to the old question about whether there are indeed thresholds for carcinogens in biological studies should have been more equivocal than it was. Rather than "Epidemiological studies ... have permitted the conclusion that no cancer risk is associated with asbestos fibers in water" probably should have been written "Epidemiological studies ... do not permit the conclusion that cancer risk is associated with asbestos fibers in water at this time."

Our Editors have decided, based on the Committee reports, that publication of your letter-to-the-editor therefore is not indicated.

AUTHOR'S NOTE: The Editor of the *Journal of Occupational Medicine* was Dr. Lloyd Tepper, Corporate Medical Director of Air Products and Chemicals, Inc. The Associate Editor was Dr. Charles Reinhardt, Director of the Haskell Laboratories of E.I. du Pont de Nemours and Company, Inc. Dr. Paul Kotin, retired Senior Vice President for Health, Safety, and Environment of the Johns-Manville Corporation, served on the editorial board.

A Committee of the National Research Council has estimated that lifetime consumption of drinking water containing 1.4 million asbestos fibers per liter would cause 10 cases of gastrointestinal cancer per 100,000 persons exposed. Similarly, water

containing 10 million fibers per liter (a concentration exceeded in 11 percent of U.S. drinking water supplies analyzed by the Environmental Protection Agency) would be expected to cause 91 cases of gastrointestinal cancer per 100,000 exposed persons. Data were considered insufficient to base any estimate of the additional risk of other forms of cancer, notably peritoneal mesothelioma. (Asbestos, *Drinking Water and Health*, Vol. 5, National Academy Press, Washington, D.C. 1983, pp. 123-147)

See also R. Lemen *et. al.*, "Report on Cancer Risks Associated With the Ingestion of Asbestos." *Env. Health Perspectives* 72: 253-265 (1987).

Appendix 4

Chart used in consolidated trial of *Wanda Jenkins et al. v. Raymark et al.* (over 700 plaintiffs) in Marshall, Texas federal court (C.A. No. M-84-193-CA), March, 1986. Plaintiffs charged defendants with a "Conspiracy of Silence."

	GAF Ruberoid	Eagle- Picher	Owens- Corning	Owens- Illinois	Keere	Philip Carey	Pittsburgh Corning	Armstrong	Fibreboard	Raymark	J-M
Asbestos 1930	X				X	X			X	X	X
Metropolitan Life										X	X
Saranac Reports			X	X						X	X
IHF	X	X	X	X			X			X	X
ATI										X	X
7th Saranac (Unpublished)			X	X							X
Contract unit w.c. compensation defendants			X			X		X	X		X
MIMA					X	X			X		X
NIMA	X	X	X		X		X				X

ATI—Asbestos Textile Institute

IHF—Industrial Hygiene Foundation

MIMA—Magnesia Insulation Manufacturers Association

NIMA—National Insulation Manufacturers Association

Appendix 5

THE ANTHONY J. LANZA RESEARCH LABORATORIES: NEW YORK UNIVERSITY'S MONUMENT TO MENDACITY IN INDUSTRIAL MEDICINE

1926—Metropolitan Life Insurance Company decides to finance a new department of industrial hygiene at McGill University for five years, on a "definite, tangible, quid pro quo" basis, to advance Met's business interests in Canada.

1930—Dr. Pedley of McGill identifies 42 cases of asbestosis among 195 Quebec miners. Pedley reports on this "interesting state of affairs" to Lanza and N.L. Burdette at Met Life, but does not obtain permission to publish his findings. Lanza subsequently writes in 1939 that asbestos miners don't get asbestosis (*Am J Tuberc*).

1932—Lanza arranges evaluation of X-rays of employees at Johns-Manville NJ plant by US government doctors in Picher (OK) clinic, finds 329 with pneumoconiosis. Histories of workers with asbestosis included watchmen, shipping clerks. Predates reports of bystander disease from asbestosis in the world medical literature. Never published or cited.

1933—Lanza advises Johns-Manville (J-M) Waukegan, IL plant doctor to not post asbestos warning signs because of "the extraordinary legal situation"; J-M sued by about 20 former Waukegan employees alleging asbestosis within months later.

—Lanza advises Saranac Laboratory to not publish research

on silicosis over the objections of mining companies who paid for the studies. He claims that Sayers (of the Public Health Service) "feels very strongly that if you and the Saranac Laboratory want to stay in the consulting business with respect to the mining industry, it will not be possible for you to publish these papers, at least at the present time." Alluding to damage suits for silicosis, he says "you are in the same position as we are with the investigations we have made in the asbestos industry."

1934—Lanza sends galley proofs on asbestosis study to J-M corporate lawyer Vandiver Brown, who advises editing changes to make asbestosis seem a less serious disease than silicosis. Brown encloses attorney Hobart's letter explaining that J-M hoped to use Lanza's paper as a lobbying tool to prevent adoption of asbestosis as a compensable disease in NJ. Lanza complies, NJ compensation law doesn't include asbestosis until 1945.

1935, 1936, 1940—Lanza papers in *Pub Hlth Rep*, *JAMA*, *Minn Med* downplay seriousness of asbestosis in US, influencing other occupational health professionals for years thereafter.

1935—Lanza a central figure in formation of Industrial Hygiene Foundation and later member of its Board of Trustees. IHF performed confidential industrial hygiene and medical surveys for Asbestos Textile Institute (1947) and many other industrial firms. IHF also performed controversial epidemiological study of lung cancer in asbestos miners for Quebec Asbestos Miners Association (1957) and altered final report published in 1958 to delete data on prevalence of lung cancer in asbestos miners who had asbestosis.

1936—Lanza assures Raybestos-Manhattan that Lanza's former colleague, Public Health Service investigator Dr. Sayers, can be relied upon to not disclose findings of asbestosis to the workers if allowed to conduct medical surveys in R-M plants.

1942—R-M President thanks Lanza for repeated efforts on behalf of R-M in defense of compensation suits over asbestosis.

1946—Following the death of Dr. Leroy Gardner at Saranac Laboratory, Lanza becomes a member of Board of Trustees of Saranac's parent organization, Trudeau Institute (in addition to his regular job at Metropolitan Life). Lanza presses pathologist Kenneth Lynch to write up Gardner's animal experiments with asbestos that had been jointly sponsored by 7 companies. Lynch declines to edit Gardner's unpublished reports. Eulogizing Gardner at the annual IHF meeting, Lanza lauds "honesty" of the Saranac Lab researchers.

1947—Lanza meets with J-M top executives to plan a way to get some of Gardner's research published by the new Saranac Lab director, Dr. Arthur Vorwald. V. Brown stresses the importance of excluding any mention of cancer from asbestos and observes that the contract with Saranac gives asbestos company sponsors editorial control over any publication.

1948—Vorwald draft report analyzed by sponsoring asbestos company executives, who decide unanimously that all references to cancer must be deleted. Lanza, now at New York University, sends the asbestos industry instructions to Vorwald, who then makes the requested changes in a paper published 1951 (the paper was given the Merit in Authorship Award by the Industrial Medical Association).

1949—Lanza tells visiting researcher Dr. Gerrit Schepers he must submit a thesis for completion of his work on pneumoconiosis at NYU. Lanza then provides the "thesis" to J-M executive V. Brown, who demands that Schepers not submit his report to his country's government (S. Africa) or publish his observations on asbestosis/cancer in any manner.

—Lanza and Vorwald attend the First National Cancer Conference and go on record as saying their experience provides no evidence that asbestos causes lung cancer.

1950—Lanza, Vorwald, J-M executive Page Woodard, and the lawyer for the Quebec Asbestos Mining Association (QAMA) meet at Saranac, and a confidential animal study is planned to determine whether mice inhaling asbestos developed pulmonary cancer. Interim report at 14 months (5/52) indicates a

positive trend in the formation of tumors, no subsequent report ever located.

—Prof. Lanza offers "postgraduate course in compensation medicine" at NYU for physicians in industrial medicine.

1951—Lanza approaches the U.S. Surgeon General, and succeeds in getting an order sent down to Dr. Wilhelm Hueper at National Cancer Institute (NCI) to cease contact with private and government organizations that had clinical data on industrial agents suspected of causing cancer.

—President of Mutual Chemical lauds Lanza (confidential letter to another chromate manufacturer) for getting Hueper's name and that of NCI removed from authorship of positive cancer epidemiology report on chromate workers—as a result of Lanza's visit to the Surgeon General.

—QAMA lawyer Sabourin lauds Lanza for contributing "greatly" in defending a workers' compensation claim against British-owned Bell Asbestos Mines, "debunking...figures relating to cancer incidence in the British Isles."

1952—Lanza comment published (*Arch Ind Hyg Occ Med*) saying the reason the UK authorities report so much lung cancer with asbestosis is because they look so carefully through lungs of asbestotics and often find tiny tumors (rebutted by WE Smith, who noted the contrast in cancer rates between UK asbestotics and silicotics).

—Neither Vorwald or Lanza mentions the ongoing animal studies for QAMA at lengthy discussion of pneumoconiosis and cancer at the Seventh Saranac Symposium. (Sept.)

1953—Vorwald fired by Saranac Lab with the active participation of Lanza. Lanza personally intercedes to prevent Vorwald from being hired by a medical school in California. Vorwald consulting in defense of Quebec asbestos disease compensation claims just about ceases entirely.

—Lanza hosts a conference (published in *Arch Indust Hlth*, 1955), where doctors associated with various asbestos companies downplay the seriousness of asbestosis, warn against "doctor-induced disability", etc.

—Lanza hired by Lead Industries Association to oppose New York City Board of Health proposal to require warning labels on lead-based paint containers.

1956—Dr. W.E. Smith fired by Lanza at NYU over Smith's interest in industrial carcinogens generally and asbestos in particular. Lanza's antagonistic attitudes toward researchers in industrial cancer vividly described in Smith's letter sent to director of NYU/Bellevue and Chancellor of NYU, pleading for reconsideration.

1960—Lanza is succeeded as Director of the Institute of Industrial Medicine at NYU by Norton Nelson, who praises Lanza for "unassailable integrity".

1962—J-M medical director refers insurance claims investigator to Lanza, saying Lanza had just completed a cancer study at a Pennsylvania brake lining plant (where local doctors had reported lung cancer). No trace of any such study by Lanza has been found.

1963—Lanza-edited book, *The Pneumoconioses*, includes a chapter on asbestos by J-M's medical director, denying that there was data to show asbestos mining in Canada caused lung cancer; the word mesothelioma does not appear.

1964—Lanza dies and is honored by NYU.

—Selikoff publishes epidemiological study in JAMA showing catastrophic mortality from cancer and asbestosis among asbestos insulators in NY/NJ.

1987-88—NYU asked by Castleman, Harriet Hardy, and Paul Brodeur to rename Lanza Research Laboratories. Replies to Castleman (6/87, 5/88) and Brodeur (4/88) say the matter is under consideration.

—Dr. Hardy recalls being asked by Prof. Lanza to author a text in defense of asbestos.

—Dr. W.E. Smith compares naming an institute of industrial medicine after Lanza to naming a synagogue after Hitler.

1994—At a conference on asbestos at Mt. Sinai Hospital in New York, the issue of the NYU Lanza Building was unexpectedly raised by the author at the end of an invited lecture (on world wide asbestos problems). Dr. Morton Lippmann of NYU angrily responded that Dr. Lanza was a leader in industrial medicine who had been maligned.

1995—Calls to NYU revealed that the Lanza laboratories had been renamed the Nelson Institute of Environmental Medicine, in honor of the late Dr. Norton Nelson. It appears that the name change occurred without ceremony, sometime in 1992, according to NYU's office of medial relations.

3

Compensation: The Final Check-Up

"I can think of no better way of illustrating management's view of compensation for industrial accidents and occupational diseases than to tell you what great concern was felt by my own company—Johns-Manville Corporation—when, after having decided to erect a new insulating board plant in southwest Mississippi, we learned that this was the one state in the Union which had no workmen's compensation law. Of course, we went ahead with our plans but we are hoping that early corrective measures will be taken by the state legislature ... It remains our firm conviction that the worst Workmen's Compensation Commission is preferable to the best jury when the issue of compensation for an industrial injury is drawn between a laborer and his corporate employer."

Vandiver Brown, 1947, at Sixth Saranac Symposium
(*Pneumoconiosis*, Paul Hoeber, pp. 567-568, 1950)

EARLY HISTORY OF WORKERS' COMPENSATION

Switzerland was the first country to provide for disablement from occupational injuries and diseases. In 1877, 45 substances used in industry were listed as specified causes of occupational disease. Germany followed this example a few years later, and Austria established workers' compensation for occupational diseases in 1897.¹

The German Industrial Insurance Act, enacted in 1883, was one of the first national schemes for providing compensation to injured workers. It seems remarkable that Bismarck, who was supported by industrialists and landowners, would have enacted state insurance for sickness, accidents, and old age in the 1880s. However, the purpose of these measures of state socialism was to woo German workers from the Social Democratic Party and defuse revolutionary tendencies among them. Bismarck was opposed to regulation of working hours or working conditions; i.e., the system mainly responsible for producing occupational injuries and diseases in the first place.

In England, the industrial age caused widespread misery in the first half of the 19th century. Describing the number of people in Manchester maimed by machinery, Engels said in 1845: "it is like living in the midst of an army just returned from a campaign."² The average age at death for working class English people in the mid-19th century was less than half of that for upper middle class people. During this brutal period of industrialization, the working people in Manchester and Liverpool died in their teenage years, on the average.³ Labor protection laws of that era were mainly directed toward curbing the most extreme exploitation of children in industry.

Britain's Workmen's Compensation Act of 1897 was introduced by a conservative government. It set up a system to compensate workers disabled by injuries (but not diseases) on the job regardless of fault. Interestingly, the unions preferred to be able to go to trial before a judge and sue for negligence rather than have this no-fault legislation.⁴ It is unclear how much management support for this legislation arose respectively from: 1) concern over losing such suits before judges from the same social strata as the factory owners; and 2) concern over the expense of high-priced legal representation even in the successful defense of claims.

The initial failure of the English Workmen's Compensation Act to cover any occupational diseases was denounced by Dr. Thomas Oliver in his 1902 text, *Dangerous Trades*. Oliver rejected the idea that "hazard pay" somehow offset this injustice:

No high wages paid to men to undertake work in a dangerous trade, even if it were always the case that such were paid, can adequately compensate the affected workman for the loss of health occasioned by following a dangerous occupation. Many dangerous trades are far from being highly paid. The class of workmen who are affected by these industries are usually very poor, their occupation is often interrupted, and they are not organized into unions, so that they neither contribute to the funds of, nor do they receive benefits from, a Friendly Society.⁵

When Britain cautiously allowed compensation for occupational diseases, it was limited to specific diseases and industries where the risk of each arose. The schedule of hazardous materials covered in the original Act of 1906 included phosphorous, arsenic, mercury, and lead. By 1918 various effects of carbon disulfide, nickel carbonyl, tetrachloroethane, and chromium compounds were added.⁶ Silicosis, well known in 19th century England, was not included until 1918; asbestosis was added in 1931.

In the United States, as in Europe, the establishment of workers' compensation systems appears to have been an effort to forestall potentially more onerous consequences to industry. Workers' personal injury suits in the U.S. were decided by juries of ordinary citizens, not patrician judges. The occupational safety and health issue was a growing threat wielded by the many injured plaintiffs and their lawyers, trade unionists, and social reformers.⁷

Industrial accidents took a staggering toll in the U.S. in the first years of this century. The death count was placed at over 15,000 per year.⁸ In the meantime, jury trials occasionally yielded large awards and substantial publicity. Some reformers targeted the employers' legal defenses under the laws, weakening them and paving the way for more and larger jury verdicts.

The common law defenses of the employers amounted to:

- 1) the worker had been careless (contributory negligence)
- 2) the worker had assumed the risk in taking the job

- 3) a fellow employee and not management was at fault.

Occupational diseases were almost completely overlooked at this time (by the workers if not management), but an additional defense of employers here would be the claim that the health hazard was not a recognized and hence foreseeable one. Employers, although generally able to win these cases, were still facing increasingly large legal expenses.

In a report of an investigation supported by the Russell Sage Foundation, Eastman criticized the common law system's inadequacies and urged the creation of a system of workers' compensation in 1910.⁹ This would replace the common law suits with a "no-fault," limited liability system administered by state industrial accident commissions. The unions were all in favor of just compensation for work-related disability and death. It was assumed that appropriate enactment of provisions for obtaining such compensation would both benefit the disabled and induce management to better protect those actively employed. But workers' compensation laws were also seen as a potential threat on both fronts, should their actual effect be to only minimize employers' liability. The powerful railroad workers' union opposed workers' compensation, and union reluctance to go along with the new scheme was largely eliminated by excluding railroad workers from inclusion under state workers' compensation laws.

The corporations were thus able to avoid jury trials and have compensation claims quietly decided by administrative agencies. Through the political appointment process (including "promotions" and transfers), and various time-honored forms of friendly persuasion (e.g., lucrative offers of jobs in the private sector), they could reduce the risk that commissioners would act with great zeal in granting disability compensation. Through the legislatures, the employers were able to set low limits for both medical and disability payments which they could be ordered to pay. They could also legislatively impose procedural obstacles and stall the processing of claims, through inadequate appropriations and salary levels for commissioners and staff, etc. Between 1911 and 1920, all but six states established workers' compensation laws.¹⁰

One aspect in the workers' compensation law of great interest to employers was the limitation of attorneys' fees. The purveyors of these limitations claimed that they wanted to keep ambulance-chasing lawyers from starting a medico-legal racket or holding up their worker clients for extravagant legal fees. But whatever the justification offered may have been, the result was that workers' compensation law was rendered about as non-lucrative as criminal law. The field was thus sufficiently uninviting to be generally overlooked by the mainstream legal profession. What few "labor lawyers" had occasion to take on workers' compensation cases were no match for the skilled and well-paid opposition, which came to include "industrial physicians" hired or consulted to work with attorneys in the defense of compensation claims.

By 1920 the unfairness of the compensation apparatus was so evident to the authorities in Pennsylvania that they asked the legislature for \$12,000 as an appropriation for attorneys' fees to help claimants.¹¹ Meanwhile, the overall cost of workers' compensation insurance and claims was costing employers a very affordable 1 percent of payroll.¹⁰

Thus, the origins of workers' compensation in the United States, England and Germany were similar. In all three countries, the legislation was introduced by business interests or conservative governments to defuse labor unrest and control the long-term costs of occupational injuries.

Occupational diseases had been completely overlooked in most of the American workers' compensation laws. But during the second decade of this century, Dr. Alice Hamilton investigated a number of industries in which severe health hazards existed. Her reports and those of her co-workers were published by the U.S. Bureau of Labor Statistics, dealing with lead poisoning, the rubber industry, the printing trades, dyes, carbon monoxide, and silicosis. By the Twenties, the compensation boards were starting to see some disease claims, and they applied their laws to these claims in interesting ways.

The early application of workers' compensation law to occupational diseases was memorably recorded by the chairman of the Pennsylvania Workmen's Compensation Commission in 1921:¹¹

Up in Massachusetts they boast they have an act which covers industrial diseases. It was an accident that they have such a law, as they never intended to write such a law. In the phrase "personal injury by accident" they left out the words "by accident." They intended to put in the usual words but they left out the words "by accident", and the supreme court says, "Why, you have occupational diseases covered." California has such a law by design, but every time I hear a Massachusetts representative boasting of her occupational disease compensation law I feel like reminding him that she only has it by accident.

In 1920 the compensation systems in only seven states made provision for occupational diseases. The exclusion of occupational diseases from coverage under most of the state workers' compensation systems continued through the 1920s, resulting from:

- 1) limiting the scope of the law to injuries "by accident"
- 2) adverse rulings of the courts and commissions
- 3) express provisions in the compensation acts themselves

But this also meant that, since workers' compensation didn't apply, it also wasn't a bar to the bringing of civil suits against employers in occupational disease cases.

It would not be until the 1930s with severe unemployment in the Great Depression, that workers with occupational lung diseases would seek compensation *en masse* through the industrial accident boards and civil courts. By 1934, suits demanding \$300 million had been filed by workers seeking compensation for pneumoconioses.¹²

The expense of occupational disease compensation to industry had risen suddenly from insignificance to a major expense by 1935. The industries and their insurers at that time were terrified that all-inclusive occupational disease laws left open the possibility that courts and industrial commissions would hold industries and their insurance carriers liable for all forms of ill health in any way contributed to by work. It was by then

well known that silicotics commonly developed tuberculosis, and asbestotics were prone to develop pneumonia. Would deaths from these common causes be charged to employers in thousands of cases where the individuals had worked in dusty trades?

Little historic material has been written about how the employers and insurers kept workers' compensation for occupational disease from becoming the tremendous ongoing expense it threatened to be in 1935. However, one aspect of the compensation laws that played a major role were the statutes of limitations they all had. Typically, a claim had to be filed within one or two years of leaving employment—the dust diseases and occupational cancer were known to have long latent periods, and employers could simply fire employees before they had time to develop disease. Alternatively, if the employee had ever been told he had a dust disease, he might find his claim "statute-barred" a few years later when he found it necessary to file a claim for disability.

Some U.S. laws enacted in the mid-1930s (New York, Michigan, Pennsylvania, Ohio) adopted the so-called "principle of limited and graduated liability." This excluded from coverage persons no longer employed in the industry at the time the law took effect. Graduated liability provisions set compensation limits for other workers based on the amount of time they had been employed in the hazardous work after the law took effect, before they became disabled. In this way, the affected industries were able to avoid facing a tidal wave of liability for disability claims following the inclusion of occupational diseases in the state workers' compensation laws. The insurers had balked at paying off claims for past years' coverage, during which time only occupational injuries had been covered by law. The industrial companies, on the other hand, had had to press for a phase-in of occupational disease coverage under workers' compensation, in order to be able to continue to purchase insurance at affordable rates for their accrued liabilities.¹³ And so, by phasing in the laws' impact, both the employers and insurers were able to largely escape liability to the disabled workers and their families. As in the case of England's compensation law for silicosis and asbestosis, such a law *invited*

employers to discharge workers who were disabled before the date it took effect.¹⁴

Another aspect of laws serving to limit liability were provisions for only *partial medical coverage*. A worker who won a compensation award in Georgia as late as 1974 could get only \$5000 in medical coverage from the employer—West Virginia and Wyoming were even worse. In South Carolina, coverage was limited to 10 weeks, in Missouri 180 days.¹⁵

A device started in Maryland around 1939 and adopted in some other states was the incorporation of a "medical board" into the workers' compensation commission. The imposition of a medical board meant an additional lengthy period of delay in processing of occupational disease claims by the commission, a condition which heavily favored the employer. The pro-employer bias of these medical boards is indicated by the fact that 2 of the 3 members of the Maryland medical board resigned in disgrace in 1981, following disclosures of conflicts of interest over their more lucrative roles as company doctors. In 1983, the Maryland Medical Board for Occupational Diseases was abolished by the legislature at the insistence of labor unions.

Some state laws required a minimum 5 or more years' duration of employment in a pneumoconiosis-producing industry. Scientifically, this was unjustified, since it had long been known that silicosis and asbestosis could be produced by shorter periods of work in dust.

Additional legal obstacles were imposed because of the numerous jurisdictions involved. Many workers traveled a great deal in their trades to find work. They would later be confronted by workers' compensation laws saying they had to have worked for some minimum number of consecutive months at a time in the state within the past ____ years to qualify. If they worked on ships, there might be additional confusion over whether they should bring a compensation claim or a suit in admiralty court.

An important structural feature of the workers' compensation systems in the U.S. is that, in most states, insurance coverage has been provided by private insurers. The private insurers, unlike state insurance carriers, had a common interest with their industrial insureds to litigate even meritorious claims. This exhausted the resources of claimants and set them up for either

dismissal or a negotiated settlement for a pittance. Equally important, it set an example for co-workers and attorneys who might have been thinking of filing additional claims. Thereby, insurance premiums could be held competitively low without necessarily controlling the known hazards in the workplace.

The situation could be very different with a state insurance carrier that didn't have to concern itself with competition for the lowest insurance rates on the one hand and the desire to maximize profits on the other. The American pioneer in occupational medicine, Dr. Alice Hamilton, was impressed with this fact as a guest of her counterparts in Russia in 1924.¹⁶ In Germany, where there had been state insurance carriers since the time of Bismarck, people with asbestosis were compensated for subsequent development of lung cancer as early as 1939.¹⁷

The very opposite role played by private insurers in the U.S. was personified by Dr. A.J. Lanza. Lanza had been with the U.S. Public Health Service, and was hired by Metropolitan Life Insurance Company in the Twenties. An expert on dust diseases, he was selected by the U.S. asbestos industry to conduct a health survey of factories and mines. The factory survey was published in 1935, four years after it was finished, and contained numerous understatements regarding the severity of the asbestosis problem (the study of the miners was not publicly disclosed until 1947). Key phrases were changed, deleted, and inserted in the galley proof stage by Lanza at the request of asbestos industry lawyers. Lanza was a frequent consultant to the asbestos companies on workers' compensation claims and on confidential animal studies on asbestos' carcinogenicity that were never published.

The dominant political lobbying role of private insurers in minimizing compensation paid to workers with occupational diseases persists to this day. Archaic provisions in the state compensation laws, where blatant social injustices still masquerade as administrative conveniences, testify to the power exercised by industries and insurers in the state legislatures. Until mid-1984, occupational cancer was not compensable under New York State workers' compensation law unless the disease was contracted and the claim filed within one year of leaving the employment that caused the cancer.¹⁸ New York was

also one of the few states where the victim of a dangerous product must bring a civil suit within 3 years of the last exposure, rather than within a comparable period after the manifestation of illness, as in most other states. This insidious law barred several thousand New York asbestos victims from filing personal injury suits, because the statute of limitations had lapsed before they developed asbestosis and cancer.¹⁹ Finally, in 1986, New York enacted a "revival statute," allowing victims of asbestos (and a few other occupational and environmental hazards) one year to file suits previously barred by the statute of limitations.

The industrial firms and their insurers were acutely aware of the pivotal role of physicians in determining what is job-related, what is disease, what is disability (and if so how much). Accordingly, the few doctors who tried to conduct legitimate scientific inquiries faced relentless persecution. Such people soon found their careers threatened or destroyed and their motives impugned by powerful business interests.²⁰⁻²⁴

It was commonly recognized in the field of occupational health in the period before 1970 that considerable information on health hazards was withheld from publication.^{25,26} The Industrial Hygiene Foundation did thousands of plant industrial hygiene surveys for member companies starting in 1937, and kept all the findings confidential. When approached by plaintiffs' attorneys in asbestos litigation in 1979 to produce such records, they were all destroyed under a new "policy."

The Saranac Laboratory ran a similar business doing animal tests on hazardous dusts. Contracts for doing such testing contained explicit provisions or at least understandings whereby industrial sponsors could control any publication of the findings. Hueper claimed that after he left DuPont's Haskell Laboratories in 1938, toxicological research that was bad for business was treated as a trade secret and withheld from publication.²²

Before 1970, the dearth of qualified, independent professionals and published scientific literature contributed to the state of ignorance of the trade unions. The unions, thus less aware of the magnitude and insidious nature of the occupational disease

problem, were more likely to miss subtle subversion of the compensation structure.

Businesses with health hazards from the classical dusts have long conducted programs of medical examination, including chest X-rays. The main purposes were:

- 1) to reduce the cost of workers' compensation
- 2) to reduce the cost of hospital and surgical insurance
- 3) to reduce absenteeism
- 4) to reduce labor turnover and increase efficiency

But some firms who regularly examined employees were reluctant to inform workers who were developing pneumoconioses. It was not until the 1970s that this was exposed (in legal discovery against Johns-Manville in California, in OSHA hearings over a citation against Bethlehem Steel in Baltimore, and in OSHA inspections of medical records at a DuPont plant in New Jersey and a Westinghouse plant in Lester, Pennsylvania), with the result that obscure provisions of workers' compensation laws have finally been used to bring suit directly against employers. These provisions, not present in every state law, say that the employer can be sued for *intentionally* harming the worker. In states whose workers' compensation laws have no intentional tort provisions, cases have been brought on the contention that limited liability under workers' compensation law doesn't apply to these particular cases. In the civil suits filed in New Jersey, Maryland, California, Ohio, West Virginia, and elsewhere, the workers and their families demanded full compensation for lost earnings and medical costs, additional damages for pain and suffering, and punitive damages. Courts in New Jersey have allowed such claims to be pursued against DuPont by its chemical plant construction trades employees.

The industries with dust and chemical hazards have long been aware of the potentially ruinous cost of compensating employees disabled by occupational diseases. By the force of sheer economic power, applied through the courts, the legislatures, administrative agencies, the professions, and the universities, business interests were able to downplay the importance of

occupational diseases and avoid compensating most of the affected workers. The result has been the physical and economic devastation of millions of American workers and their families, the wanton pollution of our environment with the same poisons that ruined the health of many workers, and the legacy of a social structure that still treats disabled workers like mendicants and gives the responsible parties every benefit of the doubt.

The asbestos industry's response to the problem of occupational disease compensation is thus an example of an even more widespread pattern, vividly seen through the documentation and testimony unearthed through legal discovery.

COMPENSATION FOR ASBESTOS DISEASE

The history of asbestos disease compensation is important for a number of reasons. Doctors can publish articles in medical journals and offer whatever conclusions they have, but what is written does not suddenly become common knowledge. It takes some time to percolate past the comparatively small groups of specialists in pathology, radiology, and clinical medicine, to reach the general practice doctors who see people from the local asbestos factory. It may take longer for these physicians to broach the subject of occupational disability and death compensation to their patients and their families. Since compensation is usually sought through a complicated, formal process, the service of an attorney is also required. The prosecution of a successful compensation claim may be an arduous process—even in cases where the opposition is limited to scientifically legitimate issues, and no deliberate hardships are inflicted upon the claimant, the case must still be proved scientifically.

What this amounts to is that an award of compensation (for disability or death) constitutes society's formal recognition of cause and effect for occupational diseases. Compensation comes only *after* an adequate body of scientific knowledge accumulates, with rare exceptions. Thus, precedents in the compensation field are tremendously important in that they serve notice on industry (and, where the industry is insured by private carriers, on the insurance industry as well). To the extent that defendants in compensation suits use the procedural means

available to exhaust the resources of claimants, they can hardly turn around and then profess ignorance of the results after the compensation is ordered to be paid.

England was the first nation to formally recognize asbestosis as a compensable occupational disease. In the United States, the situation varied from state to state. Some states had laws allowing compensation for any disease attributable to occupation; others, like the English, had schedules of compensable diseases and statutory requirements further limiting eligibility for compensation.

Asbestos manufacturers in the U.S. were generally aware of asbestosis in the 1930s. It was a severe problem, commonly affecting half of the long-term factory employees. The companies saw that the cost of compensating disabled employees could be devastating, and the issue of compensation was thus a concern of top management in the Thirties.

Industry fears about the spread of information on asbestos diseases can be best understood from this standpoint. Failure to stress the gravity of the hazard in employee training, and failure to notify employees that their chest X-rays were starting to show fibrosis may be traced to concerns about compensation. Industry apprehension over publications of all kinds describing asbestos disease can be similarly explained. Newspaper stories incited suits by workers awakened to the cause of their lung problems, while articles in professional journals provided support for the compensation actions. The industry's own contributions to the medical literature and the suppression of some industry-sponsored research appear to have been significantly motivated by compensation considerations.

The industry attempted to hold down compensation costs in different ways over the years. In the 1930s, the companies could still claim that asbestosis had "just been discovered" and so absolve themselves from liability in negligence suits. By the 1940s, time had so eroded the "ignorance defense" in negligence cases that members of the industry came to prefer workers' compensation boards to civil courts. Liability in a workers' compensation case was, after all, limited by statute to significantly less than the full compensation obtainable in a common law trial before a jury.

Workers' compensation was becoming more than just an insurance problem for asbestos manufacturers by the 1950s. By then, a medical consensus had formed that asbestos caused lung cancer, which had risen to become the most common form of cancer in U.S. males. Moreover, major asbestos manufacturers learned first-hand about the afflictions of asbestosis and lung cancer in users of their insulation products, whom they had employed in their contracting divisions. The compensation claims filed by these workers in the 1950s presaged the deluge of product liability suits that would come in the 1970s, 1980s, and 1990s.

In the absence of direct preventive measures, society's provisions for the compensation of occupational disease bore the brunt of the burden of prevention. In the United States, this situation prevailed at least until the passage of the Occupational Safety and Health Act of 1970. Compensation is thus a major theme of the history of the asbestos problem of today.

Asbestos Compensation in the Early Years:

Damage Suits

The year W.E. Cooke named the disease asbestosis, 1927, a foreman in the weaving department of a U.S. asbestos factory filed a claim for workers' compensation. The Massachusetts Industrial Accident Board awarded the man compensation for disability from occupational lung disease.²⁷ Three years later, another claimant with asbestosis in Connecticut was awarded compensation.²⁸

In many states, the workers' compensation laws either did not cover occupational diseases or applied only to designated industrial diseases, and workers seeking compensation for "unlisted" ailments had to sue their employers in civil court. Dr. Anthony J. Lanza, Assistant Medical Director of the Metropolitan Life Insurance Company, remarked that "the damage suit situation" prompted employers to deal with asbestosis.²⁹

Silicosis and asbestosis burst upon the amazed consciousness of American industry during the period 1929-1930 ... Arising out of the period of economic depression, the situation with respect to silicosis and asbestosis became

manifest as a medico-legal phenomenon of a scope and intensity that was at once preposterous and almost unbelievable. Damage suits, under the common law, were instituted against employers by employees, alleging pulmonary dust diseases, in industrial centers all over the United States, to an amount in excess of 100 million dollars.

Beginning in 1929, attorney Samuel Greenstone brought suits against the Johns-Manville Corporation on behalf of 11 employees and former employees alleging disability from lung damage.³⁰ The negligence suits typically demanded \$50,000 for total disability and specifically charged that the Manville, N.J. plant management had failed to provide:

1. a safe place to work
2. masks and other safety appliances, and
3. a proper ventilating system at the plant.

At least 3 of these complaints were served on A.R. Fisher, who rose to be the President of Johns-Manville in the early 1950s. Perhaps due to questionable practices Mr. Greenstone used in soliciting these cases, Johns-Manville lawyers were able to negotiate a settlement of \$30,000 for all the cases and obtain Greenstone's written assurance that he "would not directly or indirectly participate in the bringing of new actions against the Corporation." Settlement by the company President was thus authorized at a meeting of the J-M Board of Directors on April 24, 1933.³¹

Later that year, A.R. Fisher, manager of the Manville plant, received a confidential note from corporate Vice President S.A. Williams, referring to advice received by a plant doctor at another location (Waukegan, Illinois). Dr. A.J. Lanza's "verbatim" responses to questions were enclosed. Asked whether employees should "definitely be made aware that asbestos is hazardous to their health" by means of posters, Lanza had reportedly said he doubted the hazard justified that: "This is especially true in view of the extraordinary legal situation."³²

In 1935, Johns-Manville was hit with another volley of lawsuits (about 20) from former employees at its Waukegan,

Illinois plant. These workers alleged injury due to asbestos and other dusts in the workplace. The courts first rejected Johns-Manville's assertion that occupational disease was covered exclusively under the state workers' compensation law; but later, they threw out the suits against Johns-Manville, ruling that the workers had no right to either bring such suits under common law or file workers' compensation claims. The Illinois legislature promptly expanded the compensation law to include occupational disease, and the state distributed thousands of pamphlets to publicize the changes. A railroad industry doctor, acknowledging problems of exposure to asbestos and other dusts in railroads, worried that publicity about the Illinois law would create a "fear complex" along with unjustified compensation suits or claims.³³⁻³⁶

Compensation in Great Britain

In 1931, Great Britain had formally included asbestosis under the Workmen's Compensation Act. There were restrictions of coverage, however:¹⁴

(A) successful claim can only be made if the sufferer has worked in an industry or process included in a compensation scheme; the mere fact that a claimant is suffering from (asbestosis) does not entitle him to compensation from his employer. His condition must be due to employment in one or more of the specified processes.

A medical board was set up to screen compensation applications. One drawback of the compensation scheme was that it did not explicitly include any users of asbestos products, such as insulation workers. "Breaking, ... mixing ... of asbestos or any admixture of asbestos" applied to insulators, among them employees of Newalls Insulation Company, but the courts were left to interpret the law's applicability in other cases in the late 1940s and the early 1950s.^{37,38}

A grievous defect of British asbestosis compensation was the provision that workers who had left the industry three or more years before filing a claim were ineligible. Even before the compensation scheme for asbestosis was finalized, there was

controversy over the eligibility of women, many of whom had left their jobs in asbestos factories years before becoming crippled with asbestosis.^{39,40}

In the case of an English woman who died in 1931 from asbestosis and tuberculosis eight years after leaving her factory job, the Home Secretary was pointedly asked to do something about the arbitrary statute of limitations. The response was that even aside from the time limit, compensation in that case was barred by the fact that the woman was not employed in the industry as of May 1, 1931.⁴¹ In other words, the compensation law excluded everyone in the country with asbestosis who had already been disabled, retired, or fired by the time the compensation scheme took effect.

As of 1950, these defects in the law apparently remained. That year, Livingstone and Street reported on a man with asbestosis who had worked from 1924 to 1929 as an "asbestos crusher."⁴²

The case was referred to the Pneumoconiosis Medical Panel as a matter of interest, but as the man had not worked in the asbestos industry for 20 years he was adjudged ineligible to recover compensation under any existing scheme.

The National Insurance (Industrial Injuries) Act took effect in 1948, whereby the government assumed the burden previously borne by employers under the workers' compensation system.

British industry leader Turner & Newall became acutely aware that families of workers dying with asbestosis could lodge suits against the employer for breach of statutory duty. Common law claims made by employees had increased generally in the country, following implementation of the National Insurance (Industrial Injuries) Act. Regulations absolutely required exhaust ventilation "which prevents the escape of asbestos dust into the air of any room in which persons work." There were four claims for damages at Common Law entered in the early 1950s, and T&N's solicitors recommended out-of-court settlement, explaining the risks of taking them to judgment.⁴³

The probabilities are all in favour of claims for damages succeeding ... If Actions are allowed to go to trial with a verdict against you there will be a crop of claims, possibly

from workers suspended from the industry, which will not be capable of reasonable compromise but more importantly it will, in our view, be quite impossible once there is a Judgment against us, to persuade the Home Office to amend the Regulations.

T&N Secretary John Collins was accordingly advised to make every effort to persuade the government to amend the rules by inserting the qualifying words in the regulations, "so far as is reasonably practicable." When the T&N men approached the Chief Inspector of Factories with this idea, he told them that an attempt to alter the regulations might cause even more publicity than the trial of a common law claim. He pointed out that a public inquiry would be unavoidable unless the unions agreed to the proposed change, and then it would have to be enacted by Parliament.⁴⁴

With the issuance of the 1969 asbestos regulations, the adoption of 2 f/cc as an acceptable exposure had the effect of setting a limit on the extent of protection that the government required employers to provide to their workers. Nonetheless, in negotiations with the government, T&N tried "extremely hard" to persuade the Ministry to insert the phrase "so far as practicable" into the prevention requirements, rather than leave the matter for administrative interpretation, according to former factory inspector and Turner Brothers executive John Waddell.⁴⁵

Industry "Editing" of Medical Publications:

Lanza's Surveys

When the compensation issue first arose, the American asbestos industry commissioned studies of the workers' health. The work was directed by Dr. Anthony J. Lanza of the Metropolitan Life Insurance Company. Although the examinations of the workers and dust counts were completed by January, 1931, publication of a report was delayed until 1935.⁴⁶

Lanza and his co-workers examined 126 asbestos factory workers "selected more or less at random from among those having more than 3 years of employment in the industry." By a conservative reading of their X-rays, 53 percent of the workers were judged to have asbestosis; and most of those classed as

having "doubtful" or "negative" X-rays complained of cough and shortness of breath. With Pedley in Canada, Lanza conducted a medical survey of 195 asbestos miners in Thetford Mines and Asbestos, Quebec, and found 42 cases of asbestosis (only 76 of the miners had had more than 10 years' exposure).⁴⁷

Lanza's reluctance to publish his findings on asbestosis was touched upon in correspondence with Donald Cummings, Assistant Director of the Saranac Laboratory, in early 1933. Cummings had submitted a report on silicosis in Oklahoma lead and zinc mines to the Tri-State Zinc and Lead Ore Producers Association, and was informed that the trade association lawyer and Board of Directors had decided that nothing should be published. The reason was that, "the industry could be entirely wrecked if it were saddled with the care of everyone who might be persuaded to take action against it on the grounds of disability from silicosis."⁴⁸

Cummings, a young chemist who had only come to work at Saranac five years earlier, protested to Dr. Lanza that he had spent nearly two years and thousands of dollars accumulating the data that had gone into his papers, the first of which he had sent to the trade group and just been told not to publish. His intention had been to publish the work in the *American Review of Tuberculosis*, which, he argued, had a small circulation of specialists and would take a year to get the work into print. Moreover, he contended that the facts, if not the method of analysis, were similar to work already published by Lanza and Merewether. Besides, he hadn't anticipated censorship, and found this both surprising and unfair.⁴⁹

You understand, of course, that we did not appreciate when we entered upon this investigation the fact that it must be approved by the industry as well as by the Metropolitan Life Insurance Company and the U.S. Bureau of Mines. We were altogether satisfied with the necessity of complying with both your wishes and Dr. Sayers' suggestions, but had we known that it must also be approved by the Association itself, I am quite confident that the work would never have been undertaken.

Cummings said that not until after he returned from a conference on dust diseases in Chicago did he learn from Dr. Sayers that release of this information was supposed to be subject to the approval of the above parties.

I suppose that it is already too late (to get the material deleted from the record of that conference) and that I shall find myself investigating silicosis in the rock piles in the Federal Penitentiary in Atlanta within the course of the next few months.

Lanza's reply began with sympathy, but explained,⁵⁰

None of us could have foreseen this plague of damage suits all over the country which have scared employers out of their wits and for good reason. Your position in this regard is identical with mine with reference to the asbestosis study. Here we have a large mine of material, representing a lot of time, energy, and money, which were put into a nation wide study of asbestosis and which we cannot print. I think we simply have to recognize that in these troubled times, we have to accept a certain amount of disappointment and set back.

He closed by saying he would contact Sayers to see what could be done to press the industry people to soften their stand.

The next month, Cummings got a letter from the trade group saying that he could publish his work but would have to delete all references to lead and zinc, Oklahoma, and all identifying names of localities, persons, and institutions involved. The title, it was suggested, should say only that the site was a metal mining district in the United States. Copies of this letter were sent to Lanza and Sayers.⁵¹

Cummings talked it over with Dr. Gardner and then wrote to Sayers, at the U.S. Public Health Service, that he thought depriving the paper of any reference to the type of industry involved and its location would "rob it of any real significance."⁵²

I am therefore appealing to you for permission to publish the paper as it was originally forwarded to you or for your good counsel with regard to the whole matter.

A copy of this letter was sent to Dr. Lanza.

Lanza replied to this, saying he had spoken with Sayers.⁵³

(Sayers) feels strongly that if you and the Saranac Laboratory are going to stay in the consulting business with respect to the mining industry, it will not be possible for you to publish these papers, at least at the present time.

Lanza went on to make this threat very clear.

The mining companies in Michigan, with whom you have been in contact, have interests in the Picher district. If these papers are published against the wishes of the Tri-State Association, you will undoubtedly feel the repercussion elsewhere. As I said before, I feel the whole situation is unfortunate but it is one of those things that cannot be helped. I think it is important that the Saranac Laboratory establish and maintain contact with industrial firms, because it is going to be increasingly necessary for industry to have available a thoroughly scientific and impersonal establishment with which it can do business.

There followed some remarks about shyster lawyers stirring things up in the Oklahoma mining area, and the expressed hope that Cummings could eventually publish his updated findings "when the industrial situation starts to clear up." Lanza closed by saying,

In that respect, as I pointed out, you are in the same position as we are with the investigations we have made in the asbestos industry.

The scientists at Saranac must have given great weight to Lanza's advice. Not only was Lanza arguably the most influential figure in the country on the subject of pneumoconiosis, but Metropolitan Life had since the late 1920s been the largest contributor to the Saranac Laboratory, accounting for a large

part of Saranac's budget with annual contributions of \$5000. The 1933 annual report of Saranac referred to Met as the "mainstay of the experimental work during the past five years."⁵⁴ As Lanza himself put it, "Both Dr. Sayers and I were instrumental in establishing Saranac Laboratory in the industrial consultation field."⁵⁵

Correspondence remaining from 1934 suggests that the compensation issue may have been crucial in the decision to finally publish Dr. Lanza's research on asbestos factory workers. By 1935, compensation had become a pressing concern of industry executives. Lanza sent a galley proof of his article to Johns-Manville lawyer Vandiver Brown, who passed it along to Newark attorney George Hobart (who had earlier negotiated the settlement of asbestosis lawsuits brought by Samuel Greenstone). Hobart explained that the New Jersey Legislative Commission was considering the addition of silicosis to the list of occupational diseases under the New Jersey compensation law. Hobart worried that asbestosis might also be recognized as a compensable disease.⁵⁶

(W)e have consistently urged that there is a substantial difference between silicosis and asbestosis ... and ... we have urged that asbestosis should not at the present time be included in the list of compensation diseases, for the reason that it is only within a comparatively recent time that asbestosis has been recognized by the medical scientific professions as a disease—in fact one of our principal defenses in actions against the company on the common law theory of negligence has been that the scientific and medical knowledge have been insufficient until a very recent period to place upon the owners of plants or factories the burden or duty of taking special precautions against the possible onset of the disease to their employees.

Brown and Hobart were well aware of the fact that if asbestosis became a compensable disease under the workers' compensation code, workers would not have to prove that the employer was at fault as required in negligence suits.

Before even receiving Hobart's reply, Vandiver Brown focused on a sentence Dr. Lanza had deleted from his initial report, to

the effect that, "Clinically, it (asbestosis) is of a type (of disease) milder than silicosis."^{57,58} Brown had suggested to Lanza, and Hobart agreed, that the sentence must be re-inserted but could be reworded to "Clinically, *from this study* it appeared to be of a type milder than silicosis" (emphasis added).⁵⁶ The exact wording didn't matter, Hobart said, but that sentence must be included in some form:

Here again I have in mind the probability that the New Jersey Commission will introduce a bill in the Legislature which opens in January of 1935; and if it is the policy of Johns-Manville to oppose any bill that attempted to include asbestosis, as compensable, it would be very helpful to have an official report to show that there is a substantial difference between asbestosis and silicosis; and by the same token it would be troublesome if an official report should appear from which the conclusion might be drawn that there is very little if any difference between the two disease.⁵⁶

Vandiver Brown sent a copy of Hobart's 3-page letter to Dr. Lanza, asking that the contents be given "your most serious consideration."⁵⁹ Two weeks later, on January 4, 1935, Lanza's paper appeared in *Public Health Reports* with the sentence from Hobart's letter in conclusion number one, word for word.⁴⁶ Other changes requested by the lawyers were also made by Lanza.

It certainly appears plausible, from this record, that Lanza was asked to get his work into print so that the asbestos companies would have a tool to lobby against compensating asbestosis in New Jersey (and perhaps elsewhere). However, in the years since Lanza had originally written his findings, Merewether in England had published statistics (1933) showing that asbestotics were dying far younger than silicotics and after careers less than half as long.⁶⁰ Lanza was almost certainly aware of Merewether's work at this time, as he was a leading authority on asbestosis and referred to this article of Merewether's in his lengthy text, published in 1938.²⁹ These statistics were also published in the Annual Report of the Chief Inspector of Factories for the Years 1931-1933, and reprinted in the U.S. in

Monthly Labor Review.⁶¹⁻⁶³ Ellman also described asbestosis as a cause of more pronounced suffering than silicosis in papers published in the U.S. in 1933 and in the U.K. in 1934.^{64,65} Attorney Brown immediately noticed that the crucial sentence was deleted and quite possibly perceived that the publication of Lanza's report could backfire and hasten legislative recognition of asbestosis. By this time, the report had already been submitted for publication and was in the galley proof stage, and could hardly be withdrawn. So, as Brown realized and Hobart stressed, the report would have to be edited—and it was.

In the state of New Jersey, where Johns-Manville had its largest manufacturing plant, asbestosis and silicosis were not listed as compensable diseases until 1945.⁶⁶ By this time, Vandiver Brown had changed his mind on the comparative costs of civil suits and workers' compensation for asbestosis (see opening quote of this chapter).

The Asbestos Magazine Letters

The English radiologist W. Burton Wood published an article on the chest X-rays of asbestos workers in the May, 1929 issue of *Tubercle*.⁶⁷ An abstract of this paper appeared in *Bulletin of Hygiene*, also printed in England.⁶⁸ This in turn was summarized and discussed in *Monthly Labor Review*, a publication of the U.S. Bureau of Labor Statistics.⁶⁹ Finally, this last item was picked up by the trade magazine of the asbestos industry in the United States, *Asbestos*.⁷⁰ The magazine not only informed its readers that much had been written in England about asbestosis, but went on to say, "The Bureau urges the establishment of efficient exhaust systems and the introduction of other safety methods."

This article appeared among advertisements of asbestos companies from all over the world, including Ehret Magnesia Manufacturing Company, Philip Carey Manufacturing Company, Johns-Manville, Keasbey & Mattison Company, Asbestos Corporation Limited, Ruberoid Company, and Cape Asbestos.⁷⁰ That very month, the Merewether and Price report was laid before Parliament by the Chief Inspector of Factories. Merewether's monumental contribution to the literature on asbestosis was not, however, cited in *Asbestos*. In fact, the subject of

asbestosis received no attention at all in the trade magazine for many years after March, 1930.

By 1935, the editor of *Asbestos* had asked Raybestos-Manhattan President Sumner Simpson "on several occasions" about the possibility of publishing something on asbestosis. The apprehension of the companies over articles on asbestosis appearing among their advertisements in *Asbestos* was understandable. Copies of such publications introduced by plaintiffs in negligence suits would have shattered the "ignorance" defense described by Hobart in his letter to Vandiver Brown.⁵⁶ To compound this danger, the trade magazine was avidly read by sales and marketing personnel in the asbestos industry. The raised awareness of such people about asbestosis, which demonstrably occurred with the publication of the March, 1930 article, was bound to be counter-productive from a purely business standpoint.⁷¹ The editor of *Asbestos* wrote:

Always you have requested that for certain obvious reasons we publish nothing, and naturally your wishes have been respected.⁷²

Sumner Simpson passed the renewed request along to Vandiver Brown. He acknowledged that the magazine had been "very decent about not reprinting the English articles" on asbestosis.⁷³ Brown replied on October 3, 1935:⁷⁴

I quite agree with you that our interests are best served by having asbestosis receive the minimum of publicity.

In 1939, the editor of *Asbestos* wrote to Sumner Simpson, again expressing eagerness to run an article on asbestosis. But still, nothing more had been said about the mortal hazard of the asbestos industry:⁷⁵

Of course we understand that all this information on asbestosis is to be kept confidential and that nothing should be published about asbestosis in *Asbestos* at present.

As late as November 3, 1941, a letter from Brown to Simpson shows why the magazine was still mute on the subject. In this letter, Vandiver Brown related a conversation he'd had with

A.S. Rossiter, editor of *Asbestos*, about publishing a review of a book on pneumoconiosis.⁷⁶

(I) told her in substance that...I felt there was considerable likelihood that a number of her subscribers would dislike an article on this subject in the trade magazine of the Asbestos Industry. I had in mind the ostrich-like attitude which has been evidenced from time to time by some members of the Industry. While I did not over-emphasize this point with Miss Rossiter, but merely suggested she give it consideration, I am inclined to believe she will omit any review of the book in question.

Nothing more about the health hazards of asbestos appeared in the trade magazine until 1969.

[The 1935 *Asbestos* magazine letters are reproduced in full in Appendix 1.]

RIISING TIDE OF COMPENSATION IN THE 1930s

Insurance carriers' concern about asbestos was evident by 1932.⁷⁷ Asbestos manufacturing was listed along with industries with silicosis, lead, and serious chemical hazards as receiving special attention "for some time" in insurance underwriting. But the closing paragraph of a 1932 occupational disease report in *The National Underwriter* was reserved for asbestos:

Any processes involving asbestos are considered especially hazardous, for the asbestos fibers appear to be difficult to expel from the lungs.

Britain's industry leader, Turner & Newall, found it "impossible" to insure the risk of asbestosis by the early 1930s. Commercial Union was hired only to carry out the administrative aspects of claims processing, according to T&N instructions.⁷⁸

The Supreme Court of North Carolina (*McNeely v. Carolina Asbestos Co.*, May 23, 1934) determined that the occupational disease, asbestosis, contracted unexpectedly and gradually over a long time, if due to the employer's failure to provide means of prevention, was an injury "by accident" and was compensable

under the state Workmen's Compensation Act.⁷⁹ There had been many civil suits filed against employers by workers with asbestosis in North Carolina, according to Dr. J. Donnelly.⁸⁰

Insurance executive F.R. Jones wrote that the *McNeely* case and others like it injected elements of uncertainty that rendered the hazards of asbestosis and silicosis "often uninsurable at practicable rates." Jones went on to discuss the workers' compensation insurance rates in New York, following that state's recognition of asbestosis and other diseases under the Workers' Compensation law in 1935. He wrote that even though the rates were high, "their adequacy...is generally doubted." Jones said the State Fund charged even higher rates to companies rejected by the private insurance carriers. This, in turn, was driving operations with dust hazards out of New York, and at the same time fueling (successful) efforts to weaken the New York compensation law.⁷⁹

Jones was the General Manager of the Association of Casualty and Surety Executives, and in 1935-1936 he issued urgent warnings to the effect that dust diseases were a mortal menace to industry. He called for the development of minimum engineering standards, "to impress backward industrialists, to guide and support insurers in granting or refusing coverage, and to furnish a scientific basis for regulations kept open to continual revision ..."^{81,82} In this way, Jones hoped occupational diseases could be reduced to exceptional misfortunes instead of routine ones.⁸³

He was much alarmed about the perils to business posed by occupational disease compensation, which had risen from insignificance to a major expense, along with taxes and unemployment insurance, in three years' time. All-inclusive occupational disease laws, Jones said, "should be avoided like sin" because they would leave open the possibility that courts and industrial commissions would then hold industries and their insurance carriers liable for all forms of ill health in any way contributed to by work.^{83,84}

To confront the dust disease threat, a meeting of about 250 people representing over 50 industries with industrial disease problems was held on January 15, 1935. According to Vandiver Brown's memorandum of the meeting, speakers included Vice

President F.W. Sherwood and attorney A.C. Hirth of Owens-Illinois, Dr. A.J. Lanza of Metropolitan Life, Dr. R.R. Sayers from the U.S. Public Health Service, Dr. Philip Drinker of Harvard, and insurance lobbyist F.R. Jones.⁸⁵

Reviewing the discussions, Brown wrote,

Only two forms of dust, namely, free silica and asbestos, are definitely known to produce disabling fibrosis of the lung.

Turning to problems common to all, the meeting then focused on what Brown called "the menace of ambulance chasing lawyers in combination with unscrupulous doctors." This menace to employers was seen to be greatest where juries decided the facts in each case. Brown then quoted a speaker who urged that "the strongest bulwark against future disaster for industry is the enactment of properly drawn (workers' compensation laws)." Such legislation would:

1. "eliminate the jury" and replace it by an appointed medical board within the workers' compensation system;
2. "eliminate the shyster lawyer and the quack doctor" by strictly limiting their fees under the law; and
3. "permit the correcting of initial mistakes in the making of awards" by establishing hearing procedures where new evidence could be offered to contest awards of compensation

By March 21, 1935, Willis Hazard of Owens-Illinois reported that 14 companies had pledged funds to establish an organization on industrial dust issues, "representing industries." The Suggested Program of Initial Activities outlined a number of offensive strategies for bringing down the costs to business.⁸⁶

One objective was to set up "authoritative and approved standards for the control of industrial dusts, which, if complied with by industries or by industrial companies, will act as a defense against personal injury suits." The profession of industrial hygiene appears to have enjoyed industry's blessing after that, and within a short time professional organizations were formed (American Conference of Governmental Industrial Hygienists in 1938, American Industrial Hygiene Association in

1939). Thus, the "TLV defense" may have been a significant factor in establishing the profession of industrial hygiene in the United States.

On the medical front, it was proposed to enlist the "cooperation of the American Medical Association in setting up approved and authoritative standards of diagnosis and correction." This technique, of using established medical groups to issue "authoritative" statements limiting the extent of identifiable occupational disease, also has a familiar sound. It may not have been so widely known which doctors on expert, state-of-the-art panels were consultants to the asbestos industry in the 1930s. In the last 10 years, accusations have been raised against a number of groups for convening panels heavily weighted with scientists with close ties to the asbestos industry: the American Thoracic Society; Health Effects Institute—Asbestos Research, Asbestos Literature Review Panel; and the International Program on Chemical Safety (located at the World Health Organization).

Another modern-day use of this medical strategy is the adoption of American Medical Association guidelines for evaluating disability in workers' compensation laws. Codification of these "death before disability" guidelines in Texas reduced the number of workers receiving supplemental payments for severe injuries by 96 percent between 1991 and 1993; despite an increase in the number of claims, less than one worker in 7000 was disabled enough to obtain compensation.⁸⁷ The American Medical Association refuses to identify the authors of the respiratory chapter of the guidelines, but two pulmonary physicians with asbestos industry ties, Edward Gaensler and Hans Weill, are listed among the authors of the entire text.^{88,89}

Legislatively, the objective of the new industry organization would be to enact "state laws, of the uniform character, which, when complied with, will fairly and properly protect the interest of industry and of those engaged in industry, and of enlisting the cooperation of the Federal government in that direction." In the 1930s, this was largely accomplished by amendment of state workers' compensation laws to include limited coverage for occupational diseases. The modern-day counterpart does

employ the tactic of federal legislation to limit liabilities that exist under existing state laws. Asbestos interests clearly stand to benefit from "tort reform" bills that would, if enacted, extinguish liability 15 years after the sale of products.

The legal objective of this remarkable plan was "enlisting the cooperation of the American Bar Association and local Bar Associations in stopping the 'racket' (against industry)." Presumably, this referred to investigating and lodging ethics complaints against plaintiffs' lawyers.

The outcome was the formation of the Air Hygiene Foundation in 1936 (renamed Industrial Hygiene Foundation in 1941). Established under the auspices of the Mellon Institute, this organization provided a means for doing confidential studies and compiling medical, legal, and industrial hygiene knowledge for the member companies.

At this time, one consulting physician to the insurance industry observed, "The asbestos industry has been a bad risk for the carriers, and those taking them have been losing money for years, due to asbestosis and silicosis."⁹⁰

Raybestos-Manhattan was one company beset with compensation claims over asbestosis. The Public Health Service requested permission to examine the employees at R-M's North Charleston, S.C. plant, in 1936. R-M President Sumner Simpson advised his plant manager:⁹¹

For our own information, I should like to have an X-ray of all the employees, and if we could get this information from the United States Department of Health without it being placed in the hands of every "Tom, Dick, and Harry" in the country, I would be willing to let them make the X-rays, as it would be one way of getting them without arousing very much suspicion on the part of the employees. It would, no doubt, be interpreted as having some connection with the Social Security Act, but I certainly do not want to bring a lot of suits down on us just about the time we are getting through with the old ones.

Simpson and his plant manager then consulted with Dr. A.J. Lanza, who reassured them that Public Health Service reports were anonymous and individual records of the Service were

held confidential. Lanza was especially complimentary about one of the government investigators.⁹²

Dr. Sayers has had wide industrial experience and enjoys the highest favor and confidence of industrialists and employers all over the United States.

Simpson then wrote to the plant manager again.⁹³

(Y)ou may advise the Public Health Service that they may take the (chest X-ray) pictures, with the understanding that they are not available for any purpose whatever except public health information, and you want to stress the fact that we do not want them given to shyster lawyers and doctors so as to be the subject of suits, for, as you know, we have had enough adjustments for any one company.

With compensation costs very much in mind, Sumner Simpson and Vandiver Brown of Johns-Manville decided to sponsor confidential animal experiments at the Saranac Laboratory for the Study of Tuberculosis. Simpson solicited contributions from top executives of four other asbestos companies⁹⁴ in 1936, noting,

(W)e should have all the information we can possibly get to submit to the Compensation Commissioners of the various states when the question of asbestosis comes up.

Another person involved in the spate of workers' compensation claims was Dr. John B. Hawes, Jr. of Boston.⁹⁵

...dust is the source of one of the most vicious rackets inflicted in this country ... The basis of this racket is founded on (1) ignorance on the part of the workingman, (2) ignorance on the part of doctors as to what dusts are dangerous and (3) unscrupulous and mercenary lawyers.

He went on to decry the alliance of clever, crooked lawyers with ignorant and even unscrupulous doctors who were bringing unjustified claims against a woolen mill, a charity employing a cotton cloth cutter, a steel wire drawing operation, and the

cement industry. Hawes went on to then talk about silicosis and describe the clinical signs of asbestosis.

I have seen nearly 75 men and women that have been exposed to asbestos dust and have found that the one striking sign in those in whom I have made a positive diagnosis has been a greatly diminished chest expansion, rarely over *one inch*. (original emphasis)

He concluded that asbestosis claims were no medicolegal racket:

There is not the slightest doubt, however, in my mind at least, that asbestos dust is the most dangerous of all dusts. Asbestosis is able to produce permanent and total disability in a remarkably short length of time, even after only 2 or 3 years' exposure and occasionally less, as compared with the much slower and more gradual action of pure silicon and the great majority of silicates.

Dr. Hawes' patients had worked at the Multibestos plant of the Dewey & Almy Chemical Company (which in turn became part of W.R. Grace & Company).⁹⁶ The company president, Bradley Dewey, was also convinced that asbestosis was "a very serious and sometimes fatal disease." Dewey suspected that his shift to Rhodesian and Russian chrysotile from Canadian chrysotile asbestos had something to do with this epidemic of disease; but Drs. Lanza and Gardner disagreed.⁹⁷⁻⁹⁹ Lanza observed:

Mr. Dewey points out that Multibestos ran for years without much trouble. Of course, the reason was that nobody knew anything about asbestosis. I am not quite sure what he means when he says "trouble" but I suspect he means "lawyer trouble" which, of course, has nothing to do with the issue. The same comment holds good for the plants of his competitors. They did not have any trouble either—until the shysters got busy.⁹⁹

Radiologists Arial George and Ralph Leonard had been increasingly disturbed by Dr. Hawes' testimony in asbestosis compensation cases. They had examined asbestos factory

workers in the U.S. one year before the industry approached Dr. Lanza at Metropolitan Life to do his survey.¹⁰⁰ Their account shows first of all the importance of compensation in forcing the conversion from dry to wet processes:

In 1928, we began the intensive study of those exposed to the asbestos hazard in one of the large industrial plants in Massachusetts, where brake lining was manufactured ... Dry weaving was first used and then changed to wet weaving. This change was brought about by the fact that in 1928 and 1929 there were numerous cases which showed symptoms, referable to the lungs, characterized by increased difficulty in breathing on exertion, cough, sleeplessness, and loss of weight ... in 12 cases X-ray examination revealed changes in the lungs, upon which we based our diagnosis of asbestosis.

The insurance carrier then paid to settle these 12 disability claims. By 1933, the workers' compensation insurance premiums "had pyramided to 15 percent of the payroll, and the carriers were rather indifferent to the taking on of this risk." A large insurance firm then insisted on having clinical and X-ray examinations done of all 800 employees in the plant *before* agreeing to provide coverage. The examinations were performed by Drs. George and Leonard, who found three cases that were "definitely advanced." These workers "would not, on account of the high wages they were earning, change their occupations." When the plant closed in 1936, one of these men filed a compensation claim, and the other two "disappeared into other industries."

After the plant closed, 90 workers filed claims. Once again, they were X-rayed and physically examined by George and Leonard, who now found that 12 more had asbestosis, and three others were "questionable" cases. The insurer then put the 12 either on compensation payments or agreed to "lump-sum settlement in excess of \$50,000." Of the remaining 78, 30 cases came to trial, furnished with a lawyer from the Legal Aid Society and Dr. Hawes as the medical expert. Hawes had made a positive diagnosis on these 30 cases after clinical and X-ray examination. The State "Panel Doctors" then decided 10 of

these cases, ruling with Dr. Hawes and against Drs. George and Leonard. The complaint by the latter two was that despite marginal X-ray findings, these cases were decided, "giving the benefit of the doubt to the workmen." They then proceeded to decry Hawes for excessive reliance on history of exposure and his assumption that asbestosis was a progressive disease.

George and Leonard then returned to the 12 individuals who had been compensated for disability and discharged back in 1928-29.¹⁰⁰

At one of the hearings they were recalled by the insurance company to illustrate that these 12 who had been found positive by both clinical and X-ray examination *were, by their own testimony, free of all symptoms, and except for several women in the group, were doing laborious work in their new occupations.* (emphasis added)

George and Leonard went on to conclude that asbestosis was thus not a progressive disease, apparently based on the accounts of the patients as elicited at a hearing by the insurance company lawyer. No confirmatory X-ray or clinical examinations were mentioned, and perhaps for this reason this report of mass recovery from asbestosis is unique in the literature.

In marked contrast, the *Employers' Group Engineering Manual* advised insurance industry representatives that,¹⁰¹

A potential asbestosis hazard is to be looked for wherever asbestos dust is created...In the opinion of certain authorities it is established that asbestos may cause disability and death, and that any well-defined case of asbestosis is very likely to progress to a fatal conclusion.

Metropolitan medical experts Lanza and McConnell and industrial hygienist Fehnel were repeatedly helpful to Met policyholders, including Raybestos-Manhattan, in the defense of workers' compensation claims.^{102,103} The reading of chest X-ray abnormalities was among the services rendered by Lanza and McConnell. In at least some cases, Dr. Gardner at Saranac "clearly" saw X-ray abnormalities due to inhaled dust, in Johns-

Manville plant workers whose X-rays had been read as negative by Lanza and McConnell.¹⁰⁴

Three Stories of Compensation

What follow are examples from the 1940s about asbestos disease compensation and the ways it informed and influenced business conduct. The first anecdote describes what happened when officials from a smaller asbestos company asked Johns-Manville executives how they managed the problem of asbestosis. The second discusses the plan of a fiber-glass insulation manufacturer to capitalize on the health issue in competing with asbestos. The last story shows how industry officials confirmed that asbestos had killed some of their employees, and then sometimes paid cash settlements to the workers' widows.

A Lobster Lunch with Vandiver Brown

The United Asbestos and Rubber Company manufactured amosite asbestos insulation in Paterson, New Jersey.¹⁰⁵

Former Chairman of the Paterson Industrial Commission, Charles H. Roemer, who was unaccustomed to the rich fare he enjoyed as a guest at Johns-Manville, recalled the following story in a sworn affidavit filed in 1982. The document's text is reprinted in its entirety.¹⁰⁶ It offers a unique glimpse of the corporate policy of Johns-Manville on asbestos and health in the early 1940s.

1. I am an attorney who was admitted to practice in the State of New Jersey in 1920 and presently maintain an office at 99 Broadway, Elmwood Park, Bergen County, New Jersey.
2. I was born February 5, 1899 and am presently under the care of Dr. David Roth.
3. Sometime in 1942-43, I was advised by my cousin, Dr. Jacob Roemer, that in the course of reviewing chest X-rays of employees at the Union Asbestos and Rubber Company's Paterson plant he had observed a significant number with lung changes which he believed were due to exposure to asbestos. Dr. Roemer suggested that the men be advised of his findings and that they secure outdoor employment which did not involve exposure to asbestos dust. Dr. Roemer

said unless this was done immediately the men would suffer from painful asbestos diseases.

4. Immediately I reported what Dr. Roemer said to Robert Cryor, the Union Asbestos and Rubber Company Plant Manager, and Edward Shuman, the Assistant Plant Manager.
5. I was then informed that in accordance with the labor union contract, the 5 or 6 employees in question could not be discharged without the consent of the union. The union refused to consent to their dismissal.
6. I then suggested that since Johns-Manville was the largest asbestos company in the country, we should set up an appointment to see how they were handling the asbestos health problem.
7. Mr. Cryor and Mr. Shuman set up an appointment with Johns-Manville. Shortly thereafter, Mr. Cryor, Mr. Shuman and I met with Vandiver Brown, General Attorney for Johns-Manville and the President of the corporation, at Johns-Manville corporate headquarters in New York City.
8. We advised the Johns-Manville officials of Dr. Roemer's findings and asked them if Johns-Manville's physical examination program had turned up similar findings and, if so, what Johns-Manville was doing about it.
9. In response, Vandiver Brown stated that Johns-Manville's physical examination program had, indeed, also produced findings of X-ray evidence of asbestos disease among workers exposed to asbestos and that it was Johns-Manville's policy not to do anything nor to tell the employees of the X-ray findings. Vandiver Brown went on to say that it was foolish for us to be concerned and that if Johns-Manville's workers were told, they would stop working and file claims against Johns-Manville, and that it was Johns-Manville's policy to let them work until they quit work because of asbestosis or died as a result of asbestos-related diseases.
10. Thereafter, we contacted Dr. Lanza at Saranac Lake, who was in charge of an asbestos exposure study and we were

unable to gather any further advice or information from him.

Owens-Corning "Fiber-glass Itch Documents"

In the early 1940s, Owens-Corning Fiberglas (OCF) Corporation was facing marketing difficulties and objections by the Asbestos Workers (insulators) union. Some of the union members were having skin reactions from handling fiber-glass insulation, and there was talk of charging premium rates for using the material. Several steps were taken to overcome "market resistance" to fiber-glass, capitalizing on the greater health hazard of asbestos products.

The company prepared a brochure in 1941 or 1942, featuring a letter from the Aetna Life Insurance Company to OCF Public Relations Manager Edward C. Ames. The letter cited a 35 percent reduction in sickness and hospitalization insurance for OCF's employees. It noted further that OCF was covered by insurance for "Products Liability at an extremely low rate." The lack of any claims on this front was offered as an indication "that there is no hazard in the use of fiberglass or any of its products." On the subject of workers' compensation rates, the Aetna letter said, "(W)e feel the hazard (from fiber-glass) is much less than in the manufacture of Rockwool, Slagwool, Asbestos, or any of the so-called 85% magnesia products." It is not clear how widely this brochure, which seems to have been intended for employers, was distributed.^{107,108}

To counter union resistance, a plan of action was drafted by Public Relations Manager Ed Ames. It began,

Gather as a weapon-in-reserve an impressive file of photo-stats of medical literature on asbestosis. Available are two bibliographies covering medical literature to 1938, citing references to scores of publications in which the lung and skin hazards of asbestos are discussed. This file would cover five or six hundred pages...¹⁰⁹

This weapon in reserve would be used, if necessary, to "conceivably bring about the overthrow of the present Union leadership" if the union officials maintained their position

against fiber-glass. The plan was also summarized in a memorandum to Harold Boeschstein, who was the President of Owens-Corning from its founding in 1938 until sometime in the 1960s.¹⁰⁹ He was also a director on the Board of Owens-Illinois, which owned half of Owens-Corning in 1942. The weapon-in-reserve never was deployed, and the union's false sense of security about asbestos remained undisturbed. In 1944, Ed Ames confirmed that a Toledo physician was caring for a man who had left the insulation trade due to asbestosis.¹¹⁰ More than ten years later, when the union was again threatening to charge a premium for work with fiber-glass, Owens-Corning was dealing extensively in both fiber-glass ("Fiberglas") and asbestos ("Kaylo") insulations. The subject of asbestosis came up often in Owens-Corning documents from the 1956-1957 period.

Saranac Compensation Reviews for Manufacturers

Rose Bertogliat, widow of a Johns-Manville foreman at the Waukegan, Illinois plant, approached the company in 1947 seeking compensation payments for the death of her husband.

Sections from Dominic Bertogliat's lungs were sent by the company to Dr. Vorwald at the Saranac Laboratory, who concluded that Mr. Bertogliat must have suffered "considerable respiratory difficulty" with his asbestotic lungs. J-M headquarters safety engineer Hugh Jackson, who had worked with Mr. Bertogliat at Waukegan, wrote back that, "appropriate steps have been taken ... toward the settlement of this case." But Jackson was "particularly concerned that the type of exposure to which Mr. Bertogliat was subjected should produce the evident results." He continued,

To our way of thinking, although he had worked in the general area for a number of years, the degree of exposure was relatively slight. That is, he was subjected not to a concentrated exposure of any particular part of the process but rather only to that of the general atmosphere. Since there are numerous others who also have this type of exposure, I would appreciate your opinion as to whether Mr. Bertogliat might have had some individual susceptibility to the asbestos irritation and/or whether we should anticipate

others with similar exposures to be similarly affected. (Aug. 13, 1948).

Dr. Vorwald replied on August 19, 1948, that "I can see no other alternative than to anticipate others with similar exposures to be similarly affected."¹¹¹

The implications of Mr. Bertoglat's experience would appear grave for others at the J-M Waukegan plant; and for workers elsewhere exposed to asbestos manufacturing and fabrication dust as "bystanders."

Saranac provided similar services directly and indirectly to other U.S. asbestos manufacturers. In 1944, the Saranac lab pathologically verified asbestosis in the lung tissues of an Ohio man who had died at age 42. The man had worked at Philip Carey Manufacturing Company for 25 years making "air cell" pipe insulation. The only parts of the process in which the asbestos was not wetted were "cutting and squaring ends of finished material," and some exhaust ventilation was reportedly provided. Dr. Robert J. Ritterhoff, who performed the autopsy before sending lung sections to Saranac, discussed the findings with an official of the Carey company. It was the doctor's understanding that the company then arranged to pay the widow a cash settlement, and no workers' compensation claim was filed.^{112,113}

In 1949, Dr. Vorwald analyzed lung tissues from a deceased employee of the Paterson, New Jersey, plant of Union Asbestos and Rubber Company. He concluded that the man had died from lung cancer and had suffered from moderately advanced asbestosis. Vorwald sent his report to a company Vice President, Robert E. Cryor, who had been plant manager at Paterson. Vorwald wrote that it was his "current opinion" that there was no causal relationship between asbestos and lung cancer.¹¹⁴

*Published Literature on Compensability of Asbestosis
Disability in Asbestos Product Users*

Some medical papers on asbestos disease mentioned the issue of workers' compensation. These, together with relevant legal literature, provide a partial record of asbestos disease compensation received by asbestos product users in various countries.

Disability compensation was paid to handlers of asbestos insulation products in several countries in the Thirties. By the 1950s, such claims became much more numerous.

Perhaps the first report of disability compensation to an asbestos product user was made public by a physician with the U.S. government. Dr. Albert Russell, of the Public Health Service, reported in 1932 that a maintenance worker in a government hospital was compensated for asbestosis, which he developed as a consequence of handling pipe insulation.¹¹⁵ Russell's presentation was attended by an audience composed primarily of doctors, lawyers, and insurance company officials. (Insurers represented included Liberty Mutual and Employers Mutual.) With Russell's report and others that soon followed, the mortal risk of asbestosis to insulation workers—or asbestos workers, as they were commonly called in the U.S.—was demonstrated. This knowledge substantially expanded the size of the working population demonstrably endangered by asbestos.

Asbestosis became a compensable disease in Germany in 1936, and the following year a shipyard insulation worker was compensated for disability. This individual when examined at autopsy was determined to have died from asbestosis.¹¹⁶ Finland began to award workers' compensation for asbestosis to insulation installers in 1938.¹¹⁷

The total number of asbestosis case reports in the world literature among *asbestos product users* was small in 1938. But the disease had been well characterized by this time, and its manifestation in asbestos insulation workers was accepted by compensation authorities in at least 3 countries. In Great Britain, asbestosis was reported in an insulation worker and a boiler riveter, but if compensation for disability was awarded it was not noted in the medical literature.^{64,65,118}

In 1943, asbestosis became a compensable occupational disease in Italy, with employers' insurance required for asbestos mining and manufacturing, and fabrication of asbestos cement. Compensation claims could be filed up to 10 years after cessation of asbestos work.¹¹⁹ It was later explained that, "Special emergency legislation to provide compensation for

Table 1. Compensation for Disability from Asbestosis

Country	Year	Inclusiveness of Coverage Reported	Ref.
U.K.	1931	not explicitly extending to product users	14
	1949-1950	handlers of thermal and electrical asbestos insulation	37,38,122
U.S. (Mass.)	1927	plant foreman	27
	1932	maintenance worker handling insulation	115
GERMANY	1936	not limited;	116
	1937	shipyard insulator	
FINLAND	1938	insulator	117
ITALY	1943	plant workers and asbestos cement fabrication workers	119
NETHERLANDS	1945	not limited	218
CZECHOSLOVAKIA	1948	not limited	119
DENMARK	1950	not apparently limited	123
SWITZERLAND	1952	not apparently limited	124
SWEDEN	1956-1960	insulators	125

silicosis and asbestosis was enacted in 1943 when thousands of claims were being brought before the courts of civil law."¹²⁰

Canepa, reporting a high prevalence of asbestosis among shipyard insulators in Genoa, noted that the Italian compensation law was written too narrowly to apply to all those at risk of asbestosis (particularly insulators who had not worked with asbestos cement). He urged changes in the language of

the statute, and also pleaded for an automatic removal of least-affected (but not yet disabled) workers with provision of a 6-month "transition income." Canepa argued that it should not be necessary to await the development of disability before triggering the protection of the insurance law.¹²¹

Following the Second World War a new system of compensation was established in Great Britain under the National Insurance (Social Security) scheme. Workers' compensation claims in the United Kingdom are not accessible for complete review. However, some cases were appealed and thus appear in the legal literature. Two such cases involve the question of whether workers exposed to the asbestos dust from handling electrical and thermal insulation qualified under the statutes applying to asbestosis.^{38,122}

The first of these appeals was heard in 1949, and involved a workman who had removed the asbestos coverings on copper wire in a scrap metal reclaiming operation. Even granting that less than half of the cables he handled were insulated with asbestos, the Commissioner entitled the man's claim to be awarded with the presumption that his disease was due to the nature of his employment. The Commissioner stated that the language of the law did not justify a restriction on the "meaning or scope of the phrase" in the law, "working or handling asbestos."¹²²

In 1950, another workers' compensation claim was appealed to the Commissioner under the industrial injuries statutes of the United Kingdom. The man had made a claim for pneumoconiosis from dismantling brickwork in boilers and insulating steam pipes. The Commissioner found that the latter occupation entitled the claimant to file for disability under the provision of the law applying to "occupation involving the working or handling of asbestos."³⁸

In the years 1955-1963, there were 72 new cases of asbestosis diagnosed in Great Britain among insulation workers. All but 3 had filed claims for disability. Thirteen more cases were diagnosed among asbestos sprayers, all of whom had filed for workers' compensation. These 85 cases constituted over one third of all those diagnosed in the years 1955-1963 in Great Britain.³⁷

Cancer

It has already been noted that cancer in combination with asbestosis was recognized as a compensable occupational disease in Germany as early as 1939, and codified there nationwide in 1943. Czechoslovakia followed with a similar provision in its compensation law in 1948.^{17,119,126-128} (Details in Chapter 2.)

Meanwhile, Hueper in the United States called attention to the mounting evidence of asbestos' carcinogenicity and decried the non-compensable status of occupational diseases in states where there were large asbestos plants:

Such a condition militates against an effective hygienic control of an important industrial hazard, and impedes the collection of pertinent and essential information in regard to the incidence, nature, and potentialities of an occupational disease growing steadily in general significance."¹²⁹

In 1943 Hueper positively identified asbestos as a cause of lung cancer. Here, he pointed to the spectre of liability as the motive for the underreporting of occupational cancers in the United States:

Industrial concerns are in general not particularly anxious to have the occurrence of occupational cancers among their employees or of environmental cancers among the consumers of their products made a matter of public records. Such publicity might reflect unfavorably upon their business activities, and oblige them to undertake extensive and expensive technical and sanitary measures in their production methods and in the types of products manufactured. There is, moreover, the distinct possibility of becoming involved in compensation suits with extravagant financial claims by the injured parties. It is, therefore, not an uncommon practice that some pressure is exerted by the parties financially interested in such matters to keep information on the occurrence of industrial cancer well under cover. It is for these reasons that the statistical data being presented here concerning the incidence of

occupational cancers as caused by the different industrial agents represent only those made public.¹³⁰

By the end of 1945, only 32 states had workers' compensation laws providing coverage for occupational diseases.¹³¹

Dr. Leopold Brahdy, a New York state workers' compensation official, wrote in 1948 that "the evidence warrants the *tentative* conclusion that asbestos workers do have a higher risk of lung cancer."¹³²

In 1950, Johns-Manville plant worker Vernon Hall died with advanced asbestosis and lung cancer. Memoranda from the files of the Saranac Laboratory show that safety specialist Hugh Jackson at J-M headquarters was apprised of the possibility that a compensation claim might be brought against the company.¹³³ That year, a supervisor at Raybestos-Manhattan's Manheim, Pennsylvania plant was paid \$4,500 compensation for "asbestosis-carcinoma."¹³⁴

Anton Szczesniak, a longtime employee of Union Asbestos and Rubber Company (Unarco), died in 1951 from cancer of the intestinal tract. Company records note that "He had been at the head of the list of potential liability cases of those suffering from asbestosis." As a result, the company paid the man's widow \$2,000 to release any claims she might have against Unarco, in 1952.¹³⁵

In Massachusetts a 41-year-old man died with severe asbestosis, cor pulmonale, adenocarcinoma of the lower lobe of his left lung, and metastases. He had worked for 12 years in a "very poorly run" asbestos mill, and he had stopped working there two years before admission to the hospital. He was barred from making a workers' compensation claim because the legal time interval had passed between the time he left work and the time he complained of symptoms.¹³⁶

In contrast, West German compensation law was flexible enough in 1953 for an insulation worker with pleural cancer (mesothelioma) to receive workers' compensation while still living.¹³⁷

Wilhelm Hueper, Chief of the Environmental Cancer Section at the National Cancer Institute, made a presentation at the 1954 meeting of the International Association of Industrial

Accident Boards and Commissions. The meeting was held in Quebec, about an hour's drive from the asbestos mines. Hueper began with a table showing the number of published cancer cases for each of about 15 industrial materials, including asbestos. He urged numerous measures to prevent and control exposure to carcinogens; identify cases of occupational cancer through mandatory reporting to health officials; and fairly compensate stricken workers through equitable laws. Statutes of limitations barring claims by those whose disease was still latent until after the statute was tolled—commonly found in state laws in the U.S.—were to Hueper the "main defect" in workers' compensation laws in their application to job-related cancer.¹³⁸

Hueper wrote in 1955 that a Canadian asbestos worker had been compensated for lung cancer.¹³⁹ He urged that:

The available scientific evidence is adequate for recognizing asbestosis cancer of the lung for medicolegal reasons as an occupational disease.

Table 2. Compensation for Cancer Accompanying Asbestosis

Country	Year	Types of Cancer	Ref.
Germany	1939	lung	17
(nationwide)	1943	lung	126
West Germany	1953	pleura	137
Czechoslovakia	1948	lung	119
U.S. (Pa.)	1950	lung	134
(Mass.)	1953	lung	145
Canada	1955	lung	139
England	prior to 1960	lung	146
South Africa	prior to 1960	lung	141

Hueper's activities and publications immediately attracted the interest of members of the Asbestos Textile Institute, who were concerned about the implications of a 1956 workers' compensation case in Pennsylvania.¹⁴⁰ Dr. Hueper had testified in this Pennsylvania compensation claim, involving a worker with asbestosis and lung cancer. Commenting on the fact that compensation was awarded, an insurance official noted,

It is particularly alarming as Penna. law is not as liberal as most state laws in allowing awards for (complications attributed to occupational diseases).

The same memorandum goes on to paraphrase one of Hueper's publications as saying that "anyone living near an asbestos plant can get lung cancer." It continues,

Hueper has been quite reliable in proving the cancer causing properties of quite a number of commodities but very reliable medical opponents say he goes off the deep end and accuses other materials of having cancer causing properties without sufficient factual basis for his statement. Dr. Kenneth Smith of Johns-Manville accuses him of the latter in the case of asbestos.

The high death rate from lung cancer in the general population was viewed with awesome liability implications by the asbestos textile companies and their insurance carriers, in the event that asbestos work might be widely held responsible for causing this disease.¹⁴⁰

Out of every one hundred people employed in asbestos industries (or any other industry for that matter) three will die of lung cancer. With a "mad dog" like Dr. Hueper loose on the subject of asbestos, future claim results can be alarming.¹⁴¹

By 1964, the Turner & Newall Chairman's Committee was informed that:¹⁴²

The picture this year has been marked by two rather sinister developments. The first is that it has now become widely

known that the medical profession have established a causal connection between asbestosis and carcinoma of the lung. This is a factor which inevitably makes settlements both more difficult and more expensive especially where, as in Belfast, cases normally come before a jury. The second development is the establishment of and the wide publicity given to the fact that a type of carcinoma, known as mesothelioma, is due to exposure to the dust of crocidolite fibre.

In addition, the Parliament had just withdrawn T&N's best defense against claims by amending the Limitations Acts, after "very strong comments in the House of Lords on the obvious injustice which resulted" from having the statute of limitations run before victims became aware they had been damaged.¹⁴³

We have over the years been able to talk our way out of claims or compromise to comparatively small amounts, but we have always recognized that at some stage Solicitors of experience assisted by a Legal Aid Certificate or financed by a Union would with the advance in medical knowledge and the development of the law, and being prepared to undertake the work involved in a detailed investigation, recognise there is no real defence to these claims and take us to trial.

Workers' Compensation Claims by Insulators against Contracting Divisions of Asbestos Product Manufacturers

Major manufacturers of asbestos-containing insulation were also in the construction contracting business. Johns-Manville, Armstrong Cork, Philip Carey, Owens-Corning, Fibreboard, and Mundet Cork had contracting divisions that bid on construction and shipyard jobs, and then hired insulation workers as needed to install their products. When these workers became disabled from asbestosis and filed for workers' compensation, the contracting arms of the asbestos insulation manufacturing companies were named as defendants. Most of these claims involved numerous defendants.

The claims appear to have been bitterly contested, with payments delayed through every legal means, and the

defendants aware that claimants had asbestosis from handling their insulation products. The filing of such claims constituted notice to the manufacturers that their products were dangerous; and the importance of this fact is not diminished by the fact that some of the individual claims were dismissed.

Through legal discovery and direct approaches to workers' compensation boards in a number of states, an effort was made to look up the records of the old "contract unit" claims, starting in 1978. The findings cannot be presumed complete by *any* means. Only one company (Armstrong Cork) promptly produced a list of its compensation claims in response to discovery motions. There were frequently other defendants involved. Major limitations were posed by the availability and accessibility of state records. Many states (e.g., Texas) did not retain records going back to the 1950s. Others (e.g., New York, Massachusetts) were extremely guarded about allowing access to the old records of compensation proceedings; the records were held to be confidential, accessible only to the parties involved or their designated representatives.

Where no leads were available, the volume of claims rendered a full records search impossible. Usually, injury and illness records were not separated; and there was no "employer index" or register book to screen out extraneous material from upwards of 100,000 claims per year in the more populous states.

The earliest located compensation claim by an insulation worker in general industry was that of Henry Moore in California. He worked for Johns-Manville distributor Western Asbestos and was compensated for asbestosis in 1940.¹⁴⁴

The earliest of the Armstrong Cork Company's asbestosis claims so far located was filed by Richard Rothwell in Massachusetts in 1952. Mr. Rothwell was an insulator who had asbestosis and died from lung cancer. Armstrong Cork managed to escape liability, arguing that Mr. Rothwell's tumor had probably existed at the time he began work for Armstrong. Compensation was awarded in December, 1953, with lung cancer accepted as a result of Rothwell's occupation.¹⁴⁵

In 1953, former insulator Floyd Hyatt was told by his doctor that he has asbestosis. He filed a compensation claim against Armstrong Cork in Florida. Armstrong's insurer (successfully)

appealed the case to the Florida Supreme Court to avoid paying any more than \$5,000, the limit provided under the law at the time of Mr. Hyatt's last exposure (1945). The employer had previously contended that Hyatt's claim was barred by the statute of limitations, but the Workmen's Compensation Commission ruled that the clock did not start running until Hyatt discovered that he had an occupational disease. The record is clear that Hyatt was totally disabled by asbestosis in 1953. The Supreme Court of Florida adjudicated his case in 1960.¹⁴⁷

In Connecticut, insulator Edward Campbell filed for compensation for asbestosis against companies including Johns-Manville, Armstrong, and R.A. Keasby. In this case a \$6,000 compromise settlement was submitted by the parties involved and approved by the Workmen's Compensation Commission in December, 1955.¹⁴⁸

California led the other states in the number of contract unit compensation claims filed against Armstrong Cork. State records facilitated searching back to 1954 (25-year retention), using the intake register as an employer index, along with Armstrong's list of claims. There may have been earlier claims whose records were lost.

Two of the most extensive claims proceedings were those initiated by James Whitcomb Riley and Ervey O. McCarrell, both of Los Angeles.^{149,150} Riley initially filed against Johns-Manville, Armstrong Cork, Fibreboard, and some local contracting firms, in 1957. Within months, Owens-Corning Fiberglas was added as a defendant. The state Industrial Accident Commission agreed that he was totally disabled by pneumoconiosis and tuberculosis as of 1957, and compensation payments were ordered. Whereupon, defendants involved moved to join all employers in Mr. Riley's 37-year career as an insulator. This brought in Philip Carey in late 1960. Mr. Riley died in January, 1961, and his widow Grace filed for death benefits. Later that year, the Industrial Accident Commission even had to penalize defendants (ultimately numbering more than 50 contracting firms and insurance companies) for "Willful Failure to Pay Compensation, and Death Benefits."

Mr. McCarrell also initiated lengthy compensation proceedings against Armstrong Cork in 1956. An insurance adjuster for

Travelers wrote on June 20, 1958, that reserves in McCarrell's case amounted to over \$19,000 for disability and Medical expenses:

This case is becoming very complicated and costly, due to the advance (sic) state of asbestosis ... We are endeavoring to join numerous other defendant employers ...

Within a short time, Johns-Manville, Fibreboard, and Owens-Corning were brought in as additional defendants, along with numerous local contractors. On January 14, 1960, a Compromise and Release Agreement was approved by the Industrial Accident Commission, wherein Mr. McCarrell received a payment of \$13,500.

Armstrong claims adjuster R.C. Schiedt, Jr. was clearly concerned by the volume of claims. In McCarrell's case, he wrote,

These asbestos claims are on the increase and we are wondering if the manufacturers of this high temp insulation which we use could be of some assistance in the defense of these claims. (March 1, 1957)

The year before, Armstrong had begun manufacturing an asbestos-containing insulation product.

John Swartout's claim was filed in San Francisco at the end of 1955 against J-M distributor Western Asbestos Company.¹⁵¹ Upon the award of compensation in 1958, Western sought to join Johns-Manville and Armstrong (by whom Swartout was employed until his discovery that he had asbestosis and had to give up working). The lawyer for their insurer responded that these firms' employment of Mr. Swartout "was either outside the State of California, under contracts of hire not made in California, or involved the use of insulation materials other than asbestos." It was not denied that the man was totally disabled from asbestosis and died from its complications (cor pulmonale) as a result of his occupation, which was insulation work.

Further information on the contract unit workers' compensation claims is contained in Tables 3 and 4.

Table 3. Armstrong Cork Company
Workers' Compensation Claims
Asbestos in Insulation Workers

Claimant	Date of Notice	Where Filed	Other Asbestos Manufacturer Defendants	Outcome	Comment
Rothwell, Richard	4-26-52	Mass. Industrial Accident Board	—	Compensation awarded for asbestosis/lung cancer (1953)	Armstrong dismissed-tumor existed when Rothwell was hired by Armstrong in March of 1952
Kish, Harry	1-16-53	California Industrial Accident Commission (S.F.)	Plant Rubber and Asbestos Works (Fibreboard) and Johns-Manville	compromise settlement of \$2750/asbestosis death (1955)	—
Munger, Lewis	8-7-53	Michigan Workmen's Compensation Dept.	Johns-Manville joined in case 10-23-59	total disability and death benefits including funeral/asbestosis	

Table 3. Armstrong Cork Company
Workers' Compensation Claims
Asbestos in Insulation Workers (cont.)

Claimant	Date of Notice	Where Filed	Other Asbestos Manufacturer Defendants	Outcome	Comment
Hyatt, Floyd	9-10-53	Florida Industrial Commission Workers' Compensation Division	—	compensation awarded/ disabling asbestosis	appealed to Florida Supreme Court by Armstrong
Cuthbertson, Jack	11-15-54	California Industrial Accident Commission (S.F.)	Plant Rubber and Asbestos Works (Fibreboard) and Mundet Cork dismissed as defendants		
Campbell, Edward	12-16-54	Workmen's Compensation Commission of Connecticut (Hartford)	Johns-Manville, Mundet Cork	compromise settlement \$6000/asbestosis (12-20-55)	—

Table 3. Armstrong Cork Company
Workers' Compensation Claims
Asbestos in Insulation Workers (*cont.*)

Claimant	Date of Notice	Where Filed	Other Asbestos Manufacturer Defendants	Outcome	Comment
Swartout, John	12-28-55	California I.A.C. (S.F.)	Johns-Manville, Mundet Cork, Philip Carey	1958 award of compensation for asbestosis, terminating in fatal cor pulmonale	4-11-60 note from lawyer for J-M and Armstrong claimed he had not been employed doing <i>asbestos</i> insulation in the state of California by either firm.
McCarrell, Ervey	12-10-56	California I.A.C. (L.A.)	Johns-Manville, Owens-Corning and Fibreboard joined as defendants (4-23-59)	Compromise settlement \$13,500 (1-14-60) asbestosis	

Table 3. Armstrong Cork Company
Workers' Compensation Claims
Asbestos in Insulation Workers (*cont.*)

Claimant	Date of Notice	Where Filed	Other Asbestos Manufacturer Defendants	Outcome	Comment
Hartwig, Henry	2-19-57	Wisconsin Industrial Commission	—	\$15,540 compromise "award" permanent total disability/asbestosis	Armstrong had employed Hartwig but avoided liability
Coll, Vincent	1-15-57	New York Workmen's Compensation Board	—	award for permanent total disability \$684 (July 30, 1957) asbestosis	Coll died from cancer the day after being awarded compensation

Table 3. Armstrong Cork Company
Workers' Compensation Claims
Asbestos in Insulation Workers (cont.)

Claimant	Date of Notice	Where Filed	Other Asbestos Manufacturer Defendants	Outcome	Comment
Riley, James	7-15-57	California I.A.C. (L.A.)	Johns-Manville Fibreboard, Owens-Corning (1958); Philip Carey was joined in case in 1960	award for permanent total disability (11-27-59), pneumoconiosis and tuberculosis. Death benefits awarded (8-3-61) lung cancer	Riley was an insulator for 37 years. There were 32 employer defendants.
Haake, Harry	7-25-57	Workmen's Compensation Commission of Connecticut (Hartford)	Johns-Manville	Compromise settlement \$3363.60 (9-17-59) asbestosis death case	An insulator for 37 years. J-M employment out of state; J-M dismissed as defendant

Table 3. Armstrong Cork Company
Workers' Compensation Claims
Asbestos in Insulation Workers (cont.)

Claimant	Date of Notice	Where Filed	Other Asbestos Manufacturer Defendants	Outcome	Comment
Strickland, Fred	10-31-57	California I.A.C. (S.F.)	Owens-Corning	Settlement \$650 (asbestosis aggravating pre-existing tuberculosis)	Treating physician Dr. Hinshaw
Shepard, James	2-3-58	Massachusetts I.A.B.	—	settlement \$5,891.29 (asbestosis death claim) 1960	Armstrong concerned over failure to use preemployment examinations to screen new hires
Spencer, Thomas	5-21-58	Pennsylvania Bureau of Workmen's Compensation	—	settled	Armstrong indicates no payment in this case

Table 3. Armstrong Cork Company
Workers' Compensation Claims
Asbestos in Insulation Workers (*cont.*)

Claimant	Date of Notice	Where Filed	Other Asbestos Manufacturer Defendants	Outcome	Comment
Zini, Robert	6-19-58	California I.A.C. (S.F.)	—	disallowed (asbestosis/lung cancer)	
Reed, Clarence	12-29-58	Texas Industrial Accident Board (Austin)	(not known)	settled \$500 (1960) asbestosis	employed only one month by Armstrong, other employment not indicated
Thorsted, Roy	4-27-59	California I.A.C. (Oakland)	—	disallowed 12-30-59 (asbestosis)	3-17-60 Schiedt letter to Edgar "As you know, these pneumoconiosis and asbestosis claims are on the increase in sections of the country."

Table 3. Armstrong Cork Company
Workers' Compensation Claims
Asbestos in Insulation Workers (*cont.*)

Claimant	Date of Notice	Where Filed	Other Asbestos Manufacturer Defendants	Outcome	Comment
Bond, Thomas	7-7-59	State of Washington Department of Labor and Industries	—	Status unknown	—
Cuthbertson, Robert	7-22-59	California I.A.C. (S.F.)	—	denied (12-15-59)	letter from Schiedt to Hanna and Brophy 7-29-59 "We know your attorneys both in your San Francisco and Oakland offices have had considerable experience handling asbestos claims."

Table 3. Armstrong Cork Company
Workers' Compensation Claims
Asbestos in Insulation Workers (*cont.*)

Claimant	Date of Notice	Where Filed	Other Asbestos Manufacturer Defendants	Outcome	Comment
Viall, Lloyd	8-10-59	Nevada Industrial Commission	—	"status unknown"	7-5-59 Schiedt letter to Taylor: "If the number of lung claims keep on increasing as they have in the past several weeks, most of your time will be spent on asbestosis and pneumoconiosis claims."
Curtis, Harvey	7-16-59 (Owens-Corning)	Michigan Workmen's Compensation Dept.	Johns-Manville, Armstrong	settled for \$5250 (asbestosis 50% responsible for disability) 11-2-61	Hearing notice sent to Armstrong and J-M 1-19-61. Armstrong first informed of claim In 7-29-60 letter

Table 3. Armstrong Cork Company
Workers' Compensation Claims
Asbestos in Insulation Workers (*cont.*)

Claimant	Date of Notice	Where Filed	Other Asbestos Manufacturer Defendants	Outcome	Comment
Kendrick, Lloyd	11-16-59	State of Wash. Department of Labor and Industries	—	settled (pneumoconiosis)	Board of Industrial Insurance Appeals said his disease was compensable
Streithorst, L.	3-3-60	California I.A.C. (S.F.)	Fibreboard	"dismissed" (asbestosis)	death attributed to stomach cancer
Dean, William (widow: Mary)	9-19-60	New York Workmen's Compensation Board	Mundet Cork	settled (asbestosis)	2-10-61 letter Schiedt to Hoff: "Our file indicates William Dean's death, December 6, 1959, was caused by asbestosis."

Table 3. Armstrong Cork Company
Workers' Compensation Claims
Asbestos in Insulation Workers (*cont.*)

Claimant	Date of Notice	Where Filed	Other Asbestos Manufacturer Defendants	Outcome	Comment
Harding, Clifford	1-12-61	California I.A.C. (S.F.)	Owens-Corning	settled for \$3300 in addition to sums paid previously (asbestosis)	—
Gronenthal, John	8-16-61	State of Washington Board of Industrial Insurance Appeals	Owens-Corning	"status unknown" asbestosis/lung cancer	appellate order attributed asbestosis, lung cancer, and death for cor pulmonale to insulation dust exposure (11-30-62)
Gilivich, Steve	11-29-61 (Mundet Cork, Fibreboard)	California I.A.C. (Oakland)	Philip Carey, Owens-Corning (and Armstrong) joined as defendants 8-29-62	settled \$7968 (asbestosis) 12-22-64	—

Table 3. Armstrong Cork Company
Workers' Compensation Claims
Asbestos in Insulation Workers (*cont.*)

Claimant	Date of Notice	Where Filed	Other Asbestos Manufacturer Defendants	Outcome	Comment
Wyss, John	1-10-62	California I.A.C. (Oakland)	Owens-Corning, Mundet Cork, Fibreboard	\$6500 settlement (asbestosis) 1966	—
Miller, Arthur	2-21-62	California I.A.C. (L.A.)	Fibreboard, Mundet Cork	"dismissed" (asbestosis)	—
Greischar, Paul	4-24-62	California I.A.C. (Oakland)	Fibreboard, Owens-Corning joined as defendants (8-23-63)	settled \$8735 in addition to sums paid previously (asbestosis) 4-5-66	—

Table 3. Armstrong Cork Company
Workers' Compensation Claims
Asbestos in Insulation Workers (*cont.*)

Claimant	Date of Notice	Where Filed	Other Asbestos Manufacturer Defendants	Outcome	Comment
Staples, John	5-17-62	California I.A.C. (Long Beach)	Owens-Corning, Mundet Cork	settlement \$9250 (asbestosis) 2-1-63	partial disability at age 37
Onofrio, Anthony	6-25-52	Connecticut Workers' Compensation Commission (New Haven)	Philip Carey, Johns-Manville	settlement or comp. awarded	
Brodale, Frederick (widow, Irene)	7-13-62	California I.A.C. (Oakland)	—	settled \$1500 (lung cancer)	Cremation prevented pathological verification

Table 3. Armstrong Cork Company
Workers' Compensation Claims
Asbestos in Insulation Workers (*cont.*)

Claimant	Date of Notice	Where Filed	Other Asbestos Manufacturer Defendants	Outcome	Comment
Kingston, George	10-16-62	Minnesota Industrial Commission	—	settled \$13,500 (asbestosis) 3-27-63	—
Brokenshire, Leonard	3-15-63	California I.A.C. (Los Angeles)	Owens-Corning, Mundet Cork	award for \$13,000 (asbestosis) 11-6-63	—
Novak, Edward	3-27-63	California I.A.C. (L.A.)	Fibreboard (11-15-65)	settled \$5500 (asbestosis) 8-18-66	—
Faulkner, John	4-9-63	California I.A.C. (Long Beach)	Fibreboard	settled	—

Table 3. Armstrong Cork Company
Workers' Compensation Claims
Asbestos in Insulation Workers (*cont.*)

Claimant	Date of Notice	Where Filed	Other Asbestos Manufacturer Defendants	Outcome	Comment
Goans, Robert	8-8-63	California I.A.C. (Oakland)	Fibreboard, Mundet Cork, Johns-Manville, Owens-Corning	settled \$6750 (asbestosis) 8-3-64	—
Wines, Bernard	1963	Michigan Workmen's Compensation Department	—	—	—

Table 4. States' Workers' Compensation Records
(1978 Survey)

State	Claim File Retention	Employer Index	Public Access	Remarks
California	up to 25 yrs	+	+	Register used as employer index
Massachusetts	early 1940s—	+	+	File given only to parties in the claim
Pennsylvania	1960—	—	?	
Indiana	up to 10 years	—	?	
Connecticut	at least as far back as 1954	—	+	3 claims districts in state
Texas	1960—	—	+	
New Jersey		+	—	file given only to parties in the claim
Washington	at least back to 1960	—	+	some files were available, others could not be located
Ohio	up to 10 years after file closed	+	—	Occup. disease claims listed separately from "injuries," files at three locations, subpoena required to obtain the access
Illinois	1913—	+	+	Only fragmentary records retained
Wisconsin	up to 10 yrs after file closed	—	—	

Table 4. States' Workers' Compensation Records
(1978 Survey) (cont'd)

State	Claim File Retention	Employer Index	Public Access	Remarks
Michigan	at least back to 1954	-	+	2 or 3 files requested were unavailable; but a bigger one was retrieved
Maryland	at least 20 years	-	+	
New York	1959—for all claims in the state; back much farther for NYC area cases	+ (1941-)	- (?)	a specific file was retrieved; general search discouraged

Lawsuits by Product Users Against Asbestos Manufacturers

Damage suits against asbestos manufacturers which went to trial in the early 1970s are well known in legal circles. What is much less well known is that similar tort claims had been filed years earlier and settled quietly or dismissed. Four civil suits against asbestos product manufacturers have come to light, in which liability for the effects of asbestos product use was an issue prior to 1962. These civil suits constituted notice to manufacturers that asbestos and asbestos products were a health hazard to workers using them.

Aycock Corporation was a construction contracting firm based in Texas that was purchased by Johns-Manville. The Johns-Manville Board of Directors minutes of June 26, 1933 described the Aycock firm as a "wholly owned subsidiary." Later in 1933, Aycock Corporation was sued by Bernard Dugan, who had worked for Aycock "for a long time" as a laborer mixing asbestos in repair and construction work.¹⁵² Attesting that his lungs were so damaged that he was permanently and totally disabled, and stating that his impairment was not covered by the workers' compensation law, Dugan sued Aycock for negligence. He specifically claimed that Aycock Corporation

knew, or by the exercise of ordinary care would have known that, "asbestos fumes and particles were likely to be breathed into (Dugan's) lungs and to injure him ... yet failed to warn plaintiff of the dangers ... carelessly and negligently failed to furnish any instrument, or device for the mixing of said ingredients with safety to plaintiff and other employees, or any mask, or device or other protection to be used over his nostrils and mouth ..."¹⁵² It appears that Mr. Dugan died in 1934, and the lawsuit was dismissed.¹⁵³

There were also two damage suits filed by insulation workers in 1957 and 1961 against Johns-Manville.

The first of these cases was brought by Frederick LeGrande, who had been an insulation worker for about 30 years.^{154,155} A complaint was filed in U.S. District Court in New Jersey, stating that LeGrande had not been warned of the danger of breathing dust from the asbestos products he handled. Mr. LeGrande asked for a jury trial and \$500,000 in damages. At this time, Mr. LeGrande asserted that he was disabled by asbestosis and had ceased work involving the handling of insulation. He had worked for J-M distributor H.W. Porter & Company, against whom a workers' compensation claim was filed.

When Johns-Manville failed to respond to LeGrande's lawyer's interrogatories, a Court Order was obtained directing the company to do so. The Answers to Interrogatories in this early damage suit, made under oath, set the tone for future proceedings (and contained factual errors).

This deponent has no knowledge of any case of asbestosis ever being contracted by an applicator. Asbestosis was first contracted by an employee of this defendant at one of its plants in 1946 ...

Since this defendant never received notice of any claim of asbestosis resulting to any persons other than our employees who were engaged in the manufacture of the products, we had no reason to issue any warnings, instructions, or preventions to any other persons. (emphasis added)

As the jury was about to be selected for trial, Johns-Manville offered \$35,000 to settle the case out of court, and this was accepted in March of 1959.

Fred C. Wenham was an insulation worker who developed asbestosis and lung cancer. A workers' compensation claim was filed against Mr. Wenham's employer, and a wrongful death case was filed against Johns-Manville in U.S. District Court in New Jersey.^{156,157} This case was also settled out of court, for about \$10,000, and most of that was remitted back to the workers' compensation carrier that had insured Mr. Wenham's employer.

Eagle-Picher Company was sued in 1960 by Gladys Faciane, widow of insulator Clarence A. Faciane. Mr. Faciane had died from lung cancer. An amended petition filed with the court in Louisiana on March 15, 1961 named as additional defendants Armstrong Contracting and Supply, Johns-Manville, Owens-Corning Fiberglas, Ruberoid, U.S. Rubber, Philip Carey, Mundet Cork, Nicolet Industries, Keasbey & Mattison, Baldwin-Ehret-Hill, Pittsburgh-Corning, and tobacco manufacturers R.J. Reynolds and P.F. Lorillard.¹⁵⁸ The product liability case was dismissed because the widow could not prove whose products her husband had used.

Corporate Compensation Meetings at Manville

The compensation claim files and court documents are valuable, but offer little direct insight into the company's internal reaction to the compensation toll among both its employees and its customers.

By the late 1950s, there were regular meetings of the compensation committee at Johns-Manville's main (Manville, New Jersey) plant. At these meetings were Medical Director Ken Smith, plant engineer Cliff Sheckler, nurse Hahn, and a couple of others. Some excerpts of their notes:¹⁵⁹

Sigmund Skirzenski, age 52, advanced pneumoconiosis

Sheckler: Should we change him?

Smith: Won't make any difference. Do not transfer, retire if necessary.

Alphonso Desantis, age 50

Hahn: Should these men be advised?

Sheckler: We can put transite pipe out of business from this list alone.

John Hudak, 58, moderately advanced pneumoconiosis

Smith: Has he been counselled?

No.

Smith: I see no reason to bring in a man like this it is dangerous.

Anna Blanik, 49, moderately advanced asbestosis

DuBow: She is very nervous. If she is called in, she will get hysterical and I am sure you will have a claim on your hands.

Hahn: If she is transferred to another job, wouldn't that also precipitate something?

DuBow: Mrs. Blanik is working with no complaints. It is one year since she was (health counselled).

Smith: As a doctor, you can't leave her where she is today.

DuBow: Taking her off the job will not change things. The damage has been done.

Stella Krzesewski, 41, moderate to advanced asbestosis

Sheckler: No health counselling.

Patsy Infante, 53, 33 years in asbestos

Getter: Records indicate asbestosis in 2/51. Man was advised about dust in his lung in 1/55. (Sic)

Dishonesty toward employees was self-perpetuating. Management's dilemma was clearly expressed in a 1963 internal memo describing similar activities at another J-M plant:¹⁶⁰

- (1) From a moral standpoint, employees identified as having pneumoconiosis should be told of their condition promptly.
- (2) From an ethical standpoint, Doctors should tell these people of their condition promptly.

- (3) From a practical standpoint, if we tell 25 persons they are pneumoconiotic within the next 2 to 6 weeks, there may be an undesirable panic or near-panic.

Workers at Manville describe factory conditions in the 1950s as extremely dusty. Dust counts recorded by the company in 1954 frequently exceeded 5 million particles per cubic foot of air, and ranged as high as several hundred MPPCF.*¹⁶¹ The air pollution from the factory covered the town with asbestos dust. The Manville victims group successfully campaigned in 1980 to improve workers' compensation payments for people in New Jersey whose occupational diseases developed years after they had left their jobs.¹⁶²

The Law Journals and Informal Consultation with Insurance Officials on Compensation Matters

Manufacturers of asbestos products may also have been aware of compensation proceedings that did not concern them directly. William Muldoon was a pipe coverer for 25 years, and was compensated for total disability from asbestosis combined with tuberculosis.^{163,164} Another worker had tuberculosis as well as asbestosis after working as an asbestos sprayer's helper in closed quarters of the ship.¹⁶⁵ Cases like these, appealed for various reasons, became publicly known through the law journals and "downstream" literature.

In addition, the knowledge obtained by insurance companies sometimes made its way back to the asbestos manufacturers. Dr. A.J. Lanza, as a recognized expert on pneumoconiosis with Metropolitan Life Insurance Company, served as a conduit for all types of information on asbestosis, and was consulted by government health officials as well as industry. Massachusetts health officials contracted Lanza about a doctor's report of asbestosis in a shipyard worker in 1942. This was at the Quincy

*A crude guideline or tentative threshold limit value had been suggested by the U.S. Public Health Service in 1938. This value was 5 MPPCF. For further details, see chapter on Thresholds and Standards.

yard, operated by Bethlehem Steel Company and visited by Dr. E.R.A. Merewether during the war. (See Chapter 5, Table 8).¹⁶⁶

At the end of 1942, Sumner Simpson wrote to Dr. Lanza about a former long-term Raybestos-Manhattan employee who had taken a job at a nearby Navy yard in Charleston, South Carolina. There, the man had been diagnosed as having asbestosis by Dr. W.A. Smith (co-author with Dr. Kenneth Lynch of four medical articles on asbestosis and cancer). Simpson wrote,

Dr. W.A. Smith, whom I consider to be a crank on the subject of Asbestosis, for as soon as he finds out that anyone has worked for the Asbestos Company, he puts him down as suffering from a case of Asbestosis, has not only told us that this party has Asbestosis, from which he will die, but he told the party himself that he was suffering from Asbestosis." (Sic)

This letter to Lanza was sent via William McConnell at Metropolitan Life, to whom Simpson expressed thanks for having "made a great many personal sacrifices to be present to testify and assist us" in dealing with compensation claims brought by employees.^{167,168}

But even a lowly claims examiner could pass the word along on a compensation problem, W.E. Shoemaker, of American Mutual Life Insurance Company, was investigating a claim by Samuel P. Knopp, a former insulator in Baltimore.¹⁶⁹ Mr. Knopp had been an insulation worker and a 2-pack-a-day smoker for at least 19 years, and died with lung cancer and pneumoconiosis. The case was referred to the Chief Medical Examiner, Dr. Russell S. Fisher, who advised the defense attorney that the plaintiff had a strong case (citing papers by Doll and Hueper). After consulting with his superiors, Shoemaker phoned Dr. Kenneth W. Smith, Medical Director of Johns-Manville, who advised him to examine lung sections for "other toxic materials" and emphasize the smoking history. Though Smith declined to testify, he did refer Shoemaker to Dr. A.J. Lanza for expert medical testimony.

Dr. Smith advised that Dr. Lanza has just completed a study in an asbestos brake lining plant in Manheim, PA. in order

to determine the incidence of cancer among asbestos exposed workers. I believe you can rest assured that Dr. Lanza must not have found much cancer in this plant or Doctor Smith would not be recommending him.

[No such study was reported by Dr. Lanza, nor has any other trace of it been found.]

Shoemaker continued,

(Dr. Smith) said that where a claim for lung cancer among (J-M employees) did arise, they have only paid for it on the basis of the employee showing evidence of advanced stages of asbestosis—mainly because of what they feel to be their moral responsibility although, of course with the selfish reason of making a quiet settlement rather than having the case recorded in the law journals.

Memoranda and reports by Shoemaker and his co-workers at American Mutual mostly pertain to the compensation coverage provided to Keasbey & Mattison Company. Dust surveys by American Mutual in 1956 and 1958 yielded measurements as high as 90 and 63 MPPCF, respectively, and the insurance people spoke with growing exasperation about the management's unwillingness to clean up its Meredith, N.H. plant.^{170,171} Ten asbestosis compensation claims in Pennsylvania over a two-year period cost this manufacturer \$33,000 in extra insurance premiums.¹⁷²

Asbestosis Compensation in U.S. Navy Shipyards

The U.S. Navy Yard in Charleston, South Carolina (where Dr. W.A. Smith worked), began annual screening of "all workers employed in handling asbestos" in 1939, as Sumner Simpson discovered within a short time. The Yard Dispensary conducted physical examinations and took chest X-rays of these workers.^{173,174} Industrial hygiene practices at Naval shipbuilding yards varied widely in the mid-1940s, as Fleischer and his co-workers demonstrated.¹⁷⁵ The use of respiratory protection was advised in some shipyards during World War II but not insisted upon.¹⁷⁶ This was the case despite the Navy's publication of

"Minimal Requirements for Safety and Industrial Health in Contract Shipyards," in 1943. The "requirements" included the segregation of dusty work, use of exhaust ventilation and respirators, and periodic medical examinations of workers handling asbestos insulation materials.¹⁷⁷

Although Fleischer and co-workers reported several cases of asbestosis in U.S. Navy yards, they said nothing about compensation for disability. The Long Beach (California) Naval Shipyard was apparently among the first to confront the question of compensation.

By 1958, at least one former employee there was receiving compensation for asbestosis, which probably was started in 1956.^{178,179} Surveys conducted in 1958 through 1961 identified additional cases of asbestosis including two on compensation as of June, 1961.¹⁷⁹ Marr reported in 1964 that five Long Beach Naval Shipyard insulators were retired on disability compensation for asbestosis, and another had received such payments until he died of asbestosis in 1962.¹⁸⁰

The Mancuso Documents

The Navy's response to compensation matters could be said to have been as disorganized as its approach to prevention of asbestosis in the first place. This cannot be said of many asbestos companies, who managed compensation affairs at high levels. An example of this is provided by records of the Philip Carey Manufacturing Company in the early 1960s.

The Indiana State Board of Health informed Carey executive Louis Pechstein early in 1961 that asbestos in "Carey-temp" insulation was "toxic." Carey's own contract insulators had complained to the health authorities.¹⁸¹ In addition to the contract unit compensation claims already noted in Table 3, Carey was directed to pay William E. Latto compensation for permanent and total disability in 1962. Mr. Latto had been an insulation worker for 35 years, and filed his claim in Ohio in 1961.¹⁸²

In 1962, at the recommendation of consulting actuaries, Carey hired Dr. Thomas Mancuso as Consulting Medical Director for "long range development of a plan for company-wide observations relative to sickness and mortality, data of other plants at

different geographical locations, and evaluation of medical services in relation to employee exposure, and the resolution of potential or actual industrial health problems."¹⁸³ It was hoped that:

From the claims standpoint, Dr. Mancuso, as a nationally accredited expert, can help us differentiate an expensive asbestosis or silicosis case from non-occupational illness such as cancer and bronchitis, and make the defense stand up.¹⁸⁴

The author of this prediction was Louis A. Pechstein, Assistant Secretary of the company.

Dr. Mancuso conducted a survey of conditions at the Ohio plant and recommended extensive industrial hygiene changes, not only inside the plant but in terms of consumer warnings and air pollution control. These recommendations were couched in terms of promoting public and consumer protection while avoiding lawsuits and compensation claims.¹⁸⁵

In August of 1963 Dr. Mancuso transmitted to the company a series of scientific reports on the effects of asbestos, of asbestosis, lung cancer and mesothelioma that occurred among insulators, neighbors, and workers in manufacturing processes. These reports included the findings of Dr. Irving Selikoff (8 months prior to their publication), on the very high death rate from cancer and asbestosis among insulation workers.¹⁸⁵ Mancuso reported not only to lesser officials, but also to John W. Humphrey, President of the company.^{186,187}

He warned of the fallacy of any asbestos manufacturing company relying upon the Braun-Truan (Industrial Hygiene Foundation) report to deny lung cancer compensation claims or liability; because, in Mancuso's analysis, the study was scientifically flawed.¹⁸⁷

Dr. Mancuso submitted a confidential report to top management on Sept. 23, 1963. The report contained specific recommendations that applied to each of the company's operations, including the Canadian asbestos mines and processing plants, for the prevention and control of occupational diseases, for the control of air pollution and for the provision of technical advisory services to product users. Mancuso advised the officials

of the company to discontinue their national practice of putting sub-contractor insulators on their payroll because of the occupational disease liability.¹⁸⁸ Referring to the overall industry response to the cancer threat, he said:

Internally, within the company, the question has been raised as to why medical problems, particularly relating to cancer and asbestos, were not recognized before. Actually, they were recognized, but the asbestos industry chose to ignore and deny their existence ...

It is also possible that there was no desire by these companies to recognize the problem because of the workmen's compensation implications.

Mancuso's analysis of the asbestos industry's conduct was similar to a more general analysis published by a British factory inspector. This man, Bryan Harvey, had studied at the Harvard School of Public Health and learned about the American system from people including Philip Drinker. Harvey said:¹⁸⁹

While compensation insurance, the backbone of the American system, has done so much to stimulate the control of known occupational hazards, it may not to the same extent encourage either the medical profession or the industrial hygienists to discover new industrial diseases and hazards. British industry as a whole has come to accept perhaps more readily the implications of research into industrial disease and does not now to any marked degree contest their results. American industry in insisting on scientific proof of toxic dangers and their presence in the atmosphere seems to delay to some extent the application of measures of control, and this may account for some occupational diseases being undiagnosed in the United States while in this country they are accepted without controversy.

Carey continued to manufacture asbestos insulation, without affixing warning labels, for the rest of the 1960s.

Compensation at the Asbestos Mines in Canada

The compensation story would not be complete without a discussion of the situation in Quebec, where the Provincial

economy was heavily dependent on asbestos mining. The mines were the largest in the world, and owned for the most part by companies in the United States and England. Asbestos mining companies began to send pathological material and chest X-rays for review by the Saranac Laboratory in 1942. Dr. Gardner and his successor Dr. Vorwald examined the tissue specimens sent by Ivan Sabourin, the lawyer for the industry association, and wrote medical reports of their findings. In the late 1940s Johns-Manville officials Hugh Jackson and Dr. Kenneth Smith also started sending material in to Saranac, from deceased employees at the mines and manufacturing plants. Many of the reports from Saranac were used in the defense of compensation claims.

At the outset in developing a relationship with Dr. Gardner, Sabourin took the liberty of rewriting the doctor's "opinion" in an asbestosis case and sending back his revised version for Gardner's signature. Explaining some of the changes, the lawyer wrote (May 6, 1942):

I have also deleted from your opinion, as worded for the benefit of my clients, portions which I submit to you respectfully do not seem to alter the meaning of the opinion as a whole, that is of the conclusions, yet are very informative but need not be tabled at this stage unless in rebuttal.

Sabourin explained,

For instance, I have deleted the report of chemical analysis as I should prefer not to give these data until it has become opportune.

The file of this case contains no indication that Dr. Gardner objected to the attorney's assistance in writing medico-legal opinions.¹⁹⁰

Sabourin and Dr. Cartier at the Thetford Industrial Clinic then proceeded to send another 36 cases to Saranac for review between 1942 and the departure of Dr. Vorwald in 1953. More than half of these cases were identifiably the subjects of workers' compensation claims. The largest single source of material was Asbestos Corporation Limited (17 cases by 1953), followed by Bell Asbestos Mines (11 cases), Johns-Manville (5 mine workers), and Johnson's Company (6 cases). At least 7 of

the asbestos miners were diagnosed as having died with lung cancer in combination with varying degrees of asbestosis.¹⁹¹

The claim of Alphonse Labbe' appears to have been the first case fought in Canada over the compensability of lung cancer in an asbestos miner. More than three days of testimony were heard, with Dr. Lanza active in the defense of Bell Asbestos Mines (subsidiary of Turner & Newall, U.K.).¹⁹² Q.A.M.A. lawyer Sabourin credited Lanza with "debunking certain alleged figures, relating to cancer incidence in asbestos workers in the British Isles."

In 1949, an historic strike occurred, largely due to widespread anger over the unhealthy conditions in the mines and mills. Documentation from this era also tells us something about the state of occupational disease compensation available to the asbestos miners. Familiar patterns of information concealment are seen here, too.

Starting on January 12, 1949, *Le Devoir*, a Montreal newspaper, began to carry tragic and vivid reports by Burton Le Doux.¹⁹³ Le Doux's report, *Asbestosis*, was also printed in English.¹⁹⁴ For the next month almost daily news reports in *Le Devoir* discussed asbestosis in the miners. Le Doux described cases of individuals crippled by asbestosis contracted from working in mines of Quebec Asbestos Corporation, owned by Philip Carey Manufacturing Company of the U.S.A. He charged both the company and the Provincial government with "criminal negligence," describing the unhealthy conditions in the asbestos mining region as a "charnel house." As of 1948, Le Doux wrote, no one from Carey's East Broughton mines had ever brought suit against the company for compensation, much less received an award. He assailed the local doctors, one of whom reportedly said,

If we told the workmen of East Broughton that they were affected by asbestosis, it would cost the Company too much money.

The lack of compensation claims was thus ascribed to the workers' ignorance, corrupt government officials and doctors, and the forbidding complexities of the legal system.¹⁹⁴

Le Doux's articles aroused a great deal of feeling, and may have played a critical role in what followed. Contract negotiations had begun in December, 1948, and on February 14, 1949 the union decided not to submit the issue to arbitration. The strike started at Johns-Manville's mine in Asbestos, Quebec and immediately spread to Thetford Mines, crippling the asbestos industry for the next five months. During this time, press accounts in *Le Devoir* and other newspapers continued to emphasize the industrial hygiene demands of the strikers. Practically the only mines that kept running during the strike were relatively small, marginal operations of Philip Carey in East Broughton, where Le Doux had done his initial investigations.

Pierre Elliott Trudeau's account, *The Asbestos Strike*, noted that¹⁷³

Among the events which most concerned the miners, we should mention their long struggle to get asbestosis recognized as an industrial disease. In 1949, this struggle had won them only a partial victory, because monetary compensation was still granted only to those whose health had been impaired by asbestos dust for a period of 5 years or more. (emphasis added)

Although the unions did induce some outlays for dust control by the mining companies (\$5,500,000 set aside for this purpose by Johns-Manville), the compensation law appears not to have been changed by the strike.

Just as the strike was about to begin, Johns-Manville completed a medical survey of 708 workers at its mine in Asbestos, Quebec.¹⁹⁵ Dr. Kenneth W. Smith reported to J-M top management that 59 of these men were "probable compensation claims." He went on,

Elimination of the dust in their working areas, or transferring them to non-dusty jobs will help the men, but will not prevent claims for compensation being submitted.

Smith said that, although some of the miners had asbestosis, none were yet disabled, and so none had been told they had asbestosis. Smith even recommended (with no apparent

success) that when a man did become disabled, the company should itself submit the compensation claim and pay the man for his disability.

Dr. Arthur Vorwald of the Saranac Laboratory was presented as a medical expert to a Quebec arbitration tribunal during the 1949 strike. He told the panel,¹⁹⁶

I would like to compare lungs with our two arms, two legs, and our two eyes. When one goes bad we can use the other one, and we have two lungs in case of disease.

In Thetford Mines, one clinic has serviced several asbestos companies (Bell Asbestos Mines, Lake Asbestos, Carey's Canadian mines, and Asbestos Corp. Ltd.) since its provision was required by law in 1944. In 1975, the Thetford Mines clinic was exposed in the *Montreal Star* as telling miners they were in good health, while some had such severe asbestosis that it killed them within the next two years.¹⁹⁷ Despite Dr. Cartier's protestations of good intent, it is apparent that his practices as director of the Thetford Clinic since it opened lessened the companies' workers' compensation outlays.¹⁹⁷

Obstacles to Workers' Compensation

In the 1940s, one would perhaps not have expected to find many workers compensated for disability from occupational cancer. The New York State Workmens' Compensation Board reported that in 1948, there were 4 compensated cancer claims in New York (out of over 100,000 workers' compensations cases "closed" in that year). In 1947, there were none.¹⁹⁸

The epidemiological studies on insulators by Dr. Irving Selikoff and his co-workers, reported in the literature in 1964-1965, are credited even by the asbestos industry with establishing unequivocally the existence of a cancer hazard from occupational exposure to asbestos.^{199,200} Yet even after the big asbestos conference held by the New York Academy of Sciences in 1964, the New York Workmens' Compensation Board was not deluged with claims. (See Tables 5-6.)

Table 5. Occupational Diseases: Cancer
Number of Cases and Amount of Compensation¹

Compensated Cases Closed, New York State, 1966 - 1981

Year of closing	Number of cases	Amount of compensation
1966	6	\$ 64,631
1967	3	8,773
1968	6	30,386
1969	4	23,334
1970	7	28,207
1971	9	111,301
1972	6	44,409
1973	4	48,041
1974	6	47,343
1975	1	850
1976	2	65,954
1977	5	67,649
1978	3	66,021
1979	5	64,029
1980	7	171,913
1981	10	681,870

¹ Includes the estimated value of future payments for death, permanent total, and non-schedule permanent partial disability cases. Does not include the cost of medical and hospital care.

Table 5 shows that in New York, a state with nearly one tenth of the U.S. population and where there are some of the best hospitals in the country, only about 5 people a year have been compensated for occupational cancer.²⁰¹ In some states, there has probably not yet been a single compensated occupational cancer case (as of 1978, two states had not yet even awarded anyone compensation for asbestosis).²⁰² Nationwide, the figure would appear to be on the order of no more than several hundred compensated cases of occupational cancer from all causes per year under workers' compensation. This can be contrasted with the National Institute for Occupational Safety and Health (U.S.) estimates of 100,000 deaths from occupational disease per year, the U.S. Department of Health, Education, and Welfare's long-term projections of over 50,000 cancer cases per year from asbestos alone, an estimate by Dr. Nicholson and his

Table 6. Asbestosis and other Dust Diseases ¹
 Number of Cases and Amount of Compensation

Compensated Cases Closed, New York State, 1966 - 1981		
Year of closing	Number of cases	Amount of compensation awarded ²
1966	15	\$ 317,939
1967	4	147,619
1968	21	421,707
1969	10	257,240
1970	19	336,038
1971	19	433,099
1972	17	493,433
1973	20	433,624
1974	19	510,343
1975	28	1,026,901
1976	19	812,871
1977	29	1,545,577
1978	37	1,205,001
1979	43	1,780,682
1980	43	2,755,600
1981	27	1,880,660

¹ Does not include silicosis, but includes other dust diseases. Roughly two thirds of these claims are asbestosis cases (29 in 1980 and 16 in 1981).

² Includes estimated present value of future payments for death, permanent total, and non-schedule permanent partial disability cases. Does not include the cost of medical and hospital care.

co-workers of 9700 asbestos-related cancer deaths per year currently and Doll and Peto's figure of 8,000 to 12,000 occupational cancer deaths per year in the U.S. (4,000 to 8,000 from asbestos).²⁰³⁻²⁰⁶ Admittedly, there are no good figures on the incidence rate of occupational cancer, but it appears that far less than one percent receive compensation. A report to Congress in 1980 concluded that 5 percent of those *severely disabled from an occupational disease* received workers' compensation.²⁰⁷ The plight of the insulation workers illustrates in part why this is so.

A claim must be made in the state where disability-producing work took place. In the Asbestos Workers' Union, men traveled

all over the country doing contract work on the construction and maintenance of industrial plants, power plants, and ships. Disease developed long after exposure, and it was not uncommon for a man to find out he had asbestosis or cancer after he had moved far from the scene of the crime, so to speak. Then, to receive compensation, the worker was required to get on a plane back to New Jersey or Texas, hire a lawyer to take on the case, fly in his doctor to testify, produce the old employment records, name as defendants all the firms that employed him using asbestos (and maybe the products used as well), be prepared to prove that his disease could not have occurred from other employment or personal habits (e.g., smoking), and of course, show that his work within that state was sufficient to produce the disease. There would follow the usual sparring by insurance carriers' lawyers, who might argue that on-ship insulation work was not in the legal jurisdiction of the state compensation law, that the statute of limitations had run out before the claim was filed, and so on. This would be followed by company-paid physicians' testimony that the disease was of questionable occupational origin, and in their expert opinion the X-rays were not indicative of any more than 22 percent disability. Disability from pneumoconiosis might not be compensable unless it was total, and even total disability might not be compensable if the worker managed to find a desk job and still earn a living despite severe damage to his lungs. Some states (e.g., Maryland, 1939) limited compensation to workers disabled within 10 years of their last employment in dust, with at least 5 years' exposure to the dust. After several years of re-scheduling hearings to meet the convenience of all the judges, lawyers and doctors involved, the man might live to be offered a compromise-and-release agreement by the defendant companies or even a compensation award by the state compensation board. While all the litigation went on, the man had to somehow come up with the means to pay his medical bills and support his family. Should he resort in his desperation to taking a job, he could expect to have the defendants' lawyers introduce that as evidence that he was not really disabled at all. If a disability or death award was finally granted, the worker or his widow would, of course, have to pay the attorney's fee out of it.

Medical coverage was limited in many states to set a length of time or total financial outlay by the employer. Past limits on medical coverage included dollar amounts (e.g., \$10,500 in Kansas, \$3,000 in West Virginia, \$880 in Wyoming) and short time limitations as recently as 1974.¹⁵ So there was even less of an incentive to file for compensation for occupational disease in earlier times where less liberal "benefits" were provided by the laws. In some cases, workers had to know enough to choose among states where they had worked, to avoid restrictive statutes of limitations and ceilings on medical coverage.²⁰² Unlike most of the obvious defects of workers' compensation laws, limits on medical coverage appear to have been eliminated in all 50 states.²⁰⁸

Workers' compensation awards for occupational diseases can be pitifully small in cases where exposure occurred long ago and the claim is not barred by the statute of limitations. Asch gives an example of a man who only worked with asbestos in the 1920s and died from mesothelioma in 1975. The compensation judge awarded death benefits to the man's widow of \$15 a week based on the man's salary of \$17.50 a week at the time he was working for Johns-Manville.²⁰⁹

It is not surprising, given the adverse legislation and administration of workers' compensation laws in the United States, that the workers began to bring civil suits against the manufacturers of asbestos products and the suppliers of the asbestos fiber they had handled.

Chapter Eleven

Dr. Selikoff's publications and active involvement with the union of affected workers forced the U.S. asbestos insulation manufacturers to confront their responsibility to warn workers that the products were dangerous. In 1964, some of the companies decided that they would have to begin placing warning labels on cartons of their products, because of the potential liability from failure to do so. But the workers were becoming aware that they had faced tremendous occupational disease hazards from the many years of exposure in prior years, and some insulators in Texas filed product liability suits. When the verdict in favor of Clarence Borel was upheld by the Fifth

Circuit Court of Appeals in September of 1973, some people in the asbestos and insurance fields were stunned by its implications. "Disaster has struck," reported the claims manager responsible for Armstrong Cork. "We do not intend to pay this Judgment until all avenues of appeal are exhausted, principally because of the other pending asbestosis lawsuits." The claims manager also noted,²¹⁹

Defense attorney, W.N. Arnold, Jr., is meeting with the other defense attorneys connected with this and the other pending asbestosis cases, in order to map a strategy in the defense of other pending claims.

By 1976, the American Mutual Insurance Alliance and the American Insurance Association held meetings of representatives of a large group of major insurers to discuss strategy in the asbestos litigation.²²⁰

The study group felt that it would be helpful to have information on the state of the arts defense and some indication of doctors who would be willing to testify in such cases.

Months later, another meeting was held by this group, to discuss relevant legal developments and collective measures to reduce defense costs.²²¹

The meeting closed with a unanimous rejection of a suggestion that liability in asbestosis cases be admitted and the carriers agree between themselves as to their respective losses and expenses.

Within the next few years, thousands more cases were filed against former manufacturers of asbestos products, and as plaintiffs began to obtain documentation of corporate knowledge, giant companies began to be faced with liabilities that exceeded their worth and insurance combined.

Manville Corporation, as it is now called, faced 16,500 unresolved lawsuits for asbestos disease in August of 1982. Manville had won 41 out of 96 cases taken to trial and settled 3,344 cases out of court. In 1982, additional cases were being

filed at the rate of 500 *per month*. Jury awards for punitive and compensatory damages, sometimes in excess of \$1 million, had become increasingly frequent. In 1981, five juries returned verdicts for punitive damages against the company. During the first half of 1982, Manville was found liable for punitive damages in five more suits averaging \$616,000 per case.* The legal defense fees were placed at "close to \$2 million a month," by mid-1982. Auditors of Manville's annual report to stockholders had by 1980 concluded that the ultimate costs of the litigation "cannot be reasonably determined."²¹⁰⁻²¹³

On August 26, 1982, Manville Corporation filed for reorganization under the protection of federal bankruptcy laws. Board Chairman John A. McKinney asserted that "our businesses are in good shape despite this recession," but added, "we are completely overwhelmed by the cost of the asbestos health lawsuits filed against us."²¹² The first asbestos manufacturer to file for reorganization under Chapter 11 of the bankruptcy code was UNR Industries (formerly Unarco), several months before Manville. Amatec became the third asbestos defendant to file under Chapter 11 later in 1982.

Epidemiology consultants had advised Manville management that 52,000 such suits in all might eventually be filed. With Manville's average cost of settling claims up to \$40,000 each in 1982, other consultants projected a \$2 billion estimate for the ultimate cost to the company.²¹³

One reason the company went to the bankruptcy court, thereby halting the progress of all damage suits against it, was because its insurance carriers were refusing to pay hundreds of millions of dollars in product liability insurance coverage, purchased by Manville from 1947-1976.^{212,214} The insurers claimed that Manville had hidden information on asbestos hazards from them. Manville then sued 27 insurance companies in 1980, and not until 1985 did the complex trial of this case begin (as settlements were announced with some of the insurers

* Punitive damages are assessed in addition to damages to compensate for the injury and loss (compensatory damages) when the conduct of the defendant is a gross deviation from societal standards. The purpose is to punish the defendant for past misconduct and to set an example for others to deter them from engaging in similar activities.

and plaintiffs' attorneys criticized the terms of the first proposed settlements before Judge Lifland). Strained by the litigation of cases that Manville insisted were covered by insurance, along with punitive damage awards (which are not covered by insurance), the corporate management decided to submit to court-supervised direction of its affairs in 1982.

Another reason why Manville took this drastic step was to get the attention of the U.S. Congress, which had been considering various proposals for an "asbestos compensation act" since 1977. All but one of these bills would have completely stopped the filing of new lawsuits. The early proposals called for an industry/government fund and a federally administered procedure for adjudicating claims. Disability compensation would have been limited to about \$13,000 a year. The 1985 version, the "Asbestos Workers' Recovery Act," was soundly criticized and denounced as another industry bail-out bill by asbestos victims' groups. Representative Pat Williams finally introduced a bill that had the full support of organized labor; but his Federal Occupational Disease Compensation Act did not impede the filing of civil suits under existing law. It therefore faced united opposition from industrial and insurance interests.

As the asbestos litigation expanded, Congress has shown little interest in legislating an end to it and creating an expensive, federally-managed system for handling thousands of claims per year. Not a single member of Congress has risen to defend the innocence of the asbestos industry. More recent bills to create a compensation fund financed solely by industry have been coolly greeted by the industry.

Not the least of Manville's reasons for filing under Chapter 11 was the hope that the bankruptcy court would favorably resolve the issue of future claims. Normally, a company emerging from reorganization in bankruptcy court has arranged to settle all debts from its past activities. But bankruptcy courts were initially reluctant to concoct any scheme to prospectively pay people who hadn't yet developed asbestos disease claims but would in the future. These courts were at a loss to find anyone who could really be said to represent future plaintiffs and negotiate on their behalf.

Meanwhile, Manville's legal costs continued to be close to \$2 million a month, and the lawsuits continued to be filed. Over the six years of the Manville Chapter 11 "reorganization," more than \$106 million was billed for fees and expenses by law firms, accountants, and investment bankers. The company initially offered \$400 million to settle 20,000 outstanding cases (an average of \$20,000 each), to cover its share of the liability in these cases. Included in the total were several thousand cases filed against Manville after the company sought the refuge of the bankruptcy court. Plaintiffs' attorneys demanded at least \$32,500 per case, the figure Manville had given for its payments in 1982, net of legal defense costs.

Finally, a bankruptcy reorganization plan was finalized in 1988, creating a "trust" with Manville's insurance coverage and other payments to be made over a 25-year period. By 1990, the funding initially provided was nearly exhausted from the initial settlements of older cases. The Manville Trust is now settling thousands of claims at around \$5,000 each, on the average, based on projections that it can pay only 10 percent of the value of all the claims it will receive. (See final chapter for further discussion of Manville Trust.)

In enacting the Bankruptcy Amendment and Federal Judgeship Act of 1984, Congress made the Chapter 11 escape route considerably less appealing to asbestos litigation defendants. This legislation protects the right of trial by jury in federal courts for plaintiffs with personal injury and wrongful death cases, even against companies in Chapter 11.

CONCLUSION

We can conclude from all this that most workers with asbestosis and cancer from asbestosis didn't file workers' compensation claims or damage suits. However, the industry and its insurers were very much aware of those who did, and the defense of compensation claims and suits was a concern to top management at least as early as the 1930s.

Only fragmentary records have been discovered regarding compensation, compared to what must once have existed. State agencies have long since destroyed their records of the early

claims (pre-1950) in most cases, and in some states where the records have been preserved they are withheld from public access. Despite the openness of the original proceedings, records of them are thus excluded from our consideration. For the most part, the defendants and their insurance carriers have been at a loss to produce their own records regarding asbestos disease compensation.

What may have begun as a shortsighted reaction became the *modus operandi* of the industry's top managers: let the lawyers handle it, buy insurance and hire medical experts as necessary, and minimize the cost of the claims by every legal and political means. Dust control as a means of claims cost control was economically unattractive because of its high initial and operating cost and its rather delayed reduction in disease incidence and severity. It was cheaper to rig the compensation laws with short statutes of limitations and miserly limits of medical liability.

Asbestos victims have consequently found product liability suits attractive, despite the long wait before trial, the expense, and even the subrogation rights of their employers' insurers who have paid some of them workers' compensation. It remains to be seen if the defendant companies will be able to stem this tidal wave of liability through the legislative or judicial process.

Bills to do away with the concept of strict liability, limit pain and suffering awards, lower plaintiffs' attorneys fees, make losing plaintiffs pay defendants' legal fees, increase the burden of proof for punitive damages, and in other ways discourage personal injury suits have been urged upon the Congress with increasing fervor, though not yet with success. Business alliances involving hundreds of manufacturers, insurers, and trade associations, have come ever closer to succeeding in getting such bills enacted by Congress.²¹⁵

In the state legislatures, the asbestos litigation defendants and others with similar problems have been more successful.²¹⁶ Changes introduced into state tort laws have followed these lines:

- imposition of ceiling amounts that plaintiffs can be awarded for non-economic loss, as for pain and suffering

- elimination of "joint and several liability," whereby damages for an extinct or bankrupt defendant would have been assessed to viable co-defendants rather than deducted at the expense of the injured party
- erection of statutes of limitations so that no damage suit can be filed more than (10 or so) years after the sale of the product
- introduction of additional defenses to damage suits (e.g., absence of a government standard connotes acceptability—a state-of-the-art defense)

Compensation was seen as the Achilles Heel of the asbestos industry long ago. Dr. Donnelly's bitter words in 1936 have proved prophetic:²¹⁷

An industrial worker is entitled to every protection that may safeguard his health, so that he may earn a livelihood for himself and family for at least a reasonable period of years in the work in which he is most skilled. If he is prevented from continuing in such work because of impairment or health through no fault of his own, he is entitled to some remuneration for his loss of earning power. That protection of asbestos workers has been woefully lacking in the past has been definitely shown. It is imperative that such protection, as nearly complete as possible, be provided by mill owners. *Efficient protective devices will be far less expensive in the final check up than the aggregate of numerous claims for compensation and frequent damage suits.* That complete protection can be afforded by the devices in use at the present time seems to be somewhat doubtful, but workers are entitled to the highest type of protection which the engineers familiar with the hazard can provide. (emphasis added)

What Donnelly might not have imagined, with asbestosis and asbestos cancer taking an increasing toll of death and disease over the next 40 years, was that compensation costs could be held in check for as long as they were. And because of the long latency of asbestos diseases, the businessmen running many

asbestos companies apparently chose to put off the day of reckoning for as long as they could. Sumner Simpson handed it down to his son William Simpson. Dr. Lanza retired as a Professor of Industrial Medicine at New York University, and until recently research laboratories at the school's Tuxedo Park, N.Y. campus were named in his honor. [Further discussions of asbestos compensation and efforts to get N.Y.U. to rename the Lanza laboratories are included in the last chapter and Appendix 5, respectively.]

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4

Thresholds and Standards

"(W)here (asbestos particles) are allowed to rise and remain suspended in the air of a room, in any quantity, the effects have been found to be injurious, as might have been expected."

The Lady Inspectors of Factories, *Annual Report of the Chief Inspector of Factories and Workshops for the Year 1898*, p. 172 (1899).

"Although (The 1931 British Asbestos Industry Regulations) required that no asbestos dust should enter the workroom, they were so riddled with loopholes ... that the requirement was from the outset no more than a pious aspiration."

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"If you poison your boss a little bit each day it's called murder; if your boss poisons you a little each day it's called a Threshold Limit Value."

—James P. Keogh, M.D.

SOCIAL ORIGINS AND NATURE OF DIRECT MEASURES TO PREVENT OCCUPATIONAL DISEASE IN THE UNITED STATES

The industrial age was rife with physical hazards, as expanding urban industries absorbed workers arriving from the countryside. Moving machinery, high pressures and temperatures, and

other high energy hazards to the human body were ubiquitous. Along with these came acute health hazards such as carbon monoxide asphyxiation, sort of a cross between a safety hazard and a health hazard. And there were also well-documented health risks, such as silicosis, and mercury and lead poisoning, from substances whose main route of entry to the body was by inhalation.

It followed that limits on the concentrations of the acutely hazardous substances in the workplace air could, if followed, prevent the most harmful effects on the workers. Management had economic incentives for determining some of these limits and observing them, for otherwise workers could be overcome by carbon monoxide or solvent fumes, with disastrous effects on the expensive machinery and interruptions in production. Even such effects as eye and respiratory tract irritation could be a cause of lowered productivity, if uncontrolled.

With more chronic health hazards there was decidedly less of an economic interest in limiting exposure. These insidious causes of ill health in the workers posed no threat to the rhythms of industrial processes. Asbestos, which causes no acute toxic response and does not manifest its chronic effects for at least 5 years—effects which were easily confused with common non-occupational lung diseases 60 and more years ago—is a good example of a severe but non-acute occupational health hazard.

And so the first attempts to develop guidelines for ceiling exposures to toxic air contaminants in the workplace centered on irritating gases: sulfur dioxide, halogens, ammonia, acid fumes. K.B. Lehmann's method was to order his laboratory servant to spend one hour in the housekeeper's laundry room, where a calculated amount of volatile test fluid was poured out and vaporized. The servant was periodically observed, and in this way a concentration was determined to be "just tolerable for short-term exposure."¹ Lehmann also conducted experiments on various animal species. Lehmann's work over a century ago was the first use of quantitative evaluations based on chemical analysis for the development of guidelines for workplace exposure.² Animal experiments were also used in the

nineteenth century for recommending workplace air limits for the deadly, colorless, odorless gas, carbon monoxide.³

Short lists of harmful concentrations of contaminants in air appeared in 1912 and 1921; and in 1927, the American Chemical Society published for 25 "noxious gases" limits for acute toxic effects and "maximum concentrations allowable for prolonged exposure."⁴ In 1940, authorities in Massachusetts published "suggested" maximum concentrations for 41 toxic substances used in industry.⁵

Official occupational health guidelines and regulations in Britain and Germany followed another approach. These rules were developed in terms of general engineering controls, plant design features, and specific work practices to follow in controlling the hazards. Monitoring the worker's health was required, but monitoring the workplace air was not. The idea of a measured ceiling concentration for worker exposure was not adopted in Europe. That was an American approach: set some limit, and leave it to management to use its "ingenuity" to comply by whatever means it chose. Modern workplace standards use a combination of these requirements, both ceiling limits and work practice/engineering controls. Of course the results were similar when the guidelines—of whichever kind—were not followed, as was very often the case.

In the United States, a number of health hazard evaluations were performed starting in the second decade of this century by the U.S. Public Health Service. It is important to consider how these studies were arranged, conducted, and reported in order to understand their role in setting the first of U.S. guidelines, and later standards for substances including asbestos.

Both labor and health agencies within the U.S. government supported and published research on health hazards in industry (many of which had already been described in Europe). These reports included basic observations of health hazards by Dr. Alice Hamilton and others (published by the Bureau of Labor Statistics), and more comprehensive investigations by the U.S. Public Health Service. The Social Security Act of 1935 made federal funds available for state and local industrial hygiene programs, and by 1939 thirty such units were operating. With the added impetus of the war effort to "conserve manpower,"

these industrial hygiene units numbered 47 by 1945.⁶ Unions and their political allies got occupational safety and health on the Chief Executive's agenda following World War II, with annual President's Conferences on Occupational Safety. Between 1947-1950 federal grants-in-aid were allocated for industrial hygiene units, as Public Health Service personnel on loan were withdrawn from states and replacements were trained.⁶ In this period, only Delaware and Nevada still did not have any programs.

The Public Health Service ceased publishing health hazard evaluations in industry in the late 1940s. Following the Donora, Pennsylvania disaster in 1949, the agency directed some of its resources formerly committed to occupational health to the new field of air pollution and health. Health departments in Pennsylvania (1949), Maryland (1951), and other states kept industrial hygiene divisions at least in name by adding air pollution responsibilities while resources for occupational health were cut back.⁶

Beyond these facts lies a more sordid story. Dr. Wilhelm Hueper, who was Chief of the National Cancer Institute's Environment Cancer Section from its genesis in 1948 until 1964, ascribed the reticence of the Public Health Service in occupational and environmental cancer prevention to "political pragmatism providing a convenient cover for personal greed and corruption."⁷ Looking back on nearly 3 decades of government performance in 1976, Hueper described the problem as a structural one in American society: "the same old game is still played by new men with the old cards."⁸ Hueper supported his assertions with numerous examples drawn from his personal experience with federal and state health officialdom. His examples included cover-ups of: scrotal cancers among oil refinery workers, by the Ohio State Health Department; tumors in animals fed waxes used in milk cartons, by the National Cancer Institute; and occupational lung cancer in Colorado uranium miners, by the National Cancer Institute.

It must be borne in mind that U.S. government inspectors did not have the right of entry into general industrial workplaces until the 1970s (with passage of the Occupational Safety and Health Act of 1970). In prior decades, the Public Health Service

depended on what Hueper called "harmonious relations with industry" to even conduct its industrial hygiene studies. Not surprisingly, the Service's published findings and recommendations were minimally offensive and burdensome to industry. Government and industry participants were well aware that, eventually, enforceable state regulations might follow along the lines of the P.H.S. recommendations. Had the government hygienists published stronger reports, they risked not only widespread industry non-cooperation but also lobbying by industrial parties to cripple or kill their small program through the annual Congressional appropriations process. Political operatives at the highest levels of the Public Health Service were also mindful of the problems their published findings could cause for employment and later the War effort in the years 1930-1945. (These were the most productive years of the Service in industrial hygiene.)

By 1951, with its appropriations budget soaring, the Public Health Service's National Cancer Institute acceded to industry demands and restricted research on occupational cancer. Dr. Hueper was forbidden to contact industry and state health departments by the Surgeon General. Later in the 1950s, his bosses in the Public Health Service prevented Dr. Hueper from appearing and presenting findings at scientific meetings. His review articles were withheld from publication for extended "peer review," including surreptitious reviews by DuPont medical men.^{8,9}

The power of business interests was at least equally dominant at the state and local level. By 1950, Delaware, self-proclaimed "Chemical Capital of the World," was one of the only two states in the country that had not set up an industrial hygiene program. No doubt a large part of the reason for this is the success of the state's leading employer, DuPont, in projecting the image of a "benevolent employer" while maintaining a stranglehold on the economic and political life of Delaware. By the use of skillful propaganda, token changes, and the promotion to management or dismissal of worker leaders, etc., DuPont has been eminently successful in thwarting union drives to this day. Through its dominance in every aspect of community life (control of the United Fund; ownership of the newspapers and

magazines; control of the banks; board of directors membership and charitable donations to public and private schools, hospitals, museums, churches and community groups; control of the Delaware Bar Association; ownership and control of development interests, etc.)—DuPont and other firms faced essentially no organized opposition for generations in what Ralph Nader's researchers have called *The Company State*.^{10,11}

Industrial hygiene programs of most other states prior to 1970 could hardly be characterized as regulatory, however. Typically, these operations were small and had no enforcement powers. Widespread, uncontrolled exposure to industrial health hazards consequently went mostly uninspected by government officials. The government personnel were often not well trained in occupational safety and health. Few states or local agencies employed an occupational health physician. Few agencies had the necessary sampling gear and laboratory facilities to do proper inspections of the workplace. Government salaries were low, and the more qualified industrial hygienists were commonly attracted by offers of better pay in industry. The federal government's withdrawal from the field in the 1950s was thus accompanied by rapid attrition at the state and local levels.

At least some union leaders were aware of the workers' tragic situation in those years and pleaded for both more humane conduct by industry and federal legislation.¹² The ignorance of the unions about the magnitude of the occupational disease problem had a lot to do with their limited efforts to bring about reforms. Underlying causes of labor ignorance on this issue included: 1) the abject lack of study of these problems by industry and government; 2) the suppression and misleading reporting of some research that was done by industry and its contractors; and 3) the dearth of labor-oriented professionals in the field of industrial hygiene and medicine. The response of the unions would probably have been much greater even if only the third cause of their ignorance had not existed. There was, after all, an abundant global body of literature in print on occupational health hazards and means for controlling them. Health professionals allied with unions could have had an enormous impact.

But before 1970, most employment available in occupational health was in industry. University faculty depended on industry good-will for research funding, consulting, and field experience and jobs for their students. The few government jobs were poorly paid, irregularly funded, and hardly equipped with the necessary resources either legally or technically. There were no full-time jobs in occupational health in the unions.

The industrial physicians were organized into a professional association in the U.S. starting in 1916 (American Association of Industrial Physicians and Surgeons, now called American Occupational Medical Association). The demand for industrial physicians grew rapidly, as employers sought to "combat Bolshevism from within" by placating labor in the years immediately following the Russian revolution and the World War's devastation of European industries. The industrial physicians' group met regularly and issued its own journals starting in 1932. *Industrial Medicine*, the first of these journals, contained not one strong editorial (over 20 years publication) decrying the uncontrolled threats of occupational disease so widespread in industry. Papers describing newly discovered health hazards in industry were extremely rare. In contrast, there appeared an abundance of papers on malingering, absenteeism, and emotional factors in employee health.

Dr. Carey McCord, a frequent contributor and in later years the editor of *Industrial Medicine*, spoke at the annual congress of the National Safety Council in 1933. He warned that "plaintiff prone juries" constituted good cause for chest X-ray screening of new hires. He advised employers against apprising "any undischarged workman of his condition," and went on to assert that, "about four out of five litigants alleging dusty lung diseases are in fact free of such diseases." No evidence was offered to support this contention. Dr. McCord proceeded to then prescribe 11 medico-legal defenses to occupational disease claims, "claims richly deserving defeat."¹³

The industrial physicians' group was as much a social club as a professional organization, with great attention paid to such details as new member admissions, raising the status of members, and giving out awards at annual meetings.¹⁴ Only in 1976 did the American Occupational Medical Association, then

4,000 strong, adopt a code of ethics and establish an ethics committee. The Chairman of the ethics committee in 1984 did not know of a single example of censure of a member by the committee, however.¹⁵

The American Medical Association established a Council on Industrial Health in 1938. Though speakers such as unionists and industrialists were invited to the annual Congresses held by the Council, the key players were industrial physicians and their consultants in the insurance industry, private practice, and academia. The *Journal of the American Medical Association* (J.A.M.A.) published short summaries of these meetings typified by the following excerpts from the report of 1953: "For every case of occupational disease, (Dr. R. Johnstone) said, there are a thousand cases of fear, frustration, and futility arising from a failure in human relations." At the same meeting, the President-Elect of the A.M.A. chimed in with praise of "unlimited medical advances that are possible under the system of free enterprise."¹⁶ These meetings were not scientific discussions about occupational health, and the A.M.A. Council on Industrial Health was eventually eliminated as a result of budgetary constraints.¹⁷

The industrial medicine and hygiene establishment opposed mandatory industrial hygiene standards. Industry lawyer Theodore Walters of Baltimore said administration of workplace limits "in a police sense" would be a "tool in the hands of labor unions," at the 1954 annual meeting of the Industrial Hygiene Foundation. Harvard professor Philip Drinker, a featured guest at such gatherings and a member of I.H.F.'s Board of Trustees, agreed that any codes should be advisory, otherwise they would be "a severe burden on industry and an unfair one."¹⁸ The industrial physicians' group (at that time called Industrial Medical Association) clearly agreed that they should not be subjected to what they characterized as the arbitrary and ignorant tyranny of mandatory workplace standards enforced by the government.¹⁴

The history of physicians in industry, certainly in the asbestos industry, indicates that they were a self-select, management-oriented group. They served at the pleasure of higher management for the purpose of controlling employers' costs for injuries

and illness at work. They also gave respectability to the primacy of the physician's role as maintaining the individual in good *working* order—a view that became more widely accepted during the Second World War but did not end with the armistice. The physicians in industry either understood or learned on-the-job about the limits of management receptiveness to health-promoting recommendations not cost-effective *to management*. The asbestos story is replete with examples of management disregard for altruistic health protection ideas (employee education, warning labels, user pamphlets advising safer procedures, engineering controls in factories, removal of affected employees from exposures, publication of research, substitution of asbestos by safer materials, filing of compensation claims for employee disability by management, etc.). Corporate medical men were called upon to testify as management "expert witnesses" in compensation and legislation arenas, in addition to muddying the waters of the published scientific literature with misleadingly mild or simply unsupported, benign evaluations of the hazards in industry. Despite the continuous medical surveillance in many major U.S. industries since the 1930s, there were extraordinarily few "discoveries" published here about occupational disease problems identified by industrial physicians—prior to 1970. In this climate of corporate control of the field of industrial medicine, the industrial physician virtually had to either go along with unethical practices or get out of the specialty altogether.¹⁹

Only after 1970, with federal funding, research, and regulation creating an influx of independent experts in industrial medicine, was there pressure for change. Not the least dramatic indication of this change is the striking difference in content and quality between the *Journal of Occupational Medicine* (American Occupational Medical Association's official publication since 1959) and the independent *American Journal of Industrial Medicine* (started by Dr. Irving Selikoff and others in 1980).

Physicians in general practice might have been reached by well-directed, modest government medical education programs in previous decades. However, no such programs were

mounted. The Public Health Service merely made Dr. Hueper available upon request as a lecturer at medical schools and issued a thin volume of unannotated references, *Outline of Lectures on Industrial Disease for Medical Students*. Given the continuing ignorance of the medical profession, state laws requiring the reporting of occupational disease to state health departments were doomed to failure. Even today, this deficit in general medical education is the cause of much unrecognized occupational disease—for only cases of *suspected* occupational disease have a chance of being referred to occupational medicine specialists.

Due to the reticence of the medical profession to confront the problem of occupational disease, an important role was played by industrial hygiene engineers and toxicologists in the years 1945-1970. Following World War II, the American Conference of Governmental Industrial Hygienists, an organization established in 1938, began to issue annual lists of Threshold Limit Values (TLVs) for toxic vapors and dusts in the workplace air. This served a vital need to set guidelines for preventing acute health effects on the job. The 1946 list included 144 limits for specific gases, vapors, dusts, fumes, and mists.

ACGIH solicited industry participation, and did not at first publish the documentary basis of its TLVs. Industry communications were sometimes held confidential, even while serving as the primary basis for setting threshold limits for some materials. Technical (i.e., essentially economic) feasibility was considered in setting TLVs from the start, so these limits were clearly not purely health-based guidelines. As local and state health and labor officials, most members of ACGIH must have been concerned about setting guidelines that their districts' industries were not achieving.

It was inevitable that some such guidelines would eventually be adopted as mandatory codes by government authorities. From industry's point of view, a pliant ACGIH committee of toxicologists, industrial hygienists, and chemists offered an opportunity to preempt more onerous possibilities. Government activity during the first years ACGIH issued annual lists of threshold limits was growing rapidly, and medical and nursing personnel made up one-third of the professional staffs in the

occupational health agencies operating in 46 states.²⁰ Doctors, together with engineers and chemists in at least some of these agencies, had the capability to set limits on their own. California had in fact done so since 1936, and other states including Massachusetts, Oregon, and Ohio followed with exposure limits they had developed by 1946. It was very possible that, with the War over and the economy booming, unions would be able to achieve legislative changes so that some of these lists of advisory guidelines would suddenly be backed by new enforcement powers.

For the states, ACGIH's list of TLVs offered a way out of major difficulties. It allowed the individual states to avoid the economic disadvantages attendant upon having health-protective guidelines more stringent than those in other states competing for industry. It meant that medical personnel in the state programs could be eliminated, since the guidelines set for exposure—really a medical judgment—were being issued by an ongoing national organization. In fact, medical personnel declined in number from one-third to only one-sixth of the state agencies' professional staffs by 1955.²⁰ The Committee on Threshold Limits also had a cordial relationship with industry—and consequently a better chance of gaining access to unpublished industry data than any aggressive state industrial hygiene department could expect to have, setting limits on its own.

The TLV Committee's limited familiarity with clinical medicine and medical literature and common reliance on unpublished reports and acute-exposure animal studies might easily have caused problems in gaining *scientific* acceptance of the TLVs. The ACGIH was a voluntary organization and not an official government body. Initially, no physicians were on the ACGIH Committee on Threshold Limits. Animal data from two-week lethal-dose tests were (and still are) heavily relied upon in assigning limits for continuous worker exposure to some substances by the toxicologists on the Committee. For substances on which little was published, private communications from financially interested parties sometimes constituted the main or sole basis for the TLVs selected. But the TLVs were nonetheless quietly accepted, and no competitive effort was

made by anyone. It was rare that critiques of the TLVs appeared in print, and such critiques were usually offered in general about the list rather than in particular about specific limits for substances on it.

Yet it is obvious that the Committee on Threshold Limits has never had the resources to properly support TLVs with full and up-to-date scientific documentation. The Committee's annual budget in recent years was less than \$30,000, most of which paid travel and lodging expenses to convene Committee meetings. Extreme reliance has always been placed on the Committee members' voluntary efforts and independent access to the necessary technical resources.²¹

It was evident that many substances for which TLVs were set did not satisfy an essential theoretical requirement for safe, continual, occupational exposure: reversibility. Substances that caused cumulative, chronic, and irreversible organ injury could hardly be assigned safe limits, even if those limits were not based on inadequate short-term exposure tests on humans and/or animals.

The extreme lack of documentation of the TLVs has been criticized on this basis and others by the West Germans, who had at first simply accepted the U.S. values and are now cautiously starting to modify them. A review of 150 chemicals on their list showed that less than 10 percent of the limits were based on "sufficient animal tests and/or field experience." TLVs for most substances that had remained constant over more than 20 years, "in most cases" remained so because nobody had reassessed them, according to a leading German expert.²

As mentioned, unpublished communications from industry were accepted by ACGIH as the *sole* basis for setting some of the TLVs. The 1986 *Documentation of the Threshold Limit Values* includes 15 such examples of substances, some widely used in industry. A larger number of other compounds (89) have TLVs *mainly* based upon unpublished industry communications.^{22,23} In at least some cases, these communications downplayed or ignored adverse findings. Some of these unpublished communications were never conveyed in writing but occurred over the telephone.

The lax policies of the TLV committee invited abuse, since companies could practically write their own TLVs for substances not independently and openly evaluated in the scientific literature. By the early 1950s, industry medical consultants (e.g., Dr. Arthur Vorwald) had started to find their way onto the TLV committee; this provided further reassurance to industry that the ACGIH was not a threat.

Subsequent to 1970, corporate employees became "liaison members" of the TLV committee. In recent years, much has been disclosed about the nature and extent of their activities.²³⁻²⁵ Corporate employees of Dow, DuPont, Bayer, and other firms have been assigned primary responsibility for documenting TLVs for well over 100 substances, including at least 80 produced by their employers.²⁶

Sheldon Samuels of the AFL-CIO Industrial Union Department has watched with rising indignation as ACGIH has opposed OSHA and NIOSH efforts to apply stricter limits than the TLVs. Samuels has urged ACGIH to disband the TLV committee, calling its members "self-appointed agents of unnecessary death and disease."²⁷ Other union occupational health leaders in the U.S. express similar sentiments, and the chairmen of the ACGIH and the TLV committee have both expressed hope that NIOSH will take over the task of recommending exposure limits soon.

Tarlau, in an editorial in the *American Industrial Hygiene Association Journal*, has critically examined the extent of corporate influence and unscientific, irregular procedures of the TLV development process, and written: "This scandal leads to the inescapable conclusion that the ACGIH TLVs are tainted and unreliable."²⁸

Roach and Rappaport have reviewed the TLV *Documentation* and found no relationship between the TLVs and the human experience of adverse health effects in the literature cited as the basis for the TLVs. They did, however, find a close relationship between the TLVs and the prevailing levels of exposure reported in the cited studies.²⁹

No doubt some of the people who helped draft these weakly supported guidelines starting in the 1940s were amazed to see the whole list of them for 1968 grandfathered into force as U.S.

federal regulatory limits in 1971. With an arduous ritual of "due process" established in the Occupational Safety and Health Act for changing these "standards," most of the ones on the 1968 list were still in effect in 1988. By 1980, ACGIH had revised 160 of the limits on its 1968 list, but OSHA had issued regulations for only about 20 substances.³⁰ OSHA acknowledged in 1983 that its health standards were based on industry guidelines, and that employers "might have to be 20 years behind the times" to be in violation of them.³¹

Thus it turned out that the TLVs have presented few difficulties for industry as advisory guidelines, and they have not been particularly onerous as enforceable federal limits (1971 to date), either. Most of these limits were, after all, designed to prevent immediate effects that would disable the worker on the job. Whatever the motivations of the original TLV committees may have been, their work was conveniently timed and managed in a way that industry could accept and critically influence. As a close examination of the asbestos case study shows, industry's leading experts placed no credence in the safety of the TLV readopted year after year for decades by ACGIH. Nor did industry practice appear to be affected by the publication and adoption of the TLV as a guideline. Disregarded in practice until the imposition of federal standards in the 1970s, the old TLV for asbestos is raised in a curious way in defending against current lawsuits. Manufacturers being sued today say they didn't know or suspect that the use of their products was a danger, claiming that they believed product use entailed exposures less than the TLV.

STANDARDS FOR ASBESTOS

Defendants in asbestos litigation today point out that a Threshold Limit Value (TLV) was proposed in a 1938 report by the U.S. Public Health Service, and this was adopted as a good practice guideline over the next 30 years before stricter limits were established. Manufacturers of asbestos products and asbestos mining companies now claim that they believed the TLV advised in 1938 was a safe level during the succeeding three decades.

An associated claim is that the Public Health Service study (and an earlier one in England) involved asbestos textile plant workers, whose exposure was to "pure asbestos;" and therefore the findings from such studies could not be directly applied to workers using asbestos products whose asbestos content was only 15 to 25 percent (magnesia insulation, asbestos cement products, etc.). Since the early air sampling data included *total* particle counts, it would certainly have made a big difference if the particle counts in one process contained pure asbestos fibers and the counts from another process contained only a minute fraction of asbestos fibers. But were the workers in the textile plants exposed to an airborne dust consisting of such high fractions of asbestos fibers? At least two investigations from the 1930s and a confidential industry study in 1947 show that the vast majority of the airborne particles in asbestos textile plants were not asbestos fibers. In the factories, as in the field, the fraction of asbestos in the airborne dust varied widely and depended upon the particular task being done by the worker and by those nearby.

An issue not raised to justify adherence to the TLV is that the TLV was aimed at controlling asbestosis, and subsequent to its proposal in 1938 it became clear that asbestos was also carcinogenic. The additional hazard of cancer rendered any TLV based on preventing asbestosis alone particularly unreliable as an index of safety.

Ever since the survey of Merewether and Price in England 60 years ago, scientists have grappled with the question, "what level of asbestos dust in the air is safe?" Statements purporting to answer this question were for the most part unsupportable at the time they were made and some admitted as much. The Public Health Service's tentative recommendation in 1938 was quantitatively discredited by an earlier study in Pennsylvania, which the P.H.S. study described.

Our current deficit of knowledge on the dose-response relationship for occupational asbestos exposure is a legacy of past failures to investigate hazards in the industry (and to fully publish the work that was done). The pleas of Hoffman, Donnelly, Hueper, and others for occupational disease studies

in the growing asbestos industry document the longstanding recognition of the problem.

Early British Factory Surveys and Standards

Merewether and Price found a less severe asbestosis problem in the least dusty asbestos textile process areas. These processes were "spinning, braiding, and plaiting without local exhaust ventilation." Dustiness of other processes was expressed relative to these least dusty processes, but no absolute dust concentrations were given. The authors showed that persons with fibrosis in these "spinning" type processes had an average of 18.7 years in the industry, compared with 10.9 to 13.8 years for asbestotics found working in the more dusty processes.²⁵

The apparently less severe incidence of asbestosis found among "spinners" (term used for the collective minimally dusty processes) was emphasized.³²

(I)n order to prevent the full development of the disease amongst asbestos workers within the space of an average working lifetime, it is necessary to reduce the concentration of dust in the air of the workrooms to a figure *below* that pertaining to spinning at the time over which these cases were exposed. (emphasis added)

Following the large-scale survey by government inspectors, Merewether and Price, the British authorities moved to establish standards for dust control. Central to this process was the question, "what concentration of airborne dust would not damage the health of workers after a working lifetime in the industry?" A government-industry committee took up the dust control question.

The committee consisted of Mr. Price and another government engineer, and one representative each from Cape Asbestos, Turner Brothers Asbestos, and British Belting and Asbestos. The committee acknowledged that the dust from some processes "appears to be too small in the light of present knowledge to warrant recommendations being made for its suppression ..."

The opinion is necessarily based on one important assumption, namely, the existence of a critical limit of dust below

which workers may be employed without injury to health. As the Committee rightly observe, the only working basis that can be adopted at present is a finding of the previous Report which suggests that the conditions in "flyer spinning" carried on without exhaust may be regarded as the "dust datum"; it is however desirable to emphasize that this limit is clearly provisional and is subject to alteration in the light of further medical experience.^{33,34}

Thus, the government-industry committee in effect said that flyer spinning was provisionally acceptable uncontrolled.

This report, like the government report of Merewether and Price, contained not a single dust measurement.

Merewether did publish 51 dust measurements in his 1930 paper in *Journal of Industrial Hygiene*.³⁵ They ranged from 14.3 (braiding) to 179 million particles per cubic foot (MPPCF). Exposure levels for "spinning" were 17.6, 27.0, 30.4, 41.2, and 171 MPPCF. [Note that the air sampling instruments and analysis used at this time counted all sorts of microscopic particles in the air, not only asbestos fibers.] In virtually all cases other processes were carried on in the same room, rendering it extremely difficult to interpret the data in terms of dustiness by process. Quite likely, the exposure of "spinners" in these plants had as much to do with their proximity to other more dusty processes than to the dust from spinning per se. Merewether said only that the figures for spinning, plaiting, and braiding were "believed to be rather too high, owing to contamination of dust from neighboring and more dusty processes, and further investigation is required here."

Merewether's dust counts were obtained using an Owens Jet sampling device. In 1938, factory inspector Kenneth Goodall returned to the J.W. Roberts factory in Leeds, where Merewether had recorded his dust counts. Goodall's 6 samples were taken by thermal precipitator, which was believed to be more efficient in sampling respirable dusts than the Owens Jet device. Dust concentrations for flyer spinning in a room not visibly dusty ranged from about 8 to 24 MPPCF. These counts were not published and have only come to light in recent reviews of public records.³⁶

Merewether had seen 10 cases of asbestosis in spinning, plaiting, and braiding workers, among 47 with ten or more years' employment in the industry.³² Apparently, he hoped that control of dust from other processes would suffice to protect these "spinners" in the future.

The Asbestos Industry Regulations were framed in 1931 and resulted from meetings between the government officials and representatives of the asbestos industry. These work practice and engineering control requirements took effect in March of 1933, and covered:

- application of local exhaust ventilation, coupled with effective process enclosure
- substitution of enclosed mechanical methods for hand conveyance and for dusty hand work in general
- substitution of wet methods for dry
- elimination of certain dust-producing devices
- separation of processes and isolation of storage chambers to prevent unnecessary "bystander" exposure to dust within the factory
- use of sacks of close texture material for internal handling in the plant with cleaning of them by machinery (not hand shaking)
- regular maintenance of the ventilation system
- prohibition of employment of persons under age 18 in the most dusty processes

The British government rejected the request of the Trades Union Congress that the regulations also apply to workers involved in the removal of old boiler insulation. This was a suggestion of Reginald Tage, a man who appears to have had no formal scientific training, but who had investigated cases of asbestosis and identified one case attributable to insulation work. The regulations were acknowledged to have "certain

exceptions as regards application," according to a note from the Deputy Chief Inspector of Factories to the Chief Inspector:³⁷

(W)ork on board ships has been found to present such great difficulties in the way of adequate protection that we have thought it better to omit it altogether from the present Regulations pending further enquiry as to what action can be taken.

The industrial hygiene measures were coupled with the Silicosis and Asbestosis (Medical Arrangements) Scheme, which had come into force in 1931. This authorized a full-time medical board to manage the medical examination of asbestos factory workers upon hire and periodically thereafter. The same board conducted examinations in claims for disablement, and granted appropriate certificates in connection with occupation-related disablement and death.

Together with the extended Workmen's Compensation (Silicosis and Asbestosis) Act, 1930, which created a scheme of disability compensation for asbestosis, the above measures constituted the first comprehensive national regulatory response to the asbestosis threat.³⁸

The British government's response to the asbestos threat was limited in some very important ways, however, because of resistance by that country's dominant asbestos conglomerate, Turner & Newall. For one thing, the Asbestos Industry Regulations did not extend any protection to users of asbestos products, despite Merewether's and Price's expressed concern that insulation work such as that done at shipyards was the most important aspect of asbestos use outside of manufacturing plants. In the words of T&N Secretary (top corporate attorney) John Collins,³⁹

Before the Asbestosis Regulations came into effect in 1931, we were similarly given the opportunity of making representations to the Home Office as regards the wording thereof, and certain suggestions we then made were accepted having the effect of excluding all manufactured products from the operation of those Regulations, and

confining the latter in effect to asbestos *fibre* in its dry and unmanufactured state.

But the Medical Arrangements and Compensation Schemes raised problems of their own for the asbestos companies and insulation contractors. A meeting of T&N managers initially concluded that the requirements would apply to insulators because their work entailed mixing insulation compositions.⁴⁰ Facing a July 31, 1931, deadline for conducting medical examinations, the T&N men worried about insurance increases and feared that unions representing the workers would demand "danger money."⁴¹ Upon further examination of the regulations, Newalls Insulation Company executives decided the rules could be inferred to not apply to insulators, after all. It would have to be maintained that: 1) Newalls insulators did not and had been instructed to not saw magnesia sections in a dry state on the site of an insulating job; and 2) powdered asbestos insulating compositions were "always mixed with water which prevents anything in the form of dust." Newalls director George Carter urged that this be "the line taken," and it evidently was.⁴²

The Board Minutes of T&N of July 23, 1931, explain that the company was also instrumental in assuring that insulation workers would not receive periodic medical examinations to determine if they were developing asbestosis and incidentally have the opportunity to discuss their disease risk with doctors who knew about asbestosis.

The Joint Secretary reported that as a result of the discussions which Dr. R.H. Turner has had with Dr. Sutherland, the Chief Officer of the Medical Board appointed under the Medical Arrangements Scheme, it now appears probable that insulation coverers will be excluded from the terms of the Medical Arrangements Scheme although they will be subject to the Compensation Scheme.

Other workers not included in the Medical and Compensation Schemes, according to Robert H. Turner, were men who unloaded and brought asbestos fiber into the factory. At the company's plant in Trafford Park, there were workers who had been doing this task for many years, and Turner wrote that he

would be "very surprised if they do not show Asbestosis symptoms." He continued,⁴⁴

I am not suggesting that these men should come under the Medical and Compensation Schemes as there is no liability in connection with this operation, but it is in our interest to see that we do not have any claims from operations outside those already scheduled, otherwise these operations will also be included and we shall have to spend a lot of money in overcoming the problem of handling crude.

Turner went on to order a solution that would minimize the company's risk, if not that of its work force:

It seems to me that this is an operation which should have a change of operatives every two or three years, to be on the safe side.

Later in 1932, T&N was informed that the government was finding asbestosis in workers employed in "warehousing, packing, and despatch of asbestos products." Merewether and Middleton had examined workers at a number of locations who had not been employed in asbestos manufacturing processes. The doctors concluded that workers described as packers, storekeepers, and warehousemen were "exposed to a definite but very variable risk of asbestosis." Particularly with insulating materials, they found the dust evolved to be "considerable" and "comparable with that in certain manufacturing processes included in the Scheme"⁴⁵

The Home Office informed the larger asbestos companies that an extension of the Asbestos Industry Scheme, 1931, was under consideration and invited them to discuss the matter. R.H. Turner promptly moved to hold a meeting of the industrialists prior to sitting down with the government officials, "to devise an organised line of resistance."⁴⁶ At the meeting, the company representatives gave "definite assurance ... that the Scheme would be interpreted broadly so as to cover all genuine cases of asbestosis occurring in the works." On that basis, the Home Office decided not to expand its order to include this group of workers.⁴⁷

Another process not addressed by the 1931 regulations was that of spray application of asbestos insulation, introduced in 1932 and shortly thereafter denounced by Dr. Donald Hunter as "murderous" at a meeting of the Medical Society of Manchester.⁴⁸

The regulations did not apply to "occasional" work for less than eight hours in a week. Turner & Newall Secretary John Collins advised sending *different* workers to do one job rather than the same man each time, to avoid problems over the interpretation of "occasional."⁴⁹

One job that was covered by the Asbestos Industry Regulations was the making of insulation "mattresses" in premises not equipped with dust extraction equipment. Here, R.H. Turner decided that capital expenditures for exhaust ventilation were not justified, and directed his manager to continue to manufacture mattresses for repair work, providing only respirators to the workers.⁵⁰

In other words, we must take a small risk by stretching the regulations to suit our own ends.

U.S. Reports Relating Degree of Exposure to Degree of Disease Risk

Within a year, Dr. Harold L. Stewart and coworkers reported another case of asbestosis in a spinner.⁵¹

The patient had worked as a spinner in an asbestos mill for nine years. Although the atmosphere was not very dusty, he wore silver dust protectors in his nostrils.

This individual had left the asbestos job 5 years before his death, and asbestosis was found at autopsy. The report notes, with respect to prevention:

The exposure was for nine years in a comparatively well ventilated factory in which precautionary appliances were used, and yet the patient developed a minor grade of the disease. It would seem that further precautionary means are necessary in this occupation to obviate a disease itself so preventable.

In the other case reported by Stewart, *et al.* the asbestosis was severe. This individual had worked in an asbestos factory for only 9 months in 1921, and had taken no precautions against the inhalation of dust. Commenting on the second case, the authors illustrated the connection between short-term, heavy exposure and longterm, brief exposure. They concluded that respiratory protection should be very widely used in work with asbestos:

This demonstrates that the symptoms of a pneumoconiosis may come on years after a short exposure *and emphasizes again the absolute necessity for wearing masks in even the less dusty atmospheres.* (emphasis added)

At the other extreme, Aetna Life Insurance Company physician Roscoe Gray, in his *Attorneys' Textbook of Medicine*, threw caution to the wind in interpreting the literature:

Since asbestosis practically does not occur with spinning, unless there has been previous exposure to more dusty processes, it is considered that the dust concentration of the spinning room is *safe*. Merewether found the dust count in this department to be as low as 506 to the cubic centimeter, equal to about 13,500,000 to the cubic foot. (emphasis added)*⁵²

Such reasoning may have been useful in contesting asbestosis compensation claims; but it is doubtful that it was used by Aetna to justify the sale of life insurance to asbestos workers.

In 1935, the state of Pennsylvania published the results of a medical and engineering survey of four asbestos plants.⁵³ Table 1 shows the distribution of 14 cases of asbestosis among the 56 people examined.

The data show an increasing prevalence and severity of the disease at 4.64, 16.9, and 44.3 million particles per cubic foot.**

*The correct equivalent of 506 particles per cubic centimeter is 14.3 MPPCF, as previously noted.

**Here again, all types of particles captured by the sampling instrument were counted, not just asbestos fibers.

Table 1⁵³ Incidence and Degree of Asbestosis with Relation to Occupation,
Dust Concentration, and Years of Exposure

Occupation	Average Concentration Millions of particles per cubic foot	Years of Exposure	Total Number Examined	Asbestosis				
				Negative	Slight	Moderate	Advanced	Doubtful
Preparers and Carders	44.26	0-5	3	2	—	—	—	1
		6-10	3	—	—	3	—	—
		11-15	5	1	1	3	—	—
		16-20	2	1	1	—	—	—
		over 20	1	1	—	—	—	—
		Total	14	5	2	6	—	1
Weavers and Spinners	10.87	0-5	3	2	—	—	—	—
		6-10	4	3	1	—	—	—
		11-15	4	3	—	1	—	—
		16-20	5	3	2	—	—	—
		over 20	2	2	—	—	—	—
		Total	18	14	3	1	—	—
Winders, Twisters, Warpers, etc.	4.64	0-5	4	4	—	—	—	—
		6-10	7	7	1	—	—	—
		11-15	8	8	1	—	—	1
		16-20	1	1	—	—	—	—
		over 20	4	4	—	—	—	—
		Total	24	21	2	—	—	1
Totals			56	40	7	7	—	2

The data indicate that the "safe" level is less than any in the range reported. An abstract of this study in *Journal of Industrial Hygiene and Toxicology* concluded that, "The study was too limited to permit the formulation of permissible standards of dustiness, but a reduction in the asbestos dust concentration in the operations studied is shown to be necessary."⁵⁴

Lanza and coworkers at the Metropolitan Life Insurance Company conducted the first industry-sponsored study of asbestosis published in the United States.⁵⁵ X-ray evidence of asbestosis was found in over half the workers examined (and in 87 percent of those with over 15 years in the plants). A total of 121 dust counts for various processes in five plants were tabulated. Most of the values were below 5 MPPCF, and only a few were as high as 40-82 MPPCF. The authors declined to recommend any level of asbestos exposure as a guideline, saying, "It is not practicable as yet to establish standards for the asbestos dust content of air."

Meanwhile, other events were setting the stage for a dust limit for asbestos. At a National Silicosis Conference in April, 1936, Alfred Hirth, Chairman of the Air Hygiene Foundation's Legal Committee, urged the establishment of "safe" levels of dust high in free silica content. The Foundation's Medical Committee, chaired by A.J. Lanza, then suggested a limit of 5 MPPCF, though they separately doubted the adequacy of scientific knowledge for setting a threshold to prevent silicosis. Vandiver Brown, whose desire that asbestosis be presented by Lanza as a "milder" disease than silicosis, would later remark that the 5 MPPCF limit for asbestos-containing dust was selected with it well in the mind that this limit "had already been prescribed for silicosis."^{56,57} Dr. Leroy Gardner, in a plant survey at an asbestos plant owned by U.S. Gypsum in 1936, advised keeping dust counts less than 5 MPPCF, noting that this limit had been "tentatively suggested" by various authorities for free silica. He also said, "It is quite possible that the safe limit might be even lower for asbestos than for silica."⁵⁸

Plant Surveys by the U.S. Public Health Service

The Public Health Service employed engineers, doctors, and chemists who performed studies on hazardous industries. While

the P.H.S. had no enforcement authority, its *Public Health Bulletins* and reports in scientific periodicals advanced the state of knowledge in many industries. These studies were widely cited and commented upon; they also were directed toward determining what degree of exposure was acceptable and what was not.

In the years 1935-1937 two separate investigations were conducted. The smaller one was published first, and consisted of an industrial hygiene engineering survey of an asbestos textile plant. This facility was not described as having the best available control technology; but it was believed to be "representative of the best practice in this country at this time."⁵⁹

A table of dust counts taken with and without the exhaust ventilation in operation showed that exposures were reduced 90 percent and more by the controls in most operations. Most impressive was the rise from 1.7 MPPCF to 62.4 MPPCF in the carding process after one hour's operation without exhaust. An abstract of this paper by Dr. Philip Drinker at Harvard concluded, "A final table shows clearly that the industry can keep dustiness well below 10 MPPCF."⁶⁰

Dreessen and others from the U.S. Public Health Service were meanwhile conducting a medical and engineering survey of three North Carolina asbestos textile plants. However, prior to the arrival of the Service, the mills discharged more than one fourth of their employees.⁶¹ Public Health Service researchers later noted,

The incidence of frank disease was so great that prior to the beginning of the study out of a total of less than 600 employees the plants discharged 150 workers suspected of having asbestosis.⁶²

The reports of the Public Health Service and local chest physicians leave no doubt that most of the people discharged had asbestosis.⁶¹⁻⁶⁵ Shull, for example, wrote:

During the latter part of 1934 it was my privilege to examine the chests of 71 of 100 workers who had been dismissed from local asbestos plants. All had undergone physical

examination before they were referred for roentgenologic study and were found to be physically disabled.

Most of the people diagnosed with asbestosis by Dr. Shull had worked for the Southern Asbestos Company, Carolina Asbestos, and Raybestos-Manhattan.⁶⁶ Of the fired employees that the Service was able to locate, 43 of 69 had asbestosis. No attempt was made to assess their exposures based on their former jobs in the plants.⁶¹

Some dismissals resulted from acts of the North Carolina government, following the *McNeely* decision, in which the state supreme court held that asbestosis was covered under workers' compensation. In 1935, North Carolina set up an industrial hygiene division, with a doctor and an engineer, and required that all workers in the three asbestos plants in the Public Health Service study be examined by the state doctor. Dr. Hammond Eason, who performed this task from 1935-1939, recalled that he did not issue "work cards" for some workers because they had asbestosis. However, his recollection was that "probably less than 5 percent" were dismissed because of his actions in any of those years.⁶⁷

The average age of the asbestos workers in the 3 plants studied was only 32.1 years. This was the youngest work force in any of the 14 industries that had been investigated by the Public Health Service. The plants themselves had only been in operation for 6 to 16 years. There were *very* few workers employed in the plants with medium-term service (10 years or more) in the lower-exposure production jobs. "Personnel not exposed to appreciable quantities of asbestos dust"—including 27 seeking employment and about four dozen office workers—were examined as "controls"; and if any of them had asbestosis it was not mentioned. Previously, asbestosis had been reported in long-term (30-40 year) clerical employees in asbestos plants.^{68,69}

By firing employees with long-term exposure, especially in the less dusty processes, the companies wiped out most of the data base the Public Health Service needed in order to develop any good dose-response data on asbestosis. Only 5 workers in the

study who were considered at risk of disease had been exposed to levels under 5 MPPCF for over 10 years. For those with the lowest exposure jobs, the investigators were almost apologetic about drawing conclusions:

None of the 39 persons exposed to dust concentrations below 2.5 MPPCF had a case of asbestosis, although as a matter of fact only 6 persons had been employed more than five years.

Three "doubtful" or borderline cases of asbestosis were found among the workers whose exposure was measured at 2.5 to 4.9 MPPCF.

Among those exposed to 5.0 to 9.9 MPPCF, with more than ten years in the industry, 13 of 19 had asbestosis. Others exposed to the same dust concentrations for only 5 to 10 years had also developed asbestosis (6 out of 37).

The symptoms of asbestosis were most prevalent among the workers who had sustained the highest lifetime exposures. For workers with a cumulative exposure product of more than 100 MPPCF-years, obtained by multiplying the number of years of exposure at each job by the level of exposure in MPPCF, then adding it all together to give an estimate of life-time cumulative exposure,

- 61% had cough vs. 8% of the control group
- 61% had dyspnea (shortness of breath) vs. 7% of the control group
- 20% blood-streaked sputum vs. none in the control group
- 50% had impaired diaphragmatic movement vs. 2% of the controls

One of the four workers with the most severe grade of diaphragmatic fixation had only been exposed for less than 50 MPPCF-years (the others had had 100+). "Severe forms of diaphragmatic fixation accompanied advanced stages of lung fibrosis."

Asbestosis prevalence was related to cumulative dust exposure: 5 of 196 with less than 25 "million particle years" had early asbestosis. Three out of 84 with 25-49 million particle-years' exposure had early to moderate asbestosis. Thirteen out of 56 with 50-99 million particle years of exposure had asbestosis ranging in grade from minimal to moderately advanced. Of those with over 100 million particle years, half had asbestosis.

Nine case histories were presented, including: (Figure 49) a spinner with total exposure of 103.8 million particle years and advanced asbestosis; a weaver with 109.2 million particle years and moderately advanced asbestosis; and a spinner (Figure 51) with asbestosis and a total cumulative exposure of only 88.5 million particle years. At 5 million particles per cubic foot, these exposures would have been sustained in 21, 22, and 18 years, respectively. These data showed that a teenager going to work in the asbestos industry, exposed to 5 MPPCF on the average, could develop asbestosis before age 40.

Nonetheless, the Public Health Service investigators were determined to set some level of dustiness which could serve as an interim guideline in the asbestos industry.

Because of the importance of the problem, it seems to be desirable to use such data as are at hand to define tentative safe working conditions that may serve as standards for the guidance of factory managers and engineers until more complete data are available ...

Ideally, a threshold concentration of dust should be the highest dust concentration that would not produce pneumoconiosis in originally healthy workmen during their entire working life.

Because clean-cut cases of asbestosis were found only in dust concentrations exceeding 5 million particles per cubic foot, and because they were not found at lower dust concentrations, 5 million particles per cubic foot may be regarded tentatively as the threshold value for asbestos dust exposure until better data are available...

In order to find out the levels to which asbestos dust concentrations have been reduced in practice, an engineering study was made in an asbestos textile factory in which

dust control equipment has been recently installed. This shows that means are already available for reducing the dust exposure of a majority of asbestos textile workers to less than 5 million particles per cubic foot.

A very attractive feature of the 5 MPPCF limit was that it could be achieved, and in fact was being achieved, in every process except "picking" at one of the North Carolina asbestos textile mills in the study. The use of pitchforks to feed the picker machine was also described. However, the exhaust equipment used in that plant could not get dust concentrations below 2 MPPCF for most of the processes. The exhaust fan flow rates were by no means large, handling air flows of only 625-2570 cubic feet per minute (CFM). A 2570 CFM fan would have a power rating of only about 2 horsepower. The use of more high-powered exhaust fans than had been voluntarily applied by this textile mill was clearly technologically feasible, but would have raised capital and operating costs.

It is clear that the government investigators, who had no power to even enter plants, much less order the industry to clean up, sought to prescribe minimally burdensome guidelines. Though they frequently characterized the 5 MPPCF threshold as a *tentative* guideline, they also offered less guardedly optimistic statements, such as the closing sentence of the report:

It would seem that if the dust concentration in asbestos factories could be kept below 5 million particles (the engineering section of this report has shown how this may be accomplished) new cases of asbestosis probably would not appear.

The Public Health Service report even cited the 1935 Pennsylvania study showing the incidence of asbestosis increasing with the concentration of airborne dust, with no level of exposure free from disease risk:

In their report of a similar study carried on in Pennsylvania asbestos textile factories, Fulton, Dooley, Matthews, and Houtz found that 8 percent of the workers exposed to an average dust concentration of 5 million particles per cubic

foot had asbestosis; 22 percent of the 17 million particle group; and 57 percent of the 44 million particle group had asbestosis.

The conflict between the Pennsylvania findings and the 5 MPPCF threshold recommended by the Public Health Service was not resolved in the Service's report.

Sayers and Dreessen republished the P.H.S. findings in abbreviated form in the *American Journal of Public Health* in March, 1939.⁷⁰ Apparently, this was promptly passed on by A.S. Rossiter, Editor of *Asbestos*, to Sumner Simpson, President of Raybestos-Manhattan. Simpson, in his reply, acknowledged the feasibility of a 5 MPPCF limit.⁷¹

(H)e [the Public Health Service authors] does say that where the air can be kept down to five million microns, (sic) there is no danger, and I can tell you confidentially, but am not willing to make it public, that the air can be kept below five million microns, with proper controls, but I am not willing to start a controversy with my competitors.

Though it may sound like a high concentration, 5 MPPCF of dust in air is not even visibly dusty. Some idea of how little asbestos or silica can be harmful was evident from comparisons of dustiness in industrial environments and other places. Hurlbut at Harvard reported air sampling analyses as follows in Rochester, New York:⁷²

Lobby of Hotel Rochester	39-49 MPPCF
Riviera Theatre	69-78 MPPCF
Court house, courtrooms	30-43 MPPCF

Asbestos Fiber Fraction of Inhaled Dust

One of the more serious problems with the limit of 5 MPPCF arose from the limitations of using the impinger air sampling method, which counted total particles and not just fibers (or, even more specifically, *asbestos* fibers). Obviously, different processes entailed different exposures to asbestos particles as a fraction of total airborne dust particles. Workers unloading sacks of asbestos fiber might be exposed to much higher

fractions of airborne asbestos than others in the same plant grinding brake linings, for example. Yet with the total respirable dust as the sole index of exposure, even large variations in the asbestos exposure itself were not taken into account.

The Public Health Service found that (*asbestos and cotton*) fibers made up only 1 to 26 percent of the dust particles in the air, 8 percent and below in most operations. (Table 2) This was in rough agreement with mineralogists Hurlbut and Williams (the latter from Liberty Mutual Insurance Co.), who found that asbestos made up 8 to 15 percent of rafter dust particles in asbestos textile plants, and no more than 3 percent in other asbestos manufacturing processes.^{73,74} A confidential survey of asbestos textile plants also showed that non-fibrous particles comprised 80 to 95 percent of total airborne dust.⁷⁵

Table 2. Relation of Fibers to Particles in Various Owens Jet Samples

Activity	Number of fibers counted	Total count of fibers and particles	Percent fibers
Weaving ¹	83	316	26
Weaving ²	35	286	12
Picking ²	24	303	8
Carding ¹	22	315	7
Twisting ¹	14	289	5
Twisting ¹	14	280	5
Crushing ²	5	407	1

¹ Plant B

² Plant A

(From Dreessen *et al.* 1938)

At the Saranac Laboratory, Dr. Leroy Gardner was aware of the shortcomings of the standard measurement technique and guidelines based on it. He hoped to develop an improved device for sampling asbestos fibers using an electrostatic precipitator, and by 1943 had work in progress on the device. Gardner's views were expressed in his outline of a monograph he intended

to write on industry-sponsored studies at the Laboratory. The outline, sent to Vandiver Brown at Johns-Manville, included a section entitled "Recommendation for a New Standard of Safe Atmospheric Concentration of Asbestos Dust." Here Gardner said,⁷⁶

- While there is no official standard, the tentative one of 4 or 5 (MPPCF) is frequently quoted.
- This is probably unreliable because it is based upon sampling with a standard impinger which we have shown does not collect most of the fibres that are the source of the hazard.
- We now think that a standard should be based upon samples collected with an electrostatic precipitator if it is feasible to determine readily the relative proportion of fibres in such materials.

Fleischer and co-workers analyzed exposures in various shipyard insulation tasks for total airborne dust and for the percentage of asbestos fibers. The average air sample contained less than 2 percent asbestos, and there was considerable variation even for the same task in the same shipyard. Asbestos fractions as high as 10 percent and more were reported for layout and cutting, band saw cutting, and cement mixing. Dust sampling was done with the Konimeter sampling device.⁷⁷ (More detailed discussion of sampling devices appears in an early report of the Public Health Service and a more recent one by Walton.^{78,79})

It was recognized within the industry that standard dust counting measurements were a poor surrogate for analyses of the asbestos *fiber* concentrations in the workplace air. Asbestos Textile Institute minutes of 1953 noted that animal research at Saranac pointed to fibers longer than 10 microns as the principal agent causing asbestosis.^{80,81} "(T)he Industrial Hygiene surveys that have been made in the past, and in which only dust particles were measured, are practically without value," the member companies concluded.⁸¹ In 1958, the sampling methods in use still did not distinguish between "rock dust" and "asbestos fiber dust."⁸²

Dust Control Measures in Germany

One trade journal founded in Germany in the nineteenth century, *Gummi Zeitung* (Rubber News), became a journal for asbestos products as well. It carried an article in 1938 on medical and technical measures used to prevent asbestosis.⁸³ Technical precautions such as ventilation, use of dust masks in the most dusty jobs, and plant construction using smooth (easily cleaned) surfaces were recommended.

By this time, Regulations for Accident Prevention required that all workers in asbestos manufacturing be given preemployment physical examinations, including X-ray and clinical examination. The employment of any individual was contingent upon the physician's recommendation. Those employed in the more dusty jobs were required to have follow-up medical examinations some time after hire. In the state of Saxony, beginning in 1937 all asbestos manufacturing plant workers were examined annually by the medical factory inspector.⁸⁴

Prockat and Windel published two lengthy articles on engineering protection against asbestosis in the journal *Staub* (Dust).^{85,86} Abstracts in the U.S. and England noted the German investigators' belief that the danger from asbestos dust could be eliminated in practically all processes by well-designed equipment enclosures and exhaust ventilation.⁸⁷⁻⁸⁹

The government followed Prockat and Windel's recommendations very closely. In 1940, the *Gummi Zeitung* published "Guidelines for the Prevention of Health Hazards from Dust in Asbestos Manufacturing Plants. Effective as of 1 August 1940."⁹⁰ Some of the provisions were:

- extensive enclosure of dust-producing operations; use and maintenance of effective vacuum systems where working conditions result in substantial dust formation; no recirculation of air from the dust collectors back inside the plant; and use of adequate dust collectors so the dust-laden air is sufficiently well-filtered to protect the health of the population outside
- vacuuming of working areas after closing time, by properly protected workers

- design of new plants with smooth surfaces that can be easily cleaned of accumulated dust and elimination of window sills and similar projections where dust can settle
- use of enclosed conveyor belts and tightly covered containers for moving and storing asbestos
- preparing and manufacturing (e.g., sawing, grinding, filing) of products from asbestos-cement only under conditions of local exhaust ventilation
- plant officials required to contact the government industrial hygiene authorities before making substantial remodeling changes in the system (service free of charge)
- taking meals or remaining in dust-hazardous work areas during rest periods prohibited
- street garments not worn during work not to be left in the working area; dust retained on work clothes to be removed at regular intervals

Kuhn reported that in a German shipyard, workers were rotated out of asbestos insulation handling after two years of such work. He also described industrial hygiene measures used to protect shipyard insulators.⁹¹

In 1939, Baader in Germany wrote that,

(I)nsurance companies have unhesitatingly recognized and indemnified as occupational disease even mild asbestosis with fatal lung cancer.⁹²

Thus, the state insurance carriers in Germany recognized that life could be cut short by the development of lung cancer in a worker whose asbestosis had not become severe. It is possible that such a worker would have later died of asbestosis, and that it had taken no less asbestos exposure to cause lung cancer than to produce an ultimately fatal asbestosis. But the more likely inference is that the German authorities recognized that workers who had not been exposed to enough asbestos to die from asbestosis had nonetheless been exposed to enough asbestos to develop lung cancer (and die from it).

The British Shipyard Asbestos Regulations

The story of the U.K. shipyard regulations for asbestos is a long and tragic one, covering a period of 30 years after the need was recognized by the authorities.

The health hazard of asbestos insulation work, particularly in shipbuilding and ship repair, was noted in publications by Dr. Merewether in 1930, 1933, and 1938. In 1942, Merewether warned Bethlehem Steel shipyard officials about the danger during a visit to Massachusetts, at which time a suspected case of asbestosis in a worker was discussed. It is reasonable to assume Merewether also read in the published literature of cases of asbestosis in workers exposed to the dust from insulation products. In addition, Merewether was aware that insulators numbered among the deceased victims of asbestosis on whom the Factory Inspectorate kept records. His presentation at the Seventh Saranac Symposium in 1952 indicated that the Factory Inspectorate had continuously obtained occupational histories since the 1930s in its records of lung cancer deaths of asbestotics. At Saranac, Merewether called attention to the fact that, of the 48 individuals known to have died with lung cancer and asbestosis, 8 were insulators (references in Chapter 5, Tables 5 and 8).

The spraying of asbestos was also a concern to the Factory Department. In 1943, Merewether wrote to N.L. Dolbey of J.W. Roberts, Ltd., a Turner & Newall company, about unprotected young people observed spraying asbestos for the Newalls Insulation Company. The six sprayers were mostly aged 16 and 17, one was even younger. One of these boys was not wearing his respirator.⁹³ Merewether decried the failure to use air line respirators and the evident lack of supervision, advising that, "It is most undesirable to employ young persons on the process." Dolbey replied that the compressed air available in the shipyards was "foul" and that, moreover, it was a great problem to have to tie and untie the rubber hose of a compressed air respirator when working on ships and scaffolds.⁹⁴ He assured Merewether that the shortage of workers and tremendous demand for sprayed asbestos were "no excuse for slackness in complying with your requirements."

A year later, a factory inspector informed Newalls in Belfast that periodic medical examinations should be made on sprayers. The local Newalls official suggested to his bosses that it might best avoid "controversy among the men" if the doctor would examine the insulation workers as well as the sprayers.⁹⁵ However, the response sent to the Chief Factory Inspector in Belfast by Turner & Newall's top corporate attorney, Secretary John Collins, made no offer to conduct any examinations.⁹⁶

You will appreciate that a question of principle is involved, as in our view of the Medical Arrangements Scheme does not apply to this Spray process (the sprayed material being a mixture and the fibre being damp) and therefore there is in our opinion no statutory obligation imposing a necessity on us for arranging for medical examinations in the case of employees concerned.

Collins closed by stating,

(A)lthough the spray process was patented some 13 years ago and has been used for several years to a very considerable extent indeed, there have been no cases of asbestosis among any of the employees concerned.

The Chief Inspector for Northern Ireland replied that a medical examination "would have the advantage of either proving or disproving that there is a danger to health arising from such work." He pointed out that, even though the asbestos was damp when applied, some of it gets on the men's clothing and floors, "where it dries quickly and may give rise to (respirable) dust."⁹⁷ But, in the face of T&N's opposition, he allowed the company more time to work out an arrangement with Dr. Merewether.

The following year another doctor with the Factory Inspectorate visited a shipyard where Newalls workers were spraying asbestos. She interviewed one worker who believed he was having more difficulty breathing because of his work. Newalls officials were then asked to have the worker and other sprayers given chest X-ray examinations. Word of this was passed along to T&N Secretary John Collins, who was also informed that the Newalls managers had no intention of conducting the suggested

X-ray examination.⁹⁸ T&N would go on to delay medical monitoring of sprayers in Britain until 1958 or later.

Also in 1944, a factory inspector wrote to Newalls Insulation Company that Newalls plasterers had been observed working near enough to asbestos spraying to be in danger of inhaling asbestos, without respiratory protection.⁹⁹ This modest admonishment was promptly passed up to John Collins.¹⁰⁰ The Newalls man advised:

You will no doubt realize the consequences arising if the supply of masks is to be extended to plasterers, etc., as I should imagine the next request to be made would be for any shipyard employees working in the same spaces to be supplied with masks. This would raise a very big question with our shipbuilding clients, and in my opinion be detrimental to the future use of the Spray Process.

Collins then sent T&N's response to the government inspector in Hull, arguing that having plasterers working in a space with spraying going on was "purely a War-time problem," and that, in his opinion, plasterers' occasional exposure was unlikely to result in any risk.¹⁰¹ The response was a brief instruction that respirators be supplied to the plasterers working near asbestos spraying.¹⁰² Collins then wrote back to ask by what statutory authority such a request had been made, since the spray process was not covered by the "Asbestosis Regulations."¹⁰³

The frustrated inspector replied that his district medical inspector had approved this request to T&N.¹⁰⁴

In view of your remarks ... that your organization is at all times desirous of taking all precautions in connection with the use of asbestos fibre, I should have thought that the provision of a few respirators considered necessary would not have presented any difficulty to a firm of your standing and repute.

Collins and the Newalls executive worried that other trades, including joiners and electricians, might also have to receive similar protection in shipyards.¹⁰⁵ Collins finally resolved the

matter by telling the inspector, "we are quite willing" to provide respirators to the plasterers at Hull.¹⁰⁶

As we are, however, agreeing to fall in with your request, although it is not a statutory requirement, we should be grateful if you would not quote us to others as having done so.

The inspector agreed to that.¹⁰⁷

On the heels of that came word that an employee of another insulation company had been certified by the Medical Board and had made a claim for compensation. T&N's manager who had been approached for advice saw no chance that such a claim could be defeated, and John Collins agreed that the claim should be settled out of court.^{108,109} The manager of the other insulating firm acknowledged the risk that publicity might lead to new regulations, explaining that he did not really plan on contesting the case in court.¹¹⁰

T&N had experienced similar cases of asbestosis in its insulation workers. The Medical Board certified Bernard Stevenson totally disabled from asbestosis in 1939.¹¹¹ A note to Secretary John Collins in 1940 confirmed that liability had been admitted and compensation paid.¹¹² Stevenson died in 1942, and the Medical Board certified that his death was due to asbestosis, Collins was later informed.¹¹³ Claims for asbestosis by Newalls insulators Harry Logan and William Presland were also "admitted" by T&N in the early 1930s.

Shortly after the end of World War II in Europe, the Chief Inspector of Factories sent out a notice to industry, "Asbestos Insulation Aboard Ships." Alluding to the possibility of new regulatory requirements, the Chief Inspector "suggested" six control measures.¹¹⁵ One of these was the provision of a respirator "to each workman engaged in the fitting or removal" of asbestos insulation. Another was provision of respirators to asbestos sprayers and those engaged in "work ancillary thereto."

During spraying, no other person should work in the same compartment unless they are also provided with a respirator.

Another control measure listed was the prohibition against employment of persons under 18 "in any enclosed space" where there was a process giving rise to asbestos dust.

Collins prepared the response for the T&N companies, writing that Newalls had carried out extensive insulation work aboard ship and on land for 35 years, and claiming:

(N)o single case of asbestosis has ever occurred amongst their employees.

Therefore, Collins wrote, it was T&N's position that there was no risk of asbestosis from heat and sound insulation, and that any hazard of spraying had been eliminated by providing sprayers with respirators and not hiring young persons as sprayers.¹¹⁶

Collins closed by re-stating that Newalls and its predecessors had employed several thousand men over the preceding 35 years, and "no asbestosis cases" had occurred among them.

Collins' letter was promptly copied to members of the trade associations of asbestos insulation manufacturers and users (Magnesia-Asbestos-Glass Insulation Manufacturers Council, Thermal Insulation Contractors Association). When the Fairfield Engineering and Shipbuilding company questioned Newalls a few months later, Collins approved of a reply denying an asbestosis hazard from Newalls products, by carefully avoiding reference to non-asbestos insulation products.¹¹⁷

In a note to the T&N Board in 1946, in an annual report titled, "The Asbestosis Fund," Collins reported that the government had not yet followed up on the Chief Inspector's notice or replied to his 1945 letter.¹¹⁸

The fact, however, that several asbestosis cases amongst ... (Newalls) employees have occurred since last year's report, requires to be borne in mind in this connection.

In 1947, a newspaper carried the story that insulator James Wren had written to his employer of 42 years, Newalls, five days before his death, requesting compensation.¹¹⁹ Asbestosis was judged to be a contributing cause of death, which was attributed to lung cancer at an inquest. The jury was not

deterred by Newalls' representative, who reportedly said that insulation was only 15 percent asbestos and cases of asbestosis in this work were "rare."

Several months later, a Newalls man obtained a letter from Wren's widow that said,¹²⁰

I am definitely not taking proceedings to get my retribution through insurance as I am not in a financial position to do so. Any financial aid from your firm would be gladly appreciated.

The death certificate was also passed on to John Collins, with the recommendation that an ex gratia payment of 50 pounds be paid to Katie Wren. Collins replied to his associate,¹²¹

I see that the death certificate gives the cause of death as "Carcinoma of the lung and asbestosis," the latter being a contributing factor due to the deceased's occupation as boiler and pipe lagger, but of course so far as we are concerned we do not pay much (if any) attention to the opinion of the coroner and his jury in cases like these, as we only accept the decision of the Asbestosis Medical Board. No application for a certificate from that Board has been made, and as the death occurred in October 1947 (four and a half months ago) and as the widow says she is not making any claim, we can consider this straight-forward case, and as no evidence has been produced that the death was due to asbestosis, the case will not be included in our asbestosis case records.

In other words, since Mrs. Wren did not have enough knowledge to bring her husband's case to the attention of the Medical Board and prosecute a proper claim, T&N was pleased to let the matter rest there. Not only was T&N able to avoid the expense of attorneys' fees and compensation, it was also company policy to then act as though individuals such as this lifelong employee of Newalls Insulation Company had not even contracted asbestosis (and occupational lung cancer).

Sure enough, a tabulation of "NIC Pneumoniocosis Cases Prior to February 1950" included nine insulators, but not James

Wren.¹²² It is hard to know how many cases were disregarded in this manner, but Collins continued to follow the practice of publicly acknowledging only asbestosis cases certified by the Medical Board. Quite possibly, the Factory Inspectorate was independently aware of Board-certified cases and made use of them in compiling its regularly published statistics.

In 1950, the government circulated a draft of regulations to control shipyard asbestos hazards. John Collins began to prepare a response for the T&N companies in consultation with members of the Boards of Newalls, J.W. Roberts, Ltd., and the parent company, T&N.

He observed,¹²³

The two major points appear to be the vital necessity of excluding Finished Articles from the operation of these Regulations so far as asbestos is concerned, and secondly, the equally important question with regard to the use of respirators by others working in the "vicinity."

In the draft letter he circulated for his associates' comment, Collins went so far as to recall that T&N representations and suggestions to the government in 1931 had been accepted, "having the effect of excluding all manufactured products from the operation of the original regulations."¹²⁴ It was evidently thought better to leave this out and let it appear that that had been the government's idea, in the letter Collins finally sent.

Collins began by reminding the government of the letter he had sent in 1945, wherein T&N had objected to having to provide respirators to workers removing dry asbestos insulation in the shipyards.¹²⁵

Moreover, our reply stated that it was significant that our experience in the past had shown that no cases of asbestosis have arisen amongst employees handling and applying finished products; that, I understand, is still the case ... No suggestion has ever been made to us before that respirators should be worn in connection with the handling or application of the finished articles; on that basis every plumber for instance installing Magnesia insulation anywhere in this country should wear a respirator!

Collins went on to say that sprayers were provided with respirators, no asbestosis cases had occurred among them, and that dry damping technology had been developed which substantially reduced airborne dust from the Roberts spray process.

By then, at least one case of asbestosis in a sprayer was the subject of communications between Canadian health and workers' compensation authorities and a T&N subsidiary in that country, Atlas Asbestos.¹²⁶ Perhaps it was in anticipation of undeniable cases of asbestosis among sprayers that both the 1945 and 1950 letters Collins sent to the government claimed advances in dust damping in the latest technology for spraying asbestos. There would be many cases of asbestosis in sprayers in the years to come.

But Collins' affrontery in denying that Newalls Insulation Company had had cases of asbestosis was extraordinary. By this time, there had been 14 cases in Newalls insulators described in the company's records in addition to the Board-certified case at another company Collins heard about in 1944. Though only slightly more numerous than the surviving, documented toll at Newalls, another 16 cases in shipyard and construction workers exposed to insulation dust had been reported in the world medical literature (from 7 countries). Merewether and his associates at the Factory Inspectorate were recording the occupations of persons dying with asbestosis, knew that many of them were ladders, and most likely also knew that some had worked for Newalls. But the government changed hands with Labor's loss of power in 1951, and the government seemed to lack the will to overcome industry resistance in the regulation of shipyard asbestos hazards for many years after that.

Merewether and his fellow Medical Inspector of Factories McLaughlin continued to report in 1952, 1955 and 1956 that insulation workers were among the victims of asbestos disease. Whatever they thought of Collins' lies, their inability to enforce any control over asbestos product use went on through that decade, and the final rules would contain critical compromises.

In March of 1952 Collins arranged for former factory inspector and Turner Brothers Asbestos manager John Waddell to go with

him to meet with the Chief Inspector of Factories. Waddell advised Collins of his preparations.¹²⁷

I have been doing my best to compile statistical ammunition, but I have not been able to find anything very convincing.

Four pages of data and analysis followed. Waddell explained:

(I)f we could show that there have been no cases at all in certain processes where we know that a certain amount of dust is emitted, this could be used as an argument that there is a minimum level of dust concentration below which asbestosis does not occur. We need to convince the Chief Inspector that this minimum is higher than zero.

Figures on the Turner Brothers Asbestos plant in Rochdale showed 11 cases of asbestosis among workers with 10-20 years of employment presumably under the safeguards adopted in 1933 under the regulations. There was a 21 percent prevalence of the disease among longer-term employees.¹²⁷

In conclusion Waddell had to admit,

(W)e can hardly claim that (the data) prove that complete prevention of dust is not essential in order to eliminate the disease.

At the meeting with the government officials, Collins and Waddell suggested wording changes to the asbestos regulations that would reduce T&N's vulnerability to common law suits, while doing their best to persuade the Chief Inspector and a Deputy Chief Inspector that no new dust control requirements were needed. They were told that many points had been raised by shipbuilding and other employers in response to the 1950 draft shipbuilding regulations, and no new draft was imminent.

Another draft of the regulations was finally issued in 1957. As before, this was promptly analyzed by Collins and explained to the T&N Board. Ironically, Collins expressed pique with the government for having expressed its concern back in 1945 but then not getting beyond re-issuing the 1950 draft over the next twelve years. Over the rest of 1957 and part of the next year,

Collins set about trying to weaken the provisions most threatening to the asbestos insulation and sprayed asbestos businesses. By this time, it could not be denied that some Newalls employees applying these products had been among the victims of asbestosis in Britain, even after carefully excluding those not certified by the Medical Board and those with other prior histories of asbestos exposure (e.g., mattress making).

Collins' response to this regulatory movement was in its final stage of preparation when the government invited the affected companies to come in to discuss the draft rules. Collins readily agreed to that, and the rest of his letter dealt with T&N's objections to the proposal.¹²⁸ Admitting at last to 15 cases of asbestosis in Newalls and 4 cases among sprayers, Collins nonetheless claimed the asbestosis risk in shipyards "is definitely declining." His explanation of how this incidence of a previously denied occupational hazard represented a decline was based on the observation that all but two of the Newalls cases had occurred in men who started work before the old asbestos regulations came into effect in 1932/33. The contradiction between this rationale and the clearly understood *inapplicability* of the old regulations to asbestos product use, which Collins' letter insisted should be maintained, was not explained. The only other bases supporting Collins' claim of declining risk to workers using asbestos products were his unsupported claim that there was "no doubt that conditions (in shipyards and on land) have greatly improved" and his assertion that there had been a greater use of pre-formed materials.

T&N officials made intensive preparations for a March, 1958, meeting with the Ministry of Labor and National Service, deciding to not submit any proposed wording changes in advance. One of the most extreme proposals considered was to try to limit the definition of asbestos to materials with 20 percent or more asbestos, thereby eliminating common insulation, wallboard, and asbestos-cement sheeting. With thoroughness, numerous more successful objections and at least one "red herring" were raised. At the meeting, Dr. McLaughlin strongly opposed the suggestion that bystander trades exposed to asbestos insulation dust did not need to be given respirators.¹²⁹ He was subsequently invited to observe a spraying job by T&N.

The May, 1958, draft of the regulations was considerably more satisfactory to T&N. John Collins put it this way in his report to the T&N Board.¹³⁰

(O)ur efforts to improve the wording of the Regulations so as to limit the obligations placed on the Insulation Industries have been very successful. Our two main objections to the original Regulations have now disappeared consequent on the revisions now made.

Collins explained that T&N's strongest objections had focused on proposed requirements to provide respirators to persons manipulating, applying, or taking down asbestos, and to persons working "in the vicinity" of these activities. Further efforts were carried on to assure that, where respirators were required, air-line respirators would not be required in place of then-standard respirators.

Norman Dolby, inventor of T&N's sprayed "Limpet" asbestos process, learned in late July, 1958, that Dr. McLaughlin had left the Factory Department for a post at the London Hospital.¹³¹

We could none of us escape the feeling last Wednesday that this fact was largely responsible for the smooth manner in which our recommendations were accepted.

Further negotiations to further weaken the rules by T&N no doubt also helped delay the issuance of the final rules until late 1960.

The final rules, which covered a wide range of safety and health hazards in shipyards, did require respirators to be provided to sprayers and workers using power saws to cut asbestos-containing materials. Respirators were also to be provided to workers breaking down asbestos insulation "for removal." (The stripping of old insulation for removal was rarely done by T&N, that was usually carried out by smaller firms.) The employment of young persons in the above jobs was prohibited. Not included was any requirement to offer respiratory protection to insulators and workers in the vicinity of spraying and insulation stripping.

Limiting the scope of the regulations did not ultimately keep some employers from taking extra measures, as the shipyard hazards of asbestos became more well known. By early 1966, the Devonport Naval Dockyard was using or about to institute "very stringent precautions involving the use of helmets with air supply." The requirement for such respirators, Turner Brothers' Chairman John Waddell reasoned, would "very soon mean that asbestos will cease to be used" at Devonport.

Waddell considered it an urgent matter to learn at what level in the Navy this decision was made. Did it result from action by a local factory inspector, or was it due to directives from Naval headquarters, which would apply at other Naval yards? The T&N men dispatched to inquire about this delicate matter were confidentially advised to be less than forthright about the fact that they were opposing hygiene measures that would cost them business. In a memorandum called "Asbestos and Mesothelioma," Waddell wrote:¹³³

Our approach must be, of course, that we realize there is a problem but we have a great deal of experience and would like to be of some help, if we could only find the right people to give advice to.

T&N's leading role in opposing reasonable safeguards for the use of asbestos products proposed by the British government in 1945 would have far-reaching effects on workers in industrial countries the world over. The use of asbestos insulation in Britain and industrial nations generally continued rising until it peaked in the early 1970s. British figures published in 1995 point toward a rising incidence of mesothelioma until around the year 2030. Fully one percent of British men born in the 1940s are expected to die from mesothelioma, and in addition, perhaps an equal number or more are expected to succumb to lung cancer caused by asbestos.¹³⁴

Unsteady Movement Toward Numerical Exposure Limits

The Public Health Service study had clearly failed to determine an asbestos dust concentration that would not produce pneumoconiosis in originally healthy workers during their entire

working lives. The inadequacy of dose-response information was acknowledged in 1940 by Lanza.¹³⁵ Nonetheless, nine state industrial hygiene units recommended a 5 MPPCF limit for asbestos-containing dust in workplace air (California, Ohio, Oregon, Colorado, Michigan, North Carolina, Oklahoma, Illinois, and Pennsylvania). South Carolina alone officially condoned exposures up to 15 MPPCF.¹³⁶⁻¹³⁹ A government manual for physicians in Canada first noted that Canada was a principal producer of asbestos and went on to recommend a maximum of "5 to 10" MPPCF.¹⁴⁰

Hutchinson, an engineering professor writing in 1944 about dust hazards in the monthly trade journal, *Heating and Ventilating*, said:¹⁴¹

Very few data are available on the relation of (asbestos-containing) dust concentration to the incidence of disease. No minimal safe concentrations have yet been set up and information is scant as to the conditions in those plants where a hazard is known to exist.

In 1947, the members of the Asbestos Textile Institute commissioned a confidential medical and dust sampling survey of their plants.⁷⁵ This work was reported by engineer W.C.L. Hemeon of the Industrial Hygiene Foundation. Hemeon's report summary underscored the inadequacy of the 5 MPPCF "threshold":

The maximum permissible dustiness for asbestos is commonly taken to be five million particles per cubic foot. This represents good attainment in the dust control program. It is emphasized, however, that dust elimination to this extent does not positively insure that no asbestosis will develop in some workers after a long working life (greater than 20-25 years). Scientific evidence is obscure on this point. It is recommended, therefore, that studies be initiated aimed to develop another yardstick, because it is suggested that when control below five million is attained, present dust count methods may not properly measure the remaining hazard.

This point is repeated throughout the text. Some examples:

... dust count investigations cannot, in the present state of knowledge, give us assurance as to the extent of our success in eliminating the hazard.

... in the U.S. Public Health Service study, there were abnormally few who had been exposed for more than 15 years and practically none over 20 years. These facts seriously affected the conclusions that could be drawn.

The information available *does not* permit assurance that five million is thoroughly safe nor has information been developed permitting a better estimate of safe dustiness.

The Johns-Manville plant in the Hemeon study was the large facility at Manville, New Jersey.¹⁴² This plant had been the subject of a health survey in 1932, when Lanza at Metropolitan Life arranged for U.S. Public Health Service investigators to review the workers' chest X-rays. This investigation, which was never published, found that 327 (29 percent) of the plant's 1140 workers had pneumoconiosis, including a number of workers classed as having no exposure to dust, including a watchman, a millwright, 5 packing and shipping department workers, two machinists and two steamfitters.¹⁴³ Met had continued to look in on conditions at this group policyholder's plant, and was approached toward the close of World War II about it.

W.G. Hazard, then Director of the Industrial Hygiene Division of the state of New Jersey, was ordered by the War Production Board to make an investigation of the plant "on the basis that there were a number of unhealthy working conditions in the plant accounting for a large labor turnover." Metropolitan was able to render a special service to J-M at that point, according to an internal report of the insurer.¹⁴⁴

Due to the fact that we have periodically been surveying this plant, Mr. Hazard asked that we make the survey. Our investigations indicated that the asbestosis hazard was adequately controlled and had been for a number of years. Mr. Hazard accepted our findings and made his report to the War Production Board. The case was closed.

Met's response to the government inquiry was in stark contrast with Hemeon's findings at Manville in 1947. Referring to plant records, Hemeon said that management had "counted potential cases of asbestosis amounting in number to about 20 percent." He also observed that exhaust air from the baghouse dust collector was recirculated to the work area, to minimize heating expenses in cold weather. This was described as a practice "generally frowned upon where dusts that are hazardous to health are handled." Hemeon attributed the poor dust conditions found "consistently" throughout the plant to this practice.⁷⁵

Was the lack of scientific basis for the asbestos "threshold limit" understood by the executives in the asbestos companies? The businessman's question was succinctly put by Vandiver Brown, top corporate counsel for Johns-Manville, at the Sixth Saranac Symposium in 1947:¹⁴⁵

What is the so-called "threshold limit," on one side of which the concentration can be considered harmless and on the other side dangerous?

He went on,

Maximum limits are prescribed for a great variety of materials with which I have no familiarity, but it is my earnest hope that these limits have been arrived at on the basis of a better factual and scientific background than exists in the case of asbestos. The allowable limit (proposed in New Jersey) for industries using this material is a "mandatory" requirement of not more than 5 million particles per cubic foot ...

... So far as I have ever been able to ascertain, no one can state with certainty what is the maximum allowable limit for asbestos dust. I am certain no study has been made specifically directed toward ascertaining this figure and I question whether there exists sufficient data correlating the disease to the degree of exposure to warrant any determination that will even approximate accuracy.

Referring to then-unpublished research by Dr. Gardner at Saranac Laboratory indicating that long asbestos fibers were more important in producing fibrosis than the shorter fibers, Brown lamented:

Meanwhile, the drafters of industrial codes will presumably continue to provide us with standards which have no root in experience but which take their sustenance, like orchids, from the air and, in the case of asbestos, will relate their standards to the innocuous sizes of dust and leave unmentioned those of the character that presumably can have some ill effects.

Rutherford Johnstone's 1948 book, *Occupational Medicine and Industrial Hygiene*, lists the "allowable concentration" for asbestos dust as 10 million particles per cubic foot of air.¹⁴⁶ No authority or reference is given in support of this value. In California, where Johnstone was a "consultant in industrial health," the "suggested maximum permissible concentration (toxic threshold)" for asbestos had been 5 MPPCF since 1945.¹⁴⁷ A 10 MPPCF limit had previously been recommended by the state Industrial Accident Commission, in 1936.¹⁴⁸

The American Conference of Governmental Industrial Hygienists TLVs

The American Conference of Governmental Industrial Hygienists (ACGIH) was primarily a group of city, state and federal government health officials, although not itself an official government body. The ACGIH began to issue an annually revised list of threshold limits in 1946.¹⁴⁹ The first list contained over 140 industrial gases, vapors, dusts, fumes, and mists. The committee of volunteers who issued this list included industrial hygienists, chemists, and toxicologists, but not one physician. The Maximum Allowable Concentration for asbestos-containing dust was given as 5 MPPCF from that time on, year after year, and this figure continued to be adopted and retained by state and local health agencies.

As Chairman Fairhall, a chemist, noted in the 1948 Report of the Committee on Threshold Limits,

(I)t has been the purpose of the conference to seek values which, on the one hand protect the individual workman, and on the other would impose no impossible burden on the manufacturer.¹⁵⁰

Added words of caution were offered on the interpretation of the Committee's Threshold Limit Values (TLVs):

People vary greatly in response to drugs and toxic substances. Therefore, it is a figment of the imagination to think that we can set down a precise limit below which there is complete safety and immediately above which there may be a high percentage of cases of poisoning among those exposed.

Later that year, W. P. Yant, who had been the first President of The American Industrial Hygiene Association, spelled out some more of the shortcomings of the TLVs at the annual meeting of the Industrial Hygiene Foundation.¹⁵¹

- averaging exposures based on limited sampling can overlook peak exposures which are harmful
- the presence of more than one potentially harmful substance may result in synergistic effects that are more serious than the separate hazards ascribed to each substance
- strenuous work involves the breathing of 10 or more times as much air as sedentary activity, creating a "large factor of unsafety"; hot environments also increase respiration and circulation

He concluded,

The situation becomes very complex when all factors are considered. It requires that more attention be given to all important agents and factors of industrial environment and occupational activity in the development and use of standards; it supports the necessity of including an ample factor of safety in standards ... and it emphasizes an existing inadequacy of knowledge ...

Recognizing that some states would adopt the TLVs as legal standards, Yant expressed mixed sentiments.

Mandatory requirements are usually minimum requirements or representative of the worst permissible conditions. From one viewpoint such requirements are a necessary aid to code administration for dealing with recalcitrants; from another viewpoint, they tend to stifle progress and freeze endeavor at the established minimum.

Dr. Vorwald at the Saranac Laboratory was particularly skeptical of the reliability of the TLVs for asbestos and silica. In an industrial hygiene report to Owens-Illinois on the Sayreville, New Jersey, plant where "Kaylo" insulation was manufactured, Vorwald wrote:¹⁵²

The maintenance of the working environment in a condition which conforms to regulations promulgated by local health agencies or which is in accord with accepted standards of good practice should not be considered as a complete protection for a worker from acquiring a disease as the result of his occupation.

Vorwald had also conducted experimental animal tests on the Kaylo insulation product made by Owens-Illinois. Referring to Saranac studies done for a group of asbestos companies, he reported to O-I that "a seemingly negligible proportion of fibrous asbestos is sufficient to produce (fibrosis)." Further emphasizing this point, Vorwald wrote:¹⁵³

(I)t appears that very small numbers of fibers are capable of producing asbestosis, although the development of the lesions is delayed. The present experient with Kaylo is also an example of this fact.

One shortcoming of the TLVs was that they were set by a committee comprised almost exclusively of industrial hygiene engineers and toxicologists, and in some years not a single physician was on the committee. This provoked increasing outrage among the more established industrial doctors as the TLVs came to enjoy wider recognition. At an April 24, 1952

meeting of the Industrial Medical Association, Dr. Frank Princi said:

(M)ost of the (TLVs) are picked out of a hat, 95 percent are on the basis of animal experiments only, incorporated into state codes, and we are faced with ridiculous standards. Is there a doctor among the group that puts out these standards?

Industry contractor Vorwald replied that a main obstacle in the setting of TLVs was the lack of data on "precise concentrations of dust in an atmosphere in which the industrial worker is exposed." Dr. Vorwald did not acknowledge his own involvement with the ACGIH Committee on Threshold Limits. And no one present suggested that the members of the Industrial Medical Association either emphasize in-plant air monitoring programs or propose their own medical guidelines on ceiling exposure concentrations.¹⁴

Reaction in Other Countries to U.S. Numerical Guidelines for Asbestosis

The British had elected to prescribe controls for asbestos dust through engineering and work practice requirements. Looking at the limited basis for the Americans' TLVs and the great variability of human response under the conditions of work, Medical Inspector of Factories McLaughlin scorned the numerical limits:¹⁵⁴

The (TLVs) seem to be based on the assumption that man is a standardised machine, which clearly he is not.

British factory inspector Bryan Harvey spent a year at Harvard and later described his impressions of the industrial health scene in the United States. He referred to the TLVs as "theoretically allowable maximum concentrations." The preoccupation with taking samples and comparing the readings with such reference values was criticized as a fundamental error. It led to a tendency to consider substitution of hazardous materials with safer ones as the last line of approach to hazard control instead of the first.¹⁵⁵ Harvey would become the most senior govern-

ment negotiator in developing the British asbestos standard in the late 1960s.

His countryman Meiklejohn expressed satisfaction that the old "practical standard" of flyer spinning had lengthened the average exposure time for the development of asbestosis since its implementation 23 years before.¹⁵⁶

Turner & Newall official David W. Hills compared various approaches to air monitoring in 1955. By then, T&N in Britain was refining thermal precipitator sampling methods to analyze workplace air for fibers, not just count dust particles in general. Concluding a lengthy review, Hills turned to the question of a "safe" level of asbestos exposure (and the TLV).¹⁵⁷

A very pertinent question, and a very difficult one to answer, is what is the maximum asbestos dust concentration that is safe? The American literature quotes 5 million particles per cubic foot. There is no significance to be attached to this figure at all. In the first place, 5 MPPCF is meaningless unless the particle size distribution is given, in the second place this figure was based on results from Greenburg-Smith impingers, which have been shown above to be grossly inaccurate, and in the third place, due to the wide variations in dust concentration at any point ... and also the difficulty of knowing the total effect of exposure to high concentrations for short times and vice versa, it is almost impossible to determine the integral for any one person of dust concentration and time.

The answer to this question is really a negative one, and is that adopted by the Factory Inspectorate, namely that complete safeguard to health is only obtained by having no dust at all.

Hills was assistant to the executive director of Turner Brothers Asbestos Company (John Waddell).¹⁵⁷

Whatever guidelines and standards existed in theory, there was *in practice* a greater degree of worker protection afforded in the United Kingdom than in the United States. This striking disparity was recorded by Dr. John Knox, medical officer for

Turner & Newall in notes of his 1960 visit to his company's U.S. subsidiary, Keasbey & Mattison Company:¹⁵⁸

The legislative framework under which industries operate in the U.S.A. makes it difficult for me here to follow the lines of thought which prompt action over there in the matter of standards of industrial practice. In many industries, the employers seem so far in front of legislation as to have created a special code of practice for themselves.

During that visit to the United States, Professor Theodore Hatch, a leading industrial hygienist, told Knox he was concerned that the 5 MPPCF figure would be widely relied upon in the asbestos industry.¹⁵⁹ The T&N men independently knew of "trouble" at an asbestos plant where dust counts had been below 5 MPPCF since the plant had opened fifteen years earlier.¹⁶⁰

Authorities in New South Wales, Australia, interpreted the "American experience" as suggesting that,

clinical asbestosis is unlikely to develop unless the cumulative exposure exceeds 25 MPPCF-years.

This clearly suggests a rejection of the 5 MPPCF limit, since 25 MPPCF-years would be exceeded after 5 years of work at that level.¹⁶¹

Length of Fibers and Asbestosis

The shortcomings of the 5 MPPCF threshold limit were reiterated in 1954 by Johns-Manville safety executive Hugh Jackson.¹⁶² In a memorandum to an official at the firm's Waukegan (Illinois) plant, Jackson said:

It must be emphasized that neither the threshold limit nor the methods of sampling and counting are absolutes. The threshold limits are not established on the basis of providing an absolutely safe-exposure level for every individual, but rather a level within which most individuals will not be harmed. There is so much variation in the reaction of individuals to a particular type of material that no guarantee of full protection can be assumed at any level of exposure.

In this note, Jackson informed the plant official that J-M's "tentative M.A.C." (Maximum Allowable Concentration) had been changed to 1 million *fibers (10 microns and longer)* per cubic foot of air. This was an internal company change to reporting in terms of fibers per cubic foot instead of total particles. It appears that the company was converting to a more precise measure of the presumed most hazardous air contaminant (long fibers)—although not imposing any greater degree of control than that entailed by the 5 MPPCF "threshold limit" for total airborne dust.

By 1946, industry-supported research at the Saranac Lab had produced "typical asbestosis" in guinea pigs breathing ball-milled asbestos. The airborne concentration of total asbestos dust was 138 MPPCF, *but the concentration of fibers longer than 10 microns was only 0.8 million per cubic foot.*¹⁶³ At the same time, British researchers had produced lung damage in rabbits with asbestos fibers shorter than 10 microns in length. Replying to Gardner's general comments on his early findings, King and coworkers said:

Our results differ from those of Gardner in that asbestos fibers as short as 2.5 microns have produced an interstitial fibrosis.¹⁶⁴

Johns-Manville was thus using a fiber *size* cutoff inferred from one set of animal studies and at odds with a different test on another animal species. Moreover, the *level of exposure* to the (10 micron) long fibers sanctioned in J-M's factories was greater than that which had produced asbestosis in guinea pigs at the Saranac Lab. This was done despite J-M's awareness of King's findings and Gardner's insistence that he had *not* shown short asbestos fibers to be safe in the workplace.¹⁶⁵

The state of New Jersey had considered in 1946 applying its industrial hygiene code to control only long asbestos fibers. However, Dr. Gardner incurred the annoyance of Vandiver Brown by refusing to support this idea by testifying that short asbestos fibers were innocuous.¹⁶⁶

Gardner's successor Vorwald, on the other hand, made an effort to apply the findings of the Saranac studies as *additional* guidelines in industrial hygiene. As a member of ACGIH's

Threshold Limits Committee in 1952, Vorwald proposed that the 5 MPPCF limit for asbestos-containing dusts be augmented by a companion limit of 1 MPPCF for the concentration of airborne fibers longer than 10 microns.¹⁶⁷ This should have been no added trouble from the standpoint of compliance, since the total fiber fraction of the airborne dusts in asbestos handling was usually recorded at well under 20 percent.^{43,55-59} Nonetheless, this modest proposal was not adopted by ACGIH.

The Added Threat of Cancer

The carcinogenicity of asbestos added a new dimension to the question of whether a safe threshold for asbestos exposure existed. Dreessen and coworkers had included reference to the few pre-1938 articles on asbestosis and lung cancer, but necessarily limited their prescribed threshold to the problem of asbestosis.

By 1952, however, the Chairman of the New York State Occupational Cancer Committee observed that asbestosis was "very probably" associated with lung cancer.¹⁶⁸ Mayers went on to suggest that:

Maintenance in a factory workroom of Maximum Allowable Concentrations will not necessarily insure safe working conditions, if a potential carcinogen happens to be present.

A review of the literature on lung cancer and asbestos was published in 1953. This paper reported that pipecoverers were among the people dying from asbestosis and lung cancer, and concluded that asbestos workers faced a cancer hazard.¹⁶⁹ The article's introduction also contained this unreferenced sentence: "Experience has led to the acceptance of 5 million particles of asbestos per cubic foot of air, of small enough size to be respirable, to be the safe working concentration." The third author of that paper, Dr. Harriet Hardy, is the most well known in the field of industrial medicine. Dr. Hardy was amazed when it was brought to her attention that her work was being "used in court continually and currently against the worker." Dr. Hardy considered it erroneous to infer that *she* relied on the TLV: "I did not say Harriet Hardy considers this the safe limit, and that is what the lawyers are stating."¹⁷⁰

Hueper also expressed doubt that the TLV for asbestos would be adequate to protect against "asbestosis cancer in man."¹⁷¹ Members of the Asbestos Textile Institute observed that Hueper's works were quoted by the referee in a Pennsylvania workers' compensation case lost by the company involved. ATI members understood that what Hueper called "asbestosis cancer of the lung" in fact relied on a microscopic pathological definition of the extent of "asbestosis" required.¹⁷²

One particle of asbestos with the physical condition surrounding it can be diagnosed as Asbestosis.

By any fair standard, the question of asbestos' carcinogenicity was settled by Doll's study, published in 1955.¹⁷³⁻¹⁷⁴ Later that year, a "Symposium on Threshold Limits" was jointly held by the ACGIH and the American Industrial Hygiene Association.

The Symposium was introduced by the chemist, Warren Cook, whose 1945 article had supplied 118 of the 144 limits recommended by ACGIH in 1946.¹⁷⁵ He seemed to agree with Oettel, whose correspondence he quoted, in referring to the "known cancerogenicity of ... asbestos." Oettel had maintained that, "no man can say today which concentration of the several industrial substances is actually required to be cancerogenic." Cook credited Stokinger with offering the first remarks on setting TLVs for cancer-causing substances.

Toxicologist Herbert Stokinger admitted that the question of establishing safe limits for industrial carcinogens had been "sidestepped completely." He proposed a remedy for that:¹⁷⁶

As a suggested method of approach, the following is offered: To the level judged safe for other types of systemic injury add a safety factor for carcinogenicity. The magnitude of the safety factor is suggested to be from 100 to 500 ... This manner of approach has been used for nickel carbonyl. A tentatively safe level for systemic effects from repeated daily exposure has been set at 0.1 ppm; one-hundredth this level, or 0.001 ppm was set (as the TLV) for nickel carbonyl on the basis that nickel poisoning gives rise to a substantial increase in the incidence of lung cancer ...

There are undoubtedly substances to which the suggested procedure may not strictly apply, but imperfect as it may be, the suggested method is felt to be a step in the right direction and serves better to curb exposures to industrial carcinogens than considering the problem too difficult to cope with at the present time.

Incidentally, Stokinger was skeptical about the carcinogenicity of asbestos, at least in the American industry, placing him in the minority of those writing by the 1950s.¹⁷⁷

Stokinger was a member of the Threshold Limits Committee of the ACGIH for the next twenty years. But his idea for setting carcinogen limits was quietly left behind. By 1966, only three substances (aside from nickel carbonyl) were explicitly tagged as carcinogens by ACGIH, and no limits at all were prescribed for them. The *Documentation of the Threshold Limit Values* published by ACGIH in 1966 includes a page on asbestos with three paragraphs of text and 11 references, none more recent than 1955. The word "cancer" does not even appear on the page.¹⁷⁸

Sure, the TLV Committee knew asbestos caused cancer. But if the committee hadn't the faintest idea of how little asbestos it took to cause cancer, Chairman Stokinger, who was employed by the Public Health Service, had his own view of who was responsible:

The TLVs are industry's values ... industry has the sole responsibility to develop data on its own products; government is not in a position to develop enough facilities to handle the problem *in total*, nor should it, when reliable toxicologic consultants are now available ... There is no question that inability to obtain industrial hygiene data is one of the greatest problems facing the committee today.¹⁷⁹

Criticism of the TLV and Delayed Response

ACGIH's slowness to change its adopted TLV for asbestos can hardly be attributed to a lack of criticism. The TLV's inadequacies were thoroughly discussed at the New York Academy of Sciences conference, Biological Effects of Asbestos, held in 1964

(Volume 132 of the Academy's Annals, pp. 1-765).¹⁸⁰⁻¹⁸² Dr. Gordon Addingley of British Belting and Asbestos in England stated that,

We do not believe there is any safe limit. We have our ideas as to how low we can get and we are always striving to get right down to zero. We also have our ideas about the American limit of 5 MPPCF as a safe limit. We know that there is no scientific basis for that limit whatever ...

A Turner & Newall representative privately criticized U.S. asbestos companies for their lacking appreciation of the medical problems caused by asbestos. He believed that 5 MPPCF was "too high and it should be reduced."¹⁸² Similarly, Union Carbide's I.C. Sayers privately reported from Britain that there was a growing sentiment that the TLV was "no longer tenable."¹⁸³

John Wells, of the U.S. Rubber Company in Georgia, agreed. He reported that workers with cumulative exposure of 50 to 60 MPPCF-years began to develop asbestosis, and as exposures mounted so did the number of workers with the disease.

In terms of what has been considered a safe dust count in the area, we started out with a theory—because everybody said it was so—that 5 MPPCF was a safe figure. Our own conclusion, as we began seeing what was happening in our own process, was that the only safe amount of asbestos dust exposure was zero ... The safe level is nil and anything above the safe level represents certain risk.¹⁸¹

Recently disclosed documents from U.S. Rubber show that abnormal chest X-rays were described in a 1957 memorandum labeled "Top Secret." Of 17 employees with 5 or more years' exposure to less than 5 MPPCF of dust, 2 had "questionable lung conditions" and 6 had "suspicious symptoms of early asbestosis." The company had also been warned in 1955 that, "when one can demonstrate roentgen evidence of asbestosis, the disease is well advanced." Radiologist Eugene Pendergrass supported that conclusion on the basis of microscopic findings

of asbestosis in the absence of abnormal chest X-rays on the same individual.¹⁸⁴

An Owens-Corning official questioned the validity of the old TLV in an internal company memorandum in 1966. "Dr. Selikoff has stated that only one fiber in the body can cause cancer," he wrote.¹⁸⁵ Other asbestos product manufacturers, such as Fibreboard, were less aware of debates about the TLV and appear to have never relied on any TLV to determine the safety or danger of asbestos dust concentrations in their factories.¹⁸⁶

Dr. Clark Cooper, in a 1967 critique of the TLV for asbestos, characterized it as resting on "shakier evidence than most (of the other TLVs recommended by ACGIH)."¹⁸⁷ Cooper told the Chairman of the Committee on Threshold Limits, "When it comes to tumor prevention, I think we are in real trouble."¹⁸⁸ Cooper's colleague J.L. Balzer, who had conducted studies on asbestos exposure of insulation workers, noted:

Anyone looking at the present basis for the (TLV) of 5 MPPCF as recommended by the (ACGIH) in 1946 realizes that it is not based on solid evidence.¹⁸⁹

As indicated by the example of Dr. Vorwald, the ACGIH Threshold Limits Committee included members outside of government employment. Notable in this regard was Dr. Paul Gross, a pathologist hired in 1954 by the Mellon Institute, parent organization of the Industrial Hygiene Foundation. In the years 1954-1960, Dr. Gross was sent 6 to 8 lungs and portions of lungs by the Johns-Manville Corporation. As a result of his examinations of these tissues, in which cancer was almost always present in addition to asbestosis, Dr. Gross recalls that he came to the opinion that asbestos was carcinogenic.¹⁹⁰

In 1964, Dr. Gross became a member of the ACGIH Threshold Limits Committee, and he was promptly made chairman of the subcommittee responsible for recommending TLVs for mineral dusts including asbestos.^{191,192} Until 1983, Gross played a central role in the TLV committee's handling of asbestos and other dusts as a member of the committee. During the early part of this time, he performed confidential studies for Johns-Manville on the asbestos content of brake drum dust.¹⁹³

In 1969, Owens-Corning Medical Director Jon Konzen expressed this view of Gross' role, in an internal report:

Dr. Paul Gross, Research Pathologist of I.H.F. is a member of the Threshold Limit Value Committee and is representing the interests of the fibrous glass manufacturers in an attempt to get the current limit on fibrous glass raised to that of an inert dust.

Fibrous glass manufacturers (Owens-Corning, Johns-Manville, and PPG) also held interests in asbestos manufacturing at that time.

As a member of a U.S. Public Health Service committee in 1969, Gross secretly provided draft copies of a report to three asbestos companies. Robert de Treville, President of the Industrial Hygiene Foundation, inviting comment, explained:¹⁹⁵

We will attempt to see that needed corrections are introduced by Dr. Paul Gross, a member of the Committee.

And in 1976, Gross resigned from the Safe Drinking Water Committee of the National Academy of Sciences, amid charges of improperly sharing information with a company he consulted for—the issue was asbestos in drinking water.¹⁹⁶

ACGIH's Committee on Threshold Limits briefly toyed with the idea of a separate, stringent standard for crocidolite, the blue asbestos primarily mined in South Africa. A 1968 Notice of Intent was circulated, "so that industry-connected individuals principally, but others also, may have an opportunity to help shape the deliberations of the Committee prior to its recommendation of tentative changes in the 1967 Threshold Limits List." Commenters were asked to write either to Dr. Stokinger at the Public Health Service, or to the "Repository of Anonymous Occupational Health Data" in care of Dr. de Treville at the Industrial Hygiene Foundation.¹⁹⁷ "Revisions under consideration ... proposed for 1968 List (of TLVs)" included the following for asbestos:

A limit of 5 MPPCF, based on impinger samples counted by light-field technics (sic), is satisfactory to control exposures to most forms of asbestos. Crocidolite, however, has been

shown to produce, in addition to the asbestotic inflammation, also mesothelioma. Since no safe limit can be established for this form of asbestos at this time, until more definitive data are obtained, *it is recommended that workers exposed to crocidolite be equipped with air-supplied helmets.* (emphasis added)

Certainly such a proposal would have been problematic for the large asbestos-cement (A-C) pipe industry, which consumed virtually all the crocidolite used in the United States. The industry had found that a blend of chrysotile and crocidolite asbestos worked best in the manufacture of (about 15 percent by weight) asbestos-reinforced cement pipes. (In 1982, for example, about 16,000 metric tons of crocidolite asbestos and 21,600 metric tons of chrysotile were used in the manufacture of A-C pipes.¹⁹⁸) A representative of Certain-teed Products Corporation, a manufacturer of asbestos-cement pipe, promptly and "strongly" objected to the proposed change on crocidolite; and he requested to attend the Threshold Limits Committee's discussion of the matter.¹⁹⁹ The main market for asbestos-cement pipe was in drinking water supply systems, and at least as far back as 1968 questions had been raised by Dr. Irving Selikoff and among U.S. public health officials, including Dr. Stokinger, about the wisdom of using A-C pipes in water supply systems.²⁰⁰ (Stokinger recommended that the further use of A-C pipes for water supply systems be discontinued, based on the information available in 1969.²⁰¹) Electron-microscope studies completed by Johns-Manville in 1970-1971 showed that water flowing through A-C pipes picked up some asbestos.²⁰² Thus, the industry faced eventual scrutiny both on occupational and environmental health grounds, which would have been hastened by an official recognition in 1968 of the crocidolite constituent as a cancer threat at even low levels of exposure.

This idea, which was a parallel development to the British workplace standards approach then being developed for different types of asbestos, was questioned by medical researchers in the U.S. Drs. Selikoff, Lieben, and Cooper all expressed doubts about whether crocidolite was really more dangerous than chrysotile and amosite asbestos. Selikoff and Lieben had reported cases of mesothelioma in workers which the doctors

attributed to other varieties than crocidolite.^{200,203,204} Wrote Dr. Selikoff:²⁰⁰

If, as the proposed 1968 revision suggests, air helmets be supplied in the presence of crocidolite, some might suggest similar precautions in the presence of other fibers, equally fatal and more common.

Nothing was published by ACGIH along the lines of special stringent measures for working with crocidolite asbestos.

In 1968, ACGIH did list a "Notice of Intended Change" for asbestos, to set the TLV at 12 fibers per cubic centimeter (f/cc) of air, or 2 MPPCF.²⁰⁵ (f/cc includes only fibers; MPPCF includes all particles.) Both measures are limited to counting microscopic, but not submicroscopic, dusts; however the newer method worked at higher magnification than the old dust counting technique. This rule-of-thumb, that 6 f/cc = 1 MPPCF, was necessarily used as a bridge from the old measurement system to the new. But it seems to have been well recognized that one could not simply convert measurements for many diverse processes, with any precision, using a single conversion factor.²⁰⁶

In 1970, ACGIH's notice of intended change for asbestos was lowered further, to 5 f/cc (fibers longer than 5 microns in length, counted by phase contrast microscopy at 430X). The formally adopted value remained at 5 MPPCF in 1970. No such value was listed in 1971, only the notice of intended change to 5 f/cc. And in 1972, ACGIH acknowledged the carcinogenicity of asbestos and three other substances for which TLVs had been prescribed (also 6 chemical carcinogens for which no TLVs were proposed).²⁰⁵

Finally, in 1974, ACGIH listed an adopted TLV of 5 f/cc for all varieties of asbestos.²⁰⁵ Using ACGIH's conversion factor of 1 MPPCF = 6 f/cc, this amounted to a reduction of less than one order of magnitude in the TLV for a recognized human carcinogen, from the old 5 MPPCF tentative threshold for asbestosis advised by Dreessen *et al.* in 1938.

The TLVs listed by ACGIH in 1968 were almost all adopted nationwide in the U.S. as mandatory workplace exposure limits under the Occupational Safety and Health Act in 1971. These

TLVs have been criticized in general as inadequately safe and weakly supported.^{2,23,25,28,29} Samuels, of the AFL-CIO, has described early ACGIH efforts as "voluntary private acts by government officials, acting as individuals in alliance with management specialists." He went on to say:

Review of the documentation of ACGIH values indicates that little attention was given to chronic effects. The selected studies were, at best, sources of data critical in the selection of exposure limits which when exceeded meant that most workers would experience acute effects that would disrupt production.²⁰⁷

DEVELOPMENT OF THE CURRENT U.S. ASBESTOS STANDARD

The Public Health Service had begun another study in 1964 "to determine the concentration of asbestos dust to which workers can be exposed throughout their working career, without any adverse effect on their health." Medical and environmental evaluations, augmented by available records on previous exposures, were conducted in asbestos textile plants. Reduced Forced Vital Capacity (FVC) turned out to be the most sensitive indicator; and positive chest X-rays (for small, irregular opacities) were more frequently observed than rales (crackling lung sounds). FVC is one of many measurements possible in lung function testing. Abnormally low FVC can be caused by a reduced lung volume from pulmonary fibrosis (lung scarring), an effect not caused by smoking. Reporting on their findings in 1971, P.H.S. researchers said the "cumulative exposures below 50 fiber/cc-years cause no reduction in FVC, and exposures greater than 200 f/cc are usually associated with reduction in FVC ...The present mandatory standard of 12 f/cc (first applicable to government contractors in 1969, under the Walsh Healy Public Contracts Act and then incorporated generally under the Occupational Safety and Health Act) appears to be at least twice and, more likely, four to six times the value it should be to prevent any health effect."²⁰⁸ They were, of course, only referring to asbestosis and not to cancer.

In 1971, cases of pleural mesothelioma and extensive pleural calcification were reported in two men who had worked as installers of vinyl-asbestos and asphalt-asbestos flooring. These men had often sanded old floors before installing new floor coverings. Simulated work conditions yielded exposures of 1.2-1.3 f/cc as measured by a personal sampler worn by the operator (who wore a respirator). Considering that floor sanding was not the continuous work activity of these patients, it was especially worrisome that the daily average exposure limits later adopted for asbestos were above 1.2 f/cc.²⁰⁹

The next year, a Vice President of Armstrong Cork objected to the idea of mandatory labels for flooring products containing the phrase "May Cause Asbestosis and Cancer." He proposed instead a warning to go only to professional flooring installers reading:²¹⁰

Caution to Installer: If subfloor preparation requires machine sanding of previously installed floor tile or an asbestos-type sheet backing, *do not breathe the resulting dust.* (emphasis added)

The Occupational Safety and Health Act established a new federal authority over workplace safety in the U.S. as of April 28, 1971. The asbestos industry knew it would be one of the first regulatory targets of the Occupational Safety and Health Administration (OSHA). On October 7, 1971, the concerns of Clifford Sheckler of Johns-Manville were communicated to the Board of Governors of the Asbestos Textile Institute:²¹¹

Mr. Sheckler is very apprehensive that an impossibly low TLV will be adopted for asbestos and so make it impossible for manufacturers to stay in business if it is to be enforced.

Johns-Manville officials had told a Canadian government physician in 1969 that the company's internal standard was 6 f/cc; they said the company had no difficulty meeting this limit in most mining and manufacturing operations.²¹²

A 5 f/cc limit was adopted as an "emergency standard" by OSHA on December 7, 1971.²¹³ Following this, hearings were held to develop a permanent standard which would incorporate

medical exams, warning signs in the plants, labeling and disposal of wastes, retention of medical records, provision of separate clothes lockers separated by showers, laundering of work clothes, and the use of respirators whenever a variance from the exposure limits of the standard is granted.^{214,215} On June 7, 1972, OSHA decided to retain the 5 f/cc limit and gave industry until July 1, 1976, to control exposures to no more than 2 f/cc on an 8-hour, time-weighted-average basis. Peak exposures up to 10 f/cc for 15-minute intervals were allowed.²¹⁶ This remained the U.S. standard for occupational exposure to asbestos until OSHA issued an emergency temporary standard on November 4, 1983.²¹⁷

The 1983 emergency standard lowered the permissible workplace exposure limit for asbestos to 0.5 f/cc. It permitted employers to comply through "any feasible combination of engineering controls, work practices, and personal protective equipment." Primary reliance on respirators as a means of compliance had been rejected in OSHA's standards for cotton dust and other materials. Union health experts were understandably upset that OSHA would consider allowing employers to simply make workers wear respirators rather than engineer better controls for asbestos dust in their workplace. Under the emergency rule and the proposed permanent standard that followed it, a workplace with 2 f/cc need not be further controlled for the dust; it was just as acceptable for the employer to hand respirators of questionable value to the workers. The control limit of 0.1 f/cc had been urged earlier in 1983 by the International Association of Machinists.²¹⁸

The Asbestos Information Association immediately filed suit in the U.S. Court of Appeals for the Fifth Circuit, which issued a stay of the emergency rule.²¹⁸ OSHA also pursued a permanent asbestos standard through more lengthy rulemaking procedures. A proposal to consider limits of 0.2 and 0.5 f/cc was published in the *Federal Register* on April 10, 1984, and hearings were held a few months later. The final standard issued June 20, 1986 set 0.2 f/cc as the exposure limit and allowed use of respirators only as a last resort in achieving compliance.²¹⁹ In response to a suit brought by the AFL-CIO, OSHA was ordered by the U.S. Court of Appeals (D.C.) to make the rules more

stringent. In rules published August 14, 1994, OSHA set the permissible exposure limit at 0.1 f/cc, the lowest concentration at which standard monitoring methods can be used reliably.

How Many Fibers a Day is 2 Fibers per Cubic Centimeter?

It is important to note that 1 f/cc is equivalent to 1 million fibers per cubic meter of air. In the course of an 8-hour work day, a worker would breathe in at least 5 cubic meters of air, perhaps much more for heavy work. So, in one day, someone exposed to the 1976-1986 OSHA limit of 2 f/cc (and the current TLV for chrysotile asbestos) is breathing in over 10,000,000 microscopic asbestos fibers. This does not take into account those fibers smaller than 5 microns in length and those which are 5 or more microns long but too small in diameter (0.1 micron or less) to be seen under phase contrast with an optical microscope. Electron microscope analysis of duplicate samples viewed by optical microscopy shows that only one asbestos fiber in 100 to 1000 is seen by optical fiber counting.²²⁰ Assuming the small fibers are 100 times as abundant as the ones seen under the optical microscope using the OSHA method, the *daily* inhaled burden of asbestos at 2 f/cc in air comes to over 1,000,000,000 (one billion) fibers in all.

And though it may be the lower limit of detection using optical microscopic analysis, the lowest proposed standard of 0.1 f/cc equates to an inhalation burden of over 50 million total fibers *per day*, for sedentary work.

The small size of most airborne fibers and their ability to break down into submicroscopic sizes makes dust control most difficult. The settling speed of an asbestos fiber visible under phase contrast optical microscopy is on the order of 30 centimeters (one foot) per hour. It is easy to appreciate that this dust is slow to settle, once suspended; and once it settles, it is easily resuspended by air currents along surfaces, etc.

Unlike most man-made fibrous materials, asbestos fibers tend to break longitudinally rather than cross-sectionally, so that a larger fiber ("bundle") may break down to numerous thinner "fibrils" of comparable length. This is especially worrisome in view of animal studies suggesting that, at least for mesothelioma, long, thin fibers are the most carcinogenic.²²¹

Standards in the United Kingdom, the United States, and Sweden

In 1960, the 5 MPPCF threshold adopted by ACGIH was accepted by the Industrial Health Advisory Committee in Great Britain.²²²

It was also recognized that a more substantial response to the asbestos problem was warranted. Leathart and Sanderson, writing about the asbestosis hazard in the insulation trade in 1963, urged that the asbestos industry hygiene and medical regulations (already long in use for asbestos factory workers) be extended to cover "ladders" as well.²²³ They questioned the adequacy of a 5 MPPCF threshold, and suggested that the long-term solution was the substitution of asbestos in insulation by safer alternatives.

As the British government moved in 1968 to issue new regulations for the protection of workers from asbestos, Turner & Newall companies made contingency plans, including the replacement of asbestos in some product lines. The manager of T&N subsidiary J.W. Roberts' Railways and Insulation Department anticipated that the rules would have a devastating impact on sprayed asbestos and other Roberts asbestos products. J.W. Roberts Chairman A.N. Marshall was thus advised on a strategy for handling the government regulators while selling asbestos for as long as possible.

As indicated in my budgets, I consider that the introduction of new regulations could result in an even more rapid reduction in the use of asbestos than anticipated. If however, we demonstrate, by a token effort only of ostensible intention to comply with the regulations, it is conceivable that we can ward off the evil day when asbestos cannot economically be applied—i.e., "hold-on" until 1972/73 period.²²⁴

(It appears that sprayed "Limpet" asbestos was not changed over to mineral wool until 1975 in Britain and 1976 in T&N's overseas markets.²²⁵)

The 2 f/cc limit was in effect as the chrysotile asbestos standard in Great Britain from 1970-1983. This control limit was initially believed by some authorities to reduce the risk of asbestosis to one percent among those who have a lifetime's

exposure (i.e., 50 years' exposure at 2 f/cc).²²⁶ "By asbestosis this committee means the earliest demonstrable effects on the lung due to asbestos." The British Occupational Hygiene Society (BOHS) sub-committee on asbestos had reviewed clinical and X-ray data on 290 men at work in a Turner Brothers Asbestos Company factory in 1966. The analysis of the data but not the chest X-ray films was provided to BOHS by the company medical officer. Eight of the workers were said to have X-ray evidence of asbestosis and 16 had rales. The men had started work after January, 1933 (when factories were first required to control dust exposures), and the company had some air monitoring data on their exposures. One problem was, only 118 had worked for longer than 20 years.

Turner Brothers' medical officer, Dr. Knox, was succeeded by Dr. William Kerns, who quit when he was refused permission to publish about mesothelioma at T&N; and then, by Dr. Hilton Lewinsohn, at around the time the U.K. government moved to develop an asbestos standard. Lewinsohn presented his own report of the health status of men employed at the company's main plant in 1971. The prevalence of abnormal chest X-rays was around 35% among those employed for 10-19 years and about 55% among those with 20-29 years since first exposure. The prevalence of pulmonary fibrosis reported for these two cohorts was 30-35%. Many of these men were also in the group examined by Dr. Knox less than five years before, and it appeared that Dr. Lewinsohn had found at least several times as many cases of asbestosis on X-ray than the eight reported to BOHS by his predecessor.²²⁷

The publication of Lewinsohn's paper in 1972 greatly disturbed Dr. Irving Selikoff and others in the United States, where OSHA was issuing a standard largely based on the British standard (which had in turn been based on Dr. Knox's evaluation of X-rays at the large Turner Brothers plant).

Selikoff drew attention to the apparent difference between the evaluations of Knox and Lewinsohn and its implications at the American Industrial Hygiene Association meeting in 1973. For workers exposed over their working lives to 400f/cc-years, Dr. Knox had found that 7 or 8 percent had abnormal X-rays, "whereas in the same population a different film reader had

found somewhere between 40 to 50 percent had abnormal X-rays." Selikoff reasoned that this "considerable discrepancy" might mean that workers exposed to asbestos at the limit accepted by OSHA were at serious risk of irreversible, often fatal disease—"and in my opinion, (the OSHA standard) should immediately be reconsidered."²²⁸

Lewinsohn's "strictly private and confidential" reaction was to admit that Selikoff had "boxed clever once again and it would be difficult to deny his conclusions."²²⁹

After at least four drafts were reviewed by asbestos industry doctors, industrial hygienists, and public relations specialists in the United States, Canada, and Britain, Lewinsohn and T&N industrial hygienist Stephen Holmes sent a letter to Selikoff. Copies were circulated to industry leaders and governmental and professional organizations in the United States. The letter accused Selikoff of forming "extremely misleading" conclusions and professed astonishment at his disclosure of "private correspondence" from Lewinsohn in making his analysis. The T&N officials also noted that the BOHS Sub-committee on Asbestos, "of which we are both members," had recently reviewed the U.K. standard for chrysotile asbestos, "in the light of the latest available data," and recommended that no change be made.²³⁰

We cannot accept the implication that Dr. Lewinsohn's publication allows doubt to be cast on the validity of the BOHS standard and are of the opinion that such a conclusion is unwarranted.

This was quite a change from Lewinsohn's confidential reaction the month earlier.²³¹

I still feel that the BOHS information was to say the least scanty for the purpose. I think my figures are nearer the truth and to some extent share Selikoff's concern.

Selikoff had warmly invited Dr. Lewinsohn to speak at a seminar with the scientists at the Mt. Sinai School of Medicine during his upcoming visit to the United States. One week ahead of the planned seminar, Lewinsohn declined, claiming a change

had been made in his plans and that he would not be in New York on his visit to the United States.²³²

In replying to Lewinsohn's widely distributed letter, Selikoff called for a reevaluation of the 1966 X-rays in T&N's files by "skilled, independent British experts." Knox had been a general practitioner before joining T&N, with no academic qualifications in radiology or industrial medicine. Selikoff said that only reappraisal of the X-rays could vindicate Dr. Knox or prove he was "in error."²³³ The British industry public relations group, Asbestos Information Committee, decided that it would be "impolitic" to include an article on this correspondence with Selikoff in its newsletter.²³⁴ Lewinsohn then followed the advice of Dr. John Gilson at the Medical Research Council, writing briefly to Selikoff that new information had become available with the passage of time since 1966, that this was being assessed, and that the results would be "published in due course." No offer was made to submit the 1966 X-rays to independent review, and further correspondence was discouraged.^{235,236}

Selikoff next approached Dr. Robert Murray, Medical Advisor to the Trades Union Congress. Enclosing copies of his correspondence with Lewinsohn, he reported that the matter was important to the AFL-CIO.²³⁷ Murray replied, "I would certainly be very pleased to do all that I can to help resolve the problem." He said he would contact Dr. Gilson.²³⁸

I am sure he would be very interested in your suggestion of a new look at the X-rays on both sides of the Atlantic.

Murray said he had regarded the 2f/cc limit as an adequate one for controlling asbestosis, but noted it was "singularly difficult to establish any realistic atmospheric standards in relation to cancer."

A letter from the General Secretary of the Trades Union Congress to a senior AFL-CIO official several weeks later, evidently drafted by Dr. Murray, conveyed a decidedly different tone. Here it was stated that Dr. Murray had met with Dr. Gilson, who had explained that he and a panel of three other doctors including Lewinsohn would soon update the study of Knox's cohort through the end of 1972.²³⁹

My personal feeling is that the scientists in this area seem to be coping with the problem reasonably well and I do not think there is anything we can do to change their direction at the present time.

That day Murray also sent Selikoff a letter saying that, according to Dr. Gilson, "the situation is now being fully investigated in this country."²⁴⁰

He does not see any immediate need to marry trans-Atlantic comparisons of the X-rays ...

Murray passed copies of all this correspondence to Lewinsohn, on the guarantee of confidentiality.²⁴¹

Rebuffed at Turner & Newall, the Medical Research Council, and the Trades Union Congress, Selikoff had struck out in his effort to unlock the 1966 X-rays. He replied to Murray that he was in contact with Gilson about the updated study of Knox's TBA cohort. Selikoff had no doubt confirmed that Gilson really was opposed to reviewing the 1966 X-rays. Gilson was in an awkward position, having been a member of the BOHS Subcommittee of 9 that had accepted the data from two of its asbestos industry members without verification and had recommended a standard based on it. But there was no way that any independent British experts would get to examine the disputed X-rays if Gilson was opposed to it. Gracious in concession, Selikoff wrote to Murray that he agreed with Gilson that trans-Atlantic review of the X-rays was "currently unwarranted."²⁴²

Murray passed this along to Lewinsohn and Gilson, with a cover letter that said

I attach a copy of a letter I have had from Selikoff which would appear to scotch effectively the ideas he had about trans-Atlantic exchange of information. There is a bite in the tail of his letter but otherwise I think we can forget about the ideas he put up in his previous letter.

Murray would soon afterward leave the unions and be bitterly criticized by unionists and others for his viewpoints on asbestos, and for his appropriateness as a medical witness for asbestos

companies and chemical manufacturers opposing regulation and compensation suits (including Turner & Newall).

Dr. Selikoff wasn't the only one interested in what another reading of the crucial 1966 X-rays might imply about the 2 f/cc exposure limit. In updating medical knowledge about the 290 workers included in the 1966 cohort of Knox, Dr. Lewinsohn even applied "Knox criteria" in analyzing the X-rays of those still employed by TBA. Examining the workers' 1966 X-rays, Lewinsohn found asbestotic changes in 50 of the 162 persons from the original cohort who still worked for the company (31 percent). Knox had reported only 8 with positive X-ray changes in the entire group of 290 (3 percent). Communicating this to Jack Solon, Vice President for Environmental Affairs at Johns-Manville, Dr. Lewinsohn confided:²⁴⁴

I believe that the only definite conclusion which can be drawn from these figures is that I read X-rays more critically than Dr. Knox did—

Moreover, Knox had only assessed persons as having asbestosis if their chest X-rays were positive *and* they had basal rales. In this note to Solon, Lewinsohn recognized that an additional criticism of Knox might be his failure to diagnose cases based on positive X-rays alone.

—the alternative interpretation is that Dr. Knox underestimated the problem in 1966 and the X-rays should have been considered as more important than rales in determining the early effects of asbestos on the lung.

Lewinsohn's letter to Johns-Manville also included chilling information on the 29 persons in the 1966 cohort who were known to have died. Though only 4 of these 29 were considered to have "asbestosis present," one third had died from lung cancer (7) and mesothelioma (3). The mortality data, at least according to the records of T&N, suggested that asbestosis was not the cause of death in a single case, although another 3 deaths from respiratory disease and 10 from cardiovascular disease were recorded among the deceased former employees with "no asbestosis present."

Following a television program (Grenada: "World in Action" Oct. 14, 1974) in which the disagreement between Selikoff and Lewinsohn was highlighted, Lewinsohn drafted a letter to the *Royal Society of Health Journal*, where his article that had started the controversy had been published.²⁴⁵ He obtained his employer's counterpart to peer review by sending the draft to TBA Chairman David Hills and Turner & Newall public relations chief, W.P. Howard. But at a meeting of an Asbestosis Research Council committee, Dr. David Muir advised Lewinsohn against sending a letter to the journal to respond to Selikoff's analysis of his paper. Lewinsohn explained Muir's reasoning.²⁴⁶

(B)y amending the figures, Selikoff would simply be provided with stronger grounds for claiming that the new figures were indisputably correct and still showed a much higher incidence of asbestosis than had been found in a similar population studied by Dr. Knox.

Lewinsohn reported to Hills that he had therefore decided that, "it would be unwise at this stage to send the letter." Hills wrote back that he agreed "absolutely" with this decision.²⁴⁷

Turner Brothers Asbestos executive R.A. Wells wrote to Hills that Lewinsohn's unsent letter to the journal would have only compounded the "errors" of his 1972 paper. Referring to the paper's reference to abnormal X-rays, he wrote,²⁴⁸

How does he expect a reader to interpret his figures if not in the way Selikoff has done?

Wells criticized Lewinsohn as slipshod and naive, and went on to lambast as unforgivable Lewinsohn's "loose use of the term pulmonary fibrosis."

Since the correcting table still contains the column headed "Pulmonary Fibrosis," I would interpret it as saying that if I work in an asbestos factory for 40 years I have a 40% probability of developing asbestosis and, moreover, if I only stay between 10-20 years I have a 10% probability of developing asbestosis. Unless we are absolutely sure of these figures they should absolutely not be published.

Criticizing Lewinsohn's draft letter's closing paragraph as confusing, Wells noted that the "more important" issue of "what happened to the 290 people in the Knox cohort" was obscured. He agreed it was best to not continue an argument with Selikoff in the journal.

A chagrined David Hills wrote back to Wells that he should send his criticisms directly to Dr. Lewinsohn.²⁴⁹

Hopefully, we can make a scientist of him yet! At least, he will not be in a hurry to publish again, and next time he wants to, I will encourage careful internal scrutiny of his papers (would you like to volunteer?).

It is not hard to understand Lewinsohn's dilemma. He faced only unpleasant choices in responding to Selikoff's questions about the reliability of Knox's assessment of asbestosis in the TBA employees. He could tell the world what he'd told Jack Solon about his own incomplete reading of the 1966 X-rays (or even re-read all 290), thereby overturning standards all over the world based on Knox's review. Even asking company approval for that would have taken considerable personal courage, and publishing ultimately would have taken even more. His alternatives were publishing lies, maintaining silence, and taking refuge in obscurity. The TBA executives who wondered why Lewinsohn had not more clearly addressed the central issue acknowledged no responsibility of their own for his incoherence, in the internal corporate documents.

Lewinsohn remained at TBA until 1976 and then took the job of Medical Director for Raybestos-Manhattan. It was left for epidemiologist Julian Peto to publish the follow-up that discredited the 2 f/cc standard in 1978, based on the mortality of workers at TBA's Rochdale plant.²⁵⁰

In recommending a 2 f/cc standard for chrysotile asbestos, BOHS had admitted that it was only proposing to address the hazard of asbestosis, which it claimed was "the primary danger of inhaling asbestos dust." The Society acknowledged that for cancer, "it is not possible at this time to specify an air concentration which is known will be free of risk."²²⁶

Other researchers had already pointed out that, as asbestos workers lived longer without dying from asbestosis, more would

reach the cancer age and die from malignant diseases.^{251,252} This was well documented by German physicians, who reported that cancers of the lung and pleura had replaced asbestosis as the leading cause of death among asbestos workers in Dresden by the early 1960s.²⁵³ It was also widely accepted that asbestos caused mesothelioma in persons who did not have asbestosis. So in setting a standard for the most commonly used variety of asbestos based on asbestosis alone, it was to be expected that the British erred in the direction of insufficient worker protection.

The standards required also that the Factory Inspectorate be informed whenever crocidolite asbestos was handled. Personal protection was required whenever air concentrations exceeded 0.2 f/cc. This included insulation work where the blue asbestos was handled, too.²⁵⁴

Sweden issued regulations for protection of workers handling asbestos in March of 1964.²⁵⁵ Included were specific practices required in asbestos insulation work. Discussions of regulatory efforts in Great Britain, Sweden, and other countries, are included in Selikoff and Lee's *Asbestos and Disease*.²⁵⁴ (See also "Efficacy of Current Standards and Proposals to Change Them," later in this chapter.)

Exposure to Asbestos in Insulation Work

Case reports of asbestosis among insulation workers first appeared in the early 1930s.^{256,257} Fatal asbestosis was reported in an insulation worker in 1940 by Kuhn.⁹¹ It would appear, therefore, that measurement of the insulator's exposure could have contributed toward determining appropriate protective standards for asbestos exposure.

Beginning with Fleischer and his co-workers, a number of reports have included measurements of the asbestos dust exposures in the insulator's trade.^{77,223,258-271} An overview of these reports leads to several conclusions:

A given insulation task (installation of a particular product, mixing of boiler cement, hand-sawing lengths of pipecovering to fit the bends of the pipes, pounding into place, stripping old insulation off of pipes, etc.) might give

a wide range of possible exposures depending on the size of the working space and the amount of air movement and mixing in it. In the engine room of a ship, for example, spaces may be small and the need for exhaust ventilation, respiratory protection, etc. is thus especially urgent. Identical tasks performed on a breezy day out of doors at an oil refinery would result in lower breathing zone exposures than they would in a cramped, unventilated working space. The percentage of asbestos in a product could certainly influence the amount of airborne asbestos fiber created in working with the product. However, there is tremendous variation in dustiness from the same use of comparable products with an equal fractional content of asbestos.²⁷⁰ For this reason, one cannot make very quantitative estimates of worker exposure to asbestos based simply on ratios of the asbestos fractions in the products handled.

It is important to bear in mind some limits on the interpretability of the data in these reports. First, the method of measurement varies from one report to another. The impinger (used by Dreessen and his co-workers for total dust measurements in the 1938 Public Health Service study), Konimeter, and thermal precipitator are dust trapping devices that have long been in use. The membrane filter has been used in more recent times because of its ability to trap asbestos fibers as small as 0.1 micron in diameter.

Once the airborne dust particles are settled on the cover slip of a Konimeter or a thermal precipitator, they may be examined using optical microscopy at 400× or more. Dust particles settled at the bottom of an impinger's collecting cell could only be viewed at the magnification of 100×. Optical microscopic counting of asbestos fibers on a millipore filter is now routinely done with the phase contrast technique, which can reveal asbestos fibers down to the limit of resolution of the light microscope (about 0.1 micron in diameter).²⁵⁴

In comparisons of the impinger and Konimeter under identical sampling conditions, Murphy and his co-workers came up with a weighted average for shipyard insulation exposures of 5.2 and 24.4 MPPCF, respectively.²⁶⁵ Although these values might not

Table 3. Insulators' Exposures to Asbestos

Reference	Data Reported	Comment
Fleischer <i>et al.</i> ⁷⁷	7.6-32 MPPCF total dust in four Navy yard shops; 11-142 MPPCF avg. exposures on ship. Lower values also reported in units of "MPPCF asbestos dust."	1) processes: layout and cutting, band saw cutting, sewing and fabrication, cement mixing, grinding, general room air 2) no data on rip-out 3) recommends exhaust ventilation for: band saw cutting, grinding, cement mixing, on-ship installation 4) analysis by Konimeter
Asbestos Dust. ²⁵⁸	"dust count . . . upward of 5 m/cu. ft." (Sic) - no more information given	1) in-shop airborne insulation dust at Portsmouth, N.H. Naval Yard 2) recommends: confinement of dusty operations, ventilation, and use of respirators 3) fiberglass substitute sought for amosite insulation 4) method of analysis not given
Occupational Health Hazards ²⁵⁹	aboard ship: -installation of asbestos cloth - 5.5 MPPCF -installation and sawing block - 20.0 -installation of insulation block - 3.9 -sawing block insulation 11.7 -mixing magnesia cement - 5.6 -sweep-up after insulating boiler - 92.5	1) "dust counts for cutting and installing insulation block and ripping out old insulation usually exceed the safe concentration . . . when installing pre-fabricated insulation and asbestos cloth, dust counts are generally within acceptable limits."

Table 3. Insulators' Exposures to Asbestos (*cont.*)

Reference	Data Reported	Comment
	-rip out of pipe insulation - 6.8 MPPCF	2) respirators and wet handling recommended
Peele, R.E. ²⁶⁰	band saw cutting of insulation block: 13.1-101.4 MPPCF for Johns-Manville "Thermobestos" and 3.1-17.1 MPPCF for Owens-Corning "Kaylo."	Union Carbide report
Ayers, O. ²⁶¹	band saw, with local exhaust ventilation, cutting: J-M "Thermobestos" - 16, 34, 104 MPPCF (average: 51); and same size Owens-Corning "Kaylo" insulation blocks - 36, 52, 98 MPPCF (avg: 62)	Johns-Manville report
Leathart, G.L. and J.T. Sanderson ²²³	<i>asbestos fiber</i> counts in a well-ventilated corridor reached 5-10 MPPCF during mixing (reported in "particles per cc" - 5 MPPCF = 177 particles per cc). Lower values found while sweeping up stripped lagging in a narrow duct (less than 1 MPPCF).	1) fibers counted were 5 to 50 microns in length 2) data limited to one trial in a hospital 3) Hickish commented after the paper, in discussion, that the M.A.C. of 5 MPPCF applied to total dust, and a value of 0.85 MPPCF (30 per cc.) was "more realistic" for fibrous particles only. (p. 72) 4) sampling by thermal precipitator

Table 3. Insulators' Exposures to Asbestos (*cont.*)

Reference	Data Reported	Comment
Construction Health Hazards ²⁶²	spraying asbestos: 14-59 MPPCF	1) sampling 15 to 30 feet from asbestos spraying 2) respirators provided to sprayers and others working in the area 3) method of analysis not stated
Marr, W.T. ²⁶³	Most values between 1 and 5 MPPCF total dust, several installation processes done wet. Removal also monitored, for six asbestos products and one of fiberglass. "amosite . . . seldom applied in our shipyard because of the excessive dust it causes during removal." (Long Beach Naval Shipyard)	1) "The low counts on sampling do not appear to give an adequate indication of the actual hazard. During sawing of blocks and pipe sections and removal of old insulation, the work environment appears extremely dusty. Respirator filters often clog after an hour's work removing insulation." 2) Bausch and Lomb particle counter used
Balzer, J.L. ¹⁸⁹	1) Tabulated wide ranges of measurements for six operations, 0.5 to over 30 MPPCF; mean values of three operations between 5 and 10 MPPCF, the other three means were between 1-5 MPPCF	1) processes: pre-fabrication, application, finishing, tearing out, mixing, general
Ahlman, K. and E. Siltanen ²⁶⁴	1) breathing zone and general air concentrations for mixing insulation	1) no time intervals for exposures noted

Table 3. Insulators' Exposures to Asbestos (*cont.*)

Reference	Data Reported	Comment
	and installing it on pipes ranged from 34-92 f/cc (fibers longer than 5 microns); total counts of particles ranged from 26 to 50 MPPCF	2) single monitoring only for these construction and shipyard tasks, 5 measurements for each
	2) Sawing asbestos calcium silicate boards in a shipyard: breathing zone exposures 86-220 f/cc; 45 to 97 MPPCF	3) membrane filter method of analysis for fibers, midget impinger for particles
Murphy, R.L. <i>et al.</i> ²⁶⁵	1) shipyard insulation tasks ranged up to 10 MPPCF (band saw cutting) and gave a weighted average of 5.2 MPPCF, by the impinger method of analysis in 1965; 2) Konimeter counts for fabrication and on-ship work were higher; 8 to 62 MPPCF, with a weighted average of 32.7 (percent fiber reported as 0.1 to 3.8), for the years 1945 and 1965-1966	1) Konimeter gave values nearly 5 times as high as midget impinger on matched counts 2) one third of the Konimeter measurements were made in 1945
Ferris, B.G. <i>et al.</i> ²⁶⁶	1) average values for 1952-1966: general shop - 2.8 MPPCF layout area - 4.8 MPPCF cutting - 19.0 MPPCF opening bulk material - 7.2 MPPCF mixing cement - 57.3 MPPCF tear-out on ships - 29.2 MPPCF 2) samples taken in 1969:	1) fiberglass substituted for amosite asbestos "on major portions at work" in 1965 2) method of analysis for old data not given; membrane filter method used for fiber counts

Table 3. Insulators' Exposures to Asbestos (*cont.*)

Reference	Data Reported	Comment
	in shop - up to 3.1 f/cc, mean 0.3. on ship - up to 25 f/cc, mean 2.9	
Harries, P.G. ²⁶⁷	1) processes: removal of sprayed asbestos (avg. 226 f/cc), removal of pipecovering (avg. 152 f/cc), applying pipecovering (avg. 8.9 f/cc); 2) tables of data in the second report describe exposures in a very wide range of processes	membrane filter technique, some data also reported in mg/m ³ (mass fraction instead of a fiber count)
Barboo, S.J. ²⁶⁸	1) installation and shop handling tasks generally controlled to under 5 MPPCF, except for fitting block on the sides of steam generators (12-19 MPPCF) 2) rip-out exposures were 9-81 MPPCF, and 0.85-51.0 MPPCF, for various materials	1) greatest dust control achieved in shop handling and least control in rip-out 2) substitution of asbestos ongoing 3) impinger method used
Cross, A.A. ²⁶⁹	processes monitored: -three rip-out processes (159-353 f/cc) and adjacent exposures (83 f/cc) These are mean values, maximum of all was 3815 f/cc for sweeping and bagging debris	1) sources of data were government and industry in the U.K. 2) wider range of values shown in tables for each process than in initial summary table

Table 3. Insulators' Exposures to Asbestos (*cont.*)

Reference	Data Reported	Comment
	-spraying, undamped (150-1500 f/cc) spraying damped (1-4.7 f/cc) -application of 15% asbestos pipecovering (11.2-61 f/cc) -hand sawing incombustible board without exhaust (14-58 f/cc); with exhaust (1.1 - 3.4 f/cc); cutting incombustible board with power saws, without exhaust (63 to over 200 f/cc); with exhaust (1.4-4.5 f/cc) -drilling incombustible board without exhaust (1.0-5.4 f/cc); with exhaust (0.7-0.9) -cutting and fitting asbestos cloth (5-10); cutting "dust-suppressed" asbestos cloth (0.2-3 f/cc)	3) all data appear to employ membrane sampling method
Balzer, J.L., D.P. Fowler, and W.C. Cooper ²⁷⁰	personal and area sampling for pipe covering, tear-out, band saw cutting, scoring, and pounding (simulated). Highest exposures were from the 65% asbestos product, with personal sampling for most	1) use of one asbestos-free mineral fiber product and four asbestos insulation products (one 65% asbestos, the others 10-15%) in a closed room

Table 3. Insulators' Exposures to Asbestos (*cont.*)

Reference	Data Reported	Comment
Nicholson, W.J., D.A. Holaday, and J. Heimann ²⁷¹	operations between 100-800 f/cc, 2600 f/cc for scoring. Wide range of scatter for exposures from the three 10-15% asbestos (and calcium silicate) products, with up to ten-fold differences among them for given test conditions	2) 578 analyses in all 3) one of the calcium silicate (10-15% asbestos) insulations seemed consistently least dusty and one seemed most dusty of the three tested 4) membrane filter method
	average exposures: mixing and applying cement and cloth covering, 2.5-4.6 f/cc; cutting and applying block and pipe insulation, 5.2-11.5 f/cc; cutting materials for later use 7.6 f/cc; spraying turbines with asbestos 67 f/cc Electron microscopy showed that low fractions of the airborne fibers were longer than 5 microns; cutting block, 3.5%; mixing cement, 1.2%; fabrication of amosite blankets, 29%; removal of pipecovering, 5.9%	1) based on over 200 samples 2) authors believed time-averaged exposures of insulators while working with asbestos were 6 f/cc 3) authors believed exposures could be kept to 0.7 f/cc and below with the use of improved industrial hygiene practices and appropriate respiratory protection 4) membrane filter method

have been obtained in the same shipyard back in the 1940s it was recognized that the higher magnification used on Konimeter samples would yield higher dust counts than the impinger method.

Aside from variations in the methods of sampling and analysis, there was the problem that the work of the insulators varied from day to day in the short term, and underwent more gradual changes over the years. Even observations made at the same time were limited in applicability by differences in the work done by insulation workers at different locations. For example, a ship repair yard would have insulation rip-out work, but a purely ship-building yard would not (except in rare cases, perhaps). One yard might discriminate for or against the use of particular materials for health or performance reasons—another shipyard might not. The degree of exhaust ventilation used and availability of respiratory protection also varied widely, for common processes (e.g., band sawing of insulation).⁷⁷

Over the years, wetting to keep down the dust and other work practice changes were sporadically implemented. The fact that most of the available measurements date from 1965 on should thus be kept in mind. For by this time, the hazards of asbestos insulation were very widely recognized, and measurements of exposure might well reflect some improvement over conditions decades earlier.

Though there was little change in the materials used by insulators for many years, some researchers have reported on early efforts to phase out asbestos insulations and use insulations with lower percentages of asbestos in them.^{263,265,268}

The effect of such changes in lowering exposures could be obscured by fluctuations in the total volume of material handled, the extent of power tool use in machining it, and other factors mentioned already.

Murphy compared dust counts using the Konimeter in 1945 and 1965-1966 in the same shipbuilding facility. Total dust concentrations for sewing and fabrication (on-shore shop) operations were twice as high in the more recent years, and the reported "% Fiber" also ranged much higher in the 1965-1966 measurements. On ship, the opposite situation was found, with

the data showing both total concentrations and percent fiber higher in 1945 than in 1965-1966.²⁶⁵

The I.L.O. conference proceedings (published in 1972) presented many papers on the subject of asbestos exposure and substitution in shipyard insulation work. Perhaps the most startling and complete range of data were presented by Cross, of the British industry's Asbestosis Research Council.²⁶⁹ However, with all the data that have been compiled, the exposure history of an insulator is still not something that can be described quantitatively on a generic basis. Fleischer and his co-workers noted that, to obtain data on a worker's dust exposure over a period of years,⁷⁷

Daily dust counts at each specific job in each ship compartment and in the shop together with the time spent on each job would have to be compiled separately for each worker.

It is clear that many phases of insulation work entailed intense exposure to asbestos and other dusts. And even an operation of less than 30 minutes, if it entailed exposure upwards of 50 MPPCF, would make a sizable contribution toward an 8-hour work day average exposure. Looking back in 1972, Johns-Manville medical consultant George Wright suggested that these intermittent peak exposures might have accounted for the disastrous mortality experience of insulation workers, which was worse than that for some other types of asbestos workers.²⁷²

It is probable that in past decades insulation workers were exposed, on a daily average basis, to more than 5 MPPCF some days and (probably more often) to less on others, depending on the work they were doing. Thus, even if the 5 MPPCF "threshold" was a safe limit, asbestosis should have been anticipated in insulators based on their exposures.

Nicholson notes that three separate U.S. laboratories reported average asbestos fiber concentrations in insulation work in the 3-6 f/cc range in 1968-1971. Harries in England measured an average exposure of 8.9 f/ml for insulation application aboard ship. Nicholson factored in a reported decline by half in the asbestos content of insulation materials, and came up with crude estimates of historic *average* insulator exposure of 10-15

f/cc for construction and 15-20 f/cc for shipyard work.²⁷³ Actual measurements of fiber concentrations by the membrane filter technique were not conducted until the 1960s, however.

The high exposure from even the best-controlled uses of asbestos insulation and the substitutability of non-asbestos products have led to the virtual abandonment of asbestos insulation products. Efforts to replace asbestos for health reasons began in 1954 in Rhodesia (now Zimbabwe) and in 1958 in Sweden.^{274,275} Denmark banned asbestos in insulation in 1972. The U.S. Environmental Protection Agency banned the use of asbestos in molded insulation as an air pollution hazard in 1975; but nevertheless, a market of 600 metric tons of asbestos per year in thermal insulation persisted here through 1981.^{198,276} This appears to have been used in "air-cell" insulation, a corrugated asbestos paper used for wrapping low-pressure steam pipes (an eminently substitutable use).

Cancer from Asbestos in the Absence of Asbestosis

The early literature linking cancer with asbestos consisted of reports of workers who also had asbestosis. Hueper even referred to such tumors as asbestosis cancers, acknowledging that as of 1955 the literature did not show whether a cancer risk existed in the absence of pre-existing asbestosis.¹⁷¹ However, some early reports did suggest that lung cancer and mesothelioma appeared not only in asbestos workers with no clinical and radiological signs of asbestosis, but even among chrysotile asbestos miners whose lungs were not asbestotic when examined at autopsy.²⁷⁷⁻²⁷⁹

Wagner's landmark report of mesothelioma in a crocidolite mining district involved many patients with only non-occupational (environmental) exposure.²⁸⁰ Practically since 1960, it has been widely accepted that mesothelioma occurs among people who have not had sufficient asbestos exposure to develop asbestosis.²⁸¹⁻²⁸⁴

Both mesothelioma and lung cancer have been induced in rats inhaling asbestos dust for a total of seven hours only, at concentrations of 10-15 milligrams per cubic meter of air. Positive results occurred with chrysotile, crocidolite, and amosite.²⁸⁵ By way of comparison, the Soviet Union's official

limit for asbestos-containing dust in the workplace air was 1 milligram per cubic meter, or about 20 f/cc.²⁵⁴

Other reports further indicate that exposure to asbestos insufficient to produce asbestosis of the lungs may nonetheless cause lung cancer in humans.^{283,284,286,287-291} In view of the fact that so much of the supporting data comes from Great Britain, it is disappointing that that country's compensation law until 1985 had no provision for recognizing occupational disablement from lung cancer in asbestos-exposed workers who were not also diagnosed as having asbestosis of the lungs.^{292,293} The Industrial Injuries Advisory Council reported on the subject of compensation for asbestos-related lung cancer accompanied by pleural changes in November, 1982. It concluded, "Accordingly, we suggest the terms of prescription should be on the following lines:

Pulmonary carcinoma of the lung where there is accompanying evidence of one or more of the following:

- (a) Asbestosis;
- (b) Bilateral diffuse pleural thickening;
- (c) Bilateral pleural plaques.

Lung cancer in combination with only pleural asbestosis finally became a compensable disease in Britain in 1985.²⁹³

Roggli and others have criticized the hypothesis that asbestosis is a necessary prerequisite for the development of asbestos-related lung cancer, because it lacks biological plausibility. That is, there is no mechanism on which to scientifically base an asbestosis "threshold" of exposure for asbestos-related lung cancer. These writers point out that, even though most mesothelioma patients have pleural plaques and most lung cancer patients who smoke have some emphysema,³¹⁰

(N)o one would claim that lung cancer in a smoker who did not have emphysema was not related to smoking, nor that a mesothelioma in a patient exposed to asbestos but without pleural plaques is not related to asbestos.

Epidemiologic studies are not, generally, sensitive enough to demonstrate a lung cancer association at low levels of asbestos

exposure. Their failure to show a "statistically significant" risk in populations exposed to amounts of asbestos insufficient to produce asbestosis is more a reflection of the limits of the method of investigation than of the existence of a threshold. After all, asbestosis is a disease, not an agent of disease. The finding that most cases of lung cancer that have been associated with asbestos exposure have occurred in persons with asbestosis is merely consistent with the fact that both diseases show a dose-response relationship with asbestos exposure.^{310,311}

Efficacy of Current Standards and Proposals to Change Them

U.S. government authorities on asbestos have rated the old 2 f/cc standard "grossly inadequate" to protect against disease.²⁸⁴ They attributed this largely to be "dramatic evidence of asbestos-related disease (particularly mesothelioma) in members of asbestos-worker households and in persons living near asbestos-contaminated areas." It was concluded that the standard should be set down at the limit of reproducibility of optical microscopic monitoring, for 8-hour sampling (0.1 f/cc). Moreover, non-essential uses of asbestos should be eliminated, the government's task force recommended in 1980:

The committee also reiterates its judgment that even where exposure is controlled to levels below (0.1 fiber/cc), there is no scientific basis for concluding that all asbestos-related cancers would be prevented.

The NIOSH-OSHA panel went on to say that, while there were debates about the hazards posed by different mineral varieties of asbestos and different size distributions of respirable fibers, the evidence lacked sufficient scientific basis for setting differing standards by fiber type. U.S. government regulation has continued to be the same for all commercially used asbestos fiber types, despite urgings by industries using chrysotile asbestos that this variety is less harmful.^{219,294}

The British have taken a different view, setting tougher standards for crocidolite than for chrysotile and amosite asbestos. The Advisory Committee on Asbestos recommended in 1979:²⁹⁵

1. a ban on the import of crocidolite and products containing it; work necessitating exposure to crocidolite should have a control limit of 0.2 f/cc.
2. the control limit for chrysotile asbestos should be reduced from 2 f/cc to 1.0 f/cc by December 1, 1980.
3. the control limit for amosite asbestos should be reduced from 2 f/cc to 0.5 f/cc by December 1, 1980.

Media investigative reports about asbestos and cancer in Great Britain and pressure from trade unions prompted the government to finally put these recommendations into effect in 1983. A list of asbestos products which would be banned was also reportedly being developed.^{296,297} When asked about the adequacy of a 1 f/cc standard, Dr. Richard Doll replied:²⁹⁸

A level of one fibre is too much. I doubt if the (government's advisory committee report of 1979) has got its estimates of the effect of this amount correct.

In August of 1983, the U.K. announced that stricter rules would take effect in August 1984. The new control limits were as follows: chrysotile, 0.5 f/cc; amosite and crocidolite, 0.2 f/cc. Importation and the use in manufacturing of amosite and crocidolite were banned under the new rules; exposures will continue due to the amounts of these materials already in place from past years.²⁹⁹

Intensive study of asbestos in particular, and carcinogens in general, has convinced most scientists in this field that no level of exposure can be presumed free from cancer risk.^{219,283,284,294,300} Dr. William Nicholson of the Mount Sinai School of Medicine in New York has suggested that the term "risk limitation value" is more appropriate in setting limits for asbestos exposure in the workplace.³⁰¹

Dr. Doll's associate Julian Peto has calculated that 10 percent of asbestos workers exposed to 2 f/cc for 50 years would die from asbestos diseases. His estimates were based on the excessive incidence of lung cancer and mesothelioma in the same Turner Brothers plant used in setting the BOHS standard.²⁵⁰ More recently, Dr. Nicholson evaluated literature

Table 4. Adopted Limits for Daily Average Exposure to Chrysotile Asbestos in Workplace Air

	1946- 1969	1970	1971	1972	1974	1975	1976	1980	1982	1983	1984	1986	1987	1994
OSHA (U.S.)			12 f/cc	5 f/cc			2 f/cc					0.2 f/cc		0.1 f/cc
ACGIH	5 MPPCF				5 f/cc			2 f/cc*						
United Kingdom		2 f/cc*								1 f/cc*	0.5 f/cc*			
South Africa**			?—45	f/cc—		12 f/cc			5 f/cc		—2 f/cc		1 f/cc	

* More stringent limits were simultaneously set for crocidolite and/or amosite asbestos

** South Africa has set standards for mines only (chrysotile, crocidolite, and amosite are all mined there). Until 1987 there were no government standards for non-mine occupational exposure to asbestos. The Factory Inspectorate now has a 1 f/cc limit for all colors of asbestos, limited to factories where asbestos is a main product component.

on asbestos "dose-response" relationships for Sweden's National Board of Occupational Safety and Health.²⁷³ He found that,

- *six studies* indicate that an asbestos exposure of 2.5 f/cc for 40 years will *at least* double the risk of lung cancer and increase total mortality by 10% (original emphasis)
- three of these studies suggest that such increased mortality may result from exposures as low as 0.5 f/cc for 40 years
- at least four epidemiological studies of asbestos workers demonstrated a linear dose-response relationship with no evidence of a threshold below which disease does not appear

On the basis of observations such as these, Sweden has virtually eliminated all uses of asbestos from its economy.³⁰²

OSHA's emergency standard for asbestos included estimates of cancer risk to the workers associated with various levels of exposure under consideration. OSHA estimated the mortality from asbestos-related cancer from 45 years of exposure as: 0.3 percent of those exposed to 0.1 f/cc; 1.7 percent of those exposed to 0.5 f/cc; and 6.4 percent of those exposed to 2 f/cc.²¹⁸ Apparently, the Reagan administration considered 0.1 f/cc excessively burdensome for employers, even though the intent to regulate at that level had been expressed by OSHA in 1980.²⁸⁴

Stokinger's old idea of a 100 to 500-fold reduction of the TLVs for carcinogens, if applied to asbestos textile plants (and asbestos in general), would have been 30 years or more ahead of its time. The 5 MPPCF value equates roughly to 30 fibers per cc in such facilities, and OSHA proposed to lower the limit first to 0.5 and then 0.1 fibers per cc before issuing a 0.2 fiber limit in 1986 and a 0.1 fiber limit in 1994.^{218,219,284,303}

CONCLUSION

The hazards of asbestos were described by the Roman historian, Pliny, shortly after the time of Christ. Modern recognition of asbestosis was recorded in the last years of the nineteenth

century and after 1900 in the annual reports of the Factory Department in Great Britain.

Merewether and Price conducted a survey of dust exposure and disease in the asbestos textile industry in England, providing a basic analysis of the need for both a fibrosis-producing quantity of dust in the lungs and a fibrosis-producing ("maturation") period necessary for the disease to become manifest. These authors suggested that since spinners were less severely affected by asbestosis than other textile workers with comparable durations of exposure, that the spinners' exposure level might be considered a "dust datum." Merewether's data were inadequate for quantitative prescription of the dust datum.

By 1930, asbestosis was also reported in the United States, and within a few years three large-scale surveys were conducted under industry and government sponsorship. The state of Pennsylvania found asbestosis in workers exposed to airborne dust counts averaging as low as 4.64 MPPCF.

The U.S. Public Health Service conducted a survey of three asbestos textile plants and produced a lengthy report on medical and industrial hygiene conditions. Unfortunately, the mill owners fired 150 out of fewer than 600 workers prior to the P.H.S. survey, most of whom had asbestosis. Government inspectors found 3 "doubtful or borderline" cases of asbestosis among the few remaining workers who had been employed for 5 or more years in less dusty conditions, and proposed a tentative threshold limit of 5 MPPCF. Dreessen and co-workers cited the findings of the state of Pennsylvania, but did not attempt to reconcile their proposed TLV with this earlier finding of asbestosis at a lower exposure level than 5 MPPCF. Nor did they acknowledge the implications of their own finding of advanced asbestosis in workers with cumulative exposures equal to only 20-22 years at 5 MPPCF.

Most regrettably, Dreessen's recommendation was accepted by the American Conference of Governmental Industrial Hygienists as a good practice guideline, despite the mounting evidence of asbestos' carcinogenicity through the 1940s. While ACGIH was reporting its first lists of TLVs for industrial dusts and gases, the asbestos textile industry in the United States was surveyed by the Industrial Hygiene Foundation. Hemeon, in his

confidential report to the industry, repeatedly criticized the 5 MPPCF level as potentially unsafe and requiring further study. In the meantime, writers less familiar with the literature on asbestos disease (e.g., Sax) placed unwarranted confidence in the safety of the 5 MPPCF limit, and some states adopted this limit in industrial codes and guidelines.³⁰⁴

The publication of guidelines by ACGIH and state agencies did not assure that such limits would be observed in actual practice, however. Few state agencies had the authority and resources to enforce standards for worker exposure to toxic substances. This regulatory vacuum persisted nationwide until the passage of the Occupational Safety and Health Act of 1970.

In earlier decades, there was no requirement imposed on manufacturers to monitor employee asbestos exposures (except perhaps by workers' compensation insurance carriers). Very scant data have been published from the years 1930-1970, and it appears that very little effort was made to monitor worker exposures to see if they exceeded 5 MPPCF. This was true despite the fact that 5 MPPCF was, "a very small concentration, so small in fact that the condition may look good even to the critical eye and still present an exposure greater than this low limit." As Warren Cook went on to explain in 1942,

In the case of asbestos dust ... the toxic limit is so low that the only safe procedure is to have recourse to actual dust determinations.³⁰⁵

In actual practice, asbestos mining and manufacturing firms appear to have commonly exceeded the TLV in their own operations. Eight of the 10 asbestos textile plants surveyed by Hemeon in 1947 had dust counts over 5 MPPCF.⁷⁵ Unpublished monitoring data from Johns-Manville's plant in Manville, New Jersey show that concentrations commonly exceeded 5 MMPCF in the years 1952-1954. Measurements several times that level were common, and a number of values upwards of 50 MPPCF were recorded.³⁰⁶ The Quebec Asbestos Mining Association observed that the ACGIH Committee on Threshold Limits had "potent legal standing in theory, but not in practice." The QAMA members, mostly multinational corporations based in the U.S. and the U.K., also emphasized the fact that adequate

information was not always available to the Committee, and that in 1968 the TLV for asbestos was "not up-to-date."³⁰⁷ Other examples of non-compliance with the TLV are given in Chapter 9 (See "Raybestos-Manhattan, Inc.", Owens-Illinois, "Owens-Corning Fiberglass Corp.," "Asbestos Corporation, Ltd.," "W.R. Grace & Company," and "Westinghouse Electric Corporation.")

Stokinger suggested that the ACGIH set definite exposure limits for carcinogens in industry, utilizing a large safety factor below the level where toxic non-malignant effects were thought to occur. However, this proposal was not adopted for asbestos. The concept was applied to one substance only, nickel carbonyl, and that at the time of Stokinger's presentation. That same year, 1955, epidemiological evidence firmly established asbestos' carcinogenicity.

Between 1960 and 1965, a number of articles showed that asbestos caused malignant mesothelioma both in asbestos workers and people with "bystander" exposure. The cancer hazard from asbestos dust was thus shown to extend to workers in all the shipyard and construction trades, family members of asbestos workers, and neighbors of asbestos plants.

Despite all this, the value recommended by ACGIH in the U.S. was still 5 MPPCF until 1969. At that time, a federal standard of 12 fibers per cubic centimeter of air was adopted under provisions of the Walsh Healy Public Contracts Act (this applied only to government contract jobs costing \$10,000 or more). The Occupational Safety and Health Administration set an emergency asbestos standard for all U.S. workplaces in 1971, with an exposure limit of 5 f/cc. This remained the U.S. standard until 1976, when a reduction to 2 f/cc took effect. Proposals were made by OSHA to further lower the 8-hour time-weighted limit for asbestos exposure to between 0.1 and 0.5 f/cc (100,000 and 500,000 fibers per cubic meter of air). Eight years after the first of these proposals was published, OSHA finally issued an emergency temporary standard of 0.5 f/cc but broke with precedent by allowing the use of respirators as an alternative to engineering controls to achieve compliance. The emergency standard would have remained in effect for 6 months had it not been stayed by the courts in response to the industry's challenge. In the meantime, a permanent standard was developed

by OSHA. The permissible exposure limit was set at 0.2 f/cc, and the courts subsequently ordered OSHA to set even lower limits wherever feasible. In 1994, OSHA lowered the permissible exposure limit to 0.1 f/cc.

In Britain, asbestos regulations were limited to asbestos manufacturing plants in the 1930s, despite official recognition of hazards in the use of insulation products. Government efforts to extend protection to shipyard workers in the years 1945-1960 were obstructed by resistance from the asbestos industry leader, Turner & Newall. The final rules issued in 1960 did not require protection of bystander trades workers in areas where asbestos spraying and insulation removal were carried on.

British workplace asbestos standards were issued in the late 1960s which admittedly were not set so low that they would protect against the risk of cancer. Even this purported protection from asbestosis was postulated on an optimistic appraisal of a limited study of actively employed workers at an asbestos textile plant. Independent scientists were refused access to the chest X-ray films, whose interpretation by Turner Brothers' medical director provided the basis of the standard.³⁰⁰ The 2 f/cc standard for chrysotile asbestos had been thoroughly discredited by 1978, and a 1 f/cc standard was finally adopted in 1983. Britain then cut the control limit for chrysotile to 0.5 f/cc in 1984.

Additional human experience coming to light has offered further opportunity to quantify the relationship between asbestos exposure and the risk of disease. Yet the crucial low end of the dose-response curve remains a matter of scientific dispute, with a wide range of uncertainty.

Consumption of asbestos fiber in the U.S. peaked in 1973 (795,000 metric tons) and had dropped by more than one fourth by 1979 (to 560,500 m.t.). A one-year plunge of 35% occurred in 1980 (to 358,700 m.t.), followed by a further decline in 1982 (to 246,500 m.t.).¹⁹⁸ The Bureau of Mines figure for 1986 was 120,000 metric tons, the lowest since 1934.³⁰⁹ The Bureau's estimate for 1994 is 26,800 metric tons, lower than the quantity for 1905, the first year continuous figures for annual consumption became available. U.S. consumption of asbestos has steadily declined since 1978, and this will evidently continue,

despite asbestos interests' success (in 1991) in getting the courts to overturn the Environmental Protection Agency's regulations to phase out most uses of asbestos (See "Continuing Asbestos Exposure in the United States," in Chapter 11). This trend is largely attributable to public concern over the hazards of asbestos, and liability considerations by companies who used to use asbestos in brake linings, fire-resistant textiles, etc. Specific product bans by government regulators also played a part, as did EPA and OSHA standards that raised operating and fixed production costs.

It is tragic that only after so much death and disease have occurred and been set in motion are industrial nations turning away from the use of asbestos. The opportunity to take direct preventive action by the establishment of and adherence to truly health-based standards had hardly been given a chance.

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5

Asbestos Product Use

"As with the rest of industry, we are also aware of our responsibilities to the consuming public. Today, the products of industry are designed to promote the health and comfort of the public. Industry is constantly striving to bring about more pleasant living through improved products as better values to the consumer. Moreover, every effort is made nowadays to protect the consumer with safer products and better methods of handling them.

Years ago industrial research was unconcerned about problems of health and safety that might be involved in a product. When the product was developed, it was put on the market. Today our industrial research organizations probe into every health hazard. And every safeguard is insisted upon before the product is marketed to the consumer...

And industry has inspired, to a very great extent, the movement to label properly certain types of products that might harm the consumer if he were not forewarned."

A.R. Fisher, President of Johns-Manville Corporation,
Address to Industrial Hygiene Foundation 20th Annual
Meeting 1955 (Trans. Bull. No. 29, pp. 12-18, I.H.F.
Pittsburgh)

This chapter will discuss issues which arise in personal injury suits brought by asbestos insulation workers and others exposed through asbestos product use.

The Charges: Failure to Test, Failure to Warn

In the personal injury suits brought by U.S. asbestos product users, the manufacturers are being sued for their failure to do these things:

1. test the products for potential dangers to consumers;
2. label the products with appropriate warnings about the dangers and means to minimize them; and
3. use other available means to safeguard users of the products against the hazards involved.

U.S. Mineral Products Company considered affixing health warnings to packages of its sprayed asbestos products in 1962 and claims to have started using such labels in late December of that year. Johns-Manville considered and rejected applying health warning labels on sacks of asbestos in Canada (1952, 1965), "Marinite" asbestos-containing boards (1958), and "J-Spray" asbestos spray-on fireproofing (1960). The usual reasons for not using warning labels were the expected loss of sales, the implications for having to label other product lines, and damage to J-M's competitive position unless the other members of the industry agreed to take identical action. The reasons warning labels were considered were dust created in product use, legal protection from liability, and (in 1952) compliance with generally stated Illinois law and regulations. In 1958, the failure to warn of health concerns in addition to advising dust control was seen as a "good business answer" but not a good "legal" answer.¹

A pivotal year was 1964, when some but not all of the manufacturers of asbestos insulation products began to affix the first generation of caution labels. The Johns-Manville Corporation placed this warning label on packages of its asbestos insulation products:

This product contains asbestos fiber. Inhalation of asbestos in excessive quantities over long periods of time may be harmful. If dust is created when this product is handled, avoid breathing the dust. If adequate ventilation control is not possible, wear respirators approved by the U.S. Bureau

of Mines for *pneumoconiosis-producing* dusts. (emphasis added)

Not until 1969 were the first warnings also placed on sacks of asbestos fiber; other products, such as asbestos-cement panels and brake linings, do not appear to have borne warning labels until the 1970s.

In 1964, the epidemiologic studies of Selikoff, Hammond, and Churg were published, showing that insulation workers had a startlingly high likelihood of dying from occupationally caused diseases such as asbestosis, lung cancer, mesothelioma, and gastrointestinal cancer.² Later in the year, a large conference on asbestos disease was held by the New York Academy of Sciences. The proceedings were published in the Academy's *Annals* (V. 132) in 1965. At this meeting, Dr. Selikoff and his co-workers reported that radiological evidence of asbestosis was seen in 86 percent of the 392 insulators they had examined who had started in the trade more than 20 years before. "In half of these, the asbestosis was moderate or extensive."³

Most asbestos insulation workers swear they never saw a warning label until the late 1960s or early 1970s. They also testify, with rare exceptions, that they were unaware of the health threat of their work in the years prior to 1965.

In the precedent setting *Borel v. Fibreboard* case, the U.S. Fifth Circuit Court of Appeals concluded that "a duty to warn attaches, *whenever a reasonable man would want to be informed of the risk in order to decide whether to expose himself to it.*" (emphasis added). In this case, the trial judge instructed the jury that the manufacturers had no duty to warn of the danger from the use of their products unless and until the state of knowledge was such that a reasonably prudent manufacturer would have been aware of the danger.⁴

The court held the manufacturer to "the knowledge and skill of an *expert*" regarding scientific discoveries and, "even more importantly, a manufacturer has a duty to test and inspect his product."⁵ The court explained:

The extent of research and experiment must be commensurate with the dangers involved. A product must not be made available to the public without disclosure of those dangers

that reasonable foresight would reveal. Nor may a manufacturer rely unquestioningly on others to sound the hue and cry concerning a danger in its product. Rather, each manufacturer must bear the burden of showing that its own conduct was proportionate to its duty.

The trial judge in *Borel* defined, "unreasonably dangerous" as dangerous to an extent beyond that contemplated by an insulator with knowledge available to him. The manufacturers' claim that it was the insulation contractors' responsibility to warn the insulators was rejected.

The sellers' warning must reasonably be calculated to reach (the ultimate consumers) and the presence of an intermediate party will not by itself relieve the seller of this duty.

Each of the fifty states imposes its own laws, precedents and peculiarities on product liability. This introduction is intended only to basically frame the issues involved. Several volumes on this subject by attorneys are already in print.^{6,7,8}

Basic "State of the Art" Defense Arguments

Subsequent to the verdict in *Borel* being upheld on appeal, it was clear that many similar lawsuits would be filed by other workers. A meeting of 18 insurance company representatives in 1976 concluded with a decision to do research on the state of the art defense and identify doctors who would be willing to testify in maintaining it.⁹

The defendants in asbestos disease litigation today contend that they had no actual knowledge of a hazard to the users of their products before 1964, nor did they have sufficient cause to conduct studies to see whether their products posed health dangers for the users. They claim the risk of developing an illness from breathing asbestos dust was thought to be limited to mining, milling, and manufacturing plant workers between 1930 and 1964.

The principal defendants acknowledge that the disease, asbestosis, has been known since 1930. They point out that it was the asbestos industry that had approached Dr. Lanza in

1929 and cooperated in the plant surveys described in Lanza's 1935 article.¹⁰

They note that the broad-scale surveys published by Merewether and Price, Fulton *et al.*, Lanza *et al.*, and Dreessen *et al.* in the 1930s all involved asbestos factory workers, and asbestos textile workers in particular.¹⁰⁻¹³ They claim that a hazard to users of asbestos products could not be assumed nor necessarily anticipated based on reports of asbestosis among textile workers. As Selikoff and his co-workers had acknowledged, the asbestos textile plants were chosen in early surveys as the best places to observe the uncomplicated effects of asbestos dust.³

The textile industry was selected for study since only here was there pure or almost pure asbestos exposure. Since it was urgent to investigate the effect of this dust, limiting the investigation to this branch of the industry avoided the possible complications which might be introduced by the presence of other potentially fibrogenic dusts.

These authors noted that fibrous glass products had come into increasing use over the preceding 30 years; moreover, the molded products frequently used by insulators were approximately 15 percent asbestos. The authors characterized the insulators' asbestos exposure as "limited and intermittent."

Much is made of the reference above to "pure asbestos" in the factories versus "limited" asbestos exposure in insulation work. Some defendants in asbestos litigation today contend that they had believed that the daily exposure level of 5 MPPCF was a safe level until the late 1960s, and that insulators were exposed to lower levels of asbestos-containing dust. Some defendants further suggest that asbestos textile workers were exposed to much purer asbestos exposure in the airborne dust breathed than were insulation workers, i.e., that the asbestos fiber fraction of the dust was much greater in the textile plants than in insulation work.

The contention that insulation installers were presumed to be exposed to less than 5 MPPCF—and hence were considered, until well into the 1960s, to be within the "safe" zone of exposure to asbestos—is very open to question on both grounds (See Chapter 4). The "asbestos" and "total fiber" fractions

reported in the airborne dust for both asbestos textile factory and insulation exposures lend little if any support to the "all versus nearly nothing" account of textile plant workers' vs. insulators' fractional asbestos fiber exposure (See "Asbestos Fiber Fraction of Inhaled Dust" in Chapter 4).

Some defense attorneys have claimed that the 5 MPPCF guideline referred only to the count of asbestos particles in air, not all dusts. Corn counters that dust counts of MPPCF reported in the literature should not be viewed as having been modified by any coefficient based on the percent composition of asbestos in the collected airborne dust. He notes that no such "correction factor" was used by experts he surveyed on industrial hygiene air sampling, nor is support for the idea expressed in such texts as *Industrial Dust*, by Drinker and Hatch (1954).¹⁴

Knowledgeable lawyers representing asbestos companies and former asbestos companies have posed the question: "State of the art as a defense—is it real?" While no clear answer to that question was offered, it was concluded that, "(T)he threshold limit value concept is probably the best thing the defense has in its arsenal."¹⁵ Though this may be, few defendants have documented any historic awareness of the TLV before the 1970s; and fewer, if any, offer a persuasive record of evidence that it was corporate policy to assure conformance with the TLV in their own operations. No insulation manufacturer ever conducted product testing to see if customers' exposures were above or below the TLV; and no testing was done before Selikoff came along that even suggested that normal use of asbestos insulation could be expected to yield exposures below the TLV (See Table 3, Chapter 4). No company ever issued a warning label stating that exposure during product use should not be allowed to exceed 5 MPPCF or any other specific concentration (and if so, what disease risks would then exist and what should be done to eliminate them).

In view of the factual record, the author submits that the answer to the question posed by the knowledgeable defense attorneys at their strategy meeting is obvious, at least from a scientific point of view.

Table 1.
Recognition of Asbestosis Hazard Among Insulators and Other Asbestos Product Users

Country	Year of Recognition	Year Reported	Author(s)	Reference
United Kingdom		1930	Merewether & Price	in Table 5
USA		1932	Russell	in Table 2
Germany	1937	1940	Kuhn	in Table 2
Finland	1938	1971	Ahlman & Siltanen	Exposure of Insulation Workers to Asbestos Dust. <i>Work- Environment-Health</i> 8: 1-5 (1971)
Netherlands	1939	1988	Swuste, <i>et al.</i>	<i>Asbest, het Inzicht in de Schadelijke gevolgen in de Periode 1930- 1969 in Nederland</i> Delft Univ. Press
Norway		1940-41	Wolff, Schrumpf	in Table 2

Table 1 (cont.)
Recognition of Asbestosis Hazard Among Insulators and Other Asbestos Product Users

Country	Year of Recognition	Year Reported	Author(s)	Reference
Italy		1948	Canepa	in Table 3
Denmark		1950	Frost	in Table 2
Sweden	1950	1956	Ahlborg & Hansson	in Table 3
Switzerland		1952	Sroka	in Table 5
Australia		1957	Thomas	in Table 5

Table 2. Asbestos Disease in Insulation Workers and Other Asbestos Product Users
Medical Literature: Cases of Disease Reported Before 1964

Year	Author(s)	Reference	Occupations	Diseases
1932	Russell	<i>Proceedings of Conference Concerning Effects of Dusts Upon the Respiratory System</i> (held by the Industrial commission of Wisconsin: p. 180), Democrat Press	insulator	asbestosis
1933	Ellman	<i>J. Indust. Hyg.</i> 15: 165-183	insulator	asbestosis
1934	Ellman	<i>Brit. J. Radiol.</i> 7: 281-295	insulator	asbestosis
1934	Wood & Gloyne	<i>Lancet</i> 2: 1383-1385	boiler riveter	asbestosis
1935	Jacobson	<i>Acta Med. Scand.</i> 78: 482-488	welder	"early acute asbestosis"
1936	Ellman	<i>Seventh International Congress of Occupational Accidents and Illnesses</i> , Jean Vromans, Brussels, pp. 409-423	insulator	asbestosis

Table 2. Asbestos Disease in Insulation Workers and Other Asbestos Product Users
Medical Literature: Cases of Disease Reported Before 1964 (cont.)

Year	Author(s)	Reference	Occupations	Diseases
1939	Arnold, Beal and Cookson	<i>Brit. J. Tuberc.</i> 33: 45-48	asbestos handler in a chemical plant	asbestosis
1940	Wolff	<i>Nord. Med.</i> 5: 535-541	3 asbestos handlers in a chemical plant	asbestosis
1940	Kuhn	<i>Arch. Gewerbepath.</i> <i>Gewerbehyg.</i> 10:133-150	shipyard insulator	asbestosis
1941	Schrumpf	<i>Nord. Med.</i> 9: 704-706	asbestos handler in a chemical plant	asbestosis
1942	Williams	<i>Med. Bull. Vet. Admin.</i> 18: 250-253	aluminum plant worker wearing asbestos apron and gloves	asbestosis
1942	Holleb & Angrist	<i>Amer. J. Path.</i> 18: 123-131	2 insulators	asbestosis & lung cancer in both
1947	Kennaway & Kennaway	<i>Brit. J. Cancer</i> 1: 260-297	insulator	asbestosis & lung cancer
1947	Mallory, Castleman, and Parris	<i>New Eng. J. Med.</i> 236: 407-412	insulator	asbestosis & mesothelioma

Table 2. Asbestos Disease in Insulation Workers and Other Asbestos Product Users
Medical Literature: Cases of Disease Reported Before 1964 (cont.)

Year	Author(s)	Reference	Occupations	Diseases
1949	Franchini & Canepa	<i>Med. Lavoro</i> 40: 161-172	insulator	asbestosis
1950	Frost	<i>Ugeskr. Laeger</i> 112: 1284-1289	shipyard insulator	asbestosis
1951	Stoll, Bass, & Angrist	<i>Arch. Internal Med.</i> 88: 831-834	plumber/insulator	asbestosis & lung cancer
1953	Van Luyt	<i>Third International Conference of Experts on Pneumoconiosis, Sydney, Feb.—March, 1950, Record of Proceedings</i> , pp. 169-171	"some" insulators	asbestosis
1953	Isselbacher, Klaus, & Hardy	<i>Amer. J. Med.</i> 15: 721-732	contractor's helper sawing asbestos board	asbestosis & lung cancer
1953	Weiss	<i>Medizinische</i> 3: 93-94	shipyard insulator	asbestosis & pleural mesothelioma
1955	Sander	<i>Arch. Industr. Health</i> 12: 208-211	plumber's helper sawing pipecoverings	asbestosis

Table 2. Asbestos Disease in Insulation Workers and Other Asbestos Product Users
Medical Literature: Cases of Disease Reported Before 1964 (cont.)

Year	Author(s)	Reference	Occupations	Diseases
1956	Hampe	<i>Ned Tijdschr. Geneesk.</i> 100: 2965-2966	insulator	asbestosis & lung cancer
1956	Molfino & Zannini	<i>Folia Med.</i> 39: 525-539	6 shipyard insulators	asbestosis
1957	Marks <i>et al.</i>	<i>Am. J. Med.</i> 22: 51-73	pipefitter	asbestosis
1958	Pendergrass	<i>Am. J. Roent.</i> 80: 1-41	insulator	asbestosis
1958	Pendergrass	<i>The Pneumoconiosis Problem</i> Charles C. Thomas, Springfield, pp. 97-100	insulator	asbestosis
1958	Van der Schoot	<i>Ned. Tijdsch. Geneesk.</i> 102: 1125-1126	3 insulators	asbestosis & mesothelioma
1959	Hertz & Reinwein	<i>Ärztliche Woch.</i> 14: 361-365	3 insulators	asbestosis (and lung cancer in one case)
1960	Whitmore, <i>et al.</i>	<i>Armed Forces Med. J.</i> 11: 203-216	bricklayer	asbestosis & lung cancer

Table 2. Asbestos Disease in Insulation Workers and Other Asbestos Product Users
Medical Literature: Cases of Disease Reported Before 1964 (cont.)

Year	Author(s)	Reference	Occupations	Diseases
1960	Anderson & Campagna	<i>Arch. Environ. Health</i> 1: 27-32	insulator	asbestosis & lung cancer
1960	Ahlmark, Bruce, and Nyström	<i>Silicosis and Other Pneumoconioses in Sweden</i> Svenska Bokförlaget, Stockholm, pp. 353-357	8 to 11 insulators and two asbestos sprayers (including cases reported by Ahlberg and Hansson in 1956)	asbestosis (and lung cancer in one case)
1960	Keal	<i>Lancet</i> 2: 1211-1216	5 insulators	asbestosis & cancer
1960	Wagner, Sleggs, & Marchand	<i>Brit. J. Industr. Med.</i> 17: 260-271	3 insulators	mesothelioma and asbestosis
1960	Eisenstadt & Wilson	<i>Journal-Lancet</i> 80: 511-514	2 insulators	asbestosis & mesothelioma
1960	Joseph	<i>Med. J. Australia</i> 1: 804-806	insulator	asbestosis
1961	Ambrosi & Cavallo	<i>Riv. Infort. Mal. Prof.</i> 48: 818-827	2 insulators	asbestosis

Table 2. Asbestos Disease in Insulation Workers and Other Asbestos Product Users
Medical Literature: Cases of Disease Reported Before 1964 (cont.)

Year	Author(s)	Reference	Occupations	Diseases
1961	Castleman & Kibbee	<i>New Eng. J. Med.</i> 265: 745-751	shipyard worker	asbestosis
1961	Heard & Williams	<i>Thorax</i> 16: 264-281	carpenter, insulator	asbestosis & lung cancer; asbestosis & peritoneal mesothelioma
1961	Frenkel & de Jager	<i>Yearbook of Cancer Research & The Fight Against Cancer in the Netherlands</i> 11: 99-106	insulator	peritoneal mesothelioma
1961	Telischi & Rubenstone	<i>Arch. Path.</i> 72: 116-125	plaster mixer	asbestosis & lung cancer
1961	Brugsch & Bavley	<i>New Eng. J. Med.</i> 265: 375-381	automobile undercoater	asbestosis
1961	Sleggs, Marchand, and Wagner	<i>S. Afr. Med. J.</i> 35: 28-34	3 insulators	mesothelioma

Table 2. Asbestos Disease in Insulation Workers and Other Asbestos Product Users
 Medical Literature: Cases of Disease Reported Before 1964 (cont.)

Year	Author(s)	Reference	Occupations	Diseases
1962	Thomson	<i>S. Afr. Med. J.</i> 36: 759-760	1 builder	mesothelioma
1962	Eisentadt	<i>Amer Practitioner</i> 13: 573- 578	1 insulator, 2 refinery foremen	mesothelioma & asbestosis
1962	McCaughey, Wade, and Elmes	<i>Brit. Med. J.</i> 2: 1397	5 shipyard workers, 1 engine room fitter	mesothelioma
1962	Cordova, Tesluk, and Knudtson	<i>Cancer</i> 15: 1181-1187	hod carrier, iron worker, shipyard worker, bricklayer, 3 insulators, carpenter	asbestosis & lung cancer

Table 2. Asbestos Disease in Insulation Workers and Other Asbestos Product Users
 Medical Literature: Cases of Disease Reported Before 1964 (cont.)

Year	Author(s)	Reference	Occupations	Diseases
1963	Bogetti	<i>XIVth International congress of Occupational Health, Madrid, Spain, Sept 16, 1963, Vol. 4, Abstracts of Free communications, Excerpta Medica Foundation, Amsterdam, page E52</i>	10 insulators	asbestosis
1963	Castleman & Kibbee	<i>New England J. Med.</i> 269: 747-753	1 plumber	asbestosis & mesothelioma
1963	Farina & Mazzanti	<i>Lavoro Umano</i> 15: 276-281	1 insulator	asbestosis & lung cancer
1963	Leathart & Sanderson	<i>Ann. Occup. Hyg.</i> 6: 63-74	18 insulators	asbestosis

Table 3. Epidemiological Reports on Insulation Workers and Related Trades

Year	Reference	Disease
1946	Fleischer, Viles, Gade, and Drinker <i>J. Industr. Hyg. Tox.</i> 28: 9-16	asbestosis in 3 of 51 active workers with more than 10 years experience in the insulation trade; no cases found in over 1000 with shorter exposure
1948	Canepa, <i>Lavaro Med.</i> 2: 18-20	summary report of asbestosis in a cohort of 52 Genoa insulators
	Canepa, <i>Zacchia</i> , 12: 188-205	definite asbestosis in 5 cases and early asbestosis in others—in a survey of 52 insulators in Genoa
1954	Breslow, <i>et al.</i> , <i>Amer. J. Publ. Health</i> 44: 171-181	an excessive rate of lung cancer among "steamfitters, boilermakers, and asbestos workers" in an epidemiologic study of relation between occupation, smoking, and lung cancer
1955	Breslow, <i>Dis. Chest</i> 28: 421-430	
1956	Ahlborg and Hansson, <i>Svenska Läkartidningen</i> 53: 1376-1383	7 insulators and 2 asbestos sprayers with asbestosis in a group of about 60 workers examined
1956	Frost, Georg. and Møller. <i>Danish Med. Bull.</i> 3: 202-204	9 asbestos cases, and 19 with pleural abnormalities among 31 workers examined with 20 or more years in the insulation trade
1961	Hetzel, "Long Beach Naval Shipyard Study of Asbestos Workers in Relation To Asbestosis" 3-16, June, 1961. U.S. Navy document	17 cases of asbestosis in about 97 shipyard insulators

Table 3. Epidemiological Reports on Insulation Workers and Related Trades (*cont.*)

Year	Reference	Disease
1964	Selikoff, Hammond, and Churg. <i>J.A.M.A.</i> 188: 22-26	Follow-up mortality study on 632 insulators (255 deaths) showing excessive incidence of lung cancer and gastrointestinal cancer; also 4 deaths from mesothelioma and 12 from asbestosis.

The Published Literature on Asbestos Disease from Product Use

In fact there wasn't ever any necessity to rely on interpretations of the plant worker studies' import for insulators, analyze Dr. Selikoff's retrospective remarks, or await the publication of data showing whether insulators were exposed daily to 5 MPPCF of sufficiently asbestiform airborne dust. The reason is simple: *There were dozens of reports of asbestosis among insulators published before 1964.*

Asbestosis is a distinctive disease, both radiologically and pathologically. The clinical findings are also distinctive enough that the diagnosis can usually be made on the basis of an adequate occupational history and chest X-ray, other causes having been ruled out with reasonable medical certainty. Asbestosis is caused by one thing only—breathing asbestos. When an asbestosis patient who worked as an insulation worker is described in the literature, there are only three possible inferences:

1. the worker didn't really have asbestosis; his condition was misdiagnosed;
2. the asbestosis was contracted from an unrecognized and unreported asbestos exposure; or
3. the asbestosis was contracted as a consequence of doing insulation work.

One or two such early reports, especially if not verified pathologically, might be open to doubt. However, autopsy reports confirming the early observations were available by the early 1940s. The two insulators described by Holleb and Angrist (1942) had lung cancer as well as asbestosis. Kuhn's 1940 report appears to document the first case of fatal asbestosis in an insulation worker. Pathologists at Massachusetts General Hospital reported asbestosis and mesothelioma in an insulation worker in 1947 (See Tables 1-3).

In addition to primary reports of asbestosis in product users, abstracts, review articles and medical textbooks mentioned the asbestosis hazard to insulators and/or asbestos product users starting in the 1930s (See Tables 4-6). Other sources listed only asbestos textile processes as the occupations at risk of asbestosis. But certainly many of the doctors who authored those writings never even thought they were providing all-inclusive lists of the occupations at risk. They were, after all, more interested, in general, in manifestations of the disease process than in the myriad industrial aspects of asbestos use and control.

Usually the hazard was described as, "breathing asbestos dust." In many cases the authors were more or less explicit in including as at risk the asbestos product users as well as asbestos miners and plant workers.¹⁶⁻¹⁹ What one does *not* see expressed repeatedly in the literature is the view that: mining, milling, and manufacturing workers are at risk of asbestosis, but asbestos product users are not.

There is one article only that contains qualified statements along these lines: "Survey of Pipecovering Operations in Constructing Naval Vessels," by W.E. Fleischer and co-workers.²⁰

The Fleischer, Viles, Gade, and Drinker Report

Fleischer and his co-workers conducted chest X-ray examinations and dust surveys at four Naval shipyards at the close of World War II. As shown in their report, there were 51 workers with "10 plus" years in the pipecovering industry, out of 1,074 workers examined. Fully 948 had had less than 5 years in the

trade. Three cases of moderate and advanced asbestosis were found, all in men with more than 20 years of asbestos work.

Dust counts for individual tasks ranged from 0 to 250 MPPCF, and no attempt was made to estimate an "average" daily exposure for insulation work. Removal of old insulation for replacement, probably the dustiest job, was not monitored at all in this survey of new ship construction sites. (See "Exposure to Asbestos in Insulation Work," in Chapter 4, for more details.) The authors noted that the TLV recommended in 1938 by Dreessen and co-workers was based on total dust analyses. Although the sampling data tabulated in this study included figures for total dust and "asbestos dust," only the total dust figures were discussed in the text of the paper.

The findings of these authors were fully consistent with previous reports on the time needed for development of asbestosis. What distinguishes the Fleischer report is the authors' analysis of their findings. While recommending exhaust ventilation for the dustiest processes, these investigators gave the pipecovering trade a rather clean bill of health. Because of the importance lately attributed to this report, the authors' conclusions are included here in full:

1. The character of asbestos pipecovering industry on board naval vessels is such that conclusions drawn from other asbestos industries such as textiles, cannot be applied.
2. The operations of band saw cutting, grinding, cement mixing, and installation on board a ship should be equipped with exhaust ventilation to keep the total dust concentration low.
3. The incidence of asbestosis among pipe coverers in the shipyards studied was low, *0.29 percent or 3 cases out of 1074*. In view of the nature of shipyard pipe covering work, this low incidence is not surprising. (emphasis added)
4. Since each of the 3 cases of asbestosis had worked at asbestos pipe covering in shipyards for more than 20 years, it may be concluded that such pipecovering is not a dangerous occupation.

This report is unusual in its absence of any discussion of the disease asbestosis. Whether the authors carefully read the radiology chapter in Dr. Lanza's book (... "no appreciable number of cases of asbestosis are discovered until the second five years of employment. Relatively few cases mature in this minimum period of seven years; many, even in the more dusty processes, require eleven years.") which they cited, is questionable.²¹ The inclusion of 277 workers with 0-2 years' experience in their survey is understandable. But fully 88 percent of the workers in this study had had less than five years of employment as insulators in the shipyards. The inclusion of these workers as a dilution factor in conclusion No. 3 indicated considerable ignorance about the "maturation period" for the development of asbestosis. The only medical reference cited besides Lanza's book was the Dreessen survey.¹³

It is not even clear how the authors determined whether some of the men had asbestosis. The text and one of the tables (4) clearly indicate that diagnosis was based solely on the reading of chest X-rays. But in Table 5, on the "relationship between length of exposure and incidence of asbestosis," a total of 1124 (not 1074) subjects are included. For one of the yards (B), the number of men included in this table far exceeded the number X-rayed. For two other yards, the number X-rayed was greater than the number included in Table 5. If some of the latter yards' X-rays were of such poor quality that they couldn't be read for asbestosis, this was nowhere acknowledged. So there are questions both about men included in the analysis in Table 5 for whom there were no X-rays, and men excluded from it for whom there were chest X-rays taken.

The article published by Fleischer, Drinker, and co-workers in 1946 appears to conflict with earlier, unpublished reports by some of these writers. In 1944, Fleischer and Dr. W.C. Dreessen found radiologically well-established asbestosis in 2 men and considered the X-rays of 4 others "consistent with a diagnosis of asbestosis." In all, they examined chest X-rays of 38 pipecoverers in Bath, Maine.²² Local exhaust ventilation, respiratory protection, and yearly chest X-rays of the workers were advised. "The conditions in this shop present a very real asbestosis hazard and immediate steps should be taken to

segregate the most dusty processes into a well-ventilated area," the doctors wrote. Similarly strong recommendations were made in a 1942 survey of the Oregon Shipbuilding Corporation. In this, Drinker and his co-workers urged that the union be told about the hazards of breathing asbestos and instructed in proper preventive measures.²³ In 1944, Drinker voiced concern about high peak exposures where men worked with amosite asbestos.²⁴ Dust counts were "very much higher than anyone would recommend—they ran up to 25 million." Given the above data and expressions of concern over the industrial hygiene aspects of insulation work during the War, it is especially difficult to understand how these investigators could then write that pipecovering was "not a dangerous occupation."

It is almost impossible to find any comment on the Fleischer report in the medical literature during the fifteen years after its publication. The 1956 paper by Molfino and Zannini is the only such reference the author has located. It credited Fleischer and co-workers with being the discoverers of the asbestosis hazard in shipyard insulation work.²⁵ It is very hard to believe that anyone who was knowledgeable about asbestosis was misled by the Fleischer study's naive conclusions.

The author has seen counsel for asbestos product manufacturers go to great lengths to impress juries through strained readings of this 1946 article. The implication, at least, is that this article was read by corporate management, and that it influenced corporate policy. However, when pressed, no defendant has been able to produce documentation or testimony to show that this article was even read by any corporate executive in the asbestos industry in the 1940s and 1950s. And no defendant has produced documentation or testimony to the effect that this article was relied upon by executive management for any purpose during that era. On the other hand, corporate officials of some companies (e.g., E. Torbohn of Fibreboard, Dr. K. W. Smith of Johns-Manville) have acknowledged that they had never heard of this report, much less relied upon it in making business decisions.

Table 4. Abstracts of Articles (in Tables 2-3) Which Cite
Asbestos and Cancer Hazards to Asbestos Product Users

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- Kuhn, A. (1940)—*Bull. Hyg.* 17: 819-821 (1942). Reprinted in *Pneumoconiosis Abstr.* 11: 4-5 (1954).
- Fleischer, W.E. et al. (1946)—*Indust. Hyg. Digest* 10: 12 (April, 1946).
- Franchini, A. and G. Canepa (1949)—*Bull. Hyg.* 25: 150 (1950).
Reprinted in *Pneumoconiosis Abstr.* II: 169-140 (1954).
—*Arch. Indust. Hyg. Occup. Med.* 1: 362-363 (1950).
—*Indust. Hyg. Digest* 14: 28-29 (March, 1950).
- Stoll, R., R. Bass, and A.A. Angrist (1951)—*Bull. Hyg.* 27: 44 (1952).
Reprinted in *Pneumoconiosis Abstr.* III: 177 (1959).
- Breslow, L. (1955)—*Chest Diseases Section XV of Excerpta Medica* 9: 257 (1956).
—Breslow, L. *Arch. Ind. Health* 14: 191 (1956).
- Frost, J., J. Georg, and P.F. Moller (1956)—*Indust. Hyg. Digest* 21: abstract no. 761 (June, 1957).
—*Bull. Hyg.* 32: 260 (1957).
—*Abstr. World Med.* 21: 359 (1957).
—*Public Health, Social Medicine and Hygiene Sec. XVII of Excerpta Medica* 3: 596 (1957).
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- Ambrosi, L. and A. Cavallo (1961)—*Public Health, Social Medicine and Hygiene Sec. XVII of Excerpta Medica* 8: 837-838 (1962).
—*Chest Diseases Sec. XV of Excerpta Medica* 16: 37-38 (1963).
- Telisch, M. and A.I. Rubenstone (1961)—*Public Health, Social Medicine and Hygiene Sec. XVII of Excerpta Medica* 8: 442 (1962).
—*Chest Diseases Sec. XV of Excerpta Medica* 15: 454 (1962).
- Brugsch, H.G. and H. Bavley (1961)—*Arch. Environ. Health* 4: 114 (1962).
—*Indust. Hyg. Digest* 25: abstract no. 997 (Oct. 1961).
—*Chest Diseases Sec. xv of excerpta Medica* 15: 269 (1962).

Table 4. Abstracts of Articles (in Tables 2-3) Which Cite
Asbestos and Cancer Hazards to Asbestos Product Users (*cont.*)

- Public Health, Social Medicine and Hygiene Sec XVII of Excerpta Medica* 8: 517 (1962).
Eisenstadt, H.B. (1962)—*Indust. Hyg. Digest* 26: abstract no. 1171 (Dec. 1962).
—*J.A.M.A.* 182: 205 (1962).
Leathart, G.L. and J.T. Sanderson (1963)—*Public Health, Social Medicine and Hygiene Sec. XVII OF Excerpta Medica* 9: 988 (1963).

Note: In all the above examples, the asbestosis risk to product users is evident from the abstract itself. There are also abstracts of other papers from Tables 2-3 which do not describe the occupations of the patients, but these are not included here.

Table 5. Some Articles Noting Disease/Risk in Insulation Workers
and Other Asbestos Product Users

- Merewether, E.R.A. and C.W. Price. *Report on Effects of Asbestos Dust on the Lungs and Dust Suppression in the Asbestos Industry*. H.M. Stationery Ofc., p. 19 (1930).
Merewether, E.R.A. A. Memorandum on Asbestosis. *Tubercle* 15: 69-81 (1933).
Asbestos. *Indust. Bull.* 13: 95 (1934)
Lanza, A.J. Dust Diseases as They Affect the Construction Industry. *Trans. 25th Nat. Safety Cong.*, Chicago: Nat. Safety Council, 1936, pp. 244-246.
Sappington, C.O. Banish the Dust Hazard. *Mill and Factory* 18: 69-71, 150-152 (1936).
A Survey of Occupational Exposures to Specified Materials in Maryland U.S. Public Health Service and Maryland state agencies (1936).
Merewether, E.R.A. Dust and the Lungs. *Industrial Medicine Symposium No. 3* Medical Press and circular Supplement pp. 11-17 (July 20, 1938).
Brown, E.W. Industrial Hygiene and the Navy in National Defense. *Air Hygiene Foundation of America, Inc. Fifth Annual Meeting of Members*, 77-84 (Nov. 12-13, 1940).

Table 5. Some Articles Noting Disease/Risk in Insulation Workers and Other Asbestos Product Users (cont.)

- Annual Report of the Surgeon General, U.S. Navy* for 1939, U.S. Navy Dept., 1941, p. 24.
- Hueper, W.C. *Occupational Tumors and Allied Diseases*, Springfield, Ill.: C. Thomas Publ., 1942, pp. 399-405.
- Dublin, L.I. and R.J. Vane. *Occupation Hazards and Diagnostic Signs*. Bull No. 41, U.S. Dept. of Labor Standards, 1942, p. 25.
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- Grämer, J. Health Injuries in Electro-welders. *Arch. Gewerbepath. Gewerbehyg.* 11: 644-685 (1942). Abstract in *Bull Hyg.* 18: 847-848 (1943); reprinted in *Pneumoconiosis Abstracts* 11: 327-328 (1954).
- Minimum Requirements for Safety and Industrial Health in Contract Shipyards. *Indust. Med. Surg.* 12: 259-263 (1943).
- Homburger, F. The Coincidence of Primary Carcinoma of the Lungs and Pulmonary Asbestosis, *Amer. J. Path.* 19: 797-807 (1943).
- Lawrence, W.E. Fume Control in Shipyards. *Nat. Safety News* (1944), April, pp. 16-17, 90-92, and, Trans. 32nd Nat. Safety Cong., 1943, pp. 401-404.
- Hutchinson, F.W. Dust as an Industrial Health Hazard. *Heating and Ventilating* 41: 57-61 (1944).
- Alden, H.S. and W.H. Howell. The Asbestos Corn. *Arch. Dermatol. Syphil.* 49: 312-314 (1944).
- Annual Report of the Chief Inspector of Factories for the Year 1945*, London: H.M. Stationery Ofc., 1946, pp. 13-14.
- Drinker, P. Health and Safety in Contract Shipyards During the War. *Occup. Med.* 3: 335-343 (1947).
- Asbestos Dust. *Safety Review* 4: 13 (1946). U.S. Navy.
- Brahdy, L. Discussion. *Dis. Chest.* 14: 885-555 (1948).
- (Editorial) Asbestosis and Cancer of the Lung. *J.A.M.A.* 140: 1219-1220 (1949)
- Asbestos Regulations. *Annual Report of the Chief Inspector of Factories for the Year 1949*, London: H.M. Stationery Ofc., 1951, pp. 144-146.
- Sroka, K.H. Occupational Disease Caused by Asbestos. *Krebsarzt* 7: 167-171 (1952).
- Hardy, H.L. Occupational Medicine. *New Eng. J. Med.* 247: 473-483 (1952).

Table 5. Some Articles Noting Disease/Risk in Insulation Workers and Other Asbestos Product Users (cont.)

- McVittie, J.D. Pneumoconiosis in the United Kingdom. *Third International Conference of Experts on Pneumoconiosis, Sydney, February-March, 1950, Record of Proceedings*. Geneva: International Labor Office, 1953, p. 172.
- Lung Cancer. *Safety Maint. Prod.* 107: 66 (1954).
- Portigliatti-Barbos, M. Considerations on the Association between Asbestosis and Pulmonary Carcinoma. *Giorn. Acad. Med. Torino* 91-107 (1955).
- McLaughlin, A.I.G. The Dust Diseases in Great Britain. *Arch. Industr. Health* 12: 83-98 (1955).
- Gardiner, J.F. Occupational Diseases of the lungs. *Nebraska State Med. J.* 40: 285-289 (1955).
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- Francia, A. and G. Monarca. Asbestosis and Pulmonary Carcinoma. *Minerva Med.* 27: 1950-1959 (1956).
- Dust Hazard in Industry. *Manufacturing and Management* (Australia), pp. 20-24 (July 10, 1956).
- Thomas, D.L.G. Pneumokoniosis in Victorian Industry. *Med. J. Australia* 1: 75-77 (1957).
- The Protection of Workers against Occupational Diseases and Poisoning*. Geneva: Chemical Industries Committee, Fifth Session, Third Item on the Agenda, International Labour Office, 1957, pp. 21-23.
- Asbestos Industry Regulations, 1931. *Annual Report of the Chief Inspector of Factories for the Year 1956*, London: H.M. Stationery Ofc., 1958, pp. 141-145.
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Table 5. Some Articles Noting Disease/Risk in Insulation Workers and Other Asbestos Product Users (cont.)

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- Occupational Health Hazards* Release No. 27, U.S. Navy, p. 104 (1960).
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- Working Conditions and Safety in Shipbuilding and Ship Repairing. Metal Trades Committee, Seventh Session, International Labour Office, 1962, pp. 85-86.
- Hervieux, J. Certain Aspects de l'Asbestose, *Cahiers Méd. Inter Professionnelle* 7: 41-42 (1962).
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- An, S.H. and I. Koprowska. Primary Cytologic Diagnoses of Asbestosis Associated with Bronchogenic Carcinoma. *Acta Cytol.* 6: 391-398 (1962).
- Thomson, J.G., R.O.C. Kaschula, and R.R. MacDonald. Asbestos as a Modern Urban Hazard. *S. Afr. Med. J.* 37: 77-81 (1963).
- Construction Health Hazards. *Michigan's Occupational Health* 8: 1-5 (1963).
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- Thermal Insulation of Pipes and Vessels* EEUA Handbook 12, London: Constable & Co., 1963, p. 31.
- Gault, G.A. and M.F. Adams. *Dusting Properties of Thermal Insulation Materials* Wash. State Institute of Technology Bull. 269 (1963).
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Table 6. Some Textbook References to Occupational Disease Hazard of Insulation Work and Other Asbestos Product Use

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- Lanza, A.J. (ed) Occupational, Preventive, and Legislative Aspects in Great Britain/Asbestosis. *Silicosis and Asbestosis*, New York: Oxford University Press 1938, pp.385-390.
- Collier, H.E. Asbestosis. *Outlines of Industrial Medical Practice*. Baltimore: Williams and Wilkins Co. Baltimore, 1941, pp.364-368.

- Sappington, C.O. *Essentials of Industrial Health*, Philadelphia: J.P. Lippincott Co., 1943, p. 191.
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- DuBois, K.P. and E.M.K. Geiling. Asbestosis. *Textbook of Toxicology*, New York: Oxford University Press, 1959, pp. 105-106.
- Eckhardt, R.E. Asbestos Handling. *Industrial Carcinogens*, New York: Grune and Stratton, 1959, pp. 132-134.
- Schepers, G.W.H. (Fleming, A.J., C.A. D'Alonza, and J.A. Zapp eds.) Asbestosis. *Modern Occupational Medicine*, Philadelphia: Lea and Febiger, 1960, pp. 463-470.
- Gross, P. (A.J. Lanza, Ed.) Pathology of Asbestosis. *The Pneumoconioses*, New York: Grune & Stratton, 1963, pp. 48-53.

Table 7. Legal Literature/Cases—Asbestos Product Users

cite	issues	outcome date
<i>Lacomastic Corp. v. Parker</i> U.S. District Court, Distr. of Md. Admiralty —No. 2617, in <i>Workmen's Compensation</i> <i>Law Reporting Service</i> , Commerce Clearing House (1944), p. 1068.	aggravation of tuberculosis in an asbestos sprayer's helper in ships; decided in favor of claimant	appeal decided Feb. 9, 1941
CSI 68/49 (K.L.) <i>Reported</i> <i>Decisions of the</i> <i>Commissioner under the</i> <i>National Insurance</i> <i>(Industrial Injuries) Acts</i> . Vol. 1 1948-1952 (1955)	affirms an award of compensation for asbestosis to a man who removed insulation from old copper cables	appeal decided in 1949 (U.K.)

Table 7. Legal Literature/Cases—Asbestos Product Users (*cont.*)

cite	issues	outcome date
CWI 53/50 (K.I.) <i>Ibid.</i>	approves of a claim for pneumoconiosis by a man who had insulated pipes	appeal decided in 1950 (U.K.)
<i>Record of Proceedings/Third International Conference of Experts on Pneumoconiosis, Sydney, February-March 1950 Vol 1. Geneva: International Labour Office, 1953, pp. 235-247.</i>	workers' compensation law in France includes asbestosis from asbestos spraying; in Italy, from asbestos-cement fabrication.	
<i>Hyatt v. Armstrong</i> Florida 121 S.2d 793	ruling on liability limit in effect for an insulator last exposed in 1945, totally disabled by asbestosis in 1953 (at which time claim was filed)	appeal decided by Florida Supreme Court in 1960
<i>Muldoon v. Charles S. Woods Co.</i> New York Supreme Court Appellate Div. Third Judicial Dept. No. 1397. In <i>Workmen's Compensation Law Reports</i> , Commerce Clearing House, pp. 3048-3049 (1959)	asbestosis and tuberculosis in an insulation worker; permanent and total disability award affirmed	appeal decided June 9, 1959
The Shipbuilding and Shiprepairing Regulations, 1960 <i>Statutory-Instruments 1960 Part II</i> . 1960 No. 1932 Part VII Regulation 76, H.M. Stationery Office, London, (1961), p. 1454	requires use of approved breathing apparatus for workers spraying asbestos, ripping out insulation, cleaning sacks that contained asbestos, and cutting asbestos-containing material with a power saw	

Table 7. Legal Literature/Cases—Asbestos Product Users (*cont.*)

cite	issues	outcome date
<i>Northwestern Asbestos and Cork Co. v. Industrial Commission</i> 21 Wis. 2d 554 124 N.W. 2d 628	rejects employer's dispute over payment of compensation for asbestosis to an insulator	appeal decided by Supreme Court of Wisconsin Nov. 26, 1963

Other Early Population Studies of Asbestosis in Insulators

Earlier "case reports" of asbestosis in insulators and other asbestos product users contained no data on the prevalence of the disease in the work force at risk. The Fleischer study was the first survey of a defined population of insulators (prevalence study). During the next 10 years, reports from Italy, Sweden, and Denmark showed a consistently high prevalence of asbestosis in insulation workers (see Table 3).

The "Downstream" Literature

One abstract written in 1957 about the Danish survey (Frost *et al.*) begins with a comment that asbestosis in insulation workers was by then nothing new:²⁶

Experience in many countries has established that workmen employed in the lagging of pipes and boilers may contract pneumoconiosis in the course of their employment.

More or less continuously since 1932, insulation workers and other shipyard and construction trades workers had been numbered among the cases of asbestosis and cancer reported in the literature. Increasingly, the risk of asbestos disease associated with the use of asbestos products was noted in primary medical literature, medical textbooks, and medical abstracts (Tables 2–6). Prominent medical dictionaries in the 1930s and 1940s defined "steamfitters' asthma" as asbestosis.^{27–30}

Hazards of asbestos product use were reported as well in diverse engineering and safety publications, government reports, trade magazines, and publications even further removed from the medical literature (Table 5). Appealed workers' compensation claims of asbestos insulators made their appearance in legal forums and resulting legal literature at least as early as the 1940s (Table 7).

Unpublished Documentation

Aside from this publicly available literature, more than 3 dozen compensation claims have been discovered, filed in the years 1952-1963, involving workers (with asbestosis and cancer) employed by the contracting divisions of asbestos insulation manufacturers (see "Workers' Compensation Claims by Insulators against Contracting Divisions of Asbestos Product Manufacturers," in Chapter 3). Johns-Manville, Eagle-Picher, and others were also sued for product liability by insulation workers (See "Lawsuits by Product Users Against Asbestos Manufacturers," in Chapter 3).

There existed various other unpublished references to insulation workers' asbestos hazards, mainly contained in correspondence, that have come to light in discovery proceedings. Some of these add further to the demonstrable body of "actual knowledge" of specific companies that may not have read *Heating and Ventilation* in 1944 or the *Encyclopedia Britannica* in 1960 (Table 8).

Table 8. Nonpublished Reference to Asbestos Disease/Risk in
Insulators and Other Product Users

Document	Contents
<i>Bernard Dugan v. R.V. Aycock Co. et al.</i> (1933) Kansas City, MO.	Damage suit brought by employee of a construction contracting firm (a subsidiary of Johns-Manville) alleging pulmonary disability. (See "Lawsuits by Product Users against Asbestos Manufacturers," in Chapter 3.)
General Managers Association documents, 1936-1937	Railroads in Illinois developed guidelines for the prevention of asbestosis in insulation work on locomotives (See "Railroad Companies," in Chapter 9).
<i>Dust Producing Operations</i> , by Roy S. Bonsib, 1937	Internal report of Standard Oil Co. (N.J.) refers to asbestos dust hazard in insulation work.
E.O. Gustafson (college student in Seattle) letter to A.J. Lanza (Nov. 1, 1939)	Says Dr. George Dowling at a local clinic had seen a number of cases of lung disease "which resulted from no more than handling asbestos while wrapping steam pipes with insulation material."
C.S. Stephenson (U.S. Navy Commander of Preventive Medicine) memorandum to Rear Admiral McIntire (March 11, 1941)	Under the heading "Asbestosis" he notes that "we are not protecting the men as we should," citing reports from several Naval yards. Refers to objections by the Navy to teams of Public Health Service scientists doing health surveys at Navy yards; the writer preferred having medical officers in the yards to do this. "I told (the Assistant Secretary of the Navy) that I had spoken to you and that you had indicated that President Roosevelt thought that (letting the P.H.S. inspect Navy yards) might not be the best policy, due to the fact that they might cause disturbances in the labor element." Also referred to as the "triple hearsay memo."

Table 8. Nonpublished Reference to Asbestos Disease/Risk in Insulators and Other Product Users (*cont.*)

Document	Contents
"Asbestos Workers Union." Ed Ames, memorandum to E.J. Marshall (Owens-Corning Fiberglas Corp.), Jan. 7, 1942.	Discusses the idea of using "the asbestosis weapon in reserve" to overcome union reluctance to work with fiberglass insulation—including U.S. Public Health Bulletin #241 (Dreesen <i>et al.</i> , 1938).
"Bethlehem Steel Company, Quincy." Dr. Morris memorandum to M. Bowditch (Massachusetts Dept. of Occupational Hygiene) Jan. 7, 1943. M. Bowditch, letter A.J. Lanza of Metropolitan Life, Feb. 13, 1942.	Report of interview with Dr. Manley, the company doctor, about a visit to the shipyard by Dr. Merewether of England. "Dr. Manley and Dr. Merewether discussed the asbestosis problem and both agreed that a definite hazard exists, especially in the removal of old asbestos in ships which are being repaired." There is also reference to an asbestosis case seen earlier, which Bowditch tells Dr. Lanza was brought to his attention by Dr. Manley — "a man who had been engaged for some twelve years in the installation of molded asbestos pipe insulation." Lanza replied "I think it is possible that this man may have asbestosis ... We have found evidence of it in men who trim asbestos pipe moldings, shingles, and other material of this nature, with a power saw." The chest X-rays were apparently never sent in to the state officials. An inquiry by Brandt brought back a note in 1954 quoting the 1943 memorandum on Merewether's visit and concerns about asbestos.
A.J. Lanza reply to M. Bowditch, Feb. 16, 1942.	
H.E. Elkins letter to A.D. Brandt (Medical Division, Bethlehem Steel Co.), May 17, 1954.	
H.M. Aber (Eagle-Picher Sales company salesman) internal memorandum to E.C. Carter D. Via, and C.B. Igade, April 8, 1942.	A state health officer in Texas had been asked by officials of Humble Oil and Refining Company for an opinion on the safety of handling Eagle-Picher Supertemp Block insulation. The reply placed Eagle-Picher "in an awkward and costly position," according to salesman Aber, who obtained a

Table 8. Nonpublished Reference to Asbestos Disease/Risk in Insulators and Other Product Users (*cont.*)

Document	Contents
	promise from the state official responsible (W.E. Wardlow) to "help straighten things out." Aber continued, "Wardlow will contact Humble in person to make any reasonable test on Supertemp relative to its being injurious to workmen, if requested by either Humble or ourselves. If we are sure of ourselves on this product this might be the thing to do ..." Aber asked for further instruction on that question. "While in Mr. Wardlow's office I had the opportunity to read a section in 'Occupation and Health', as compiled by the International Labor Institute (sic), on asbestos, compiled in 1938 ... If you think mineral wool is dangerous you should read this." Aber urged that a copy of the article by Gloyne and Merewether be secured from the I.L.O. office in Washington, D.C.
"Industrial Health Survey of the Oregon Shipbuilding Corp. Portland Oregon, Sept. 3-4, 1942" (P. Drinker <i>et al.</i>)	Consultant reports to the U.S. Maritime Commission and Navy about industrial hygiene problems in private contract shipyards during World War II. These reports mention asbestosis hazards in pipecovering shops and on ships; many call for local exhaust ventilation, respiratory protection, and/or annual medical examination of the workers exposed to asbestos. The 1944 Bath Iron Works survey includes 6 radiologically diagnosed cases of asbestosis.
"Industrial Health Survey of the South Portland Shipbuilding Corp. and the Todd-Bath Ironworks, South Portland, Maine, Sept. 18, 19, 22, 1942" (P. Drinker <i>et al.</i>)	
"Industrial Health Survey of the Bath Iron Works, Corp. Bath, Maine, Sept. 22, 1942" (P. Drinker <i>et al.</i>)	

Table 8. Nonpublished Reference to Asbestos Disease/Risk in Insulators and Other Product Users (*cont.*)

Document	Contents
"Re-Inspection Report Safety and Industrial Health, Defoe Shipbuilding Co., Bay City, Michigan" Jan. 20-21, 1944" (K.W. Nelson and R.F. Clow)	
"Industrial Hygiene Survey of Gulf Shipbuilding Corp. Chickasaw, Alabama, March 21, 22, 23, 28, 29, 1944" (K.W. Nelson and J.P. Morgan).	
"Asbestosis from Amosite Pipe Covering at Bath Iron Works, Bath, Maine, Dec. 19, 1944" (W.C. Dreessen and W.E. Fleischer)	
"Industrial Health and Safety Re-Survey of Albina Engine and Machine Works, Inc. Portland, Oregon, March 20-26, 1945" (H.G. Beck, L.O. Hughes, and L.G. Wayne)	
E. DeForest (Northwest Magnesite Association) "Copy," letter to J.E. Morgan (Washington Department of Labor and Industries) June 14, 1943	De Forest's angry letter to the state officials (describing asbestosis as a so-called disease ... "Since this foreign disease has not come to our attention, we feel it should be left in Europe where it belongs and not brought to our local communities and create hysteria and fear amongst the lives of our contented workmen who are now enjoying good health and living to a ripe old age, which is significant of Pipe Coverers Union ...") was received by the trade magazine.
A.S. Rossiter (<i>Asbestos</i> magazine) letter to S. Simpson (Raybestos-Manhattan) June 18, 1943	<i>Asbestos</i> editor Rossiter passed it on to Simpson for reply, who sent it to Brown. Brown wrote: "I am inclined to let Mr. DeForest learn the facts of life
Vandiver Brown (Johns-Manville) letter to S. Simpson, June 24, 1943, (all from the Summer Simpson papers)	

Table 8. Nonpublished Reference to Asbestos Disease/Risk in Insulators and Other Product Users (*cont.*)

Document	Contents
	and asbestosis from the State of Washington Department of Labor and Industries, and shall merely file his letter unless you feel strongly there is something I should do about it and so advise."
Chief of the Bureau of Ships, memorandum to Supervisor of Shipbuilding, USN, Camden, N.J. "Insulation—Water Repellent Amosite for Cold Water Piping" (Aug. 12, 1943)	Announces that a mineral wool insulation is being tested which would be safer than amosite; recommends medical and hygiene measures to observe in handling the amosite. The first memorandum was transmitted to the contract shipyard by local Naval personnel.
G.H. Wood (Navy Dept., Camden, N.J.) memorandum to New York Shipbuilding Corp. (Sept. 24, 1943)	
Gardner, Leroy (Saranac Laboratory), letter to Dr. Ludwig Hektoen, Executive Director, National Advisory Cancer Council (Chicago) Sept 29, 1943	Following up an earlier request for federal funding of a cancer assay of asbestos dust, Dr. Gardner noted, "A considerable number of persons are also exposed in the electrical industries where asbestos is used not only in wiring but but motor armatures. The U.S. Navy has had a real problem from the use of asbestos in insulating marine boilers, electrical installations, and other insulating work."
P.Drinker (consultant to U.S. Maritime Commission) letter to Captain Ingram (Navy Bureau of Ships), Jan. 8, 1944.	Transmits union concerns about use of amosite insulation at New York Shipbuilding Co. and warns that there could be a labor "disturbance" if union questions about the hazards of amosite are not properly handled. Recommends

Table 8. Nonpublished Reference to Asbestos Disease/Risk in Insulators and Other Product Users (*cont.*)

Document	Contents
	respiratory protection, exhaust ventilation, and/or substitution of the amosite. Mentions reliance on air line respirators in a similar case on the west coast.
Asbestos Insulation Aboard Ships. Two-page notice issued by A.W. Garrett, Chief Inspector of Factories, London, August, 1945.	Factory Inspectorate expressed concern over asbestosis hazard in shipyard insulation work. Six work practices were listed, which "have been accepted by the Shipbuilding Employers' Federation and the Trade Unions concerned ..." Provisions listed included respiratory protection for asbestos sprayers and workers removing old insulation. No one was to work in the same space with asbestos spraying unless equipped with a respirator. Ventilation, damping dust, prompt clean-up were also advised. Seventy more copies of the circular were requested by Thermal Insulation Contractors Association. Sending of the Notice was described in the <i>Annual Report of the Chief Inspector of Factories for the Year 1945</i> .
C.W. Dawe, Thermal Insulation Contractors Association, letter to the Chief Inspector, Sept. 14, 1945.	
Newalls Insulation Company Limited Pneumoconiosis Prior to February 1950	Turner & Newall document listing specifics of 9 cases with dates of disablement 1932-1950. Does not include J. Wren, who died with asbestosis and lung cancer in 1947, a career insulator for Newalls.
A.J. Vorwald (Saranac Laboratory) Letter to U.E. Bowes, Owens-Illinois Glass Co. Nov. 16, 1948 and the accompanying Interim Report Regarding the Biological Activity of Kaylo Dust, Oct. 30, 1948	Described inhalation experiments using the dust from Kaylo insulation on guinea pigs. "In all animals sacrificed after more than 30 months of exposure to Kaylo dust unmistakable evidence of asbestosis has developed, showing that Kaylo on inhalation is capable of producing asbestosis and must be

Table 8. Nonpublished Reference to Asbestos Disease/Risk in Insulators and Other Product Users (*cont.*)

Document	Contents
Willis G. Hazard. Memorandum to M.M. Olander, (boath of Owens- Illinois) Oct. 5, 1955.	regarded as a potentially-hazardous material." The letter ends: "I realize that our findings regarding Kaylo are less favorable than anticipated. However, since Kaylo is capable of producing asbestosis, it is better to discover it now in animals rather than later in industrial workers. Thus the company, being forewarned, will be in a better position to institute adequate control measures for safeguarding exposed employees and protecting its own interests." Hazard, who was continuously informed about the Kaylo test results, noted that they had been published by Dr. Schepers of the Saranac Lab with no mention of the names Kaylo and Owens-Illinois (Effect of Inhaled Commercial Hydrous Calcium Silicate Dust on Animal Tissues. <i>Arch. Indust. Health</i> 12: 348-360, 1955).
E.R.A. Merewether (British Factory Department) Discussion in "Pneumoconiosis and Cancer," Seventh Saranac Symposium (unpublished), p. 404 of transcript. Sept. 24, 1952. From the archives of Dr. A.J. Vorwald, Armed Forces Institute of Pathology, Washington, D.C.	On a panel with Drs. Hueper, Cartier, and Lynch, introduced by Dr. Vorwald, he noted the occupations of 48 workers in the UK known to have died with asbestosis and lung cancer. Included were "eight pipe and boiler coverers."
<i>Conference on Environmental Carcinogens</i> Sept. 12-13, 1955 at National Institutes of Health (from the unpub- lished papers of Dr. Wilhelm Hueper, National Library of Medicine, Bethesda, Md.)	Panels of specialists rated the evidence that various materials were carcinogenic. The asbestos panel consisted of Dr. William E. Smith (New York University,) Dr. Kenneth W. Smith (Johns-Manville), and Dr. Arthur J. Vorwald (Wayne State University, formerly

Table 8. Nonpublished Reference to Asbestos Disease/Risk in Insulators and Other Product Users (*cont.*)

Document	Contents
	Saranac Lab). "English reports are very suggestive" of a lung cancer risk. "Widespread hazard if a causal relationship exists due to many uses of this material under various conditions."
Kane, J.W. (International Association of Heat and Frost Insulators and Asbestos Workers) letter to Industrial Hygiene Foundation, Aug. 13, 1955	Kane noted that "seven of the last nine of the members of our Union, the Asbestos Workers, (pipe coverers) have died of lung disorders." He expressed concern not only about "asbestos but also fiberglass and thoughtful human beings will help us make a deep cut in the preventable cases, by giving the proper knowledge and safety factors we may practice."
Walmer, C.R. (I.H.F.) letter to Hugh Jackson (Johns-Manville) Aug. 26, 1955.	Walmer passed the letter on to Jackson saying: "We did not feel we could reply in correspondence to Mr. Kane, and therefore invited him to the Institute for a conference. We notified him of the fact that much information is available on the safe handling and use of practically all insulating materials, and we supplied him with sufficient data to allay his fears."
Frederick LeGrande (insulation worker) damage suit against Johns-Manville 1957	See "Lawsuits by Product Users Against Asbestos Manufacturers," in Chapter 3.
D.C. Braun (Industrial Hygiene Foundation) letter to Hugh Jackson (Johns-Manville) Aug. 23, 1957.	Discusses literature search and numerous reports of lung cancer and asbestosis, "occupations given were: ... lagger, pipecoverer ..." Also mentions Isselbacher's case ("a contractor's helper engaged in cutting and sawing asbestos board ...")

Table 8. Nonpublished Reference to Asbestos Disease/Risk in Insulators and Other Product Users (*cont.*)

Document	Contents
Dr. J.F. Knox (Turner Brothers Asbestos Co.), opening remarks at Meeting of the Asbestosis Research Council's Research Committee at Cambridge, 15th December 1958; 5 pages	Refers to research in Denmark and Sweden showing "abnormalities in the lungs of insulating workers."
H. Jackson (Johns-Manville) letter to W.T. Marr (Long Beach Naval Shipyard) June 22, 1959	"Your reference to asbestosis arising out of insulation operations is of considerable interest. I am aware of only two cases of asbestosis arising out of exposures involving the installation of asbestos insulations ... Another area in which there is a lack of knowledge is that of the import of short duration massive exposures. I would assume that in shipboard installations, a part of the work, at least, would be performed in confined spaces which might result in heavy concentrations for short periods of time."
G. Faciane civil suit against Eagle-Picher and other manufacturers of insulation, 1961	See "Lawsuits by Product Users Against Asbestos Manufacturers," in Chapter 3.
Fred C. Wenham (insulator) damage suit against Johns-Manville, 1961.	See "Lawsuits by Product Users Against Asbestos Manufacturers," in Chapter 3.
A. Edwards letter to L. Pechstein (Phillip Carey Manufacturing Co. Feb. 17, 1961; and Pechstein memo of Edwards' phone call, Feb. 21, 1961	Indiana health official told Pechstein that "Careytemp insulation" contained a "toxic" material, asbestos. Complaints had been received from Carey's own contract insulation workers in Indiana.

Table 8. Nonpublished Reference to Asbestos Disease/Risk in Insulators and Other Product Users (*cont.*)

Document	Contents
W.E. Latto claim for workers' compensation filed against Philip Carey Manufacturing Co. in 1961 (No. OD 117 279)	Compensation for permanent and total disability awarded to Latto in 1962 by Ohio Bureau of Workmen's Compensation.
H.C. Hinshaw letter to I.A. Schwab, April 17, 1961.	Medical report on R.E. Borden's workers' compensation claim for asbestosis against Western Asbestos Co. in California. Notes that insulation workers face a risk of asbestosis, and that, "rather substantial evidence that asbestosis may predispose to lung cancer" was recorded in medical literature.
R.E. Peele (Union Carbide Chemicals Co.) Industrial Hygiene Survey Construction Insulation Shop. Building 511-2018 Reports 62-1-H-1-G-1 and 62 1-H-2-G-1 (March and July, 1962)	Report of total dust counts from bandsaw curring of Johns-Manville "Thermobestos" and Owens-Corning "Kaylo" insulation blocks. Dust counts ranged from 13.1 to 101.4 MPPCF for Thermobestos and 3.1 to 17.1 MPPCF for Kaylo. Report advised against continued use of Thermobestos unless improvements were made in either the bandsaw exhaust ventilation or the product itself.
W.E. Shoemaker (American Mutual Liability Insurance Co.) memorandum to Blaine, March 20, 1962.	Shoemaker asked J-M medical director K. Smith to testify for the defense in a compensation claim brought by an insulation worker with lung cancer.
R. Fisher (Chief Medical Examiner, State of Maryland) letter to A. Porth, Feb. 3, 1962.	Smith declined, recommended Dr. Lanza. Dr. Fisher had earlier replied to defense attorney Porth to the effect that the claimant had a strong case. (See "The Law Journals and Informal Consultation with Insurance Officials," in Chapter 3)

Table 8. Nonpublished Reference to Asbestos Disease/Risk in Insulators and Other Product Users (*cont.*)

Document	Contents
O. Ayers. Johns-Manville Research and Engineering Center Report No. 432-257-S1, November 6, 1962.	Band sawing (J-M) Thermobestos and (Owens-Corning) Kaylo blocks produced exposures of 15-104 MPPCF total dust. (See Table 3 of Chapter 4 for further details)
Washington Chemical Co. memorandum to A.D.N. Jones (Turner & Newall), "Asbestosis Claims" (Oct. 24, 1962) enclosing "Downward Trend in Number of Factory Accidents Last Year" (from <i>Belfast Telegraph</i>)	Confidential memorandum returning news report that 6 insulators died in 1961 "of asbestosis or lung cancer."
Thomas Mancuso consultation for Philip Carey Manufacturing Company 1962-1963	Dr. Mancuso advised Carey executives to institute a comprehensive program to advise product users about hazards and protective measures. Mancuso also recommended cessation of contracting activities due to their compensation liability. (See "The Mancuso Documents" in Chapter 3)

Sprayed Asbestos

When sprayed asbestos was introduced by J.W. Roberts, Ltd., a Turner & Newall company, in 1932, an editorial in the *Lancet* predicted that an increase in asbestosis would result from extensive use of the process. Describing the application in the London tube railways, the editorial said:³¹

Though it is true that the workman was provided with a mask, it is equally true that his clothing was covered by asbestos powder.

Thereafter, official concerns in Britain were met by Turner & Newall with assurances that 1) sprayers were provided with respirators, 2) bystander workers were not in danger, and 3) advances in spray technology damping were continuing to

reduce whatever hazards there might be (See "The British Shipyard Asbestos Regulations," in Chapter 4).

T&N's subsidiary in Canada, Atlas Asbestos, was informed in 1949 when a disability claim was filed by a spray operator who had worked on ships in Vancouver. When the Vancouver Workmen's Compensation Board expressed concern to the federal government about the growth of asbestos use in western Canada, a Ministry of Health official contacted the company and was told they had never had a claim for asbestosis in Canada. Back at T&N's J.W. Roberts subsidiary, Norman Dolby, the inventor of the spray process, concluded that the worker had been granted compensation for total disability.³²

One employee who was not protected by T&N's safeguards was Charles Coyle, who was employed by Newalls as an asbestos sprayer on ships from 1945 until 1954. (Company doctor John Knox would remark in 1960 that it was "regretted that the pre-damping drum is not used in Marine work," in Limpet spray operations.³³) When Coyle's lawyers contacted Turner & Newall in 1955, T&N's knowledgeable lawyers promptly discerned that they had a poor grasp of the relevant laws. The complaint charged that the respirator provided to Coyle was unsuitable. Informed that Coyle was not expected to live more than a few months, T&N's solicitors observed,³⁴

If the man does not survive, then there will be obvious difficulty in establishing any claim in negligence because in all cases of this kind, the man's own personal evidence is vital.

They suggested that it would be tactically advantageous to defer taking action in the case, in the expectation that Coyle would soon be dead. T&N Secretary John Collins agreed with this strategy. It was meanwhile determined that Coyle, a non-smoker, had had no prior work that would have put him at risk of pneumoconiosis. He had been certified as 50 percent disabled when last seen by the Pneumoconiosis Medical Board. The solicitors for T&N estimated the total damages as at least 4000 pounds. After Coyle's death, they met with Coyle's lawyers, now representing his widow, and assured them that T&N would put up a formidable defense to the negligence

charge. T&N was able to settle the case for only 500 pounds to Margaret Coyle and her 3 children, the youngest of whom were aged 2 and 9.

National Gypsum officials were aware of the potential dangers of asbestos dust in their spray-applied Thermacooustic insulation at least as early as 1949. Corporate records from 1953 make clear that the company did not have a policy of recommending that workers mixing and applying it wear respirators for pneumoconiosis-producing dusts (See "National Gypsum Company," in Chapter 9).

In published reports, asbestos spraying hazards were addressed in the *Annual Reports of the Chief Inspector of Factories* for the years 1945 and 1949. Two cases of advanced asbestosis in sprayers were reported by Swedish doctors in 1956.³⁵

T&N research established by 1957 that non-asbestos, mineral wool compositions performed satisfactorily and were cheaper than Limpet asbestos, but conversion to mineral wool could also have ultimately put T&N out of the sprayed insulation business.³⁶

The purpose of adding asbestos and, or, cement, can be seen to be that of permitting the manufacturer to sell a proprietary article to the contractor who carries out the application. We know that at least one of these contractors is aware of the fact that he can buy granulated rock wool at market price without restriction and that this is capable of being sprayed alone (Mr. Cathcart of New York Art Crafts).

Conversion to non-asbestos, spray formulations would be rapidly achieved in the early 1970s, when government regulators and the media focused on the environmental risks of such products.

T&N first conducted medical examination of its spray operators in Bombay, India, in 1956, and pulmonary disease was diagnosed in some workers. It does not appear that these employees were informed that they had occupational disease or were compensated for it. Ten years later, T&N executive for the group's Indian companies Harry Hardie would acknowledge that:³⁷

Over a period extending beyond ten years, we have created for ourselves a condition which cannot be solved easily.

T&N's Board was told that the spray contracts department had had "a bad asbestosis record," evidently including lung cancer as well.^{37,38} The company had shut down the spray business and laid off the workers in 1965.³⁹ In 1981, a reporter from *India Today* contacted the plant manager of T&N's Bombay subsidiary to ask about two former sprayers with asbestosis.⁴⁰

In Australia a sprayer had also been diagnosed with asbestosis in 1956, and construction workers' unions became concerned about the risks from asbestos spraying in 1959.⁴¹ Construction companies threatened with work stoppages agreed to safeguards, including minimization of workers allowed in the vicinity of spraying, screening and drop cloths to be used in spray areas, and clean-up requirements before removal of temporary screens. In the course of the controversy, T&N's manager asked headquarters to give some thought to discrediting Dr. D.L. Gordon Thomas, with the Victoria State Health Department, who was raising health issues.⁴² It was decided not to try that, because of Thomas' governmental affiliation.

Undaunted by its experience with the product's hazards, including additional cases of asbestosis among sprayers, T&N set up a new subsidiary to bring sprayed "Limpet" asbestos to Germany in 1960. The brochure for the Spritzasbest company featured a picture of a worker spraying Limpet without wearing a respirator, and a picture of T&N's prized new contract: the world headquarters of Chase Manhattan Bank in New York. T&N's subsidiary in the United States, Keasbey & Mattison, also advertised featuring the Chase building and an unprotected workman spraying Limpet (containing "no dangerous solvent").⁴³

Despite earlier assurances to others that technical advances in damping sprayed asbestos had minimized or eliminated the health hazard, a more sanguine view was privately expressed by Alexander Marshall, who was about to become Managing Director of T&N's J. W. Roberts subsidiary.⁴⁴ He was responding to a report that the government might "eventually prohibit" asbestos-based insulation.

The awkward thing about this is that even if we succeed in perfecting a way of applying the material by dustless and "safe" method (and that is a big "if"), we are still liable to come unstuck according to Mr. Smith when somebody eventually comes to remove the asbestos. I cannot see much hope of rendering this "safe" from a health point of view so that reliance would still have to be put on protective measures.

T&N directors finally decided to discontinue selling sprayed asbestos in the British market in 1975 and in overseas markets the following year.⁴⁵ It appears that a sprayed slag wool replacement was then marketed. Sprayed insulation products containing more than 1 percent asbestos have been banned in the United States in 1973.

Epidemiology of Cancer in Asbestos Product Users

In 1954, California health officials published a report on smoking and occupational factors in lung cancer. They had interviewed 518 hospital patients with lung cancer and an equal number of "control" patients. When the researchers saw how the results were coming out, they created a special category of jobs whose common hazard was asbestos exposure: steamfitters, boiler makers, and asbestos workers. In most, if not all of these cases, the dust hazard arose from the handling of asbestos insulation products. Ten lung cancer patients but only one of the "matched control" patients had substantial work histories in the asbestos-exposed jobs. After taking smoking habits into account, the excess lung cancer liability of these jobs was statistically significant.⁴⁶

Of course, reports of cancer among asbestos product users didn't emerge in a vacuum. In the context of overwhelming evidence of an excessive lung cancer risk among asbestotics, it became an inescapable conclusion in the 1950s that insulation workers had an occupational cancer hazard in addition to an asbestosis one.

CONCLUSION

The epidemiologists at the Mount Sinai School of Medicine finally showed vividly the devastation to health sustained by

insulation workers in 1964. The observation that insulators died from asbestosis was not new, and an excessive incidence of cancer was anything but surprising to find. But such a large number of "excess deaths" was shocking nevertheless. How many men would have knowingly entered a trade with an almost guaranteed chance of developing asbestosis in 30 years and nearly a 50 percent chance of dying from occupational cancer or asbestosis?

Dr. Selikoff and his colleagues deserve praise for their many fine works. But accolades to the Mt. Sinai group as the *discoverers* of asbestos disease in insulators should go to their predecessors instead. The 1965 article by Selikoff, Hammond, and Churg on asbestosis in insulators cites no less than 18 pre-1964 references to asbestosis and cancer among asbestos product users.

An increasing number of asbestos products have been shown to be hazardous, including asbestos-cement sheets and pipes, valve packings, industrial "protective clothing," vinyl asbestos flooring, and drywall patching compounds.⁴⁷⁻⁶⁴

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6

Alternatives to Asbestos Insulation

Stephen L. Berger, P.E

INTRODUCTION

Of all uses of asbestos that have achieved widespread application, none can rival the toll of death and disease resulting from the use of thermal insulations. Used in the presence of millions of workers in shipyards, construction sites, oil refineries, and chemical and power plants, the dust from insulation wafted onto surrounding communities in an ever-widening radius of destruction. In light of the long-standing recognition of the hazards of asbestos and the essential role of insulation in modern times, the necessity of using asbestos was brought into question:¹

(M)any doctors have asked whether the properties of asbestos are as unique as the salesmanship of the asbestos companies appears to indicate. There are many other mineral fibers such as glass wool, rock wool or slag wool, which have useful inherent fire-proofing properties but not the fibrogenic or carcinogenic effects on the lungs. Is it certain that the properties of asbestos justify the risks of asbestosis, carcinoma of the lung and mesothelioma which are entailed by its use?

There were three main categories of asbestos-containing thermal insulation. Each had its own range of uses, mainly

determined by the temperature limits of its composition. In each category, asbestos substitution was achievable, as attested to by numerous patents and scientific articles. Many of these patents were held by companies manufacturing asbestos insulation or companies purchased by asbestos insulation manufacturers.

An extensive patent and technology investigation was necessary to resolve the question of available alternatives. It has shown that, first of all, asbestos played a limited role in thermal insulation products. Moreover, the acceptability of alternative materials in place of asbestos has been a fixture in this technology since the 19th century. As the technology developed, increasing numbers of substitutes emerged even while the use of asbestos in heat insulation soared.

Patents and Government Publications

Before a detailed analysis of possible alternatives to asbestos-containing thermal insulations can be undertaken, a few words should be mentioned about patents because they preponderate all references disclosing these alternatives.

Patents contain the history of technological advances. A patent is actually a nonrenewable grant by the United States government for a term of 20 years giving the patentee the right to exclude others from making, using or selling the invention. A full disclosure of the invention is given by the patentee in exchange for this limited monopoly. The application for a patent contains a specification, which is a written description of the invention; drawings, if necessary; and an oath. The specification ends with claims that particularly point out the subject matter which the applicant regards as the invention. Patents are considered intellectual property and can be assigned, sold or licensed. However, inventors employed by companies usually have prior contracts stating that any patents issued to them would be automatically assigned to their employers. The assignee of a patent owns that patent and all rights associated with ownership.

The issue date of the patent is the day of public disclosure, but the patentee or the assignee would have had knowledge of the disclosure on or before the filing date of the application. Moreover, if the patent is a division, continuation, or

continuation-in-part from an earlier (parent) application, the disclosure will not usually contain much new matter, and the patentee or assignee would have had knowledge of the bulk of the disclosure on or before the filing date of the parent application. Typically, two or more years elapse between the filing date of a patent application and the granting of a patent.

Although patents reveal the technological advances behind the development of the various thermal insulations, they only occasionally state that a specific invention was used or available commercially. These revelations are best found in references such as journal articles, books and government publications. Journal articles inform the insulation engineer, distributor or user of recent developments and disclose the commercial availability of insulation. Books generally compare the physical properties and uses of various types of insulations. Government publications deal with reviews of current and past insulations, and also establish industry standards or specifications.

Three specific government publications were particularly useful in reviewing thermal insulating materials. First, a 1929 Bureau of Mines Information Circular provided a history of mineral wool in the United States, manufacturers and processes of making it, and its uses including pipe covering.² Second, a 1943 Bureau of Mines Information Circular surveyed the available industrial insulations, including mineral wool, asbestos, magnesia, vermiculite, diatomaceous earth, silica aerogel, and Foamglas.³ Third, a 1955 Bureau of Mines Bulletin was directed to asbestos and its uses, but contained a section devoted to substitutes for asbestos.⁴

In 1949, the United States Department of Commerce promulgated a Commercial Standard entitled *Mineral Wool Insulation for Heated Industrial Equipment* which revised the original 1944 standard for mineral wool insulation.⁵ One of the purposes of this standard was "to establish minimum specifications for insulating heated surfaces with mineral wool for the guidance of manufacturers, distributors, installers, contractors, engineers, and users" As with many other government specifications, the basis for developing this standard originated with the manufacturers, distributors, and users. A standing committee was formed to review any proposed revisions. This committee

included representatives from Eagle-Picher, Owens-Corning, National Gypsum and Baldwin-Hill. Also, the acceptors of the standard are listed, all of whom must have had knowledge of the many uses for mineral wool.

Government and military specifications for thermal insulations disclosed available types and, more importantly, demonstrated that asbestos was not a necessary constituent of many of these insulations. The asbestos industry has asserted that the government insisted on the use of asbestos through its military procurement specifications. This argument, referred to by some plaintiffs' attorneys as the "Devil-Made-Me-Do-It defense," has been used by defendants' attorneys in litigation. In fact, Asbestos Textile Institute minutes of Sept. 11, 1953 and Industrial Hygiene Digest news items of May 1945 indicate that industry's role in drafting specifications may have been dominant. It is true that some government specifications were written specifically for asbestos insulation and, therefore, necessitated the use of asbestos. However, the major specifications covering pipe and block insulations were performance specifications and did not specify a particular insulating material, only that the material meet the required physical properties. For example, the 1953 specification for pipe covering, MIL-I-2781A, stated, "The thermal pipe insulation shall be composed of heat-resisting compounds suitable for the temperature conditions and the purpose intended." Others mention specific material such as asbestos and/or alternative materials. In its book, *Specifications for Construction of a Twin Screw Passenger and Cargo Vessel*, the U.S. Maritime Commission stated, "The insulating materials for temperatures below 600°F shall be 85% magnesia, fibrous asbestos, rock wool, or fibrous glass; except that for temperatures below 200°F, 85% magnesia or asbestos shall not be used."⁶ Another military specification, 32P5b, in force in the 1930s, was entitled "Rock Wool; Pipe Covering, Blanket, Cement and Fiber."

The Role of Asbestos

Before this question of substitutability can be answered, the role of asbestos in thermal insulation must be examined. Although asbestos insulations were also made in the form of blankets, felts and paper, the great majority of asbestos-containing

insulations were either "85% magnesia" or calcium silicate molded compositions. These latter two were especially dangerous to installers and their co-workers because frequent sawing of the insulation, necessary to produce correct fittings, created much airborne dust. Asbestos was also used in insulating cements that were troweled into place.

The major function of asbestos in all three of the above types of insulation was to reinforce the finished product so that it would not crack or disintegrate at the temperature of use. Two kinds of substitution were possible to maintain this reinforcing property of the insulation. First, alternatives to asbestos-containing insulations were feasible if other reinforcing fibers or materials could directly replace the asbestos in magnesia, calcium silicate, or cement. Second, if completely different insulation products manufactured without asbestos could withstand the same temperature conditions as asbestos-containing insulations, substitution would also be possible.

A secondary function of asbestos was to suspend the initial reacting materials that form calcium silicate. If other fibers or materials could suspend these initial reactants, the need for asbestos would be obviated.

Magnesia Insulation

From the late nineteenth century until the mid 1960s, a common and popular insulation was "85% magnesia." The common source material used to prepare magnesia was dolomite, a mineral consisting of calcium and magnesium carbonate. First it was heated and then mixed with water to form a suspension. Pressurized carbon dioxide was bubbled through this suspension to separate the insoluble calcium carbonate from the soluble magnesium carbonate. The solution of magnesium carbonate was then boiled down and concentrated to produce magnesia. This product was commonly mixed with asbestos fiber and then molded into the desired shape. *Asbestos acted merely as a reinforcing fiber and added little to the insulating value of the magnesia.*⁷

The limitations of magnesia insulation were numerous. It could be used only for temperatures up to 550–600 degrees F.⁸ It had a poor resistance to water and lost strength when wet.

One patent noted: "At high temperatures its thermal conductivity is excessive; its breaking load is low; its shrinkage is unduly severe; and its loss in weight is notable."⁹ Increasing the amount of asbestos in magnesia insulations only made it more dense and reduced its insulating value.¹⁰

There are two ways in which asbestos substitution could have been accomplished in these products. If other reinforcing materials could have directly replaced the asbestos in magnesia, the problem of substitution was solved. Similarly, if different insulation products without asbestos could withstand the same temperature conditions as the asbestos-magnesia insulation products, then this would offer another means for eliminating asbestos-reinforced magnesia insulations.

Beginning with the first magnesia pipe insulation patent issued in 1886, the major manufacturers were granted patents that disclosed substitute reinforcing agents.¹¹ (See Table 1.) Keasbey & Mattison, the assignee of this first patent, included as choices of the fibrous material animal hair, wool, asbestos, and various other fibers not readily affected by heat.¹²

Other companies, including Philip Carey and Johns-Manville listed in their patents specific fibers as alternatives for the asbestos in magnesia.^{13,14,15} In a patent application filed in 1945, for example, Johns-Manville stated that "satisfactory and useful products" could be made using raw cotton, spun glass (a type of fiberglass), fine rock wool (a type of mineral fiber formed from melted rock), and steam-treated wood as the reinforcing fibers.¹⁶ Additional patents assigned to these and other manufacturers suggested that there were other suitable fibers without naming them specifically.^{17,18,19,20,21}

Not only major insulation manufacturers but independent inventors have suggested substitutes for asbestos fiber in magnesia insulations. One of the best examples of this is a 1952 patent issued to Mason Baxter. He used a mixture of fiberglass and slag wool pellets (a type of mineral fiber derived from melted blast-furnace slag, a steel industry by-product) to bind and strengthen magnesia and calcium silicate compositions. Comparing the magnesia product with conventional 85% magnesia, the patent states "a product using [slag] wool and

Table 1. Patents Describing Alternatives to Asbestos Fiber in Magnesia Insulation

Year	Company (unless otherwise noted)	Reference Number
1886	Keasbey & Mattison	11
1930	Philip Carey	17
1940	Plant Rubber & Asbestos Works	18
1942	Philip Carey	13
1943	Philip Carey	14
1946	Armstrong Cork	19
1947	Johns-Manville	20
1947	Johns-Manville	15
1952	James D. Akins*	22
1952	Johns-Manville	26
1957	Keasbey & Mattison	21

*assignee of patent by inventor M. Baxter

magnesia would have a lower "K" factor, a better temperature range, lower costs of production, and less shrinkage in the manufacture and when used at high temperatures."²² ("K" factor is thermal conductivity; the greater the K factor, the poorer a heat insulator the substance is.)

Product alternatives to asbestos-containing magnesia insulation also existed. (See Table 2.) These were completely different types of thermal insulating materials whose useful temperature range approximated that of magnesia. The most common of these was fiberglass insulation, which was used in Europe since before World War I and was substituted for asbestos thermal insulation in factories, power stations, locomotives and ships.²³ A 1923 article remarked, "Due to its lightness and high qualities this material is absolutely without peer for insulation on shipboard ..."²⁴ The advantages of fiberglass over 85% magnesia thus included lower thermal conductivity, lower density, and higher resistance to water, acids and alkalies.

The first types of fiberglass insulation were in the form of "blankets" and were good up to 1000 degrees F.²⁵ Later developments included molded fiberglass pipe insulation.^{26,27,28} Many of the molded insulations were formed by mixing fiberglass with a resin binder and then molding into a semi-rigid pipe insula-

tion. (Resins used in these products were synthetic plastic-like polymers such as nonvolatile organic compounds.) Because the resin would smolder and char at higher temperatures, these types were generally good only up to 600 degrees F.^{29,30}

Also of interest historically is a report by the British Intelligence Objectives Sub-Committee (B.I.O.S.) which stated that Owens-Illinois licensed its patented process for making glass fiber, covered by a German Patent, to a Germany company, which produced the glass fiber from 1936 until the end of 1944.³¹ The report further stated that during World War II, "Glass fibre has been used extensively as an asbestos substitute."³² This report also described the most common heat insulation used in Germany before and during World War II. "They had accumulated a great deal of data and experience to show that slagwool was one of the most efficient heat insulators obtainable, and that it was suitable for temperature up to 1300-1400 F. ... The rigid form of pipe section common in this country [Great Britain] and in America, is rarely encountered in Germany (there is practically no magnesia manufacture, and sections based on kieselguhr [diatomaceous earth] are not favoured on account of their weight and lower efficiency), so that the forms based on slagwool described above are accepted as standard throughout the industry."³³

Fiberglass insulation was not the only product capable of substituting for magnesia insulation. As will be discussed later, molded mineral wool pipe insulation had a temperature limit of at least 600 degrees F. Exfoliated vermiculite insulation had even higher temperature limits.³⁴ (Vermiculite is a mineral, and exfoliated vermiculite is the lighter product resulting from heat expansion of the mineral.) This was molded into brick, slab or pipe covering shapes and found use aboard ships, among other places. Rigid glass insulating material made of thousands of glass bubbles was suitable for temperatures up to 800 degrees F. and available in both blocks and pipe coverings.³⁵ Another insulating sheet material, suitable for use on ships, contained an inorganic fiber, such as asbestos, fiberglass, or mineral wool (the latter was preferred). This product was "utilized with a

Table 2. Patents Describing Product Alternatives to Magnesia Insulation

Year	Company (unless otherwise noted)	Main Constituents	Reference Number
1928	Babor et al*	vermiculite	33
1953	Baldwin-Hill	fiberglass or mineral wool	35
1957	Gustin-Bacon	fiberglass	26
1959	Pittsburg Plate Glass	fiberglass	27
1962	Johns-Manville Fiber Glass	fiberglass	28

*inventor

minimum of dusting and breakage and, therefore, with practically no industrial health hazard."³⁶ This 1953 Baldwin-Hill patent may have been the first patent to acknowledge a health hazard in the use of thermal insulation products.

Calcium Silicate Insulation

Although calcium silicate insulation was first patented in 1912, it did not gain widespread use until the 1940s. Briefly, a typical manufacturing process included reacting a lime (a mineral containing calcium) and a silica (naturally occurring silicon dioxide, such as sand, quartz, or diatomaceous earth) under certain conditions.³⁷ The silica was usually diatomaceous earth (a silica composed of fossils of microscopic algae). The reaction was conducted in heated water and in the presence of a suspending agent, commonly asbestos. Additions, such as clay and other bonding agents, were made and then the product was shaped and hardened by steam treatment under pressure. *Here again, asbestos served not as an insulator, but rather as a suspending agent during the reaction period and reinforcing agent to prevent cracking in the final product.*³⁸

Calcium silicate has replaced magnesia because it overcomes some of the deficiencies of magnesia and could withstand higher temperatures. The need for insulation that could withstand temperatures above 600 degrees F. grew steadily with the increased scale and advances of technology in power gener-

Table 3. Patents Describing Alternatives to Asbestos Fibers in Calcium Silicate Insulation

Year	Company (unless otherwise noted)	Reference Number
1912	Armstrong Cork	36
1924	Celite	41
1926	Celite	42
1941	Johns-Manville	43
1947	Paraffine	62
1949	Paraffine	63
1950	Owens-Illinois	49
1951	Owens-Illinois	50
1952	James D. Akins*	22
1955	Johns-Manville	44
1955	Insulex Mineral Products	65
1956	Columbia-Southern Chemical	66
1956	Owens-Illinois	55
1959	Fibreboard Paper Products	64
1963	Owens-Corning	56
1965	Owens-Corning	57
1966	Joseph Crosfield & Sons	67
1969	Owens-Corning	58
1971	Owens-Corning	59
1971	Owens-Corning	60
1975	Owens-Corning	61

*assignee of patent by inventor M. Baxter

ation, oil refining, and numerous other industries. Calcium silicate could be used up to a temperature of 1200 degrees F., and in the case of high-temperature calcium silicate, up to 1800 degrees F. It has good resistance to water, moisture and abrasion. Also, its shrinkage is low at high temperatures. On the other hand, its breaking load is low and its thermal conductivity slightly higher than that of magnesia.³⁹

An analysis will show that alternatives existed to asbestos-containing calcium silicate thermal insulations since their initial development. The first part of this analysis is on a company-by-company basis for the major manufacturers and, as with magnesia, examines direct replacements for the asbestos fibers in the product. (See Table 3.) The second part of the analysis

will discuss other types of thermal insulating materials whose useful temperature ranges approximated that of calcium silicate.

The earliest calcium silicate insulation patent, obtained in 1912 by Armstrong Cork, could have substituted either spun glass or mineral wool for the asbestos.⁴⁰

Johns-Manville's knowledge of possible substitutes became proprietary in 1928 when it purchased, under the guidance of J.P. Morgan & Company, the Celite Company, owner of the largest and purest deposit of diatomaceous earth that had been discovered.⁴¹ Among its many patents, Celite had at least two that mentioned substitutes for asbestos in calcium silicate heat insulating compositions.^{42,43} The first was a 1924 patent which noted that for blocks not requiring refractory properties, "the use of asbestos fiber may be dispensed with and a cheap manila or cellulose fiber substituted therefor."⁴² (*Refractory* means extremely high temperature applications, usually over 2000 degrees F., such as furnace walls).

A Johns-Manville patent, applied for in 1936, described a sheet or block material useful as a ship panel and containing calcium silicate and wood fibers.⁴⁴ This sheet product was similar to and served the same purpose as Marinite® asbestos insulation. In addition, a 1955 Johns-Manville calcium silicate pipe insulation patent listed glass and mineral wool as alternatives to asbestos reinforcing fiber.⁴⁵

Johns-Manville had timely knowledge of other companies' patents. John McKinney, former Chairman of the Board and patent attorney for the company, has testified that Johns-Manville automatically received copies of their competitors' new patents from the Patent Office.⁴⁶ McKinney and Johns-Manville received and acknowledged other information concerning patents and their disclosures. During the prosecution of a typical patent application, correspondence will be exchanged between the applicant, or more likely applicant's attorney, and the patent examiner, a governmental employee who decides on the patentability of an invention. This correspondence, usually in the form of a rejection of the proposed claims by the examiner and a response by the applicant, is placed in the application file. After a patent is issued, this exchange is not printed with the patent specification but is only available by inspecting

the patent file at the Patent Office in Arlington, Virginia. Johns-Manville thus received not only copies of the patents cited by the examiner in rejecting the claims, but also comments by the examiner relating these patents to the proposed invention.

For example, in the file of a 1962 Johns-Manville patent directed to hydrated calcium silicate, the 1951 and 1954 Kalousek patents (see Owens-Illinois patent list at end of chapter) are cited by the examiner in his rejection of the pending claims.⁴⁷ Johns-Manville's attorney acknowledged in his response to the rejection that the 1954 patent resulted "in a porous insulation which has found wide application in the art." Another example involved an exchange of correspondence between the patent examiner and Johns-Manville's attorney during prosecution of a patent application which eventually was eventually issued in 1976.⁴⁸ The examiner pointed out that both the 1959 Hoopes et al. and the 1947 Abrahams et al. patents (see Fibreboard patent list at end of chapter) contemplated the use of inorganic mineral fibers equivalent to asbestos. The examiner quoted directly from the Hoopes et al. patent: "other suitable non-combustible reinforcing fibers may be employed, such as mineral fiber or glass fibers." In both examples, McKinney was one of the attorneys of record.

Owens-Illinois developed the Kaylo line of calcium silicate insulations starting in the 1940s.^{49,50,51} One of these patents disclosed the utility of cellulosic fibers, such as paper pulp, both as suspending agents during mixing of the reactants and reinforcing agents in the final product.⁵⁰

Although an organic fiber such as cellulose might not seem suitable as a reinforcement in thermal insulation, there is ample evidence to suggest the opposite. First, the use of cellulose continued to be recommended in later patents as well as the earliest ones. Second, a 1947 report from Arthur D. Little, Inc. to Owens-Illinois evaluated the combination of Kraft paper, a common type of strong paper made from a specific kind of wood pulp, and heat-treated clay in calcium silicate insulations, and recommended pilot plant experimentation.⁵² Third, Everett Shuman, the Kaylo Division director of research at that time, has testified that bagasse (fiber derived from dried sugar cane), wood or other organic fibers could have been used because only

within a short radial distance from the hot pipe would the fibers in a pipe covering be altered.⁵³ The temperature in a covering, measured outwardly from the pipe, drops very quickly, so the integrity of the covering as a whole would not be affected by the use of cellulose.

One of the patents in the Kaylo series, applied for in 1949, described a product so strong it needed no asbestos or other fibers to reinforce it. Its crystalline structure, called xonotlite, was superior in terms of heat insulation, strength, and resistance to shrinkage and corrosion.⁵¹ It also had "freedom from shrinkage and cracking wherein no reinforcement, such as asbestos fiber, need be utilized for increasing strength or preventing cracking in the finished product."⁵⁴ The patent further mentioned that paper pulp or starch could be used as suspending agents. A 1948 report on xonotlite Kaylo, which was the basis for the above patent, stated that xonotlite would be cheaper to make and perform better than the then-present Kaylo and would have eliminated the fuzzy appearance that asbestos fibers gave Kaylo.⁵⁵ In further refinements, even the above non-asbestos suspending agents were rendered unnecessary by using discrete particles of the calcium silicate product to suspend the initial reactants.⁵⁶

Owens-Corning Fiberglas was formed in 1938 by Owens-Illinois and Corning Glass Works, each initially holding an equal percentage of the common stock. During the 1980s, Corning Glass sold its share in Owens-Corning. In 1958, Owens-Corning bought the Kaylo Division from Owens-Illinois and continued the research on this type of insulation. Several patents assigned to Owens-Corning gave examples using fibers other than asbestos.^{57,58,59,60,61,62} These fibers included cotton and coated fiberglass.

Another company active in manufacturing calcium silicate insulation was Fibreboard Corporation, whose former names included The Paraffine Companies, Inc., Pabco Products, Inc. and Fibreboard Paper Products Corporation. Two patents, issued in the late 1940s and assigned to Paraffine, described calcium silicate insulation using either asbestos, mineral wool, glass or metallic fiber.^{63,64} A 1959 Fibreboard Paper Products

patent also disclosed asbestos, mineral wool, or fiberglass as usable for reinforcement.⁶⁵

In addition to these larger manufacturers, other companies and independent inventors had patents which formed calcium silicate insulation without the need of asbestos. The previously mentioned 1952 Baxter patent disclosed a mixture of fiberglass and slag wool pellets as a reinforcement for insulating materials, such as magnesia or calcium silicate. A similar invention was disclosed in a 1955 British patent to Insulex Mineral Products Limited.⁶⁶

An important 1956 patent to Columbia-Southern Chemical Corporation, at that time a subsidiary of Pittsburgh Plate Glass Company, listed asbestos, fiberglass, or rock wool as the possible reinforcement.⁶⁷ In two out of three examples given, acceptable products were obtained using fiberglass.

A significant advance was disclosed in a 1966 patent to Joseph Crosfield & Sons Limited, a British company.⁶⁸ By including certain metals, aluminum, nickel, or zirconium, in the reaction mixture, the pressurized steam treatment was obviated. This treatment tended to weaken fiberglass reinforcement. Examples 54 through 58 replaced the asbestos with either fiberglass or rock wool. This was probably the first calcium silicate insulation without asbestos that was commercially available.

Perhaps the most widely used product alternative to asbestos was mineral wool insulation. (See Table 4.) Mineral wool was first produced commercially in Wales in 1840.⁶⁹

The source of the raw material determined the type of mineral wool product. Rock wool was made from natural rock, primarily a calcareous shale, a type of rock shale mineral containing calcium, whereas slag wool was made from blast-furnace slag. Glass wool or fiberglass can also be classified as a type of mineral wool. Mineral wool was manufactured by first melting the raw materials, then blowing or drawing the resultant molten mass into fine fibers. The wool was fabricated into blankets, felts and molded coverings.

The advantages of mineral wool were its flexibility and lower heat conductivity than calcium silicate and magnesia. Felts and molded coverings were generally good up to 600 degrees F.; however, one type of high-temperature bonded mineral wool

had a limit of 1700 degrees F.⁷⁰ Blankets had a temperature limit of 1200 degrees F. and found extensive use in the petroleum refining industry.⁷¹ Mineral wool was also employed aboard ships.⁷²

Rock wool was probably first made in 1897 by Charles Hall who later formed the Banner Rock Products Company.⁷³ This company developed rock wool pipe insulation in the 1920s.⁷⁴ In 1928, Banner Rock was purchased by Johns-Manville. In view of the fact that Johns-Manville derived a large amount of its profits from the sale of asbestos, it is possible that competitive considerations adversely affected the advance of rock wool for pipecovering and other applications. Other patents for mineral wool insulations were issued in the early 1930s, including one each to General Insulating and Manufacturing Company and to Coast Insulating Co.^{75,76}

Later representative patents for mineral wool pipe insulation included two assigned to Eagle-Picher Company (1960, 1962); one to Johns-Manville (1964); and one to Keene Corporation (1971).^{77,78,79,80} In general, the above patents described products good up to 1200 degrees F. From 1931 to 1957, Eagle-Picher made an asbestos-free pipe insulation called 77 Pipe Covering, which contained mineral wool and metal fabric.⁸¹ Baldwin-Hill Company was also active in manufacturing mineral wool insulation products.⁸²

A 1964 article in *Thorax*, a medical journal, mentioned that glass wool and rock wool could be used as substitutes for asbestos in insulation. This article also reported that exposure

Table 4. Patents Describing Mineral Wool Product Alternatives to Calcium Silicate Insulation

Year	Company	Reference Number
1926	Banner Rock	73
1931	General Insulating and Manufacturing	75
1933	Coast Insulating	76
1960	Eagle-Picher	77
1962	Eagle-Picher	78
1964	Johns-Manville	79
1971	Keene	80

to glass wool or rock wool dust did not lead to fibrosis of the lungs or impairment of cardiopulmonary functions.⁸³

Superior high-temperature fiberglass pipe insulations were developed by both Owens-Corning and Johns-Manville. (See Table 5.) The molded type patented by Owens-Corning could withstand temperatures of up to 1200 degrees F.^{84,85,86} The product patented by Johns-Manville in 1962 had a temperature limit of about 2000 degrees F. Comparing it with several other insulations, including calcium silicate, Johns-Manville concluded that a greater resistance to thermal transmission "has been achieved by an insulation unit of the present invention over all of the known similar insulation materials which had the same or even greater density."⁸⁷

As with the case of rock wool (Banner Rock) and calcium silicate (Celite), Johns-Manville entered the fiberglass business by acquisition; in this case, of L.O.F. Glass Fibers Company in 1958.⁸⁸ Within months, another competitor in the insulation field, F.E. Schundler & Co., Inc., was also purchased by Johns-Manville.⁸⁸

Another category of insulation useful at high temperatures was composed mainly of expanded perlite, a volcanic ore. (See Table 6.) The ore was ground, mixed with water and then expanded by heating in a furnace. An interesting 1952 patent, to independent inventor Harold Thomas, combined a specific grade of expanded perlite with a binder.⁸⁹ The mixture was formed into a pipe covering in compression molds and applied immediately to pipes without drying. The insulation had a 1200 degree F. temperature limit and "has been found to be cheaper and to provide better insulation than compositions heretofore used."⁹⁰

Table 5. Patents Describing Fiberglass Product Alternatives to Calcium Silicate Insulation

Year	Company	Reference Number
1939	Owens-Corning	85
1960	Owens-Corning	86
1960	Owens-Corning	84
1962	Johns-Manville Fiber Glass	87

In 1959, the Philip Carey Manufacturing Company patented an insulating material comprising expanded perlite, binders, and fiber, such as asbestos or mineral fiber.⁹¹ The material withstood temperatures up to 1700 degrees F. In 1970, the Panacon Corporation, into which Philip Carey Manufacturing Company merged in 1970, filed a patent application for another expanded perlite insulation containing fiberglass.⁹² Moreover, this application acknowledged the health hazards of asbestos, stating that the result of asbestos inhalation "in many cases is the lung disease termed 'asbestosis,' which often develops eventually into lung cancer."⁹³

Johns-Manville became involved with perlite insulation after it purchased, in 1959, F.E. Schundler & Co., Inc. which mined and processed perlite. Two 1960s patents were obtained by Johns-Manville Perlite Corporation for expanded perlite insulation, usable to 1200 degrees F., in which the fiber was asbestos, fiberglass or rock wool.^{94,95} A du Pont patent filed in 1971 for asbestos-free perlite insulation referred to "the serious health hazards in handling asbestos ..."⁹⁶

Other miscellaneous insulating materials (see Table 7) patented by Johns-Manville and other companies might also have substituted for calcium silicate in at least some applications.^{97,98,99,100,101} An example is the previously mentioned fiberglass blanket, whose temperature limit was 1000 degrees F.²⁵ Another type, disclosed in a 1948 patent assigned to F.E. Schundler, contained light-weight refractory particles, a dispersing agent and, if necessary, asbestos or metal fiber reinforcement. The product was superior to both 85% magnesia and calcium silicate in insulating efficiency. It was superior to the former in strength, hardness, and resistance to abrasion and vibration, and was capable of resisting temperatures up to 1400 degrees F. "Its cost of manufacture is less than that of 85% magnesia."¹⁰²

Insulating Cements

Insulating cements were used as protective coverings and in situations in which an odd-shaped insulation was necessary or advantageous. To apply them, water was added to a mixture of ingredients to form a trowelable mass. Typical uses included

Table 6. Patents Describing Perlite Product Alternatives to Calcium Silicate Insulation

Year	Company (unless otherwise noted)	Reference Number
1952	Thomas*	89
1959	Philip Carey	91
1962	Johns-Manville Perlite	94
1963	Johns-Manville Perlite	95
1972	Panacon	93
1973	E.I. du Pont de Nemours	96

*inventor

filling joints and seams, covering pipe bends, and covering the outside of pipe insulation. Insulating cement was sometimes applied to pipes and boilers as the sole insulation. It was also used to bond blocks of refractory material. Insulating cements commonly contained a fibrous material, such as mineral wool, and any of various cements or binding agents. When used, the purpose of asbestos was to strengthen these formulations. Other types of insulating cements were composed almost totally of asbestos or ground up 85% magnesia.

Various patents described insulating cements or related compositions (see Table 8) in which asbestos was not included in the composition or was not an essential ingredient. Two 1925

Table 7. Patents Describing Miscellaneous Product Alternatives to Calcium Silicate Insulation

Year	Company	Main Constituents	Reference Number
1934	Johns-Manville	reacted mineral wool	98
1943	Asbestos Limited	cement plus mineral fibers	9
1947	Johns-Manville	mineral wool or fiberglass	99
1948	F.E. Schundler	cement plus metal fiber	102
1952	Johns-Manville	mineral wool or fiberglass	100
1957	Johns-Manville	silica	101

patents assigned to Celite combined diatomaceous earth with other ingredients.^{103,104} One of these patents used a binding agent, such as Portland cement, and a fibrous material, such as "asbestos, manila fiber, hair, wood fiber, or any kind of fiber which may assist in giving mechanical strength to the composition."¹⁰⁴

A plaster composition patented in 1934 was comprised mainly of rock wool and diatomaceous earth. Rock wool was included because it could withstand temperatures over 1500 degrees F. On the other hand, materials such as asbestos were specifically excluded because they had "a critical point of about 1400 degrees F., that is, at this temperature they break down and become of practically no use as a fire-proofing material."¹⁰⁵

A corrosion-resistant insulating cement, patented in 1950 by Baldwin-Hill, contained mineral wool and an inorganic binder.¹⁰⁶ Although asbestos could have been included, it was not deemed essential.

A weather-resistant insulating cement used as an outer layer covering other layers of insulating cements, was patented in 1951. This had no asbestos and was composed primarily of cement, clay, and mineral wool.¹⁰⁷ Other asbestos-free insulating cements were patented in the United States and the Soviet Union.^{108,109,110,111}

Table 8. Patents Describing Perlite Product Alternatives to Calcium Silicate Insulation

Year	Company (unless otherwise noted)	Reference Number
1905	Hayde*	108
1920	Winkley**	109
1925	Celite	103
1925	Celite	104
1934	Jenkins*	105
1939	Blokh*	111
1950	Baldwin-Hill	106
1951	Randall et al.*	107
1963	Quigley***	110

*inventor

**assignee of patent by inventor R. MacDonald

***assignee of patent by inventor R. Demaison

Use of Mineral Wool Insulation in Oil Refineries and Industrial Plants

Most of this chapter has been devoted to what the manufacturers of asbestos-containing insulation could have achieved to alter their products to eliminate asbestos or search for other insulation products that did not contain asbestos. But from the perspective of the users of insulation in industrial, chemical and power plants and the oil refineries, what asbestos-free insulations were available, the most common type was mineral wool insulation, as discussed previously in this chapter.

The design or other responsible engineer at an industrial plant specifies the requirements and types of insulation used in the plant. For example, at an oil refinery the design engineer selects the most appropriate insulation based on service requirements, one of the most important being the range of temperature use. Several journal articles featured the use of mineral wool insulation at refineries. A 1935 article by John Schaeffer of Eagle-Picher Lead Company stated that mineral wool products "are used extensively in insulating high-pressure steam lines, oil refinery lines, furnace and boiler lines ... For these uses, mineral wool blankets and pipe covering are superior to 85 per cent magnesia blocks and pipe covering because they are able to withstand much higher service temperatures, and at the same time have lower thermal conductivity."¹¹²

The 1949 Commercial Standard for *Mineral Wool Insulation for Heated Industrial Equipment* listed as acceptors of the standard the National Cooperative Refinery Association, several oil companies and various industrial and chemical companies.¹¹³ Several articles in the petroleum trade journals reported that an Ashland Oil & Refining Co. refinery, a Tidewater Oil Co. refinery and two Mexican refineries were insulated with mineral wool.^{114,115,116} Another article in *The Petroleum Engineer* of October 1951 discussed general requirements of mineral wool application for piping, and closely followed the 1949 Commercial Standard.¹¹⁷

Similarly, the engineer who selected the insulation at a chemical or power plant had ample knowledge concerning mineral wool insulation. Many articles in the trade journals of the 1940s and 1950s alerted their readers to the application of

mineral wool in power plants and other types of plants.^{118,119,120,121,122} A 1947 article in *Chemical Engineering* stated "It is matter of personal preference whether a designer specifies mineral wool insulation or any of the other standard insulating materials for the average pipe covering job when no special difficulties are to be expected."¹²³

In summary, mineral wool heat insulation was commercially available, had several advantages over asbestos-containing insulations, and could have easily replaced asbestos insulations for almost all applications.

CONCLUSION

In summary, many alternative materials were capable of substituting for asbestos-containing thermal insulation throughout the history of asbestos use in such products. Asbestos was used in magnesia and calcium silicate insulations not for its insulating property, but only as a reinforcing agent in the finished product and a suspension aid in processing.

Not only were magnesia products disclosed in numerous patents using alternative fibers such as animal hair, mineral wool, fiberglass, wood and cotton; but also other types of insulation, such as fiberglass, vermiculite, and rigid glass, could have replaced asbestos-reinforced magnesia insulations.

Asbestos-free calcium silicate compositions, now widely used, appear to be based essentially on technology that was available long before asbestos was banned in molded insulations in the 1970s (1972 in Denmark, 1975 in the U.S.). Examples of substitute fibrous reinforcement in calcium silicate insulations included fiberglass, mineral wool, cellulosic fiber, and paper pulp. Moreover, xonotlite, a particular calcium silicate developed in the late 1940s by Owens-Illinois, needed no reinforcement. Various materials, such as cellulose, paper pulp, or starch, were usable as suspending agents in the initial slurry of lime and silica reactants. Certain types of fiberglass, mineral wool and expanded perlite insulations, whose useful temperature ranges approximated that of calcium silicate, could have replaced calcium silicate (and thus magnesia as well).

Several patents disclosed insulating cements and related compositions in which asbestos was not included in the composition or was not essential.

Once the dangers of asbestos, and specifically the use of asbestos in insulation, became known, the manufacturers could have vigorously developed and used the above alternatives to eliminate the asbestos hazard in manufacturing, product application, and removal. Over the decades that the tragedy of asbestos unfolded, an increasing number of technological alternatives were available but underutilized. The substitution of less hazardous products would have been preferable to the use of warning labeling by manufacturers or the use of partially effective control measures by workers exposed to asbestos insulation dust.

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ANNOTATED LIST OF THERMAL INSULATION PATENTS

The following are lists of patents that suggest alternatives to asbestos-containing thermal insulations. There is a separate list for each of the major manufacturers. These are followed by a single list combining other companies and independent inventors. Collectively, these patents contain claims directed towards methods and apparatus for forming insulating compositions, in addition to the compositions themselves.

To better understand the development of each company's knowledge, the former names of the companies, their subsidiaries, and the companies purchased by them are given below.

Manville Corporation

Johns-Manville Corporation
Johns-Manville Perlite Corporation
F.E. Schundler & Co., Inc.
Johns-Manville Fiber Glass Inc.
L.O.F. Glass Fibers Company
Banner Rock Products Company
The Celite Company
Johns
Manville

Jim Walter Corporation

Panacon Corporation
The Celotex Corporation
The Philip Carey Manufacturing Company

Nicolet, Inc.

Keasbey & Mattison Company

Fibreboard Corporation (merged into Louisiana-Pacific Corporation)

Fibreboard Paper Products Corporation
Pabco Products Inc.
The Paraffine Companies
Plant Rubber & Asbestos Works

Armstrong World Industries, Inc.

Armstrong Cork Company

Bairnco Corporation

Keene Corporation
Baldwin-Ehret-Hill, Inc.
Baldwin-Hill Company

PPG Industries, Inc.

Pittsburgh Plate Glass Company
Pittsburgh Corning Corporation (50% owned)
Columbia-Southern Chemical Corp.

UNR Industries, Inc.

Unarco Industries, Inc.

Union Asbestos & Rubber Company

Raymark Corporation

Raybestos-Manhattan

Most of the assignees in the lists are given as shortened names of the above companies.

Patent Number	Issue Year	Patentee (Assignee)	Description
<i>Manville Corporation</i>			
433,471	1890	Johns	Covering containing wood pulp plus sawdust and chopped cork, sponge, hay, straw or hair
465,701	1891	Manville	Covering containing clay, graphite, glue, and wool dust
441,165	1890	Johns	Covering containing wood pulp plus binder and sawdust, straw, hay, cork, sponge, hair or asbestos
1,520,893	1924	Teitworth (Celite)	Calcium silicate with manila, cellulose or asbestos fibers
1,544,196	1925	Teitworth (Celite)	Insulating composition containing diatomaceous earth, a vegetable gum, and manila fiber, hair, wood fiber or asbestos
1,544,215	1925	Caldwell (Celite)	Insulating mortar comprising diatomaceous earth and a vegetable gum

Patent Number	Issue Year	Patentee (Assignee)	Description
<i>Manville Corporation (cont.)</i>			
1,569,755	1926	Irvine (Celite)	Calcium silicate with hemp, hair or asbestos
1,590,132	1926	Teitsworth (Celite)	Calcium silicate with manila fiber, hair or asbestos
1,611,907	1926	Hall (Banner Rock)	Rock wool jacket for pipe insulation
1,613,137	1927	Seigle (Johns-Manville)	Method for making insulation containing diatomaceous earth, bentonite, and asbestos; asbestos not essential
1,734,209	1929	Huffine (Banner Rock)	Rock wool or asbestos jacket for pipe insulation
1,824,430	1931	Hall (Banner Rock)	Process for treating mineral wool
1,948,395	1934	Powell (Banner Rock)	Apparatus for producing rock wool products
1,956,377	1934	Drill (Johns-Manville)	Molded insulation formed with reacted mineral wool
1,972,500	1934	Toohey et al. (Johns-Manville)	Wool scrap plus wood pipe insulation
1,982,542	1934	Siegel (Johns-Manville)	Magnesia with hemp, jute, organic wool or asbestos

Patent Number	Issue Year	Patentee (Assignee)	Description
<i>Manville Corporation (cont.)</i>			
2,019,021	1935	O'Brien (Johns-Manville)	Moisture-resistant mineral wool heat insulation
2,055,446	1936	Powell (Johns-Manville)	Mineral wool felt
2,077,720	1937	Siegel et al. (Johns-Manville)	Mineral wool felt pipe insulation
2,116,303	1938	Coss (Johns-Manville)	Mineral wool composition
2,190,271	1940	Powell (Johns-Manville)	Apparatus and process for manufacturing mineral wool
2,192,524	1940	Powell (Johns-Manville)	Apparatus for the manufacture of mineral wool
2,247,355	1941	Brown (Johns-Manville)	Calcium silicate ship panel with wood fibers or asbestos; example with wood fibers given
2,282,230	1942	MacAlpine (Johns-Manville)	Mineral wool insulation mat
2,384,614	1944	Dinkfeld (Johns-Manville)	Magnesia shingle, wallboard or other shape with jute, cotton or asbestos
2,413,958	1947	Dinkfeld et al. (Johns-Manville)	Magnesia with asbestos or other reinforcing fibers and fillers

Patent Number	Issue Year	Patentee (Assignee)	Description
<i>Manville Corporation (cont.)</i>			
2,425,293	1947	McDermott (Johns-Manville)	Method and apparatus for making asbestos, mineral wool or glass fiber blanket or tape
2,428,555	1947	Cummins et al. (Johns-Manville)	Magnesia with mineral wool, diatomaceous silica or asbestos
2,456,643	1948	Napier (F.E. Schundler)	Portland cement or calcium silicate containing metal fiber or asbestos
2,554,934	1951	Ayers (Johns-Manville)	Thermal insulation in which part of the asbestos can be replaced with wood fibers
2,584,300	1952	Simmers (Johns-Manville)	Liquid binder for mineral wool bats
2,609,312	1952	Farrell (Johns-Manville)	Tubular pipe covering containing glass, mineral wool or asbestos fibers
2,609,733	1952	Honnig (Johns-Manville)	Magnesia products made using raw cotton, spun glass, fine rock wool, steam treated wood, or asbestos fibers
2,699,097	1955	Binkley (Johns-Manville)	Calcium silicate with mineral wool, glass fibers or asbestos

Patent Number	Issue Year	Patentee (Assignee)	Description
<i>Manville Corporation (cont.)</i>			
2,699,397	1955	Hahn (Johns-Manville)	Mineral wool composition
2,808,338	1957	Bruno et al. (Johns-Manville)	Heat insulation comprising silica aerogel plus fibers such as asbestos, mineral, glass, cotton, acetate, rayon or acrylic fibers
2,904,453	1959	Labino (L.O.F. Glass Fibers)	Glass fiber pipe wrap
3,012,930	1961	Labino (Johns-Manville Fiber Glass)	Silica glass fiber mats
3,017,318	1962	Labino et al. (Johns-Manville Fiber Glass)	Thermal insulation board comprising siliceous fiber, mineral filler and colloidal silica
3,042,578	1962	Denning (Johns-Manville Perlite)	Expanded perlite insulation containing vegetable, glass or asbestos fibers
3,050,106	1962	Pusch et al. (Johns-Manville)	Apparatus for forming pipe insulation containing rock wool, glass or asbestos fibers
3,053,715	1962	Labino (Johns-Manville Fiber Glass)	High temperature glass fiber pipe insulation

Patent Number	Issue Year	Patentee (Assignee)	Description
<i>Manville Corporation (cont.)</i>			
3055831	1962	Barnett et al. (Johns-Manville)	Heat insulation comprising silica aerogel plus fibers such as asbestos, mineral, glass, cotton, acetate, rayon or acrylic fibers
3,063,887	1962	Labino (Johns-Manville Fiber Glass)	Method and apparatus of forming glass fiber pipe insulation
3,081,207	1963	Fox (Johns-Manville Fiber Glass)	Glass fiber mats
3,092,531	1963	Labino (Johns-Manville Fiber Glass)	Siliceous glass fiber bats
3,095,347	1963	Becker (Johns-Manville Perlite)	Expanded perlite insulating board containing newsprint, rock wool or asbestos
3,118,807	1964	Holcomb (Johns-Manville)	Refractory mineral wool felts and blankets
3,128,503	1964	Hahn et al. (Johns-Manville)	Apparatus for forming mineral wool and fiberglass pipe insulation
3,162,895	1964	Pusch (Johns-Manville)	Apparatus for forming pipe insulation containing

Patent Number	Issue Year	Patentee (Assignee)	Description
<i>Manville Corporation (cont.)</i>			
			rock wool, mineral wool, glass, asbestos, or synthetic fibers
3,331,669	1967	Sinclair (Johns-Manville)	Apparatus and method for forming felted products containing mineral and glass fibers
3,346,016	1967	Blau et al. (Johns-Manville)	High temperature laminated insulation containing glass, mineral, rock wool, asbestos, or alumina-silica fibers
3,816,149	1974	Zettel (Johns-Manville)	Calcium silicate with glass fiber, rock wool, rayons, cellulosic fiber, nylons or asbestos
3,856,544	1974	Benner et al. (Johns-Manville)	Calcium silicate with poly (ethylene terephthalate) fibers (Dacron [®]) plus glass fibers
3,965,020	1976	Noll et al. (Johns-Manville)	Calcium silicate with glass, polyester and cellulosic fibers
4,111,712	1978	Pusch (Johns-Manville)	Calcium silicate (tobermorite form) with wollastonite and organic fibers (kraft paper, newsprint fiber, polyester or cotton)

Patent Number	Issue Year	Patentee (Assignee)	Description
<i>Manville Corporation (cont.)</i>			
4,128,434	1978	Pusch (Johns-Manville)	Calcium silicate (tobermorite form) with wollastonite, mineral wool and organic fibers (kraft paper, newsprint fiber, polyester or cotton)
4,131,638	1978	Whitaker et al. (Johns-Manville)	Calcium silicate with asbestos, rock wool, glass fiber, cellulosic fiber, rayons, nylons or polyesters

Owens-Corning Fiberglas Corporation

All of the patents in this list were assigned to Owens-Corning Fiberglas Corporation.

2,160,009	1939	Walker	Spring clip for glass wool pipe insulation
2,184,316	1939	Plummer	High temperature glass wool felt pipe insulation
2,189,840	1940	Simison et al.	Method for applying coatings on glass fiber mats
2,206,059	1940	Slayter	Glass wool felt useful as pipe insulation
2,252,157	1941	Bergin et al.	Glass wool, slag wool or rock wool insulating bats

Patent Number	Issue Year	Patentee (Assignee)	Description
<i>Owens-Corning Fiberglas Corporation (cont.)</i>			
2,288,072	1942	Collins	Method and apparatus for making glass or mineral wool insulation mats
2,331,146	1943	Slayter	Method for producing glass wool pipe coverings
2,335,102	1943	Bergin et al.	Method of producing glass wool, slag wool or rock wool insulating bats
2,350,996	1944	Atkinson et al.	Method for producing glass wool pipe coverings
2,528,091	1950	Slayter	Glass fiber thermal insulating mats
2,566,619	1951	Lyon et al.	Glass wool, slag wool or rock wool thermal insulations and method for forming them
2,640,784	1953	Tiede et al.	Glass fiber compositions
2,694,025	1954	Slayter et al.	Heating-insulating panel containing gypsum cement and glass fibers
2,702,069	1955	Lannan	Method for forming glass fiber mats

Patent Number	Issue Year	Patentee (Assignee)	Description
<i>Owens-Corning Fiberglas Corporation (cont.)</i>			
2,703,762	1955	Slayter	Heat resistant products containing magnesium oxide and glass fibers
2,731,066	1956	Hogendobler et al.	Glass fiber sheets useful as electrical, sound or heat insulation
2,941,899	1960	Stalego	High temperature glass fiber pipe insulation
2,941,904	1960	Stalego	High temperature glass fiber pipe insulation
3,002,857	1961	Stalego	Binder for glass fiber insulation
3,104,196	1963	Shannon	Board made from expanded polystyrene
3,116,158	1963	Taylor	Calcium silicate with asbestos or wollastonite fibers; examples 4 and 5 use wollastonite fibers
3,151,633	1964	Shuman	Disclosed shaped glass fiber pipe insulation
3,216,881	1965	Pfeifer et al.	Calcium silicate with resin coated glass fibers

Patent Number	Issue Year	Patentee (Assignee)	Description
<i>Owens-Corning Fiberglas Corporation (cont.)</i>			
3,227,570	1966	Bishop	Calcium silicate slurries including asbestos or other fillers
3,239,369	1966	Glaser	Heat-insulating silica glass fibers
3,286,785	1966	Shannon et al.	Thermal insulating board containing siliceous fibers
3,317,643	1967	Denny	Calcium silicate with or without asbestos
3,348,994	1967	Rees et al.	Glass fiber insulation board
3,472,668	1969	Pfeifer et al.	Method for forming calcium silicate with resin coated glass fibers
3,562,084	1971	Shannon	Calcium silicate with cotton fibers
3,574,113	1971	Shannon	Calcium silicate with asbestos or resin coated silica glass fibers (example 12)
3,794,505	1974	Helser et al.	Calcium silicate with cellulose plus zirconia glass fibers
3,923,674	1975	Shannon	Calcium silicate with asbestos, bagasse or glass fibers
4,015,994	1977	Hill	Coated glass fibers as replacement for asbestos in calcium silicate, cement,

Patent Number	Issue Year	Patentee (Assignee)	Description
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Owens-Corning Fiberglas Corporation (cont.)

mortar or gypsum
composition

Owens-Illinois, Inc.

All of the patents in this list were assigned to Owens-Illinois Glass Company

2,133,236	1938	Slayter et al.	Apparatus and method for making glass wool useful for insulation
2,469,379	1949	Fraser	Calcium silicate with spiculated cellulose or asbestos; disclosed use of cellulose fiber as a suspending agent
Re. 23,228	1950	Fraser	Reissue patent of and same disclosure as 2,469,379
2,540,354	1951	Selden	Calcium silicate with asbestos or cellulose such as paper pulp
2,547,127	1951	Kalousek	Calcium silicate (xonotlite form) without the need or reinforcement; disclosed starch or highly pulped and beaten paper as suspending agents
2,665,996	1954	Kalousek	Calcium silicate (lepisil form) with cellulose or asbestos; disclosed use of cellulose as a

Patent Number	Issue Year	Patentee (Assignee)	Description
<i>Owens-Illinois Inc. (cont.)</i>			
			suspending agent and to prevent the "hinging effect" (cracking)
2,748,008	1956	Kalousek	Method of making calcium silicate using lepisil or xonotlite to suspend the initial reactants
<i>Jim Walter Corporation</i>			
1,782,384	1930	Greider (Philip Carey)	Magnesia with asbestos or other suitable fibrous materials
1,882,810	1932	Greider (Philip Carey)	Magnesia with asbestos or other suitable fibrous materials
2,262,953	1941	MacArthur et al. (Philip Carey)	Magnesia with asbestos or other mineral fibers
2,275,032	1942	Greider et al. (Philip Carey)	Magnesia with asbestos or other mineral fibers or substances
2,335,242	1943	Greider et al. (Philip Carey)	Magnesia with mineral wool, glass wool, cellulose or asbestos
2,348,829	1944	MacArthur et al. (Philip Carey)	Disclosed hydraulically set heat insulation composed of gypsum and diatomaceous earth,

Patent Number	Issue Year	Patentee (Assignee)	Description
<i>Jim Walter Corporation (cont.)</i>			
			and a molded insulation of mineral wool and binder
2,348,898	1944	Greider et al. (Philip Carey)	Magnesia with asbestos or other mineral fibers of substances
2,354,593	1944	Greider et al. (Philip Carey)	Plastic composition useful for fire-resistant floor or pavement, conduits for electrical wires, or coatings for oil pipes; contained fibers such as asbestos, rock wool or glass
2,396,915	1946	Greider et al. (Philip Carey)	Magnesia with asbestos or other mineral fibers or substances
2,884,380	1959	Cook et al. (Philip Carey)	Expanded perlite insulation with mineral fibers
2,971,878	1961	Heilman et al. (Philip Carey)	Expanded perlite insulation containing asbestos or other mineral fibers
3,639,276	1972	Mueller (Panacon)	Expanded perlite insulation containing glass fibers; described health hazards of asbestos

Patent Number	Issue Year	Patentee (Assignee)	Description
<i>Nicolet, Inc.</i>			
345,843	1886	Hanmore (One-half to Keasbey & Mattison)	Magnesia with animal hair, wool, asbestos or various other materials
Re. 22,952	1947	Miller (Keasbey & Mattison)	Magnesia with fibrous matter such as asbestos
2,486,050	1949	Miller et al. (Keasbey & Mattison)	Method for forming heat insulation containing asbestos, rock wool or glass wool
2,574,652	1951	Miller (Keasbey & Mattison)	Process of producing magnesia containing asbestos and/or other suitable ingredients
2,800,415	1957	Seipt (Keasbey & Mattison)	Magnesia with asbestos or similar fibers
4,244,781	1981	Heckman (Nicolet, Inc.)	Nonasbestos millboard refractory composition; also acknowledged various nonasbestos insulating compositions, including those disclosed in U.S. Patents 3,042,578 and 3,658,564, both perlite insulations

Patent Number	Issue Year	Patentee (Assignee)	Description
<i>Fibreboard Corporation</i>			
2,209,754	1940	Abrahams et al. (Plant Rubber & Asbestos Works)	Magnesia with asbestos or other suitable fiber
2,339,041	1944	Abrahams et al. (Plant Rubber & Asbestos Works)	Magnesia with asbestos or other suitable fiber
2,432,981	1947	Abrahams et al. (The Paraffine Companies)	Method of making calcium silicate containing mineral fiber, glass fiber, or asbestos
2,483,498	1949	Lewon et al. (The Paraffine Companies)	Method of making calcium silicate containing mineral fiber, glass fiber, metallic fiber of asbestos
2,517,001	1950	Lewon et al. (The Paraffine Companies)	Molding apparatus for magnesia or calcium silicate containing asbestos or other fibers
2,904,444	1959	Hoopes et al. (Fibreboard Paper Products)	Method of making calcium silicate containing mineral fiber, glass fiber or asbestos

Armstrong World Industries, Inc.

All of the patents in this list were assigned to Armstrong Cork Company

1,045,933	1912	Belknap	Calcium silicate with asbestos, mineral wool or spun glass
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Patent Number	Issue Year	Patentee (Assignee)	Description
<i>Armstrong World Industries, Inc. (cont.)</i>			
2,367,093	1945	Brown, Jr. et al.	Method of manufacturing insulating firebrick or block
2,396,246	1946	Callis	Heat insulation block for furnaces and kilns and containing asbestos, mineral wool or glass wool fibers
2,409,297	1946	McGarvey	Process for making magnesia suitable alone, or with fibers such as asbestos
2,423,839	1947	McGarvey et al.	Method of making magnesia suitable alone, or with fibers such as asbestos
2,476,306	1949	King	Heat-insulating block using mineral wool
British 766,428	1955	Armstrong Cork Company	Heat-insulating board containing mineral wool and kraft pulp
<i>Bairnco Corporation</i>			
2,509,599	1950	Hollenberg, Jr. (Baldwin-Hill)	Mineral wool insulating cement; asbestos not necessary
2,633,433	1953	Hollenberg, Jr. (Baldwin-Hill)	Insulating sheet containing mineral wool, glass wool or asbestos; characterized by

Patent Number	Issue Year	Patentee (Assignee)	Description
<i>Bairnco Corporation (cont.)</i>			
			ease of handling, minimum of dusting and breakage, with practically no industrial health hazard
2,732,295	1956	Hollenberg, Jr. (Baldwin-Hill)	Same disclosure as 2,633,433
3,577,889	1971	Eriksen (Keene)	Method and apparatus for slitting and trimming mineral wool pipe insulation

The Eagle-Picher Company

All of the patents in this list were assigned to The Eagle-Picher Company.

2,950,225	1960	Losse	Method of producing mineral wool insulation
3,030,250	1962	Losse	Mineral wool blanket pipe insulation
3,336,951	1967	Huelster	Mineral fiber pipe insulation

PPG Industries, Inc.

2,620,513	1952	Cryor et al. (Originally assigned to Union Asbestos & Rubber, but records in the U.S. Patent Office show this	Method and apparatus for forming rigid pipe insulation containing glass, mineral or asbestos fibers
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Patent Number	Issue Year	Patentee (Assignee)	Description
<i>PPG Industries, Inc. (cont.)</i>			
		patent was later sold to Pittsburgh Corning)	
2,754,547	1956	Allen (Columbia- Southern Chemical)	Calcium silicate with rock wool, glass fiber or asbestos
2,906,317	1959	Keyes (Pittsburgh Plate Glass)	Method for forming glass fiber pipe insulation
<i>UNR Industries, Inc.</i>			
2,468,589	1949	Cryor et al. (Union Asbestos & Rubber)	Insulating tape containing asbestos or glass rovings
2,620,513	1952	Cryor et al. (Union Asbestos & Rubber)	Method and apparatus for forming rigid pipe insulation containing glass, mineral or asbestos fibers
<i>Raymark Corporation</i>			
2,514,170	1950	Walter et al. (Raybestos- Manhattan)	Composite blanket pipe insulation filled with asbestos, glass wool, mineral wool or slag wool
<i>Other Companies and Independent Investors</i>			
148,972	1874	O'Hara	Covering consisting of ashes and sodium silicate

Patent Number	Issue Year	Patentee (Assignee)	Description
<i>Other Companies and Independent Investors (cont.)</i>			
308,516	1884	Ordway	Pipe Covering containing charcoal and water glass (sodium silicate)
570,634	1896	Hicksex	Pipe insulation containing mica flakes
775,541	1904	McConnell (McConnell Asbestos & Covering Co.)	Pipe covering containing hair, asbestos, mineral wool, plastic magnesia, or similar fibrous or granular material
803,285	1905	Hayde	Insulating cement comprising Portland cement, burnt clay, and mineral wool
1,228,609	1917	Schmid ("Lipsia" Chemische Fabrik, Actien- Gesellschaft)	Process of making magnesia containing asbestos, coconut fiber, hairs or fibrous peat
1,332,348	1920	MacDonald (W.H. Winkley)	Insulating mortar or plaster consisting of diatomaceous earth, alkali, starch and water
1,427,014	1922	von Pazsiczky	Apparatus for producing spun glass useful as insulation
1,693,015	1928	Babor et al.	Insulation containing exfoliated vermiculite and a binder

Patent Number	Issue Year	Patentee (Assignee)	Description
<i>Other Companies and Independent Inventors (cont.)</i>			
1,827,035	1931	Mottweiler et al. (General Insulating and Manufacturing Company)	Rock wool jacket pipe insulation
1,907,307	1933	Smith (Coast Insulating Co.)	Mineral wool pipe insulation
1,939,329	1933	White	Mineral wool pipe insulation
1,968,489	1934	Jenkins	Insulating cement containing rock wool, diatomaceous earth, lime and flour
2,047,187	1936	Becher (The Agasote Millboard Company)	Insulation comprising exfoliated vermiculite and gelatinized cellulose
2,101,921	1937	Shaver	Mineral wool pipe insulation
Russian 54,360	1939	Blokh	Thermal insulation for hot pipes containing calcium hydrosilicate; troweled into place
2,309,206	1943	Newman (Asbestos Limited Incorporated)	Process of producing insulation containing cement, silica and fibers such as rock wool, mineral wool or asbestos

Patent Number	Issue Year	Patentee (Assignee)	Description
<i>Other Companies and Independent Inventors (cont.)</i>			
2,460,848	1949	Rover (Foster Wheeler Corporation)	Mineral wool, rock wool or asbestos insulating blanket useful as a furnace wall
2,491,761	1949	Parker et al. (The H.I. Thompson Company)	Silica glass fiber insulation
2,574,843	1951	Randall et al.	Insulating finishing cement comprising mineral wool, fly ash, aluminous cement, and bentonite
2,598,102	1952	Baxter (James D. Akins)	Magnesia, diatomaceous earth or calcium silicate insulation with glass fiber and slag wool pellets
2,600,812	1952	Thomas	Insulation containing expanded perlite, sodium silicate and sodium chloride
British 722,012	1955	Insulex Mineral Products Limited	Calcium silicate with rock wool and glass fibers
2,778,759	1957	Stephen et al. (Gustin-Bacon Manufacturing Co.)	Glass fiber pipe insulation
3,015,626	1962	Kingsbury	Insulating board containing expanded perlite, vermiculite particles, a binder, and a fiber, such as

Patent Number	Issue Year	Patentee (Assignee)	Description
<i>Other Companies and Independent Inventors (cont.)</i>			
			newsprint pulp, kraft paper pulp, bagasse, asbestos or glass fibers
3,025,176	1962	Herrington	Premolded insulation jacket for pipe fittings
3,092,505	1963	Demaison (Quigley Company, Inc.)	Refractory insulating cement comprising mineral wool, fireclay, Portland cement, and porous particles
3,238,052	1966	Burak et al. (Joseph Crosfield & Sons Limited)	Calcium silicate with glass fiber, mineral wool or asbestos; examples 54-58 without asbestos
3,501,324	1970	Kubo (Kabushiki Kaisha Osaka Packing Seizosho)	Calcium silicate with rock wool, glass fiber or asbestos
3,718,491	1973	Yates (E.I. du Pont de Nemours and Company)	Process for producing perlite-silicate insulation; mentioned the health hazards of asbestos
3,769,072	1973	Echerd et al. (H.K. Porter Company, Inc.)	Pipe lagging with mineral, glass, ceramic or asbestos fibers
4,144,121	1979	Otouma et al. (Nippon Asbestos Co., Ltd.)	Calcium silicate board with fibrous wollastonite and wood pulp

ANNOTATED LIST OF CEMENT PATENTS

This list contains patents that disclosed various fibers useful as replacements for asbestos in cement products such as asbestos-cement pipe.

Patent Number	Issue Year	Patentee (Assignee)	Description
3,736,162	1973	Chvalovsky et al. (Ceskoslovenska Akademie Ved.)	Corrosion-resistant mineral fibers coated with polysiloxane resin; replaced asbestos in a cement medium
3,854,986	1974	Chvalovsky et al. (Ceskoslovenska Akademie Ved.)	Corrosion-resistant mineral fibers coated with polysiloxane resin; replaced asbestos in a cement medium
4,040,851	1977	Ziegler (GAF Corporation)	Cement articles reinforced with cotton fibers
4,064,307	1977	Lajoie (L. Lajoie Inc.)	Urea-formaldehyde fibers useful in cement, sealants and paints
4,085,001	1978	Fukuwatari et al. (Asahi Glass Company, Ltd.)	Process of preparing fiberglass-reinforced cement sheets
4,095,986	1978	Matsuda et al. (Director- General of the Agency of Industrial Science and Technology)	Alkali-resistant glass composition useful in cement products

Patent Number	Issue Year	Patentee (Assignee)	Description
4,118,239	1978	Gagin (Johns-Manville Corporation)	Alkali-resistant glass composition useful in cement products
4,140,540	1979	Caspar et al. (Societe Anonyme dite: Lafarge)	Ettringite fibers useful in cement products
4,153,439	1979	Tomić et al. (Rockwool Aktiebolaget)	Method for producing mineral wool useful in a basic medium such as cement
4,191,585	1980	Jaunarajs (Johns-Manville Corporation)	Alkali-resistant glass fibers coated with zinc stearate, and useful in cement products
4,199,366	1980	Schaefer et al. (Inventa AG fur Forschung und Patent- verwertung)	Cement-like material reinforced with polyvinyl alcohol fibers

ANNOTATED LIST OF FRICTION ELEMENT PATENTS

This list contains patents which have disclosed asbestos-free friction elements, such as brake linings, disc brakes, and clutch facings.

Patent Number	Issue Year	Patentee (Assignee)	Description
1,950,262	1934	Norton (Bendix Brake Company)	Brake facing containing asbestos or cellulose
2,110,571	1938	Elerath	Brake or clutch; asbestos not necessary

Patent Number	Issue Year	Patentee (Assignee)	Description
2,158,337	1939	Rasmussen (General Motors Corporation)	Brake linings containing glass fiber
2,239,134	1941	Wellman (The S.K. Wellman Company)	Brake linings or clutch facings comprising mainly metals
2,369,502	1945	Walker (Raybestos- Manhattan, Inc.)	Clutch facings or brake linings comprising metal powder and binder; asbestos not necessary (Ex. 2)
2,408,430	1946	Lowey et al. (The S.K. Wellman Company)	Metallic brakes and clutches containing molybdenum sulphide
2,784,105	1957	Stedman et al. (Bendix Aviation Corporation)	Asbestos-free aircraft brake containing metal and mullite
2,861,964	1958	de Gague et al. (Johns-Manville)	Railroad brake block with organic reinforcing fibers instead of asbestos
2,938,790	1960	Stedman et al. (Bendix Aviation Corporation)	Aircraft brakes containing mullite, and metal , but no asbestos
2,945,291	1960	Ankeny et al. (General Motors Corporation)	Clutch or brake containing iron, graphite and molybdenum disulfide
2,945,292	1960	Luther, Jr. et al. (General Motors Corporation)	Clutch or brake containing iron powder, graphite and bismuth powder

Patent Number	Issue Year	Patentee (Assignee)	Description
3,033,326	1962	Byers (The S.K. Wellman Company)	Aircraft brakes containing iron and graphite, but no asbestos
3,184,001	1965	Reinsch et al. (General Motors Company)	Brake lining (as in 2,945,291 or 2,945,292) and brake drum, wherein the drum contained no ferrite
3,210,303	1965	Biggs (American Brake Shoe Company)	Asbestos-free passenger car brake linings containing iron, graphite, and resin binder
3,269,976	1966	Ueda	Railroad brake containing graphite, copper, aluminum and resin
3,494,884	1970	Kraft (Jurid-Werke GmbH)	Brake or clutch composition containing metal, an abrasive, a binder, and a filler, such as asbestos, glass, metal, barytes, or metal oxides
3,552,533	1971	Nitz et al. (Abex Corporation)	Structural part including facing, made with carbonized filaments
3,743,069	1973	Barnett et al. (Johns-Manville Corporation)	Clutch facings containing glass fibers, cement, and brass wire

Patent Number	Issue Year	Patentee (Assignee)	Description
3,756,910	1973	Peters et al. (Johns-Manville Corporation)	Process of preparing clutch facings containing glass fibers, brass wire, and cement
3,835,118	1974	Rhee et al. (The Bendix Corporation)	Brake linings comprising metallic powder, sponge iron, ceramic powder, rubber particles, steel fibers, graphite particles, and a binder
3,870,581	1975	Afflerbach et al. (Johns-Manville Corporation)	Method of making clutch facings containing glass fibers and metal chips
3,896,075	1975	Longley (BBA Group Limited)	Brake lining or clutch in which basalt fibers are substituted for conventional asbestos fibers
3,967,037	1976	Marzocchi et al. (Owens-Corning Fiberglas Corporation)	Asbestos-free brake linings or pads containing glass fibers
4,118,528	1978	Lowry (Raybestos- Manhattan, Inc.)	Clutch facings containing glass fibers, carboxy nitrile rubber, phenol formaldehyde resin, and furnace black
4,119,591	1978	Aldrich (The Bendix Corporation)	Brake linings comprising at least one of steel, cellulose, glass, mineral and rayon

Patent Number	Issue Year	Patentee (Assignee)	Description
			fibers, thermosetting resin, cashew nut particles, elastomeric modifiers, and inorganic modifiers
4,197,223	1980	Bartram (Ferodo, Ltd.)	"Asbestos-free" clutch facing using a wide range of organic and inorganic fibers
4,217,255	1980	Griffith (Abex Corporation)	Lead-free, asbestos-free railroad brake
4,244,994	1981	Trainer et al. (Raybestos-Manhattan, Inc.)	Clutch facings containing aramid fibers

ANNOTATED LIST OF
FLOOR COVERING PATENTS

This list contains patents which disclosed various fillers for floor coverings, including vinyl and linoleum. Some patents are listed as general knowledge about floor coverings.

Patent Number	Issue Year	Patentee	Description
<i>Armstrong Cork</i>			
2,077,004	1937	Penner et al	Felt covering. Rags, cellulose
2,268,759	1942	Martin	Wear resistant tile. Cotton, wool, asbestos
2,378,377	1945	Bare	Mastic tile. Clay, asbestos, serpentine, talc, whiting

Patent Number	Issue Year	Patentee	Description
<i>Armstrong Cork (cont.)</i>			
2,382,212	1945	Dunlap	Linoleum. Fillers: Cork, wood flour
2,389,079	1945	Powers	Linoleum. Backings: burlap, cotton. Fillers: cork, wood flour
2,457,848	1949	Stubblebine	Alkali-resistant floor covering. Fillers: cork, serpentine, limestone
2,552,600	1951	Stubblebine	Linoleum. Fillers: calcium carbonate, cotton, etc.
2,624,683	1953	Bezman	Vinyl floor covering. Slate flour, clay
2,649,428	1953	Moore et al.	Mastic tile. Breakage, damage. Fillers: asbestos, limestone
2,696,447	1954	Bezman	Vinyl felt base floor covering. Filler
2,720,476	1955	Baymiller	Backing material: cellulose and cork
2,772,141	1956	Dunlap	Homogeneous vinyl? Fillers: wood flour, cork
2,772,970	1956	Feigley, Jr.	Sheet material for backing of floor covering. Cotton, kraft, wool, asbestos fibers
2,773,851	1956	Tolman	Vinyl floor tile. Mention of fibrous talc

Patent Number	Issue Year	Patentee	Description
<i>Armstrong Cork (cont.)</i>			
2,802,765	1957	Baymiller et al.	Linoleum. Backing of cotton and ground wood
2,802,797	1957	Lerch	Greaseproof floor tile. Mention of fibrous talc
2,880,090	1959	Feigley, Jr.	Vinyl floor tile. Overcomes difficulties of asbestos, instead of cellulose, in backing
2,926,150	1960	Lerch	Vinyl asbestos tile. Mention of graining, dimensionally stable
2,961,029	1960	Rainar	Floor covering. Fillers: wood flour, cork, asbestos, whiting, clay, silica, slate flour
3,056,224	1962	Almy et al.	Vinyl floor covering. Backing: asbestos felt, burlap, cotton, etc.
3,095,318	1963	Petzold	Mention of homogeneous vinyl
3,376,187	1968	McKee, Jr. et al.	Vinyl covering. Various backings
3,560,315	1971	Evans et al.	Seamless monolithic flooring. Various backings
3,649,433	1972	Drout	Foamed vinyl floor covering. Two layers bonded to glass strand layer

Patent Number	Issue Year	Patentee	Description
<i>Armstrong Cork (cont.)</i>			
3,887,409	1975	McCreary et al.	Vinyl floor covering. Top layer and foam base
4,020,020	1977	Appleyard et al.	Recovery of asbestos backing
4,083,821	1978	Harris	Flooring without asbestos. Discussion of health hazards of asbestos and vinyl chloride
4,083,824	1978	Harris	Flooring without asbestos. Discussion of health hazards of asbestos and vinyl chloride.
4,247,364	1981	Culp	Glass fiber and mica flake backing for vinyl floor covering. Use of asbestos suspect
<i>American Biltrite Rubber</i>			
3,049,459	1962	Smith et al.	Marble-like vinyl floor covering
3,152,002	1964	Wisotzky et al.	Vinyl floor covering. No mention of asbestos
3,272,683	1966	Marcus et al.	Pebbled vinyl floor covering. Glass fibers
3,310,619	1967	Slosberg	Vinyl-acrylic floor covering. No mention of asbestos

Patent Number	Issue Year	Patentee	Description
<i>American Biltrite Rubber (cont.)</i>			
3,370,114	1968	Holmstrom et al.	Marbleized vinyl flooring. Homogeneous floor tile
3,518,153	1970	Slosberg et al.	Two layer embossed vinyl flooring.
<i>The Flintkote Company</i>			
3,134,829	1964	Brown	Wood-grained vinyl floor tile. Mention of fibrous talc. Fillers: asbestos, limestone
3,607,590	1971	Califano et al.	Mention of homogeneous vinyl floor tile
<i>Congoleum</i>			
1,968,204	1934	Hazlehurst	Linoleum bonded to base material. Fillers: wood, cork flour or other mineral. Backings: jute or cotton
2,482,185	1949	Hubert, Jr. et al.	Two layer floor coverings. Asphalt felt base. Surface layer contains limestone.
2,551,282	1951	Palmer et al.	Floor covering. Fillers: cork, wood, asbestos, etc. Example with cork and wood flour. Burlap or felt backing
2,590,032	1952	Petry	Laminated floor covering. Fillers: asbestos, cork, wood flour, and cellulose

Patent Number	Issue Year	Patentee	Description
<i>Congoleum (cont.)</i>			
2,769,726	1956	Wetterau et al.	Flexible vinyl floor covering. Base felt: wood fiber, rag fiber, etc.
3,129,194	1964	Kupits	Decorative vinyl floor coverings. Fillers: limestone, clay, whiting, pumice, talc, asbestos, wood flour. Backing: cotton, rags, etc.
3,218,382	1965	Benedict et al.	Typical fillers: Linoleum: cork, wood flour, whiting, china clay, asbestine. Vinyl: asbestos, cork, wood flour, fibrous talc, etc.
3,310,422	1967	Petry	Foamed floor covering. Backing: cellulose or asbestos
3,502,611	1970	Palmer et al.	Vinyl flooring with non-fibrous platy talc. Discussion of fillers
<i>GAF Corporation</i>			
3,741,851	1973	Erb et al.	Foamed vinyl floor covering. Base layer: asbestos, wood, cotton, etc.

Patent Number	Issue Year	Patentee	Description
<i>Allied Chemical Corporation</i>			
3,401,129	1968	McGinley	Vinyl floor tile. Discussion of "semiflexible" and "flexible" types. "Flexible" types had no asbestos
<i>Union Carbide Corporation</i>			
3,019,597	1963	Henriques	Vinyl floor coverings. Various fillers
3,904,579	1975	Braddicks	Vinyl floor covering without asbestos. Discussion of health hazards of asbestos

ANNOTATED LIST OF PAINT, PLASTER AND TILE PATENTS

Patents in this list disclosed paint, plaster and tile products in which asbestos was not included or was not necessary.

Patent Number	Issue Year	Patentee (Assignee)	Description
1,814,086	1931	Haggerty et al. (National Gypsum Company)	Gypsum paint containing wood, fiber or paper
1,858,369	1932	Linzell et al. (United States Gypsum Company)	Gypsum paint in which asbestos is not necessary
1,871,806	1932	Ross (United States Gypsum Company)	Gypsum acoustical plaster containing no asbestos
Re. 18,739	1933	Ross (United States Gypsum Company)	Same disclosure as 1,871,806

Patent Number	Issue Year	Patentee (Assignee)	Description
1,901, 057	1933	Ross (United States Gypsum Company)	Gypsum acoustical tile containg wood fiber
1,961,525	1934	Offutt (United States Gypsum Company)	Gypsum acoustical plaster containing asbestos, asbestine pulp, or mineral wool
1,996,032	1935	Ross (United States Gypsum Company)	Sound absorbing material or tile containing mineral wool
1,996,033	1935	King (United States Gypsum Company)	Sound absorbing material containing mineral wool
2,681,863	1954	Croce et al. (Certain-Teed Products Corporation)	Gypsum plaster composition with glass fibers
2,871,134	1959	Loechl (The Celotex Corporation)	Gypsum plaster and other products containing individualized mineral wool fibers
2,980,548	1961	Hampton (United States Gypsum Company)	Gypsum plaster containing perlite
3,062,670	1962	Marzocchi et al. (Owens-Corning Fiberglas Corporation)	Gypsum plaster and other products reinforced with glass fibers

ANNOTATED LIST OF PACKING AND GASKET PATENTS

Patents in this list disclosed packing and gasket products that could have been manufactured without asbestos.

Patent Number	Issue Year	Patentee (Assignee)	Description
1,927,477	1933	Walton (The Anchor Packing Company)	Machinery packing containing-asbestos, flax or hemp
2,134,324	1938	Brackett	Packing containing flax, asbestos, or other fibers
2,930,106	1960	Wrotnowski et al. (American Felt Company)	Gasketing or packing material produced from synthetic fiber and Teflon
3,080,247	1963	Slayter (Owens-Corning Fiberglas Corporation)	Glass-reinforced article useful as a high temperature gasket
3,271,308	1966	Veit et al. (Garlock Inc.)	Packing material containing asbestos, fiberglass, or aluminum silicate fibers
3,306,155	1967	Zumeta et al. (The Marlo Company, Inc.)	Packing material containing glass fibers and Teflon
3,403,595	1968	Watson (Garlock Inc.)	Braiding packing material made of flexible graphite filaments
3,646,846	1972	Houghton et al. (Garlock Inc.)	Packing containing graphite filament yarn
4,330,442	1982	Lindeman et al. (Armstrong World Industries, Inc.)	Asbestos-free gasket containing synthetic fibers. "These health hazard problems of asbestos fibers are well-known . . . "

ANNOTATED LIST OF MISCELLANEOUS
ASBESTOS SUBSTITUTE PATENTS

Patents in this list disclosed products that could have replaced asbestos for various applications. These included textiles, filters, electrical insulations, and roofing felt.

The 1,730,609, 1,807,178 and 2,018,478 patents claimed to have made synthetic or chemical asbestos, but the products were really forms of mineral or rock fibers and, therefore, would not have exposed the product user to the dangers of asbestos

Patent Number	Issue Year	Patentee (Assignee)	Description
1,730,609	1929	Grossman	Process for producing synthetic mineral fibers useful as a replacement for asbestos
1,807,178	1931	Seil	Synthetic "amphibole" products useful for the same purposes as amphibole asbestos
1,913,242	1933	McClure (Gustin-Bacon Manufacturing Co.)	Mineral fiber blanket useful in gas or electric stoves, or refrigerators
2,018,478	1935	Whittier	Apparatus for making chemical "asbestos-like" fibers useful for the same purposes as natural asbestos, including textiles
2,461,841	1949	Nordberg (Corning Glass Works)	Methods for making refractory glass fibers useful as substitutes for asbestos fabrics and textiles, thermal insulation, and electrical insulation

Patent Number	Issue Year	Patentee (Assignee)	Description
2,494,259	1950	Nordberg (Corning Glass Works)	Refractory glass fibers useful as substitutes for asbestos fabrics and textiles, thermal insulation, and electrical insulation
2,503,454	1950	Quinn (Johns- Manville Corporation)	Roofing felt containing asphalt and wood fibers
Dutch 65,729	1950	Algemeene Kunstvezel Maatschappij N.V.	Refractory glass fibers useful as absorbents, or insulation of wires and electrical conductors
2,685,527	1954	Labino (Glass Fibers, Inc.)	Glass fibers useful in the preparation of paper for electrical insulation, heat insulation, and filters
2,756,158	1956	Hahn et al. (Johns-Manville Corporation)	Glass fibers useful as thermal insulation or as plastic reinforcement
3,366,001	1968	Meserole (Johns- Manville Corporation)	High temperature yarns consisting of silica fibers encased in synthetic plastic
3,634,250	1972	Commons, Jr. (United States of America as represented by the Secretary of Commerce)	Process of producing an insulation useful as a fill for roofs and walls of furnaces, tunnel kilns, and muffles, and as a reinforcing additive for plastics and resins

ANNOTATED LIST OF OTHER ASBESTOS SUBSTITUTE
REFERENCES

This list contains references, other than patents, that disclosed various substitutes for asbestos.

Reference	Description
Saborsky, A.D., "Glass Wool Heat Insulation in Europe," <i>J. Amer. Ceram. Soc.</i> , 6:674-684 (May, 1923).	Glass wool thermal insulation used in Europe before World War I and useful for pipes, boilers, etc., especially aboard ships, in chemical factories, and in power stations
Thoenen, J.R., <i>Mineral Wool</i> , Bureau of Mines Information Circular No. 6142, June 1929.	Mineral wool useful as high temperature pipe insulation, and linings for furnaces and stoves
"Glass Silk for Heat Insulation," <i>Engineering</i> , 131:613 (May 8, 1931).	Glass silk insulation for steam pipes; heat loss lower than same thickness of 85% magnesia
"Glass Silk as a Heat Insulator," <i>The Engineer</i> , 152:150 (Aug. 7, 1931).	Glass silk insulation for boilers on ships and steam pipes
"Chance Brothers and Co., Ltd.," <i>The Engineer</i> , 156:229-230 (Sept. 8, 1933).	Glass silk insulation for boilers and steam pipes
Gurley, R.R. and Sinclair, W.P., "Pipe Covering Materials for High Temperatures," <i>Journal of the American Society of Naval Engineers</i> , 47:247-256 (May 1935).	High temperature pipe coverings for naval use included felted mineral wool and aluminum foil
Schaeffer, J.A., "Mineral Wool and Vermiculite as Insulation," <i>Industrial and Engineering Chemistry</i> , 27:1298-1303 (Nov. 1935).	Mineral wool pipe covering superior to 85% magnesia
Cox, O.L., "Heat Insulation," <i>The Society of Naval Architects and Marine Engineers Transactions</i> ,	Naval heat insulations included rock wool and aluminum foil; procedures for testing insulations;

Reference	Description
44:470-486 (1937).	table of physical characteristics and chart of conductivities for various insulations
"Fibrous Glass Insulation," <i>Marine Engineering and Shipping Review</i> , 42:653 (Dec. 1937).	Owens-Illinois glass fiber insulation useful "in stoves, ovens, for pipe covering, in ships, in refrigerator truck bodies, residences, factories and many other fields"
"Glass Fiber Enters Electrical Insulation Field," <i>Electrical World</i> , 110:40-42, 110 (Nov. 19, 1938).	Glass fiber electrical insulation; advantages listed and compared to asbestos
Ferris, R.E. and Moses, G.L., "Fibrous Glass for Electrical Insulation," <i>Electrical Engineering</i> , 57:480-483 (Dec. 1938)	Glass fiber electrical insulation; compared to asbestos
Moses, G.L., "Fiber Glass Compared With Asbestos," (Letter to the Editor), <i>Electrical World</i> , 111:39 (Apr. 8, 1939).	Advantages of glass fiber electrical insulation over asbestos included greater tensile strength, and higher resistance to vibration and moisture
Slayter, G., "A New Marine Insulating Material," <i>Marine Engineering and Shipping Review</i> , 45:60-65 (Feb. 1940).	Uses of glass fiber insulation aboard ships
Phillips, C.J., "Glass as an Electrical Insulator," <i>Journal of Applied Physics</i> , 11:173-181 (Mar. 1940).	Glass fiber electrical insulation; compared to asbestos
Cope, E.T. and Kinney, W.F., "A Study of Heat-Insulation in Steam Power Plants," <i>Mechanical Engineering</i> , 62:465-470 (June 1940).	Heat insulation, including glass wool, for the power plant
Slayter, G., "Fiberglas A New Basic Raw Material," <i>Industrial and Engineering Chemistry</i> , 32:1568-1571 (Dec. 1940).	Uses for glass fiber heat and electrical insulation in houses, ships, trains, and aircraft

Reference	Description
Saginer, S.V., "Thermal Insulation for Industry," <i>Chemical & Metallurgical Engineering</i> , 48:82-86 (Jan. 1941).	Physical and thermal characteristics of some commercial insulations
"Woven-Glass Insulation for Electrical Windings," <i>The Engineer</i> , 171:38-39 (Jan. 10, 1941).	Glass fiber electrical insulation; compared to asbestos
"Fiberglas on Shipboard Its Uses in Merchant and Naval Vessels," <i>The Nautical Gazette</i> , 131:14-17 (Oct. 1941).	Uses of glass fiber heat and electrical insulation aboard ships
Allcut, E.A., "Properties of Heat Insulating Materials," <i>The Engineering Journal</i> , 24:514-523 (Nov. 1941).	Comparisons of various pipe insulations, including 85% magnesia, rock wool, and glass wool
Saginer, S.V., "Thermal Insulating Materials for Industrial Equipment," <i>Product Engineering</i> , 13:494-497 (Sept. 1942).	Physical and thermal characteristics of some commercial insulation
Tooley, F.V., "Fiberglas: Some Properties and New Applications," <i>Bulletin of The American Ceramic Society</i> , 22:60-64 (Mar. 15, 1943).	Fiberglass useful as thermal and electrical insulation
"Glass Fabric for Electrical Insulation," <i>Engineering</i> , 155:452 (June 4, 1943).	Glass fiber electrical insulation; compared to, and used as a replacement for, asbestos
Allcut, E.A., "Tests of Steam-Pipe Insulation," <i>Transactions of the American Society of Mechanical Engineers</i> , 65:407-419 (July 1943).	Comparison tests of various pipe insulations, including rock wool, glass fiber, 85% magnesia, and corrugated asbestos
Bowles, O., <i>Industrial Insulation with Mineral Products</i> , Bureau of Mines Information Circular 7263, Dec. 1943.	Survey of various insulating materials, including mineral wool, asbestos, magnesia, vermiculite, diatomaceous earth, silica aerogel, and Foamglas

Reference	Description
"Insulation—How to Install It," <i>Power Plant Engineering</i> , 48:96-100, 162, 164 (Sept. 1944)	How to install mineral wool thermal insulations
<i>Specifications for Construction of Twin Screw Passenger and Cargo Vessel</i> , United States Maritime Commission, Jan. 1945.	"The insulating materials for temperatures below 600° F shall be 85% magnesia, fibrous asbestos, rock wool or fibrous glass . . ."
"'Fiberglas' Insulation—A Most Versatile Material," <i>Machinery</i> , 51:163 (Jan. 1945).	Oens-Corning fiberglass insulation useful "as insulation in stoves, ranges, ovens, refrigerators, water heaters, industrial boilers, trucks, trailers, buses, railroad cars, merchant ships, etc."; also useful for pipe insulation, electrical insulation, and welding curtains
"Cellulated Glass Blocks for Insulation," <i>Heating and Ventilating</i> , 42:63-65 (Feb. 1945).	Cellulated glass thermal insulation blocks for temperatures up to 1000 degrees F.
"Glass Fibers for Insulation," <i>Heating and Ventilating</i> , 42:59-61 (Mar. 1945).	Owens-Corning glass fiber insulation in rigid, blanket or block form useful for pipes, boilers, etc.
"Fiberglas in Post-War Ships Will Go Beyond War-Time Insulation Uses," <i>Marine News</i> , 32:48, 53-54, 159-164 (Jan. 1946).	Uses for glass fiber insulations
Hogendobler, H.R., "Fibrous Glass in the Power Plant," <i>Power Plant Engineering</i> , 50:88-90, 122 (July 1946).	Glass fiber thermal and electrical insulations for the power plant
"Glass Fibers as an Engineering Material," <i>Steel</i> , 120:96-99, 127-128 (Mar. 10, 1947).	Glass fiber thermal, sound and electrical insulation useful in homes, railroad cars, and ships

Reference	Description
Parker, S.S., "Insulation Technique for Oil-Refinery Structures," <i>The Oil and Gas Journal</i> , 45:160-162 (Apr. 26, 1947).	Mineral wool insulation at an oil refinery
Dutton, G.R., "Mineral Fiber Insulations & Textiles For Marine Service," <i>Marine News</i> , 33: 62, 64, 66, 68, 70 (May 1947).	Rock wool, glass wool, and asbestos fiber insulations and textiles used aboard ships
"Heat Insulation Solves Breeching and Boiler Troubles," <i>Power Plant Engineering</i> , 51:88-89 (May 1947).	Mineral wool insulation at a power plant
Otto, F.C., "Estimating Mineral Wool Insulation," <i>Chemical Engineering</i> , 54:102-106 (July 1947).	Mineral wool blankets, pipe insulation, blocks, and cement; lists prices and conductivities
"Modern Boiler, Tank and Line Insulation," <i>Power Plant Engineering</i> , 51:84-86 (Sept. 1947).	Mineral wool thermal insulation for a boiler
"Mineral Wool Insulation of Ducts Cuts Plant Operating Costs," <i>Sheet Metal Worker</i> , 38:100,102 (Sept. 1947).	Installation of mineral wool duct insulation
"What the Power Engineer Needs to Know About Heat Insulation," <i>Power Plant Engineering</i> , 51:77-79 (Oct. 1947).	Mineral wool insulation in the power plant
<i>Minutes of the General Meeting of the Asbestos Textile Institute</i> , p. 2, Apr. 7, 1949.	Glass cloth, laminated with aluminum or silver foil, as protective clothing for firefighting purposes
<i>Mineral Wool Insulation for Heated Industrial Equipment</i> , Commercial Standard CS117-49, United States Department of Commerce, June 1, 1949.	Commercial standard for mineral wool products, including pipe and block insulation; lists members of the standing committee for revisions and acceptors of the standard

Reference	Description
Stone, J.F., "Thermal Insulation in Refineries," <i>The Petroleum Engineer</i> , 22:C-11 to C-16 (Jan. 1950).	Various insulating materials, including cellulated glass, useful in refineries
Swain, P., "Insulation Handbook: Part 2—Types and Shapes of Heat Insulation," <i>Power</i> , 94:118-119 (Mar. 1950)	Types of thermal insulation and their uses
Swain, P., "Insulation Handbook: Part 5—How To Apply Mineral Wool Heat Insulation," <i>Power</i> , 94:86-90 (Sept. 1950)	Installation of different kinds of mineral wool heat insulations
<i>Specifications for Construction of a Single Screw Cargo Vessel</i> , United States Department of Commerce Maritime Administration, Nov. 1950.	Insulating materials for piping systems and machinery, including 85% magnesia, amosite asbestos, fibrous glass pipe insulation, fibrous glass sheet insulation, calcium silicate, and diatomaceous silica; high temperature insulating cement composed predominately of mineral wool; lagging of asbestos or fibrous glass
"Insulation and Application Methods for Heated Piping," <i>The Petroleum Engineer</i> , 23:C-44 to C-46 (Oct. 1951).	Mineral wool pipe insulation in both blanket and molded forms as used in the petroleum refining industry
<i>Asbestos A Summary of Information on Uses, Production, Trade, and Supply</i> , Industrial Materials Series Report No. M-3, United States Tariff Commission, Dec. 1951.	Glass fiber electrical and high temperature thermal insulation as a substitute for asbestos
"Insulating Papers Vs. Asbestos," <i>Chemical Engineering</i> , 59:248 (July 1952).	Quartz paper and ceramic paper as electrical insulation; developed by the U.S. Navy
Lewis, H.E. and Young, C.E., "Application Methods for Mineral Wool Pipe Insulation," <i>Heating, Piping & Air Conditioning</i> , 24:106-108 (July 1952).	Installation of mineral wool pipe heat insulation

Reference	Description
"Ceramic Fiber Resists 2,300°F," <i>Chemical Engineering</i> , 59:198 (Sept. 1952).	Carborundum Co. alumina-silica fiber useful for heat insulation and filters
"Manufacture of Heat Insulating Sections for Pipes," <i>The Engineer</i> , 195:512 (Apr. 3, 1953).	Molded glass fiber pipe insulation
Thomas, R. And Turner, W.C., "Insulation for Heat and Cold," <i>Chemical Engineering</i> , 61:221-225 (June 1953).	Characteristics of thermal insulation materials, including their advantages and disadvantages
"Pipe Wrapped in Glass Blanket," <i>Chemical Engineering</i> , 61:250 (June 1953).	Glass fiber pipe insulation
"Snap-Around Pipe Insulation Cuts Labor Costs 20%," <i>Factory Management and Maintenance</i> , 111:132-133 (Nov. 1953).	Gustin-Bacon glass fiber pipe insulation
"Owens-Corning Improves Fibered Pipe Insulation," <i>Marine Engineering</i> , 58:136 (Nov. 1953).	Glass fiber pipe insulation
Hadley, J.B., "Improved Hull Board For Marine Use," <i>Marine Engineering and Shipping Review</i> , 59:65-66 (Oct. 1954).	Glass fiber hull board developed by Glass Fibers, Inc.
Bowles, O., <i>The Asbestos Industry</i> , Bureau of Mines Bulletin 552, 1955.	Soda-lime-silica glass fibers useful in stoves, refrigerators, electrical insulation, cable coverings, filters, gas masks, and pipe insulation; high-silica glass fibers useful as high temperature insulation; fiberglass replaced amosite asbestos in 85% magnesia; during World War II, Germany developed cardboard with an organic plastic as a substitute for asbestos packings in steam and water pipe flanges; during this same time they also developed a polyvinyl

Reference	Description
	chloride diaphragm as a substitute for the asbestos cloth diaphragm in a Siemens-Billiter cell in the manufacture of NaOH by the electrolysis of NaCl solution
"Thermal Conductivity of Pipe Coverings," <i>Electrical World</i> , 143:142 (Mar. 21, 1955).	Thermal conductivity of seven types of pipe insulations
"Inorganic Fiber Insulation," <i>Materials & Methods</i> , 42:152, 154 (Nov. 1955).	Two high temperature glass or quartz fiber insulating materials developed by L.O.F. Glass Fibers Co.
Mansergh, R.A., "Thermal Insulation Materials - I," <i>Power and Works Engineering</i> , 51:257-260 (July 1956).	Survey of thermal insulations available
Klingholz, R., "Materialien fur Thermische und Akustische Isolierungen," <i>Schiff und Hafen</i> , 8:845-849 (Oct. 1956).	Types of thermal and acoustical insulation aboard ships
Waller, E.L. and Humes, H.L., "Tidewater Insulates Refinery," <i>The Oil and Gas Journal</i> , 55:166, 169 (Feb. 18, 1957).	Felted block type of mineral fiber insulation used in a refinery
"Prefabricated Metal Insulation Offers New Features," <i>Marine Engineering/Log</i> , 63:128 (Dec. 1958).	Reflective type all-metal thermal insulation for marine use
"Piping Insulation Costs," <i>Chemical Engineering</i> , 66:128 (Feb. 9, 1959).	Costs of Foamglas, Kaylo, and Fiberglas pipe insulation (including weatherproof covering)
McGinnis, E.J., "Reflective Blankets Cut Welding Costs," <i>American Machinist</i> , 103:109 (Nov. 2, 1959).	Insulating blanket for welding operations replacing ones made with asbestos
"Fiberfrax Production: Carborundum's Versatile Ceramic Fiber," <i>Ceramic Age</i> , 78:37-40 (Feb 1962).	Ceramic fiber useful as high temperature insulation and textiles

Reference	Description
Williams, A.E., "Refractories and Insulation for Steam Raising Plant - III," <i>Steam Engineer</i> , 32:232-237 (Apr. 1963).	Types of thermal insulations, including glass fiber, mineral wool, and asbestos
Roberts, J.C.H., "Reducing Costs of Thermal Insulation of Marine Machinery & Piping Systems," <i>Insulation</i> , 8:108-111,117 (May 1964).	Advantages of glass cloth over asbestos cloth to wrap pipe insulation
"Search for Composites Spurs Growth in Inorganic Refractory Fibers," <i>Chemical & Engineering News</i> , 45:28-29 (Oct. 2, 1967).	Babcock & Wilcox alumina-silica welding blanket as a substitute for asbestos blanket
Bewsher, M.R., "Cost-Effectiveness Evaluation of Thermal Insulation in Naval Vessels," <i>American Society of Mechanical Engineers</i> , Paper 67 - WA/Mgt-10, Nov. 1967.	Cost comparisons between thermal insulations for marine use
Aldrich, F.W., "Semi-Metallics: A New Type of Friction Material," <i>Society of Automotive Engineers Transactions</i> , Paper 710591, 1972.	Asbestos-free semi-metallic brakes compared favorably to conventional organic brakes
Kwolek, J.P., "Friction Material for Small Car Solid Rotor Applications," <i>Society of Automotive Engineers Transactions</i> , Paper 750874, 1976.	Advantages of semi-metallic brakes as compared to conventional organic brakes
"Friction Modifiers Tailor Brake and Clutch Characteristics," <i>Automotive Engineering</i> , 87:74-76, June, 1979.	New friction modifier for asbestos-free semi-metallic brake
Loken, H.Y., "Asbestos Free Brakes and Dry Clutches Reinforced with Kevlar® Aramid Fiber," <i>Society of Automotive Engineers Transactions</i> , Paper 800667, 1981	Kevlar® aramid fiber as a replacement for asbestos in friction materials

7

"Bystander" Asbestos Disease

"However one assesses the hazard of inhaling asbestos fibres, as it exists today, as a trifling matter or as a potentially significant one, it must become greater with years. The half-life of strontium 90 is 28 years, but the half-life of the asbestos fibre is an infinity of years. The 2,400,000 tons of asbestos used each year are added to the millions of tons used in previous years, and even if a small portion becomes available as an air-contaminant in towns, the actual amount will increase, as more asbestos accumulates on the surface of the earth.

(A) lurid picture could be painted of what conditions might be in 30 years' time, when the accumulations of so much asbestos in towns would lead to much higher concentrations of asbestos fibres in the air. The results of life-long inhalations of these fibres might be ... a frequency of mesothelioma of pleura or peritoneum higher than that of bronchial carcinoma today. It could be added that even if the hazard were then appreciated, and all mining and utilization of asbestos ceased, there might be no significant reduction of the air contamination, owing to the indestructibility of the asbestos already mined and used, and its inevitable weathering and disintegration with time."

J.G. Thomson, R.O.C. Kaschula, and R.R. MacDonald. Asbestos as a Modern Urban Hazard. *S. Afr. Med. J.* 37:77-81 (1963).

INTRODUCTION

We now recognize that the threat to life from breathing asbestos extends in some degree even to individuals only slightly exposed to the dust. We also know that levels of exposure insufficient to produce asbestosis can nonetheless cause cancer; moreover, the exposures that can cause asbestosis are not as great as once imagined. On the continuum of risk were, roughly speaking, the asbestos handling workers ("direct" occupational exposure), others who worked nearby but did little or no work with asbestos themselves ("indirect" occupational exposure), asbestos workers' family members (household contact exposure), and neighbors of sources of asbestos air pollution and solid wastes. This section will trace the historic recognition of environmental asbestos contamination as a menace to people other than those we would think of as asbestos workers.

*Earliest Recognition of the Potential for Bystander
Asbestos Disease*

The idea that industrial air pollutants could cause chest diseases and death among factory neighbors is nothing new. Ramazzini in 1713 described a "violent dispute" culminating in a lawsuit against an Italian factory owner demanding the relocation of a plant releasing sulfuric acid ("vitriol") fumes.¹

Various cleverly worded documents were produced by both sides, and this dispute which was literally 'about the shadow of smoke,' as the saying is, was hotly argued. In the end the jury sustained the manufacturer, and vitriol was found not guilty. Whether in this case the legal expert gave a correct verdict, I leave to the decision of those who are experts in natural science.

Environmental exposure to carcinogenic dye intermediates was attributed as the cause of bladder cancer among persons residing in the vicinity of dye factories as early as 1919.²

Asbestos air pollution was unlikely to provoke neighborhood complaints, because asbestos caused no irritation or immediate breathing problems in the way an acid mist did. Yet as early as 1929 medical authorities were commenting on "asbestos

bodies" in the lungs of an asbestos factory neighbor who never went inside the plant.³ While it doesn't appear that this person had asbestosis, still the characteristic "signature" of asbestos in the lungs was recognized as a result of exposure to the dust.

The idea that workers next to those with dusty jobs were also endangered by the asbestos dust created was expressed by Collis in 1911 (quoted by Hoffman in the U.S. in 1918).^{4,5} Watchmen and shipping clerks at the Manville, New Jersey plant of J-M were among the plant's many employees diagnosed as having asbestosis in 1932, in an unpublished survey by Lanza and Fellows of Metropolitan Life Insurance Company.⁶ In Britain, a coroner determined that asbestosis had contributed to the death in 1934 of a man who had worked 30 years as a cashier for J.W. Roberts (subsidiary of Turner & Newall).⁷ A 1934 review by British physicians Wood and Gloyne of 100 cases of asbestosis described the disease in an asbestos factory employee with about 40 years of "clerical and administrative work."⁸ This man had serious lung damage ("fibrosis involving all but the apical regions of the lungs"). A U.S. report less than a year later described "mild" asbestosis in an asbestos plant cashier with 30 years' exposure.⁹ A former bookkeeper in an asbestos plant filed a claim for disability from asbestosis against U.S. Gypsum Company in 1937 (See "United States Gypsum Company," in Chapter 9). Railroad companies in Illinois recognized the potential for bystander exposure from the handling of asbestos insulation by 1937 (See "Railroad Companies," in Chapter 9). So it was evident by the mid-1930s that "bystanders" such as clerical workers in asbestos plants could develop asbestosis from years of relatively light exposure.

Similar results arose from brief but intense exposure. Wood and Gloyne saw asbestosis in patients with as little as 6 months of asbestos factory work.⁸ Pathologists in Philadelphia reported fatal asbestosis in one man who had worked only nine months in an asbestos plant. They also reported that another man developed "a minor grade of the disease" from 9 years of work "in a comparatively well ventilated factory in which precautionary appliances were used" (he wore "silver dust protectors" in his nostrils). These authors concluded from their two cases and

the literature that there was an "absolute necessity for wearing masks in even the less dusty atmospheres."¹⁰

If the production workers in the asbestos plants of that era should have all been wearing respirators and even office workers were contracting asbestosis, could the danger not also extend further out, into the community? If people could develop advanced asbestosis from brief, intense exposure, was there not a grave potential for an equal lung burden accumulated over a period of decades to also produce disease? Despite some differences in the physiology of lung clearance and deposition for heavy and light exposures, Stewart and his co-workers in Philadelphia clearly were concerned about individuals with long-term, low-level exposure to the airborne mineral fibers.¹⁰

It was recognized by 1933 that asbestos breathed in normally reached all the way to the alveoli, the tiny air sacs of the lung. Here, the pathologist S.R. Gloyne discovered that removal of asbestos from the lungs into the lymph system was much more limited than such clearance of minute coal and silica dusts (which are not fiber-shaped). Moreover, the relative inability of scavenger cells to engulf and carry off the asbestos fibers in the lung was readily apparent under the microscope. Gloyne also described foreign body giant cells which formed as "an attempt on the part of the tissues to protect themselves against an irritant" Gloyne believed that significant retention of asbestos fibers occurred in the lung.¹¹

With this question (of scavenger cells as a lung defense) is bound up that of the 'cleansing action' of the lung in removing from its tissues foreign particles whether harmless, such as carbon, or deleterious, such as silica In view of the size and shape of the asbestos particle it is difficult to believe that much cleansing action can take place.

The lung defenses were thus especially ill-prepared to deal with these tiny mineral fibers. It followed that there was probably no concentration of asbestos dust in air so low that retention of some fibers in the lung could not occur. Whether there was much or little asbestos in the inspired air, some of it was likely to lodge in the lungs and remain there to provoke cell

damage. Simply put, it was known by 1933 that inhaled asbestos fibers got into the lung tissues, were partly retained there, and caused scarring there.

Asbestosis and Cancer in Bystanders

Asbestosis and lung cancer in non-production asbestos factory workers (machine adjuster, plant manager, departmental manager) were reported in the 1940s by Canadian and British writers.^{12,13} In 1947, Johns-Manville Waukegan plant foreman Dominic Bertogliat died with asbestosis, and arrangements were made to compensate his widow after she approached the company. It was acknowledged by J-M safety engineer Hugh Jackson that Bertogliat had only been exposed to the general atmosphere in the plant (See "Saranac Compensation Reviews for Manufacturers" in Chapter 3 for further details).¹⁴

The British Factory Inspectorate sent a notice to asbestos manufacturers and the Thermal Insulation Contractors Association in 1945, recommending that, during asbestos spraying aboard ships, no person be allowed in the compartment unless provided with a respirator.¹⁵ Here, the bystander shipyard workers' risk was explicitly acknowledged, with its potential for widespread disease which has since occurred. This followed several years of government efforts to obtain protection for people working in shipyards in areas where asbestos spraying was done. In 1944, it was pointed out to Turner & Newall that material being sprayed got on the men's clothing and floors, "where it dries quickly and may give rise to dust."¹⁶ (See "The British Shipyard Asbestos Regulations" in Chapter 4 for further details).

The Thetford Industrial Clinic provided medical services to asbestos mining companies in Quebec in the 1940s. One of the clinic's patients who was diagnosed as having pleural mesothelioma was the Treasurer of Asbestos Corporation, Ltd. The cause of death was verified at autopsy. This man's exposure history was recorded as "only office work from 1920 to 1949."¹⁷

Quebec asbestos miners were also dying from pleural mesothelioma at that time, according to a published report of Thetford clinic director Dr. Paul Cartier.¹⁸

Asbestos Air Pollution in the Community

The threat of asbestos air pollution was recognized in different ways in the U.S., Germany, and Canada. Cause for concern increased with the growing recognition that asbestos was carcinogenic.

In 1936, North Carolina health officials examined asbestos textile employees at the Thermoid Company and found varying degrees of asbestosis in about half of the workers. The dust inside the plant was so thick at times that one could not see across the room. Of 11 dust counts reported by health officials, the *lowest* was 45 MPPCF. Some of the dust was sucked out by a few fans in the plant and drifted over to nearby homes.¹⁹ In the wake of the health officials' survey, the company was sued by some of the neighbors of the factory:

(S)urrounding property owners were entering suits for damage claimed as the result of air pollution. All of this was attended with the newspaper publicity that might be expected to accompany such disclosures.

German guidelines for asbestos plant hygiene in 1940 called for filtering systems to be used before releasing the exhaust air into the environs. The expressed concern was that it could otherwise pose health hazards to the population outside.^{20,21} Unfortunately, compliance in at least one asbestos plant in Hamburg was delayed until after World War II, at which time so much material was recovered that the installation of dust collectors was ascribed to economic reasons.²²

Dr. Kenneth W. Smith, who went to work for Canadian Johns-Manville in 1944, recalled a discussion he had had with his chief, Dr. R.H. Stevenson, about community asbestos hazards in the 1940s:

Metropolitan Life was conducting personnel studies of employees and non-employees in Thetford and, to a lesser degree, in our town. And, walking through the town of Asbestos on a dry August day, you could see little rolls of asbestos fiber rolling along the street like tumbleweed, and you just assumed that anybody walking the streets—the storekeepers or policeman walking his beat, or anybody in

the house—would be exposed to that airborne dust We were standing on the edge of the open pit (Johns-Manville's huge asbestos mine) on the eastern side. The whole town of Asbestos was behind us, and, of course, the winds are constantly from the west, blowing across the mine, across the mill, and into the town. And Stevenson said, 'What a shame the town wasn't built on that hill over there on the western side of the pit. There would have been no dust in the town.'

A.R. Fisher, who was then a corporate Vice President and would in 1951 become President of Johns-Manville Corporation, was also present at this discussion. In the mid-1940s, the J-M doctors had seen chest X-ray changes typical of asbestosis in some of the mining town residents who had never had occupational exposure to asbestos.²³

In Quebec, LeDoux's scathing exposé of the asbestos industry publicly called attention to the air pollution threat to the communities.²⁴ Medical surveys showing disease among Johns-Manville asbestos mine and mill workers (millwrights and electricians were also examined) and a lengthy, bitter strike induced the corporate management to spend more than \$5 million for dust controls in 1949. It was understood that the ventilation system was designed to "improve the dust situation in and outside of the mills."^{25,26}

The installation of some early asbestos plant ventilation systems may have even *increased* the neighborhood pollution by respirable fibers. In some cases, dust withdrawn from the workplace air was vented directly to the atmosphere. In other cases, settling chambers and "cyclone" type dust collectors were used that recovered only the largest particles from the exhaust air. Such devices were able to recover most of the *mass* of material that would otherwise have been blown away, but were useless in controlling the most abundant tiny, respirable-sized particles polluting the neighborhood of the plants. The advantages and limitations of various dust collectors were discussed in the early 1950s by members of the Asbestos Textile Institute. Ralph Smith of Raybestos-Manhattan was especially critical of the cyclone type collectors.²⁷

This type was effective in collecting the dust, but the top outlet would discharge very fine particles of dust to the atmosphere. This would create a problem to the Plant Property and adjoining community.

In at least one case, substantial outdoor air pollution was admitted, in the approach taken to ask the U.K. Factory Inspectorate to waive worker protection requirements. Turner Brothers' big asbestos plant in Rochdale, England, sought an exemption from the government, to be able to recirculate exhaust air from the dust collectors back into the plant. If the dust collectors were damaged and in need of maintenance, the dust not captured would go back into the workplace air, and this is why recirculation was discouraged. The company argued that it was "clearly in the National Interest" for Turner Brothers to reap substantial savings on heating costs. Moreover, the claim was made that, at least when the dust collectors functioned optimally, that there was more asbestos in the air outside the plant than in the air in the filter rooms.²⁸

Consequently, by recirculating the air from the filter rooms into the workrooms instead of using air from the outside, less asbestos dust would be introduced into the workrooms and an improvement in working conditions would be obtained.

Residents and scientists visiting communities where asbestos was mined, milled, and processed have commented on the large amount of dust emitted by the old asbestos mills and factories.^{22,29-31} This was true as well in the Soviet Union, which was second only to Canada in the production of asbestos. One study attributed an increase in children's respiratory infections to ambient dust in the city of Asbest, where three plants processed asbestos ore.²⁹ "It may be wise to consider" the possible existence of environmental cancer in the "fume zones" of asbestos plants and other sources, advised Dr. Hueper in 1950.³²

In a report of an air pollution conference in Washington in 1950, *Newsweek* cited Dr. Hueper as referring specifically to air pollution with asbestos and other carcinogenic agents as

the "probable cause of increased lung and respiratory tract cancer" in the general public.³³ This was noted by officials of Johns-Manville.³⁴

Hueper noted in 1955 that, "since asbestosis, like berylliosis, presents a characteristic histologic lesion, there should be no serious difficulty in identifying 'neighborhood' cases of asbestosis and asbestosis cancer of the lung."³⁵ Neighborhood cases of berylliosis had been identified some years earlier, and at least to Dr. Hueper this suggested the need for and feasibility of investigations of potential environmental asbestos disease.³⁶

Hueper's message was immediately picked up by members of the asbestos industry. His remarks on asbestos as a carcinogen in U.S. Public Health Monograph No. 36 and the above-quoted editorial were the subjects of intense discussion at meetings of the Asbestos Textile Institute in March, 1956.³⁷⁻³⁹ The minutes of one meeting attribute to Johns-Manville's Dr. Kenneth W. Smith the conclusion,

Dr. Hueper also infers that Asbestosis-Cancer may be determined in an autopsy performed on persons living in the area of a plant.³⁸

Hueper's editorial was cited in an insurance claim adjuster's memorandum of March 13, 1956. It was paraphrased as saying "that anyone living near an asbestos plant can get lung cancer."⁴⁰ (See "Cancer," in Chapter 3).

Had anyone acted on Hueper's challenge, there should have been little difficulty identifying asbestosis among people living in the neighborhoods of asbestos plants. For many neighbors were doubly exposed, both by pollution released to the community and by accumulated household contamination carried home on the clothes of family members employed in the factories.^{41,42}

Hueper himself was unable to conduct such studies, despite his position as Chief of the Environmental Cancer Section of the National Cancer Institute. Following 1951 "lobbying activities" by Dr. Anthony J. Lanza, representing industrial concerns, Hueper was forbidden by his supervisors in the government to do industrial cancer epidemiology research. Hueper was even ordered to have no further contact with industry and state

health departments on matters of environmental and occupational cancer.⁴³

But if Hueper had been a voice in the darkness, he did not remain so for long. By the end of the 1950s, the threat of asbestos air pollution was becoming more generally recognized. Even Rosato's book on asbestos technology, no medical reference, mentioned that neighborhood asbestos air pollution "could become harmful to the people who are constantly exposed to it."⁴⁴

Environmental pollution from the Wittenoom, Australia, asbestos mine and mill of CSR, brought expressions of concern from health official Dr. James McNulty in Western Australia. Having already seen at least one mesothelioma from this crocidolite mine, he described high dust counts inside and waste dumping around the community. To the company doctor H.M. Rennie he wrote:⁴⁵

I am still a little concerned about the carcinogenic effect of crocidolite and wish that the company wouldn't use its tailings for roads and paths. Tailings were used as fillers at the golf course so that the poor devils inhale asbestos at recreation as well.

*A Mesothelioma Epidemic Forces the Issue of
Environmental Asbestos Cancer*

In the late 1950s, a large number of mesothelioma cases were found in a crocidolite asbestos mining district of South Africa.⁴¹ It was soon confirmed that rare mesothelioma was a "signal tumor" for asbestos exposure, simplifying the task of tracking the mortal asbestos hazard into the community. The histories taken from mesothelioma patients and their survivors (as well as "matched controls" where appropriate) readily showed these patients all too commonly had had prior residence in the households of asbestos workers and in asbestos-polluted neighborhoods.^{41,42,46,47}

Then, in 1963, the South African pathologist Thomson discovered asbestos bodies occurring routinely in the lungs of urban dwellers at autopsy, and he feared the worst. It might be dismissed as pathological curiosity, he said, since none of these urban dwellers had mesothelioma. But it alarmed Thomson that

ordinary urban dwellers had asbestos in their lungs, and that every year several million more tons of asbestos was being added to the vast quantity already in place in the world's cities.^{48,49} There could eventually be a frequency of mesothelioma "higher than that of bronchial carcinoma today," he wrote.⁴⁸

The period 1953-1962 also saw a number of reports of "bystander worker" asbestosis, lung cancer, and mesothelioma, as well as secondary reports citing the bystander risk from exposure to asbestos.⁵⁰⁻⁶⁶ And in 1963, Philip Carey Manufacturing Company executives were pointedly warned of the firm's potential liability for cancers attributable to the firm's community asbestos air pollution.⁶⁷⁻⁶⁸ (See "The Mancuso Documents," in Chapter 3).

Household-Contact Asbestos Disease

The families of asbestos workers have sustained significant exposure over the years, due to dust brought home by the workers on their clothes, shoes, hair, toolboxes, lunch boxes, and more recently, automobiles.

In 1897, the first physician in modern times to comment on lung disease in asbestos workers (weavers) also observed ill health among the members of their families.⁶⁹ But, in general, there is little explicit commentary on a hazard to asbestos workers' families in the early literature.

Nonetheless, it has long been an internationally recognized good practice to provide washing accommodations and cloak-rooms separated from process areas in industries with dust hazards.⁷⁰⁻⁷³

A 1913 text, *Safety*, emphasized that street clothes, should be taken off and replaced by special clothes to be worn at work.

By removing the working-clothes before meals and before leaving the factory, the poison is not carried into lunch-rooms or into the homes of the workers.

Partitioning of lockers to separate street clothes, and work clothes, and the provision of adequate washing facilities, were stressed.⁷⁴

American specialists in industrial medicine, writing in 1924, also advised that street clothes not be worn at work, and added that provisions for changing clothes and washing were needed in all dusty occupations.⁷⁰

It is desirable, in all dusty occupations, that the workmen should take off all their street clothing before beginning work, and this is absolutely essential when the work involves exposure to poisonous dust. For this purpose suitable dressing-rooms, provided with lockers for street suits and separate compartments for overalls, are necessary. Facilities for washing and bathing, brushes, soap and individual towels should be furnished. In most of the civilized countries statutory provisions have been made for these sanitary requisites, in all establishments in which poisonous substances are manufactured or used and the result has been most beneficial.

Asbestos insulation was not the first insulation product to be definitely associated with illness in the households of workers handling it. "Cable rash," or "Halowax acne," was reported during World War II among electricians handling electrical cables and some of their wives, who had had contact with the men's work clothes and laundered them. Halowax, a wax-like gray powder, was used to insulate cables on ships, and it was made by a subsidiary of the Union Carbide and Carbon Company.⁷⁵

The Germans, in their 1940 industrial hygiene guidelines for asbestos plants, established the practice that, "outdoor clothes were not to be kept in workrooms and work clothes had to be cleaned at regular intervals."^{20,21,76,77}

The death of Frank Watkins at age 18 was the subject of a coroner's inquest in 1946. He had worked mixing powdered insulation with water and otherwise assisting insulators for 4 years. The boy was introduced to the trade by his father, Ernest, who also worked for Newalls Insulation Company, as a pipecoverer. The testimony of Dr. Stephen Roodhouse Gloyne, a leading authority on the pathology of asbestosis, persuaded the coroner that asbestosis had contributed to the boy's death. During the boy's entire lifetime, his father had worked as an

insulator, and thus many years of household exposure preceded his occupational exposure. The father died within months after the son, and T&N solicitors under instructions from corporate Secretary John Collins settled both cases with Mrs. Watkins for 450 pounds.⁷⁸

Monsanto chemist and industrial hygienist Jack Garrett recalled efforts to reduce asbestos hazards at some chemical plants in the 1950s. Respirators and shower facilities were provided for employees doing insulation work. In addition, he testified,⁷⁹

Every day they got changes of clothes. We went down to shoes and socks, underwear and all. We didn't want it at home.

But little attention was paid directly to the families of asbestos workers until the 1960s. Researchers in Finland reported cases of pulmonary asbestosis in the households of asbestos workers at the large conference held in 1964 by the New York Academy of Sciences. These investigators and others in Germany had previously called attention to pleural changes they had observed in chest X-rays of populations with environmental asbestos exposure.⁸⁰

In compiling histories of 76 deceased mesothelioma patients and 76 hospital patient "controls" in London, British investigators identified 9 mesothelioma patients as having had "domestic" exposure to asbestos.⁴⁶ Only one of the control series had had household-contact asbestos exposure, a highly significant difference.

The most usual history was that of the wife who washed her husband's dungarees or work clothes. In one instance, a relative said that the husband, a docker, came home 'white with asbestos' every evening for three or four years and his wife brushed him down. The two men in this group, when boys of 8 or 9 years old, had sisters who were working at an asbestos factory. One of these girls worked as a spinner from 1925 to 1936. In 1946 she died of asbestosis. The press report of the inquest states, 'she used to return home from work with dust on her clothes.' Her brother had apparently

no other exposure to asbestos ... He died in 1956 of a pleural mesothelioma.

The authors concluded,

There seems little doubt that the risk of mesothelioma may arise from both occupational and domestic exposure to asbestos ... Among these with no evidence of occupational or domestic exposures, 30.6% of the mesothelioma patients and 7.6% of the in-patients with other diseases lived within half a mile of an asbestos factory ($p < 0.01$). [$p < 0.01$ means that there is more than a 99 percent chance that the difference observed in the two groups was real, and not a random chance event such as flipping a true coin and having "heads" come up seven or more times in a row.]

It is noteworthy that these authors considered household exposure predominant in importance over neighborhood exposure, in cases where both types occurred.

Between 1960 and 1976, there were seventeen reports published including 37 household-asbestos-exposure mesothelioma cases. Anderson and his co-workers at the Mt. Sinai School of Medicine in New York conducted examinations of 326 members of the households of former amosite asbestos insulation manufacturing workers. Fully 35 percent showed (pleural and/or lung) chest X-ray abnormalities characteristic of asbestos exposure. Among the total household cohort under observation, four persons were diagnosed with pleural mesothelioma.⁸¹

Dr. Paul Kotin of Johns-Manville vividly described the insidious hazard of asbestos accumulating inside the home.⁸²

I would suggest, however, that once asbestos gets into the home, carried home by the workmen, which in itself is a tragedy, it shouldn't happen, it is asbestos that is there virtually permanently—it gets into the rugs, into the carpets, it gets suspended by movement and actually you are getting 24 hour/day exposure, relatively speaking, rather than a partial exposure. But even worse than that is the fact that you are exposing the population of the family which includes the very young and very old. And in the induction

of cancer, it is the very young that are always the most susceptible. We use the fact that it is the young that are the most susceptible in the laboratory when we want to test agents for their ability to induce cancer.

The thrust of Dr. Kotin's presentation to an OSHA advisory committee was that household cases of mesothelioma resulted from substantial exposure, and thus their occurrence did not necessarily imply that current workplace asbestos standards were unsafe.

Anderson and co-workers eventually examined 679 individuals with household-contact asbestos exposure. The subjects' family members handling asbestos had been employed at the same amosite asbestos manufacturing plant just mentioned (Unarco in Paterson, N.J.). The exposures in all cases had begun at least 20 years prior to the study. In many cases the periods of asbestos employment of members of these households were brief—several months.⁸³

Some of the findings are shown in Tables 1-2. In summary, they show that asbestosis was not a rare occurrence among the spouses, children, and siblings of asbestos workers.

While it may be curious that no reports of asbestosis in the workers' families appeared until relatively recently, one has to consider the repercussions for the community practitioner who discovered such a thing and had the courage to announce it in a public manner. Workers may have expected to have to run some risk of getting an occupational illness. But as sensitive as the matter of the job hazards may have been, the recognition that the health of workers' whole families was endangered might have had an even greater impact. Such reports do not long remain unnoticed in medical journals. The discoverer of such a scourge coming from a mainstay of the town's livelihood might, in the words of Ibsen and Selikoff, find himself branded "an enemy of the people."⁸⁴ In the 1970s, a man didn't have to be a doctor to face death threats (for himself and his children) and violence in Quebec for questioning the safety of asbestos.²⁸

It is surprising that more early medical reports were not published documenting the hazard of asbestosis and cancer to the workers' families. But the gross contamination of asbestos-

Table 1. Prevalence of Asbestos-Associated Radiographic Abnormalities among Household Contacts of Amosite Asbestos Workers and Controls⁸³

Group	Total Examined	Small Irregular Opacities	Pleural Thickening	Pleural Calcification	Pleural Plaques	One or more Abnormalities
Household contacts	678	114 (17%)*	128 (19%)*	54 (8%)*	57 (8%)*	239 (35%)*
Controls	325	10 (3%)	4 (1%)	0	2 (0.6%)	15 (5%)

* Prevalence of all types of abnormalities significantly higher in the household contacts than the controls, $p < .001$.

* * *

Table 2. Distribution of Profusion of Combined Small Opacities among Household Contacts and Controls⁸³

Group	Total Examined	Combined Small Opacities						Combined Opacities 1/0 or Greater
		0/0	0/1	1/0	1/1	1/2	2/2	
Household contacts	677	398 (59%)	165 (24%)	47 (7%)	61 (9%)	4 (1%)	2 (0.3%)	114 (17%)
Controls	325	288 (89%)	27 (8%)	8 (3%)	2 (.06%)	0	0	10 (3%)

exposed workers' homes largely grew out of a more obvious neglect: the lack of industrial hygiene protection afforded to the workers themselves.

CONCLUSION

Since the 1930s, it has been known that, even with low levels of exposure to asbestos, the lung defenses were inadequate to totally remove the inhaled fibers. By then, it was also obvious that the dust in the workplace atmosphere did not respect job classifications in claiming its victims. Reports of "bystander" workers with asbestosis and cancer continued to appear despite the lack of any apparent effort to look for them.

Meanwhile, in practice, environmental contamination with asbestos continued to be generally treated as a mere nuisance by those mining asbestos, and those manufacturing and using asbestos products. This went on despite official guidelines to control asbestos air pollution in Germany, official expressions of concern about bystander asbestosis in shipyards in England, and very pointed alarms raised in the U.S. by Dr. Hueper of the National Cancer Institute.

The full horror of asbestos contamination of the environment suddenly became apparent in 1960, with the report that a rare form of cancer (pleural mesothelioma) was rampant in the crocidolite asbestos mining region of South Africa. Worldwide attention immediately focused on this rare disease, which became known as a "signal tumor" for asbestos exposure generally. Many of the victims of this disease had worked directly with asbestos. But even more frequently, these people got their exposures in general shipyard and construction trades or from the contamination of their homes and communities. Thus it occurred that the virtually unrestrained use of asbestos gradually broadened the population at risk from a few thousand asbestos workers to millions of people in the general population. This tragedy is best understood as an outgrowth of the failure to take the appropriate precautions in the workplaces where asbestos was used and long known to be a mortal threat to those using it.

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8

Asbestos Disease in Brake Repair Workers

"Only recently did I learn that when a vehicle is taken in for brake work, the mechanic cleans the drums and wheels by blowing the dust with a high-pressure air hose. The volume of dust raised is unbelievable, and it drifts about in the shop for a long time before it floats out or settles down in the shop. The mechanic inhales this during the blowing procedure and again when dusting. I understand that many mechanics are not aware that there is asbestos as well as metallic dust in the air."

Mrs. Arthur G. McLeod. Asbestos and Cancer
(Letter). *Canad. Med. Assoc. J.* 93:278
(Aug. 7, 1965).

Automotive brake linings, brake shoes, and clutch facings have contained asbestos since the beginning of this century. Brake linings containing asbestos cloth were first made in 1906, and rigid molded linings were developed in the early 1930s. The type of asbestos used in the United States has been chrysotile, and in general it has made up roughly 50 percent of the composition of brake linings and brake shoes. "Friction products," as they are called, have been a major U.S. market for asbestos, consuming 50,000 metric tons or more of fiber annually, until the latter half of the 1980s. The government estimates that about 900,000 workers in the U.S. are regularly exposed to asbestos in brake servicing.

In the wake of epidemiological reports identifying environmental exposure to asbestos as a cause of mesothelioma, the

Public Health Service analyzed brake lining decomposition products and identified a small fraction of surviving asbestos fiber (Lynch, 1968). Even before this was published, Turner & Newall industrial hygienist Stephen Holmes knew that wear products from brake linings contained "very little" asbestos (letter to Mrs. D.M. Thorley, Nov. 17, 1967). Subsequent studies showed that brake mechanics were exposed to appreciable quantities of asbestos dust. Work histories of mesothelioma patients published in the literature have periodically included automotive brake servicing. However, the lack of any large, unionized, traceable work force with longterm (30 years or so) exposure has impeded the collection of quantitative data on the occupational disease risks of brake repair workers.

Measurements of the exposure of brake mechanics were practically high enough to include some of them under the 2f/cc workplace standard for chrysotile asbestos issued in Britain in 1969. Air sampling in brake shops in the U.S. showed that with the commonly used technique of blowing out dust from brakes with compressed air jets, peak levels of exposure could exceed the 15-minute ceiling of 10 f/cc allowed by the 1972 OSHA standards. In addition to the high fiber counts monitored under conventional optical microscopy, a much larger number of the asbestos fibers released were so small they could only be detected by tedious electron microscopy.

It is evident from visual observation that immense dust exposures are sustained by mechanics blowing out brake drums. The presence of 50% asbestos in the brake linings whose disintegration products made up that dust cloud should have been reason enough in itself for testing to have been done. Tests reported by Lee in England (1970) showed that when total dust counts were made on the exposures during "blow-out," the old (1938 U.S.) guideline of 5 Million Particles Per Cubic Foot (MPPCF) of air could be exceeded.

The author, first surveying the asbestos literature in 1970-1971, promptly developed a concern for the health of brake mechanics. And despite their apparent lack of recognition under either the U.K. standard or the 1972 OSHA asbestos standard, a warning was sent to brake repair workers in Baltimore County in 1972 advising the use of vacuum methods. As the results of

local attempts to warn brake mechanics of an occupational cancer risk and advise safer work practices were published in the literature, the federal government (NIOSH) sent out a lengthy notice of its own (Castleman *et al.*, 1975; Lloyd, 1975).

This was soon followed by the publication of additional measurements of brake mechanics' exposures and clinical studies on brake repair workers by the Mount Sinai (N.Y.) research team. Lorimer and co-workers (1976) identified signs and symptoms of asbestosis in a limited survey of workers who had been doing brake repair for more than 10 years and were actively employed at the time. Nicholson and co-workers estimate that over the next 40 years there will be 20,000 "excess deaths from asbestos-related cancer" among automobile maintenance workers in the United States.

It appears that the first warning labels on asbestos friction products appeared in 1972. The Annual Report of the largest U.S. manufacturer (Raybestos-Manhattan) for 1976 evidenced a corporate decision to substitute asbestos-containing friction products as soon as possible. Similar assertions by Bendix and General Motors soon followed. U.S. consumption of asbestos for friction products peaked at 83,000 metric tons in 1977.

Friction products manufacturers, beset with mounting asbestos disease damage suits and increasing government regulation in the 1970s, have developed alternative formulations using "semimetallic" compositions with steel fibers and conventional organic compositions reinforced with non-asbestos fibers. However, with the non-regulatory posture of the Reagan Administration, U.S. manufacturers appear to have set back their asbestos replacement investment schedules. U.S. consumption of asbestos in friction products remained unchanged in the period 1980-1984, while consumption of asbestos in every other major use declined dramatically. There was a steady decline afterwards, leveling off at 9,000-10,000 m.t. in the years 1990-1994.

U.S. manufacturers have seemed willing to gradually make new cars with asbestos-free brakes, but were more "pessimistic" about providing competitively priced, asbestos-free replacement brakes for older cars. It is certain that U.S. brake repair workers will be exposed to asbestos for many years to come before

government regulations force the conversion to safer materials. With the 1991 court ruling overturning the E.P.A. regulations to phase out most uses of asbestos, asbestos-containing friction products can continue to be imported into the United States. Imports of these products doubled between 1990 and 1994. Asbestos-free replacement brakes are commercially available for a large number of cars and larger vehicles. Sweden requires asbestos-free brakes for replacement on older cars; and since 1987, new cars have not been allowed for sale in Sweden unless they had asbestos-free brakes. Similar steps have been taken in Denmark and Austria.

But recent developments suggest that simply banning asbestos in brakes will not suffice to protect mechanics, and other additional options warrant consideration. The carcinogenicity of inhaled aramid fibers in rats raises concern over similar risks to mechanics servicing brakes made with these synthetic fibers. And even after the imposition of a ban on asbestos in friction products, millions of vehicles still in use will eventually have to be serviced after their asbestos brakes wear down.

Fortunately, at least 4 manufacturers have offered enclosed systems for doing brake repairs. Two of the enclosed systems have been tested and shown to involve little or no exposure to the dust. The best solution to the immediate problem may be to require licensing of brake repair shops by government health, environmental, or labor agencies. (Barber and beauty shops, far less hazardous, have been licensed for decades.) The shops should have to provide government-approved training for the workers and use approved equipment for repairs (to be maintained regularly in an approved manner). This would provide immediate protection to workers doing brake repairs, their shop-mates, and the general public. Brake repair would become a specialty business with relatively fewer shops for the regulators to monitor.

The U.S. Environmental Protection Agency published *Guidance for Preventing Disease Among Auto Mechanics* in 1986. This summed up the state of knowledge about the hazards of asbestos in brake servicing and the available protective measures.

The E.P.A. proposed a ban on most uses of asbestos on January 29, 1986, and the final rules were published in the *Federal Register* July 12, 1989. Manufacture and importation of some friction products would have been banned on August 25, 1993. The balance of friction product categories would have faced a ban on manufacture and importation as of August 26, 1996. The E.P.A. declined to complement its ban with a brake shop licensing program as described above and urged by the Natural Resources Defense Council.

A trade magazine poll of key friction product suppliers "produced nothing but yawns" in response to the E.P.A. ban. "At least one major supplier has completely eliminated asbestos already, and a couple of others said they could do so tomorrow if necessary." *Brake and Front End* predicted that the brake industry would have new products available in plenty of time to meet the 1996 deadline ("Was Ban Foreseen by All," Aug. 1989).

OSHA, which issued an asbestos workplace standard on June 20, 1986, was ordered to further lower the permissible exposure limit from 0.2 fibers/cc in those industries where feasible, including brake repair. The 1986 standard did ban the use of compressed air to remove asbestos unless it is done within a system that captures the dust so produced. Responding to a challenge from the AFL-CIO, the U. S. Court of Appeals in Washington, D.C. ordered OSHA to make major changes to the rules in a February, 1988 decision. On July 20, 1990 OSHA proposed to lower the permissible exposure limit for asbestos in all workplaces to 0.1 f/cc, and this limit was adopted on August 14, 1994. OSHA had taken the position that more expensive technology should be provided for protecting brake and clutch repair workers; but after the 1994 elections, OSHA reversed its stand and informed industry in early 1995 that the solvent spray can method would be sufficient, if coupled with appropriate work practices.

The following annotated bibliography chronicles the developing awareness of asbestos health hazards from friction product manufacture, fabrication, and replacement. Virtually all of this material is drawn from public sources. Very limited discovery

has been conducted so far from the standpoint of friction materials. The bibliography is divided into 8 parts:

1. Brake lining manufacture
2. Grinding and Drilling Brake Linings—Early Papers
3. Compensation
4. Asbestos Air Pollution Hazard from Brake Wear
5. Remaining Chronology of Papers Relating to Asbestos Hazard in Brake Repair (through 1985)
6. Commercial Substitution of Asbestos in Friction Products
7. Control Technology for Brake and Clutch Work
8. Case Reports of Mesothelioma in Brake Repair Workers

ANNOTATED BIBLIOGRAPHY OF HEALTH HAZARDS FROM
FRICTION PRODUCT MANUFACTURE AND REPAIR

Brake Lining Manufacture

1. Lanza, A.J., W.J. McConnell, and J.W. Fehnel. "Effects of the Inhalation of Asbestos Dust on the Lungs of Asbestos Workers," *Publ. Health Rep.* 50:1-12 (1935).

High prevalence of asbestosis among workers with "more than 3 years of employment in the industry" at five plants including one where molded brake band and clutch friction materials were manufactured.

2. Fulton, W.B. *et al.*, Asbestosis. Harrisburg, Pennsylvania: Department of Labor and Industry, Commonwealth of Pennsylvania, 1935.

Report of 25 percent prevalence of asbestosis among selected workers at four asbestos fabricating plants, including three where brake linings were manufactured.

3. George, A.W. and R.D. Leonard. "An X-ray Study of the Lungs of Workmen in the Asbestos Industry Covering a

Period of Ten Years," *Radiology* 33:196-209 (1939).

Documents asbestosis in brake lining manufacturing workers since 1928, with compensation. Explains that the asbestosis cases seen by Hawes (*New Engl. J. Med.* 216:162-165, 1937) were brake lining manufacturing workers. Discusses switch from dry to wet methods of processing.

4. Stone, M.J. "Clinical Studies in Asbestosis," *Amer. Rev. Tuberc.* 41:12-21 (1940). Also, "Studies in Asbestosis," *Dis. Chest* 6:170-171 (1940).

Asbestosis in 148 brake lining manufacturing workers seen by Drs. Stone and Hawes.

Grinding and Drilling Brake Linings—Early Papers

1. Osborn, S.H. *Forty-Ninth Report of the State Department of Health, State of Connecticut Public Document No. 25*, Hartford, CT, 1934, pp. 507-511.

Describes the grinding of molded asbestos brake and clutch parts under varying degrees of local exhaust ventilation. Total dust counts ranged from 0.6 to 17 MPPCF. The need for dust sampling and analysis to evaluate these exposures was stressed, as the visual appearance of the worst grinding exposure was unremarkable.

2. *Memorandum on the Industrial Diseases of Silicosis and Asbestosis*, London: H.M. Stationery Ofc., 1935.

Lists under "Industries and Processes in which asbestosis occurs...the sawing, grinding, and turning in the dry state of articles composed wholly or partly of asbestos such as motor car brake and clutch linings..."

3. Brachmann. "Asbestosis in Grinders and Drillers of Brake Bands," *Arbeitsschutz* 172-174 (1940). Abstract in the *Abstracts* supplement to *J. Indust. Hyg. Tox.* 23:76-77 (1941).

Clinical and X-ray examination showed asbestosis in nearly all workers employed 5 years or more as grinders and drillers of brake linings.

4. Castrop, V.J. "Fume and Dust Exposure," *Nat. Safety News* (Feb. 1948).

By General Motors industrial hygienist. Section on asbestos noted that brake lining grinding and "surfacing" operations were equipped with local exhaust ventilation systems.

5. Thomas, D.L.G. "Pneumokoniosis in Victorian Industry," *Med. J. Australia* 1:75-77 (1957).

The following occupations (involve asbestosis hazards)...sawing, cutting and finishing any product containing asbestos—for example, brake linings, asbestos sheeting, and various insulating materials...

6. Patty, F.A. *Industrial Hygiene and Toxicology*, New York: Interscience, 1963 (2d ed.), pp. 2243-2244.

Written by former director of Industrial Hygiene Dept., General Motors.

The sawing, filing, drilling, and grinding of brake linings is ordinarily well controlled... It is desirable in asbestos exposures to keep the dust count down to 5 million particles, or less, per cubic foot of air.

Compensation

1. McVittie, J.C. "Asbestosis in Great Britain," *Ann. N.Y. Acad. Sci.* 132:129-138 (1965).

Describing the occupations of workers diagnosed with asbestosis (and compensated for disability) in the years 1955-1963, he lists "brake lining" workers with an average of 14 years' exposure.

2. Smither, W.J. "Surveillance of High-Risk Groups—A Survey of Asbestos Workers: The Present Position in the United Kingdom," *Ann. N.Y. Acad. Sci.* 330:525-532 (1979).

Updates McVittie's figures through 1969, showing that the four U.K. Pneumoconiosis Panels diagnosed 10 cases of asbestosis in "brake lining" workers in the years 1963-1969.

Asbestos Air Pollution Hazard from Brake Wear

1. Thomson, J.G., R.O.C. Kaschula, and R.R. MacDonald. "Asbestos as a Modern Urban Hazard," *S. Afr. Med. J.* 37:77-81 (1963).

Expresses fear of public cancer hazard from asbestos released into the air of cities by brake wear. (See opening quote in Chapter 7)

2. "Pulmonary Asbestosis," *S. Afr. Med. J.* 37:629-630 (1963).

Editorial expresses similar concerns to Thomson's.

3. Lynch, J.L. "Brake Lining Decomposition Products," *J. Air. Pollut. Contr. Assoc.* 18:824-826 (1968).

Electron micrograph showed no free fibers in accumulated brake drum dust. Testing was then done on dust released by braking, using equipment of a brake lining manufacturer. The apparatus permitted simulation of stopping using complete brake assemblies.

In all but a few tests the automobile drum brake linings showed less than 1% free fiber in the decomposition product... In those tests where a *significant* mass of free fiber was released, the temperature was in an extremely high range for the lining in question as evidenced by the rapid drop in the coefficient of friction...(under which conditions the brakes would have failed)... Similar results were obtained in the bus and truck drum brake tests... (emphasis added)

(Subsequent studies would confirm the presence of asbestos in brake emissions and also demonstrate that asbestos is retained in accumulated brake drum dust.)

Remaining Chronology of Papers Relating to Asbestos Hazard in Brake Repair (through 1985)

1. Hueper, W.C. "Carcinogens in the Human Environment," *Arch. Path.* 71:237-267 (1961).

Lists brake linings under, "operations and products with contact to asbestos for producers, processors, users, consumers, residents." Lists as a population with occupational and environmental exposure, in italics, "brake linings producers."

2. Enterline, P.E. and M.F. McKiever. "Differential Mortality from Lung Cancer by Occupation," *J. Occup. Med.* 5:283-290 (1963).

A study of the relation of lung cancer rates and occupation in the U.S. One group with significantly high lung cancer mortality was, "mechanics and repairmen, automobile." The authors suspected automobile exhausts as a cause.

3. Newhouse, M. and H. Thompson. "Mesothelioma of Pleura and Peritoneum following Exposure to Asbestos in the London Area," *Brit. J. Indust. Med.* 22:261-269 (1965).

Major study linking asbestos exposure (household, neighborhood, etc.) to mesothelioma in England. Listed in table at end as "no history of contact with asbestos" is case #66: "garage hand, chauffeur, mechanic." The basis for stating no exposure appears to simply have been that there was no household or occupational asbestos exposure as the authors had defined such exposures.

4. Hueper, W.C. "Occupational and Nonoccupational Exposures to Asbestos," *Ann. N.Y. Acad. Sci.* 132:184-195 (1965).

Table lists "garage attendants" under the heading of groups occupationally exposed to asbestos and lists brake linings as a source of general environmental asbestos exposure.

5. Gross, P. "The Pulmonary Response to Brake-Drum Dust: A Preliminary Investigation." Indust. Hyg. Foundation—Report for Johns-Manville (July 1968). Unpublished.

The index card for document no. 3071 at the Institute for Occupational and Environmental Health, library of the Quebec Asbestos Mining Association in Montreal, recorded the authors' summary: "Brake-drum dust has evoked a pulmonary response which suggests that this dust is biologically 'inert.' Brake-drum dust is capable of producing ferruginous bodies in the lungs of hamsters that are indistinguishable from asbestos bodies." Handwritten on the card are the phrases, "Not to circulate!" and "Scientific Committee only." The library is now part of the Asbestos Institute in Montreal.

6. Gross, P. and R.T.P. de Treville. "Pulmonary Ferruginous Bodies/Studies on Their Origin," *Pneumoconiosis Proceedings of the International Conference Johannesburg 1969*. H.A. Shapiro, Ed. Cape Town, South Africa: Oxford University Press, 1970, pp. 86-91.

(O)f the 6 ferruginous bodies isolated from hamster lungs injected with brake drum dust, all gave an electron diffraction pattern characteristic of chrysotile; this, in spite of the relative paucity of fibers in the dust by optical microscopy and the negative X-ray diffraction pattern of the powder. These 6 ferruginous bodies were, therefore, asbestos bodies.

7. Sullivan, R.J. and Y.C. Athanassiadis. *Preliminary Air Pollution Survey of Asbestos*. Litton Systems, Inc. report prepared for the National Air Pollution Control Administration, 1969, p. 32

Refers to Newhouse and Thompson's report of mesothelioma "in a mechanic."

8. McDonald, A.D. *et al.* "Epidemiology of Primary Malignant Mesothelial Tumors in Canada." *Cancer* 26:914-919 (1970).

In a retrospective review of the potential asbestos exposures of a series of mesothelioma patients in Canada,

Men employed in ... the installation of brake linings ... were responsible for most of the excess of cases over controls.

In a tabulation of the "occupations classified under definite or probable exposure to asbestos," are 21 cases of mesothelioma, including 2 who did "brakelining installation" and one more who worked in brake lining manufacture (Table 6). This study attributes the main risk of mesothelioma to asbestos exposure in manufacturing and product use, as opposed to the mining of chrysotile asbestos. Funded by Quebec Asbestos Mining Association.

The following papers (9-17) are from the Conference on Exposure to Asbestos During Brake and Clutch Maintenance, held at Ford's Central Office, Brentwood, Essex, England, March, 1969. Published in *Annals of Occupational Hygiene*, Volume 13, 1970. Chairman of the conference was Dr. G.H. Channing, Chief Medical Officer, Ford of Britain. In the "Preface," Ford's D.E. Hickish explains that the motor industry was concerned about whether it was affected by the British government's promulgation of an asbestos standard.

9. Smither, W.J. "Asbestos and Asbestosis." *Ibid.* 3-5.

The medical advisor to Cape Asbestos opens with discussion about the different mineral varieties of asbestos, then notes that all "current" friction materials contain 50% chrysotile asbestos. This figure he expected to gradually decline to as little as 30%.

10. Roach, S.A. "Hygiene Standards for Asbestos." *Ibid.* 7-15.

Describes standard-setting committees in U.K. as containing industry representatives in order to "take into account the economic consequences of any recommendations made." Describes variable susceptibility:

In a real population the threshold dose will vary from one individual to another ...

Admits that regulators accept standards that do not assure the protection of all workers from asbestos disease (implying a need to warn workers so that they, too, can knowingly accept or reject such risks):

An air quality standard is still associated with a small but non-zero probability of men being affected by the contaminant in question. The risk of people being affected can be made as small as one wishes. Zero risk is the ultimate target and an air quality standard has to be a compromise between the costs of bearing a health risk and the costs of air contaminant control.

He went on to cite a paper (pub. 1965) by Schall criticizing the inadequacies of the TLV in the U.S., which was roughly "17 times higher" than the British standard scheduled to take effect in 1970. He noted that the British standards committee "has not decided whether their chrysotile standards...give sufficient protection against lung cancer or mesothelioma."

The reader gets a glimpse of the Committee's internal disputes over how much safety could be afforded in setting a limit for asbestos exposure. Of major concern to the industry was the number of workplaces covered by the standard. The government must also have shuddered at the thought of enforcing a standard for asbestos in thousands of brake repair shops as well as the asbestos plants and shipyards, etc.

Our present information is very imprecise, particularly in terms of the practical consequences of specific hygiene standards. In developing recommendations for a hygiene standard *the (committee) found that knowledge of the relationship between exposure and risk was not the greatest area of uncertainty.* A much more difficult and contentious problem was to decide on what, in fact, was an acceptable level of dust control. (emphasis added)

The balance of the article discloses the uncertainties of the economics of dust controls to meet the standards. It looks as though Roach and the others on the standards committee accepted the fact that chrysotile asbestos caused cancer. However, this risk to workers breathing asbestos was weighed against the cost to employers and the asbestos companies in protecting workers from the dust.

11. Hickish, D.E. and K.L. Knight. "Exposure to Asbestos During Brake Maintenance." *Ibid.* 17-21.

This paper contains data on the asbestos dust exposure of brake mechanics reported by the Medical Services of Ford of Britain.

The first car servicing tests were done using Cortina and Anglia vehicles, which presumably had smaller brakes than American cars of this era. Sampling was done in the dust cloud generated by blow-out of the accumulated dust in brake drums. This yielded an average value of 2.55 fibers per cc of air (Table 1). Other tests were done beside the car when the repairs were in progress, yielding somewhat lower values averaging 1.25 f/cc (Table 1). Personal samples were also taken, to get the best measure of the workers' actual exposure to airborne asbestos. The average exposure during brake servicing was 0.68 f/cc (Table 2).

Truck brakes generated more dust. Sampling was done in an adjacent bay and two bays away from the service bay where brake repairs were performed. The values recorded were lower in these bystander locations. The bystander fiber counts ranged from 0.17 to 0.49 f/cc in the mornings, during which time only 1.5-2 hours was devoted to brake cleaning. Personal sampling for mechanics doing truck brake repair showed concentrations of 7.09 f/cc, declining to 0.08 after cleaning and averaging 1.75 f/cc over the time sampling interval. The duration of this interval could easily have been adjusted to yield an average value on either side of the new British asbestos standard, 2 f/cc. Even clutch repair in the adjacent bay was recorded as 2.25 f/cc "during cleaning." Samples from bays adjacent to truck brake repair showed 0.79 f/cc as a time-averaged exposure (for cleaning

and a post-cleaning combined interval). (Table 4) The authors conceded that "personal exposures in the vicinity (of truck brake repair) do exceed the standard."

Brake drum dust was analyzed by Holmes, of Turner & Newall, who found chrysotile asbestos present at up to 1% in it. The authors advised safeguards during brake repair:

It is however recommended that care should be exercised during brake cleaning to avoid inhalation of dust produced, and the development of cleaning procedures that would reduce air contamination is desirable.

They also noted that their studies did not include sampling during such procedures as "filing or grinding brake lining," but they assumed that these were hazardous processes "with the attendant need for strict precautions to prevent the inhalation of fibres."

12. Luxon, S. "Technical Implementation of the New Asbestos Regulations." *Ibid.* 23-24.

Representative from the Factory Inspectorate says the 2 f/cc limit should be applied to 4-hour sampling periods, "and it seems reasonable to expect that a concentration of say 12 fibers/cc should not be exceeded during any period of 10 minutes."

Brake drum dust analyses showed a content of 1 to 3 percent chrysotile asbestos. Expresses concern over the "increasing tendency to carry out brake overhauls on an assembly line basis."

13. Hatch, D. "Possible Alternatives to Asbestos as a Friction Material." *Ibid.* 25-29

Representative of Ferodo, a manufacturer. Begins with history on the development of friction products and the technical role of asbestos in the products. For brake linings the author said "there is no substitute for asbestos which would not result in a deterioration of performance and strength." For disc brake pads the picture was brighter:

(I)t cannot be said that the use of asbestos in disc brake pads remains a technical necessity, and it is in this field of friction materials that some departure from resin-asbestos based composites could occur in the next few years on technical and performance grounds.

On the subject of clutches, he said the spider clutch being used in the U.S. for "heavy duty manual shift gear boxes" could use asbestos-free materials such as sintered metals or ceramic-metal composites.

Towards the end, he said: "the wear products from friction materials are probably no more dangerous to health than many other dusts and can be treated as merely dirty." But this is balanced by an earlier remark, "I am not suggesting for a minute that the practice of blowing out brake drums with a compressed air line is to be recommended, merely that an intense dust cloud of this composition is a lot less harmful than one might think."

Data from compressed air brake cleaning showed a preponderance of fibers in the 2-5 micron range (the asbestos standard applied only to fibers 5 microns and longer).

14. Bentley, M.L. "Control of the Use of Asbestos-Containing Friction Materials." *Ibid.* 31-32.

The author was employed by Mintex, a manufacturer of friction materials in Britain. He noted that the Asbestosis Research Council (ARC) was set up by the industry in England (in 1957), after it had become apparent that "cases of asbestosis were occurring (among) certain users of asbestos products, such as ... ladders ... "

A working group of the ARC's Environmental Control Committee was devoted to friction products. Constituent members were Small and Parkes (now part of Cape Industries), Ferodo, and Mintex. "The Group (which has been formed recently) is concerned with the users of friction materials...in the replacement and service field."

Bentley also said the ARC work group on friction materials was preparing "two codes of practice for users of

asbestos based friction materials which will be used by (ARC). One of these is for ... the guidance of those engaged in servicing brakes and clutches."

He called the codes of practice "Notes of Guidance."

15. Lee, G.L. "Removing Dusts from Brake Assemblies During Vehicle Servicing—Alternative Cleaning Methods." *Ibid.* 33-36.

The author worked for the auto manufacturer British Leland. He noted that a technique for cleaning brakes that would reduce dust emissions would also involve an increase in time and effort involved (hence an increase in cost). He commented:

When viewed under normal lighting conditions, the result of applying a compressed-air line to remove brake dusts is very dramatic.

Lee provided data (Konimeter sampling) in units one can convert for comparison with the old asbestos TLV. He showed that at the beginning of brake blow-out, there were 5000 brake dust particles per 5 cubic centimeters of air; this declined within minutes to 580 particles per 5 cc. Converting the units of these measurements to millions of particles per cubic foot of air:

(1 cu. ft. = 28,317 cc),

$$\frac{5000 \text{ particles}}{5 \text{ cc}} = 28.3 \text{ Million particles/cu. ft. (MPPCF)}$$

$$\frac{580 \text{ particles}}{5 \text{ cc}} = 3.3 \text{ MPPCF}$$

Though it was only for brief periods of exposure that these high values were measured, it is still conceivable that the exposures would be kept high in a shop where numerous and continuous brake repairs were being done. The old TLV for asbestos exposure was 5 MPPCF, and it applied to dusts containing asbestos fibers (i.e., all particles were

counted, not just the asbestos fraction of the particles). So peak exposure levels would have exceeded 5 MPPCF in brake repair although daily-average exposures were unlikely to have been that high in most shops, according to this report.

For 5-minute samples of *fibers* only,

...Asbestos fibers counted on membrane filter samples gave a concentration on the order of 3-5 fibers/cc.

A "modified technique" for cleaning brakes used a portable vacuum unit to extract dust raised by brushing out the brake dust with a paint brush. Damp rag wiping followed. This eliminated visible dust emissions, vastly reduced airborne particle counts, and no fibers were detected in the airborne dust samples.

16. Knight, K.L. and D.E. Hickish. "Investigations into Alternative Forms of Control for Dust Generated During the Cleaning of Brake Assemblies and Drums." *Ibid.* 37-39.

Notes that when the brake dust is blown off with a compressed air hose, the dust cloud in which the operator works is "proportionate in size to the drum assembly being cleaned."

Vacuum funnel and vacuum brush cleaning methods were tested. The peak exposures for both of these were way below that observed for "blow-off"—1.04 f/cc for the funnel, 0.57 f/cc for the brush, and 87 f/cc for blow-off. The vacuum brush method was preferred for its ease of use as well as the lowering of exposures.

17. Luxon, S. "Respirators for Protection against Asbestos." *Ibid.* 41.

He was with the Factory Inspectorate and discussed British respirator standards.

For "ordinary respirators" the "protection factor is of the order of 20, that is, the external concentration is reduced to one twentieth that inside the face piece." Mentioned that "High Efficiency Dust Respirators" (of the full facepiece or positive pressure type) provide a protection factor of 400.

Respiratory protection should in general be regarded as providing protection for work where control is difficult or where the work is intermittent and of short duration. It is hoped that the control of the dust will be achieved by the methods indicated earlier and that respiratory protection will therefore only be needed for special work not of a routine nature.

18. *Asbestos*. Washington, D.C.: National Academy of Sciences, 1971, p. 22

This report on asbestos air pollution notes that "an appreciable percentage (1-3%)" of the asbestos in brake linings survives the heat of friction and remains as fibrous asbestos.

19. Oels, H.C. *et al.* "Diffuse Malignant Mesothelioma of the Pleura: A Review of 37 Cases," *Chest* 60:564-570 (1971).

One mesothelioma patient with a history of "probable occupational exposure to asbestos" was a "service station operator."

20. Harwood, C.F. "Asbestos Air Pollution Resulting from the Wear of Brake Linings," Supplementary Notes Supplied to the Attendees of Seminar on Asbestos, Illinois Institute of Technology Research Institute, Chicago, pp. 65-74 (April, 1972).

(A)n estimate is presented which indicates that the asbestos emission from brake linings is significant.

He assumes that 1% of brake dust is asbestos fiber, that 80% of this dust is emitted and 20% remains lodged within the brake system.

This paper contains a several-page discussion, "Alternatives to Asbestos," in which sintered metals, ceramic metal, fiberglass, and sealed systems are discussed.

At the present time, no alternative to asbestos containing friction products is developed to the stage of finesse required by the industry. It is difficult to believe that

modern technology cannot overcome the problems presented by the use of alternates.

This was a several-day seminar attended by a number of industry representatives and the author (BC).

21. Newman, B. "Perilous Particles," *Wall Street J.* (June 8, 1972).

Article on asbestos begins with description of some mechanics blowing dust out of brake parts:

What the mechanics don't seem to know—like thousands of other mechanics—is that the brown dust is dangerous. And if a mechanic breathes in enough dust from worn out linings it could eventually kill him.

22. Moertel, C.G. "Peritoneal Mesothelioma," *Gastroenterology* 63:346-350 (1972).

Explaining that mesothelioma is caused by asbestos, he says, "Particularly vulnerable occupations are ... brake lining installation ... "

23. *Control Techniques for Asbestos Air Pollutants* Research Triangle Park, N.C.: U.S. Environmental Protection Agency Office of Air and Water Programs, (Feb. 1973), pp. 3-48 and 3-49.

"In the course of servicing and overhauling motor vehicle brakes and manual clutches, the accumulated asbestos-containing dust is frequently dislodged from drums and housings by directing a compressed air jet against the deposits." Expressed concern over environmental air pollution.

24. Boillat, M.A. and M. Lob. "Risk of Asbestosis among Workers Replacing Brake Linings," *Schweiz. Med. Woch.* 103:1354-1359 (1973).

English summary:

Thirty nine workers with the job of replacing automo-

bile brake linings (asbestos) have been investigated. The working conditions and clinical findings, including radiology and spirometric studies, are discussed. In view of the comparatively brief exposure during the working day, the maximum permissible concentration of asbestos fibers, according to the norms indicated by American health workers, does not appear to be exceeded. No cases of asbestosis were detected, but in one instance the diagnosis is open to discussion. Despite the satisfactory outcome of this study, periodic examinations of workers in this type of occupation are indicated.

Subjects of the study averaged only 8 years of brake repair experience at 1/2 to 2 hours per day of work. Fiber concentrations from drilling holes for rivets and grinding ranged up to 29.2 f/cc; four of nine measurements exceeded 5/cc.

25. Jacko, M.G., R.T. DuCharme, and J.H. Somers. "Brake and Clutch Emissions Generated during Vehicle Operation." Society of Automotive Eng. meeting, Detroit (May 14-18, 1973).

The first two authors were with Bendix Corp., the other worked for the U.S. Environmental Protection Agency. Tests of brake wear emissions from braking showed 14.4 percent of total car asbestos emissions were "retained in brake" of test vehicle. The corresponding figure for trucks was 9.2%. The overall figure for all vehicles in U.S. was 11.2% brake retention.

26. Davis, J.M., and S.W. Coniam. "Experimental Studies on the Effects of Heated Chrysotile and Automobile Brake Lining Dust Injected into the Body Cavities of Mice," *Exper. Molec. Pathol.* 19:339-353 (1973).

Automobile brake lining dust was provided by Turner & Newall from a test vehicle. The dust produced "very small granulomas and little fibrosis" when injected into the pleural cavities of mice. The study was terminated after

only one year, and sponsored by the Asbestosis Research Council.

It is planned to undertake a new series of experiments that will test the long-term effects of brake lining dust in conditions where normal chrysotile is known to produce tumors. [Davis says no such studies were done—1986.]

27. Greenberg, M. and T.A. Lloyd-Davies. "Mesothelioma Register 1967-68," *Brit. J. Ind. Med.* 31:91-104 (1974).

Lists "Industry or Job Title in 167 'Definite' Mesotheliomas with Definite Occupational Exposure to Asbestos" (Table 5)—includes one "motor mechanic."

28. Castleman, B.I. *et al.* "The Hazards of Asbestos for Brake Mechanics," *Publ. Health Rep.* 90:254-256 (1975).

Review of literature and report of efforts to warn brake mechanics about cancer risks from blowing out brake dust with a compressed air hose. Surveys starting in 1972 found that the blow-out method was most commonly used, that most mechanics seemed unaware of a cancer risk (or other serious health risk). Follow-up surveys found that some establishments and mechanics acted on the warning but most did not. Concluded that asbestos regulations needed to be stricter so that brake repair by the "blow-out" method would be forbidden.

The manufacturers of automotive friction materials could easily attach a clear hazard warning to every item sold.

29. Lloyd, J.W. "Dear Colleague..." Hazard Alert letter, National Institute for Occupational Safety and Health, Rockville, MD (Aug. 8, 1975).

Reports on July 21, 1975 NIOSH meeting with industry, labor, and academic attendees to discuss brake repair asbestos hazards. Data generated by the Mt. Sinai Environmental Sciences Laboratory included 1) blowout of auto-

mobile drum brakes, 2) grinding used truck brake linings, and 3) bevelling new truck brake linings. "Average peak asbestos air concentrations for these three activities based on personal samples taken within 10 feet of the operation were, respectively, 10.5, 3.75, and 37.3 fibers (greater than 5 microns in length)" per cc. of air.

The present findings indicate that enough asbestos is preserved to produce significant exposures during certain brake servicing procedures.

Earlier reports of mesothelioma among persons with jobs involving automobile brake servicing were cited. NIOSH estimated that 833,535 auto mechanics, 67,679 garage workers, and 6,657 (original and rebuilding) manufacturing employees made up a workforce "potentially exposed to asbestos."

"Recommended (Interim) Procedures for Asbestos Brake and Clutch Servicing" were attached. These procedures included: 1) posting signs in the work area warning people not to stay there unless their work required it ("... May Cause Asbestosis and Cancer"); 2) use of industrial vacuum cleaners (with high efficiency filters) for removing dust from brakes; 3) use of respirators; 4) use of local exhaust ventilation and high efficiency dust collection on grinding machines; 5) adherence to OSHA asbestos regulations' provisions regarding special clothing and change rooms.

30. "HEW Warns of Asbestos Hazard in Work with Brake Linings, Spackling Mixtures," *Wall Street J.* (Aug. 15, 1975).

Summarizes the NIOSH alert notice (previous item).

31. Marsh, J. (Raybestos-Manhattan) letter to B. Castleman. (Oct. 29, 1976).

Announces that "work practice instructions are included with every package of brake lining shipped from our factories."

When inquiries are received from the field, we routinely supply the (Asbestos Information Association) booklet, "Recommended Work Practices in the Fabrication and Use of Asbestos Friction Materials."

32. *Asbestos and Brake Linings*. Asbestos Information Association, Washington (1976).

Pamphlet on asbestos air pollution from brake decomposition:

Emissions from brake lining wear are *not* a significant source of asbestos in the environment. (original emphasis)

33. *Fabrication and Use of Asbestos Friction Materials*. Asbestos Information Association, Washington (1976).

Summary and text of 1972 OSHA asbestos standard.

34. Menck, H.R. and B.E. Henderson, "Occupational Differences in Rates of Lung Cancer," *J. Occup. Med.* 18:797-801 (1976).

This study on occupation and lung cancer rates in California shows a statistically significant Standard Mortality Ratio (146, meaning 46 percent higher than expected) for "Auto Repair" workers. This figure is based on eight deaths from lung cancer in the years 1972-1973.

35. Alste, J., D. Watson, and J. Bogg. "Airborne Asbestos in the Vicinity of a Freeway," *Atmos. Environ.* 10:583-589 (1976).

Chrysotile asbestos fibers from new and worn brake linings and from the air near a freeway were examined by electron microscopy and electron diffraction. The major effect of braking appears to be in separating bundles of fibers and reducing their average length but not altering their crystal structure. The majority of particles had a maximum linear dimension of 2 microns or less.

36. Rohl, A.N., A.M. Langer, M.S. Wolff, and J. Weisman. "Asbestos Exposure during Brake Lining Maintenance and Repair," *Environ. Research* 12:110-128 (1976).

Unaltered chrysotile asbestos was found in garage air samples and brake drum dust. "(E)xposure of garage mechanics during brake lining maintenance and repair show that fiber concentrations frequently in excess of regulated limits are common." (optical microscopy)

Blowing out automobile brake drum dust yielded exposures of 6.6 to 29.8 f/cc with measurable exposure 50-75 feet away. Some of the other data had been summarized in the NIOSH alert of Aug. 8, 1975.

Electron microscopy showed most of the fibers were too small to be seen by optical microscopes. The authors warned that exposure to these very small and numerous asbestos fibers could have adverse effects.

37. Lorimer, W.V. *et al.*, "Asbestos Exposure of Brake Repair Workers in the United States," *Mount Sinai J. Med.* 43:207-218 (1976).

Tabulates exposures previously measured by others, includes their own data in great detail for all types of brake work.

Clinical study of 90 men with ten or more years of brake repair work and no other history of occupational exposure to asbestos. Most of the general mechanics examined did brake lining more than once weekly. Parenchymal fibrosis was seen on X-ray in 18 (20%) and pleural thickening in 5 (6%). Those who started work before 1946 had twice the prevalence of abnormal X-rays as those starting in 1946-1955. One quarter of the workers had restrictive pulmonary function test findings.

(T)he findings suggest that asbestos disease will be present among (brake maintenance) workers and that appropriate control measures should be urgently instituted.

38. Rohl, A.N. *et al.*, "Asbestos Content of Dust Encountered in Brake Maintenance and Repair," *Proc. Roy. Soc. Med.* 70:32-37 (1977). Another report from the Mt. Sinai group on the presence of chrysotile asbestos in brake drum dust from all over the world, the submicroscopic size of most of the asbestos fibers, and comparison of brake mechanics' asbestos exposure with OSHA standards (optical microscopy). Authors call for implementation of industrial hygiene practices and for epidemiological mortality studies of garage mechanics.
39. Bruckman, L., R.A. Rubine, and B. Christine. "Asbestos and Mesothelioma Incidence in Connecticut," *J. Air Pollut. Contr. Assoc.* 27:121-126 (1977).

Reports a case of mesothelioma in a toll booth operator. These investigators found increased asbestos exposure at toll booths compared to ambient air of Connecticut cities.

40. Seshan, K. "On the Utility of Dark-Field Electron Microscopy in the Determination of the Degree of Deformation in Chrysotile Asbestos: An Environmental Research Application" *Environ. Research* 16:383-392 (1978).

New technique of analysis verifies that "chrysotile asbestos in various stages of deformation" survives in brake drum dust.

41. Rohl, A.N., A.M. Langer, and I.J. Selikoff. "Airborne Asbestos in the Vicinity of a Freeway," *Atmos. Environ.* 12:2030-2031 (1978).

Adds a number of unpublished reports confirming the presence of chrysotile in disintegrated brake linings from Great Britain (F. Pooley), France (P. Sebastien), and South Africa (M.S. Kikine). Refers to findings of asbestosis among automotive maintenance workers.

42. "Friction Materials Work Practices Guide." Friction Materials Standards Institute, Paramus, N.J. (Oct. 1978), 12 pp.

When removing worn friction materials remove the accumulated dust in the assembly with an industrial vacuum cleaner equipped with a high efficiency filter system. If such equipment is not available, dust can be removed with a damp cloth. Do not use compressed air or dry brushing for cleaning. Use a NIOSH approved respirator when removing worn friction materials, or cleaning brake or clutch assemblies.

Local exhaust ventilation is recommended for machining of friction materials. Machining and repair areas "should be isolated from other work areas in a restricted area to prevent unnecessary exposure of other workers." Warning signs are suggested to limit access to brake work areas.

Work clothing should not be taken home.

Disposal of vacuum cleaner waste in marked, impermeable bags is also covered in this pamphlet by the industry trade group.

43. Kagan, E. *et al.* "Asbestos-Associated Neoplasms of B Cell Lineage," *Amer. J. Med.* 67:325-330 (1979). And, Kagan, E., and R.J. Jacobson. "Lymphoid and Plasma Cell Malignancies: Asbestos-related Disorders of Long Latency," *Amer. J. Clin. Path.* 80:14-20 (1983).

Reports one case of pleural mesothelioma in a man who had installed automotive brake linings for 25 years.

44. de Lajartre, M. and A.Y. de Lajartre. "Mesothelioma on the Coast of Brittany, France," *Ann. N.Y. Acad. Sci.* 330:323-332 (1979).

"Certain" occupational exposure to asbestos was identified in 51 cases of mesothelioma, including 4 "mechanics." Exposure characterized as "probable" for 6 "construction mechanics."

45. McDonald, A.D. and J.C. McDonald. "Malignant Mesothelioma in North America," *Cancer* 46:1650-1656 (1980).

A review of mesothelioma cases included 11 with occupational histories of garage work. A series of matched controls without mesothelioma included 12 with such histories. Individuals with histories of asbestos mining and manufacturing, or construction and shipyard work in addition to garage work were not counted as garage workers.

46. Roberts, D.R., and R.D. Zumwalde. "Industrial Hygiene Summary Report of Asbestos Exposure Assessment for Brake Mechanics." NIOSH Report #32.4, Cincinnati (1982).

Time-weighted average exposures for mechanics using various brake repair techniques were generally in the range of 0.1 to 0.3 f/cc. General area air samples were 0.01-0.13 f/cc.

47. Williams, R.L., and J.L. Muhlbaier. "Asbestos Brake Emissions," *Environ. Research* 29:70-82 (1982).

Report of brake asbestos emissions from General Motors Research Laboratories.

The ratio of small fibers which can be seen with an electron microscope (less than 5 microns in length) to large fibers as determined with an optical microscope (more than 5 microns in length) was about 460 for disc brakes and 230 for drum brakes.

The authors conclude that over 99.9% of the asbestos in the brake materials is destroyed in braking. They calculate that concentrations of asbestos at toll booths from braking could be 19 nanograms per cubic meter of air. Comparing this to a published report of 25 ng/cm at a Connecticut toll booth, the authors deduce that "a significant fraction ... could arise from braking."

48. Selikoff, I.J. *et al.* *Disability Compensation for Asbestos-Associated Disease in the United States*, U.S. Dept. of Labor Contract No. J-9-M-8-0165 (June, 1981). Printed by the Mt. Sinai School of Medicine. Similar data and analysis in

Nicholson, W.J., G. Perkel, and I.J. Selikoff. "Occupational Exposure to Asbestos: Population at Risk and Projected Mortality 1980-2030," *Amer. J. Indust. Med.* 3:259-311 (1982).

Projects a risk of asbestos cancer for a number of occupations compared with insulation work. "Automobile maintenance" is estimated to carry 4% as much risk as insulation work. Projected number of deaths from asbestos-related cancer among automobile maintenance workers estimated to be rising steeply, from 400/year in 1983 to a peak of 500-600/year during the years 1990-2015. Quotes Weston as saying that 900,000 workers are continually exposed and 1,070,000 are exposed occasionally or infrequently.

49. Langer, A.M. and W.T.E. McCaughey. "Mesothelioma in a Brake Repair Worker," *Lancet* 1101-1102 (Nov. 13, 1982).

Finds asbestos fibers in the lung tissue of a mesothelioma patient whose occupational exposure consisted of many years of brake servicing work.

50. Glickman, L.T., *et al.* "Mesothelioma in Pet Dogs Associated with Exposure of Their Owners to Asbestos," *Environ. Res.* 32:305-313 (1983).

Over a five-year period, 18 pet dogs were diagnosed with mesothelioma at a veterinary hospital. The owners of 2 were car and truck mechanics by occupation, and the hobby of a third was automobile servicing. Two of the other dogs' owners were an automobile body repairer and a used automobile parts supply worker.

51. Mancuso, T.F., "Mesothelioma Among Machinists in Railroad and Other Industries," *Amer. J. Indust. Med.* 4:501-513 (1983).

Report of pleural mesothelioma in an automechanic.

52. "Asbestos Fact Book." U.S. Environmental Protection Agency, (Feb. 1985), 11 pp.

(P)eople who work directly on brake maintenance are widely exposed to exceptionally high levels of asbestos. This occurs when brakes are cleaned and serviced during routine maintenance activities. EPA is establishing a Brake Mechanics Program to provide information and education on asbestos problems to vocational/technical students, working mechanics, and brake repair and maintenance specialists. The program will alert these specialists to the presence of asbestos in brakes and to methods that will minimize the release of asbestos fiber into the workplace.

Commercial Substitution of Asbestos in Friction Products

U.S. Patents of asbestos-free friction products—see "Annotated List of Friction Elements Patents," in Chapter 6. This list includes a molded composition brake block for railroad cars (No. 2,861,964) patented in 1958 by a former patent attorney of Manville Corporation who later became Chairman of the Board of Directors. More recent developments are noted here:

"ICI Asbestos-Free Brake Shoe," *Asbestos* 12-14 (Sept. 1976).

Announces immediate production and worldwide marketing of a railroad brake shoe that contains no lead or asbestos. Called Tiger, the product was developed by Abex Corporation, subsidiary of IC Industries, Inc.

Kwolek, J.P. "Friction Materials for Small Car Solid Rotor Applications," *SAE Transactions*, paper no. 750874, (1976).

Gives history of development of semimetallic brakes, starting with their use in police cars, taxi cabs, and "a few vehicles sold to the general public." Notes that semimetallic front disc brakes achieved success in meeting standards of the Los Angeles Police Department, and displayed a number of advantages over conventional asbestos-organic brake compositions by 1970. Increased

cost was a major obstacle to widespread usage at that time. Author worked for Bendix Corporation.

1976 Annual Report, Raybestos-Manhattan, Inc.

The escalating costs associated with handling this raw material and the uncertain consequences of future government asbestos regulations, however, have necessitated our decision to work toward the elimination of asbestos from all our friction products and this eventuality has become an essential part of our long term product and manufacturing plans.

1978 Annual Report, Raybestos-Manhattan, Inc.

Although from a social and political standpoint, publicity concerning asbestos has not adversely affected our business nor do we expect it to in the near future, from a long-range standpoint, we are planning to eliminate asbestos from our friction materials products by 1982 in order to minimize the effect of any further government regulations in this area.

Castleman, B.I. and M.J. Vera. "Impending Proliferation of Asbestos," *Internat. J. Health Serv.* 10:389-403 (1980).

Paraphrases a communication from General Motors to the U.S. Environmental Protection Agency (Sept. 7, 1979), called "General Motors Programs on Non-Asbestos Friction Materials for Brake Systems." Approximately 60 percent of all passenger car disc brakes manufactured and used by G.M. had non-asbestos friction materials in 1979. G.M. projected that all its 1983-model passenger cars with disc brakes would have asbestos-free brakes, and all cars with drum brakes and light trucks would have asbestos-free brakes by the 1985 model year.

Norman, J.C. "Synthetic Fibers Find Applications in Transportation," *Indust. Research and Development* (July, 1981).

DuPont marketing specialist for "Kevlar" aramid fiber presents test results and describes performance of this product as an asbestos substitute in brakes. Cost of use initially higher but longer service life expected to offset the 25 percent initial cost premium in the life-cycle cost of the product. Excels in heavy duty applications, compared with conventional asbestos brakes.

Jacko, M.C., M. Brunhofer, and F.W. Aldrich. "Non-Asbestos Friction Materials," *Proceedings of the National Workshop on Substitutes for Asbestos. Arlington, VA, July 14-16, 1980.* Contract No. 68-02-3168. Washington: U.S. Environmental Protection Agency, 1981, pp. 9-34.

Bendix researchers report on the company's efforts to manufacture asbestos-free brakes. Excerpts:

Semimetallic development began in 1962 ... General acceptance came in the mid-1970s with the second generation of semimetallic formulations. Today, semimetallic disc brakes are utilized on the disc brakes of approximately 50 percent of the new vehicles built in the U.S., and projections approach 100 percent utilization by 1985 ...

The initial generation of asbestos-free organic drumbrake linings is in the final development stage at Bendix, and initial evaluations are underway at vehicle manufacturers. Some asbestos-free blocks are available commercially for heavy truck applications. While it is too early to tell whether these formulations will achieve commercial success, the first significant production release would probably be in 1982...

(I)t may not be possible to substitute the asbestos-free materials directly in older vehicles without compromising safety...

As stated in the Bendix Corporation's 1979 annual

report, '...Bendix early in the 1980s will offer its automotive customers brakes made with long-wearing, high-performance friction materials that are asbestos-free.' We intend to meet that commitment.

Environmental Tidbits. *Working Environment 1982 in Sweden*.

Stockholm: Swedish Work Environment Association, p. 24

During 1982, asbestos-free (brake) linings will be introduced in all Saab models. The asbestos is replaced by so-called semi-metallic linings.

Ählberg, R. (Swedish Metalworkers Union, Stockholm) letter to B. Castleman, June 8, 1982.

Reports that in Sweden only brake linings still use asbestos. "We are now at the end of the fight for a total ban on asbestos." He continued:

The Swedish car Saab has now completely changed over to asbestos-free brake linings, even when they are exchanging linings on older Saab cars. Today there are asbestos free brake linings for nearly all cars.

Ählberg enclosed leaflets advertising asbestos-free brake products from the Hesselman, Bennetter, and Rydahls companies in Sweden. Hesselman "Metal Master" asbestos-free brakes were offered for dozens of different models of cars by Audi, BMW, Fiat, Ford, Mercedes, Opel, Peugeot, Renault, Saab, Toyota, Volkswagen, Volvo, and others.

Tombs, F. (Chairman of the Board), *Turner & Newall 1982 Report and Accounts*.

Announces progress on the introduction of asbestos-free brakes in Europe and the United States (including original-equipment drum linings in Ford Sierra models).

Reinhardt, C.F. (DuPont), certified letter to the Environmental Protection Agency, Docket WH-557 (Apr. 4, 1985).

Report of a two-year inhalation study of aramid fibers in rats. Animals exposed to the highest concentrations developed "cystic keratinizing squamous cell carcinomas": 6 of 56 females and 1 of 36 males exposed to 400 fibrils/cc; 4 of 69 females and 0 of 68 males exposed to 100 fibrils/cc; no tumors in animals exposed to 25, 2.5, and 0.

DuPont has adopted a workplace exposure limit of 5 fibrils/cc (8 hr. time weighted average) for its operations and is suggesting this limit to its customers.

No data were provided for exposures from machining aramid-fiber-reinforced brakes. DuPont has invested \$500 million in aramid ("Kevlar") fiber, which is used in many applications including canoes and bomber planes. Other chemical companies also make aramid fibers.

Castleman, B., certified letter to Robert Nelson (Nuturn Corp., subsidiary of Turner & Newall, U.K.), Apr. 26, 1985. No reply received.

Informs the leading U.S. producer of aramid-fiber-reinforced brake and clutch parts about the above report from DuPont. Urges analysis of brake drum dust, animal exposure tests of such dust, and air monitoring of worker exposures to aramid fiber from working with brakes made with aramid fibers.

Swedish Ministry of Labor, General Agreement on Tariffs and Trade Notification (May 13, 1985). Based on Government Resolution March 21, 1985.

(Sweden) intends proposing a ban on the sale of newly manufactured passenger cars and motorcycles with brake linings containing asbestos...to take effect on 1st January, 1987.

The government announced that extension of a similar ban to cover larger vehicles was under consideration. Its

actions on asbestos became an issue in the 1985 elections, in which the Social Democrats retained control in Sweden.

Following the petition of the Natural Resources Defense Council, a leading environmental group, asking for a ban on asbestos in brakes, the U.S. Environmental Protection Agency published a notice in the *Federal Register* on December 19, 1984. Several companies responded with comments that they were developing asbestos substitutes for use in brakes, among other applications.

American Kynol, Inc., New York (agent for Nippon Kynol, Inc., Osaka, Japan)—commercially markets novolid fibers for use in friction materials: "generally used in conjunction with other materials including aramid and/or glass fibers and inorganic filler materials."

Jim Walter Corp., Tampa, Florida—commercially markets one type of processed mineral wool fiber now used in friction materials (PMF 204) and is developing another (PMF 1104). The latter is of non-respirable size, about 1100 microns long and 4 microns in diameter.

Ashland Petroleum Co. (Ashland, KY)—manufactures carbon fibers "as a suitable substitute for asbestos in automobile and truck brakes."

Engelhard Corp. (Edison, NJ)—manufactures a mineral composition based on attapulgite clay for use in friction products.

Monsanto Co. (St. Louis, MO)—developing a calcium sodium metaphosphate fiber for use in friction products.

Enka AG Product Group Industrial Fibers (Wuppertal, West Germany)—manufactures aramid fibers.

Control Technology for Brake and Clutch Work
(by Dr. Grace Ziem)

1. *Asbestos Dust Control in Brake Maintenance*. PEI Associates, Inc., P.O. Box 46100, Cincinnati, OH 45246 (July 22, 1985). Prepared for the U.S. Environmental Protection Agency, Office of Pesticides and Toxic Substances.

This report reviews exposures with a variety of improvised control techniques which have emerged as alternatives to the compressed air hose. Their performance was generally poor: damp rag use permitted peak asbestos exposures up to 2.6 f/cc with time-weighted averages (TWAs) up to 0.28; a liquid squirt bottle created a 10-minute peak of 0.54 f/cc with TWA over five hours of 0.21; the use of stoddard solvent flowing through an air gun caused peak levels up to 0.68 f/cc and TWAs slightly under 0.1; dry rag and brush generated peaks up to 0.81 f/cc with TWAs up to 0.2.

Wetting methods not using a collection system simply disperse the fibers, and when the liquid dries, fibers remain in the shop ready to enter the room air with minimal motion. Background contamination from such methods, therefore, would not necessarily be less than with the compressed-air cleaning method.

A wet method system with a collection tray was also evaluated (Ammco Brake Assembly Washer). Unfortunately, 15-minute peaks were 1.1 f/cc.

2. *Asbestos Product Test Results*. GCA Corp., Bedford, MA 01730 (1980). Prepared for the U.S. Environmental Protection Agency, Office of Pesticides and Toxic Substances.

Widespread garage contamination is illustrated by worker exposure measurements during compressed air use of 0.85 f/cc with levels of 0.1 f/cc 25 feet away. When the mechanic removed the brake housing and cleaned it by repeatedly striking it with a hammer, his 14-minute exposure was measured as 1.29 f/cc. In these tests, a scanning electron microscope was used to analyze the air samples, so this would not be comparable to measurements using conventional optical techniques.

3. Nilfisk of America, Inc., 201 King Manor Dr., King of Prussia, PA 19406.

This manufacturer was the first developer of a brake enclosure system, the Asbesto-Clene system. Nilfisk was also the first to obtain transmission electron microscopic

analysis of exposure levels during equipment use (by Dr. Arthur Rohl of the Mt. Sinai School of Medicine, NY). Essentially zero exposure levels were monitored during use. The enclosure size did not permit internal drum removal and hammer use.

4. Clayton Associates, Inc., P.O. Box 589, Farmingdale, NJ 07727

The Clayton enclosure system has been tested by Dr. Rohl during use and also during coarse filter change, with zero exposure measured by transmission electron microscopy. Vacuum suction within the filter enclosure pulls released dust away from the mechanic during coarse filter change, toward the High Efficiency Particulate Air filter (HEPA filter). The manufacturer offers the service of changing the HEPA filter at cost.

A clutch enclosure system has also been recently developed by this manufacturer. Exposure measurements during the system's use are not yet available.

5. Hako, 111 S. Route 53, Addison, IL 60101.

The Hako "Minuteman" asbestos brake drum vacuum system is a newly developed, relatively inexpensive but somewhat flimsy appearing enclosure system. Like other brake enclosure systems, it surrounds the brake assembly and uses a compressed air jet for cleaning inside the enclosure.

No air measurements are available during use of the Hako equipment. Such measurements are essential, since if the enclosure does not provide a tight seal (such as against the backing plate), leakage can occur, with fiber release.

6. Control Resource Systems, Inc. P.O. Box 421, Michigan City, IN 46360.

This company produces the "Brakemaster" enclosure unit. Unlike Hako, non-permeable gloves are offered as an optional feature to prevent hand contamination (and the

resulting ingestion hazard). The unit allows both hands inside the enclosure for two-handed work, but is not large enough to accommodate a hammer for use on sticking drums. No air measurements are available to verify the claim of "100% safe."

Note: The brake enclosure systems offered by Nilfisk, Hako, and Control Resource Systems can be purchased without the vacuum/HEPA filter attachments. Clayton will not sell an enclosure unless the whole system is obtained. The use of one of these enclosures with hook-up to an ordinary shop vacuum would render the enclosure largely ineffective, since the filter in an ordinary vacuum cleaner is incapable of capturing most of the tiny asbestos fibers—which would be re-released by the vacuum into the shop air.

7. National Loss Control Service Corp., Long Grove, IL 60049. *Report of Industrial Hygiene Study for Ammco Tools, Inc. North Chicago, IL (1978).*

A 15-minute exposure peak of 1.1 f/cc was found with brake washing using the Ammco Model 1250 brake assembly washer after use of a hammer. A "poorly maintained" Model 880 created operator exposures during grinding of 1.4 f/cc, but the "well maintained" Model 880 also created operator exposure of 1.4 f/cc for grinding brake linings.

This system uses a solvent which dries into a gel in the collection tray, trapping the fibers, according to verbal communication from the manufacturer. Nonetheless, measured asbestos levels using optical microscopy are excessive and allow shop contamination to occur.

8. U.S. Sales Co., 17 Nepperhan Ave., Elmsford, NY 10523

This company makes a wet method brake cleansing system with a wet brush attachment. No air measurement data are available to evaluate this equipment. Until proven otherwise, it must be assumed to create potentially hazardous asbestos exposures to the mechanic and others generally

present in the shop, as do all of the "wet" approaches thus far evaluated.

Case Reports of Mesothelioma in Brake Repair Workers

These case reports were compiled in 1984-86 by a review of medical records and legal depositions or occupational history interviews by Dr. Grace Ziem. One of these cases was the subject of tissue analyses reported by Langer and McCaughey (*Lancet*, 1982). Subsequent cases have been reported (e.g., E.S. Hansen, "Mortality of Auto Mechanics." *Scand. J. Work Environ. Health* 15:43-46, 1989).

* * *

T.Y. was a 60-year-old man diagnosed by pleural biopsy in 1980 as having a left pleural mesothelioma (later confirmed by autopsy). He had worked as an electric arc welder for 6 months in 1942. He used no asbestos blanket and primarily did tack or spot welding, using few welding rods each day. He worked in a shipyard building new ships. At the time of his work, insulation had not been installed in the ships. He never recalls seeing any insulation crews or jobs nor did he ever weld near or handle any insulation material.

From 1946 to 1953 he worked as a mechanic on trains in a public transportation system. All brakes were steel-to-steel without asbestos, and there was no other known asbestos exposure during this time. In 1953 he was transferred to do brake and mechanical work on buses. He did 4 to 5 brake jobs weekly, each lasting about 3 hours, in a very large garage with a 30-foot ceiling. The brake debris was blown out with an air hose, forming a visible cloud of dust. No local ventilation, respirators, or wet methods were utilized, nor was he warned of any hazard.

Brake linings were rounded on a grinder to improve contact, without exhaust ventilation. Approximately 10-12 other mechanics worked in the same garage, each doing approximately the same number of brake repairs. He was not aware of any other exposure to asbestos than described above.

* * *

J.M. was a 55-year-old man who was diagnosed in 1975 as having a right pleural mesothelioma, with metastasis to the liver, diagnosed surgically by biopsy.

He worked for a military supply company in 1940 for 18 months as a lathe machine operator on shells. In 1942 he worked for a year as a maintenance mechanic installing diesel motors in LST boats. In 1943 he went into the army for 18 months. In none of these positions was he aware of any asbestos exposure.

From 1945 to 1965 he worked as a brake repair mechanic for a general contractor. He had almost daily exposure to asbestos during those 20 years, on truck, crane, and other large vehicle brakes.

In 1965 he operated a service station for a year doing frequent brake repair. In 1967 and 1968 he worked on call through an operating engineers' local union with no brake repair exposure. From 1969 until 1975 he worked for a vehicle service contractor as an operator-mechanic, including brake repair duties.

Brake dust was blown out of the drum with an air hose. No local exhaust, respirators, or wetting procedures were utilized at any time. He was unaware of any hazards from asbestos until after his diagnosis.

* * *

C.H. was a 54-year-old man diagnosed by biopsy in 1980 as having a right pleural mesothelioma. His diagnosis was confirmed at autopsy in 1981. At age 19 he began to work in his father's used car business, changing brakes about once a week. In 1963 at about age 37 he bought a service station and did frequent brake repair work for the next three years. In 1966 he bought a used car business and again was involved regularly in brake repair. The last several years prior to his diagnosis he was able to work only intermittently due to health reasons unrelated to asbestos exposure.

He removed debris from the drums with a compressed air hose. No wet methods, respirator or local ventilation was utilized. He was unaware of the hazards of asbestos exposure.

He did not recall ever seeing a warning label on either the brake lining material or the shipping boxes. He had no other known exposure to asbestos.

* * *

R.H. was diagnosed at the age of 78 as having mesothelioma involving the right pleura after a thoracotomy procedure with biopsy. His first exposure to brake dust was in 1924 working with an auto dealership in Los Angeles. For about 7 years he averaged about 3 brake jobs daily and sometimes did as many as 25 or 30 in a day. After that he worked in smaller garages for another 20 years or more, averaging one or two brake procedures daily. He used a compressed air hose for all brake work and was unaware of the hazard.

For a twelve-year period somewhat later, this man worked as a supervisor for maintenance operations in buildings in a professional center. However, all insulation repair procedures were subcontracted, and Mr. H. was never around these jobs during their implementation nor afterward until clean-up was complete. (Such activities were fairly uncommon.) He does not recall seeing any insulation products left behind after clean-up. He does not recall ever being exposed to asbestos in any other manner, such as from sprayed insulation, ceilings, roofing jobs, construction, shipyard work, etc.

* * *

C.T., a 45-year-old woman, was diagnosed with right pleural mesothelioma by open-chest biopsy in 1982. She was the wife of an auto mechanic, and several times a week beginning in 1959 she went to the garage at lunch time. She also laundered her husband's work clothes, placing them into the washer without shaking. The garage was a 3-bay station servicing an automobile dealership. Her last exposure to his work-clothes or the garage was in 1964. During those 5 years there were several long intervals with neither garage nor clothing exposure, so that the total exposure duration she estimates as not longer than a full year. She had no other known asbestos exposure, either as a child or as an adult.

This case is an illustration of the critical importance of occasional bystander exposure, thus re-emphasizing the potential for disease among customers and others not directly conducting brake repair, nor even having regular ongoing bystander exposure. This may be the first published report of mesothelioma in the spouse of a brake mechanic.

Two additional cases of mesothelioma from brake and clutch repair have been seen by Dr. Susan M. Daum (J.Z., 59-years-old and C.J., 37-years-old). Both had frequent brake dust exposure for over 20 years, one as a bystander (an automobile salesman) and the other as a mechanic. Dr. Daum personally obtained the occupational history from both and is satisfied that friction products constituted the only known source of asbestos exposure (Personal communication to Grace Ziem from Susan M. Daum, River Edge, New Jersey).

9

Company Knowledge

"I'll never forget, I turned to Mr. Brown, one of the Browns made this crack (that Unarco managers were a bunch of fools for notifying employees who had asbestosis), and I said, 'Mr. Brown, do you mean to tell me you would let them work until they dropped dead?' He said, 'Yes. We save a lot of money that way.' "

Testimony of Charles H. Roemer about the meeting of Unarco officials with Johns-Manville President Lewis Brown and his brother, Vandiver, in 1942 or 1943. (Deposition taken April 25, 1984, *Johns-Manville Corp. et al. v. the United States of America*, U.S. Claims Court Civ. No. 465-83C.)

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Much could be said to further acquaint readers unfamiliar with the U.S. judicial system for resolving civil claims. However, this section is focused on the utility of legal discovery as a tool for doing historical research on asbestos disease.

To encourage fair settlement of damage suits, the U.S. legal system allows each side to ask the other questions (Interrogatories) which must be answered in writing under oath. By means of Interrogatories, the plaintiff may verify that a defendant asbestos company manufactured certain products and sold them to the shipyard where the plaintiff worked, for example. The defendants, on the other hand, can fully inquire about the nature of the damages claimed, and about the plaintiff's medical and occupational history—did the man smoke cigarettes, did he work with other carcinogens, who is the treating doctor, and so on. Some questions will be directed toward legal matters: When did the manufacturer begin to put warning labels on his products; how long ago did the plaintiff learn he had asbestosis (i.e., does the statute of limitations prevent the case from being prosecuted)?

The Interrogatories are supplemented by the right of each side to take depositions and examine documents in the other side's possession. This also takes place in advance of the trial. The plaintiff wants to know when and how the manufacturers

became aware of the product dangers, and what was the subsequent conduct by each manufacturer. This "actual knowledge" is not ascertainable by merely reading the published literature that may have been *available* to the manufacturer. Reports *published* by the manufacturers and their employees cannot be relied upon as complete or valid statements of the firms' internal knowledge.

For the purpose of legal "discovery," as it is called, corporate employees and former employees can be deposed. The deposition is a scheduled questioning session where the person deposed is under oath and every word said is recorded. Statements made in a deposition may then be used in trial, if an out-of-court settlement or dismissal of the case does not intervene. The deponent might be a company executive, medical director, industrial hygienist, or a clerk who has been the custodian of records of interest (and can thus testify that the records are "authentic").

It is not usually difficult to find out who the principal people in the company were who had responsibility for plant and product safety. This can be gleaned from company answers to interrogatories, inquiries to "old timers" in the health and safety field, and sources like the historical publications of the Industrial Health Foundation (previous to 1971, Industrial Hygiene Foundation). The old IHF Transactions list members of numerous committees, and note the companies where these people were employed.

Under the discovery rules, defendants are required to produce the relevant corporate documents upon request. Other persons or institutions, such as research bodies that did contract work for the companies, may also be subjected to discovery proceedings. Concealment of vital evidence can result in the granting of a new trial (if the case was lost by the disadvantaged party) or, even more rarely, in disciplinary action against the offending lawyer by the state licensing authority or the court.

Documentation obtained from sources other than the asbestos companies and their employees is, for the most part, discussed elsewhere in the book. This chapter will attempt to at least note the possible knowledge specific companies had of such information and provide fuller discussion of documentation obtained in

discovery from the companies themselves. The role of company doctors will also be noted here.

(For reference to specific companies not included in sections in this chapter, the reader may find the Index helpful).

RAYBESTOS-MANHATTAN, INC.
(Renamed "Raymark" in 1982)

This company has been a leading manufacturer of asbestos friction products (brake linings, etc.) and textiles since the 1920s. It has more recently diversified into additional lines of business not involving asbestos.

In Answers to Interrogatories, this company has acknowledged paying compensation for disability from asbestosis to employees since the 1930s. The first employees compensated for "asbestosis-carcinoma" worked at the Manheim, Pennsylvania plant. One of these individuals was paid compensation in 1950 (R. Gelder) and another apparently was compensated before 1946 (K. Hilton, no date given). The company acknowledges paying compensation for mesothelioma to another worker at the same plant, in 1962 (H. Frey).

Raybestos-Manhattan produced what have become the best-known discovery documents in the history of asbestos litigation. These are known as the "Sumner Simpson Papers." Popularly dubbed the "Pentagon Papers of the Asbestos Industry" in news reports, this is the single most revealing cache of corporate documents found in these legal proceedings. The documents are the correspondence and file reports retained by Sumner Simpson, President of the company in the 1930s and 1940s. Many of these documents are discussed in Chapter 3 in greater detail, and the most important documents are letters exchanged with attorney Vandiver Brown of Johns-Manville Corporation.

A measure of the importance of these documents is the decision by South Carolina Circuit Judge James Price to grant a new trial in an asbestos damage suit won by the defendant companies. The after-discovered evidence, as it was called, would likely have led the jury to an opposite verdict—and on this basis a new trial was granted.

Judge Price characterized the documents as follows:

The correspondence very arguably shows a pattern of denial and disease and attempts at suppression of information which is highly probative.

The correspondence

reveals written evidence that Raybestos-Manhattan and Johns-Manville exercised an editorial prerogative over the publication of the first study of the asbestos industry which they sponsored in 1935.

(It) further reflects a conscious effort by the industry in the 1930s to downplay, or arguably suppress, the dissemination of information to employees and the public for fear of the promotion of lawsuits.

(Amended Order. *Barnett v. Owens-Corning Fiberglas Corp. et al.*, State of South Carolina, County of Greenville, Court of Common Pleas, Aug. 23, 1978).

Federal Judge Harold Ackerman of New Jersey has agreed to grant plaintiffs trial by jury in negligence, fraud, and conspiracy claims against Metropolitan Life Insurance Company (*Anna Billetz et al. v. Johns-Manville*, Civ. No. 80-2976). The judge found that the study as published by Lanza and co-workers was altered, "apparently in accordance with the asbestos industry's wishes." One of the "most glaring alterations" was the deletion from conclusion 4 of the sentence: "However, it is possible for uncomplicated asbestosis to result fatally."

There are thousands of pages of documentation, but the highlights only are given below:

1. Asbestos Magazine Letters

Sept. 25, 1935	Rossiter to Simpson
Oct. 1, 1935	Simpson to Brown
Oct. 3, 1935	Brown to Simpson
March 23, 1939	Rossiter to Simpson
Nov. 3, 1941	Brown to Simpson

These describe ongoing patterns of non-publication of articles on asbestosis in the trade magazine, *Asbestos*, at the direction of industry executives. (See "The Asbestos Magazine Letters," in Chapter 3, and Appendices 1-2).

2. Editing of the Metropolitan Life study (by Lanza and co-workers)—letters

Dec. 10, 1934	Brown to Lanza
Dec. 15, 1934	Hobart to Brown
Dec. 18, 1934	Brown to Judd
Dec. 21, 1934	Brown to Lanza
Dec. 24, 1934	Brown to Judd
Jan. 2, 1935	Judd to Brown

Key changes asked by Johns-Manville lawyers of Dr. Lanza, in consultation with Judd of R-M (See "Industry Editing of Medical Publications: Lanza's Surveys," Chapter 3).

3. Industry Sponsorship of Saranac Lab Research—letters.

Nov. 10, 1936 Simpson to Schluter—calls meeting of Schluter (Thermoid Rubber Co.), Blagden (Keasbey & Mattison Co.), Lamont (Asbestos Manufacturing Co.), Williams (Russell Manufacturing Co.), and Brown (Johns-Manville).

The idea of Mr. Brown and myself would have to have four to five (or even more if we could get them) Asbestos manufacturers take over this study by subscribing an equal amount per year, for three years, and then we could determine from time to time after the findings are made, whether we wish any publication or not. My own idea is that it would be a good idea to distribute the information among the medical fraternity, providing it is of the right type and would not injure our companies.

Nov. 20, 1936	Brown to Gardner
Nov. 23, 1936	Gardner to Brown

The asbestos companies authorized commencement of animal studies.

Brown:

It is our further understanding that the results obtained will be considered the property of those who are advancing the

required funds, who will determine, whether, to what extent, and in what manner they shall be made public. In the event it is deemed desirable that the results be made public, the manuscript of your study will be submitted to us for approval prior to publication.

Gardner agreed to those terms.

Feb. 27, 1937 Brown to Simpson

Lists contributors:

American Brake Block Corp.
Gatke Corp.
Union Asbestos and Rubber Co. (Unarco)
United States Gypsum Co.
Russell Manufacturing Co.
Asbestos Manufacturing Co.
Johns-Manville Corp.
Keasbey & Mattison Co.
Raybestos-Manhattan, Inc.
Thermoid Company
Southern Asbestos Co.

May 3, 1939 Brown to Simpson

May 4, 1939 Simpson to Brown

May 10, 1940 Brown to Simpson

Brown and Simpson expressed alarm that Dr. Gardner had published information on his research in violation of the 1936 funding agreement.

4. Chest X-rays at R-M Plants—letters

Oct. 30, 1936 Lanza to Mitchell
Oct. 31, 1936 Simpson to Jeffords
Nov. 5, 1936 Simpson to Jeffords

R-M President wrote to his general manager in Charleston, S.C. that the Public Health Service can take X-rays on conditions that they not be given to "shyster lawyers" etc. Lanza assured that Public Health Service records are confidential, lauded P.H.S. investigator Sayers.

5. Founding of Air Hygiene Foundation

Jan. 22, 1935	Brown to Judd
Jan. 15, 1935	Memorandum Re: Mellon Institute of Industrial Research Symposium on Dust Problems.
Dec. 4, 1935	Brown to Stover
Dec. 8, 1936	Stover to "Members Asbestos Industry"

Vandiver Brown represented the Asbestos, Cork, and Non-Metallic industries. He and six other representing industries with dust hazards advanced the idea of forming an industry center for research and consultation. This was passed on to Stover, publisher of *Asbestos*, who sent the word out industry-wide:

I have before me a list of the officers and trustees of the Air Hygiene Foundation, and it certainly is a cross-section of the very finest American industries, insurance companies, chemists, attorneys, and others interested in the prevention of silicosis and the protection of industries from unreasonable claims of workers.

6. Dr. Lynch's Criticisms of the Saranac Research

May 6, 1938	Lynch to Mitchell
May 17, 1938	Simpson to Mitchell
May 18, 1938	Brown to Simpson
May 19, 1938	Gardner to Simpson
May 23, 1938	Simpson to Gardner

Simpson was sent a letter from Dr. Kenneth Lynch concerning the work at Saranac and referred it to Brown. Brown said he thought Lynch was saying that no conclusions could yet be drawn from the Saranac tests. But Gardner responded defensively to Lynch's implication of the questionable value of his animal studies:

I am of course sorry that he feels that our experiments have no practical bearing on whether there is such a thing as asbestosis ... This is a matter of opinion ...

Simpson encouraged Gardner:

I want to say I am pinning my faith on you, and am quite positive it will not be very long before you con-

vince Dr. Lynch that your findings, whatever they be, are correct.

7. Northwest Magnesia Association letter

June 14, 1943	DeForest to Morgan
June 18, 1943	Rossiter to Simpson
June 29, 1943	Brown to Simpson

DeForest expressed concern about Washington state standards for workers using insulation to be protected against asbestosis. Also complained that asbestosis was a "foreign disease" and discussion of it could arouse hysteria among insulators. Letter passed on by *Asbestos* magazine to Simpson, and thence to Brown. Brown decided "to let Mr. DeForest learn the facts of life and asbestosis from the State of Washington Department of Labor and Industries."

8. Air Sampling for R-M and Other Members of the Asbestos Textile Institute

May 2, 1944 Cilley to Simpson

Provides record of dust counts in various processes. With a range of 1.7 to 9.9 MPPCF, three of the fourteen values were over 5 MPPCF.

June, 1947. *Report of Preliminary Dust Investigation for Asbestos Textile Institute*. By W.C. Hemeon, Industrial Hygiene Foundation.

Shows continuing occurrence of asbestosis industry-wide, with 20 percent prevalence of asbestosis in two of five plants where employees were regularly examined. Criticizes the 5 MPPCF guideline as requiring additional scrutiny and urges industry-wide investigations.

Raybestos-Manhattan was associated with the Industrial Hygiene Foundation from its start in the late 1930s, and hence received the *Industrial Hygiene Digest* containing abstracts of medical articles on asbestosis. The Sumner Simpson Papers indicate that Simpson was also aware even earlier of articles on asbestosis appearing in "British trade magazines," and he expressed his appreciation that this material was not being reprinted by *Asbestos* magazine in the United States (Oct. 1,

1935 letter to Brown). These letters show that Simpson was familiar with Public Health Service studies on asbestosis in the 1930s. The company was also a member of the Asbestos Textile Institute, whose minutes include reference to discussions about asbestosis and lung cancer starting in the 1940s. (See "Industry Trade Associations and Research Organizations," in Chapter 10).

More recent documentation has also been produced by this company in discovery:

Nov. 7, 1966.—M. Scowcroft (R-M) letter to R.L. Lebel (Bath Iron Works, purchasing agent). Referring to Lebel's concern over asbestos cloth, the writer arranges to have a sample of treated cloth sent in which "the fibers have been coated and brushed so that they will not tend to migrate." Scowcroft also says:

We feel that the recent unfavorable publicity over the use of asbestos fibers in many different kinds of industries has been a gross exaggeration of the problems. There is no data available to either prove or disprove the dangers of working closely with asbestos.

July 12, 1971.—Scowcroft letter to R.E. Wartham (Newport News Shipbuilding and Drydock Co.).

You will recall that we were the unsuccessful bidder on your inquiry ... because your Pipe Shop reported that our original samples exhibited a higher degree of fiber fall-out according to their test procedures.

Discusses efforts to provide free samples to the customer.

March 7, 1973	I. Weaver memorandum to J. Marsh
Jan. 29, 1974	G.W. Gibbs (McGill Univ.) letter to J. Marsh
March 1, 1974	J.H. Marsh memorandum to P.G. Dolan and four others
March 4, 1974	J.J. Magenheimer memorandum to J. Marsh
March 6, 1974	J. Hawkins memorandum to J. Marsh
June 17, 1974	J.J. Magenheimer memorandum to J. Trainor

July 15, 1974 J.J. Magenheimer memorandum to J. Marsh
July 24, 1974 J. Marsh memorandum to M.Q. Scowcroft

Discusses studies of asbestos exposures from wearing asbestos "safety clothing," conducted by Gibbs at McGill. Gibbs reported that men wearing asbestos garments at a plant were exposed to average concentrations of more than 5 f/cc and 15-minute peak concentrations above 10 f/cc, in violation of OSHA standards. Various modifications of the fabric were made and suggested, including surface treatment with an adhesive, without apparent success. The last memo by Marsh acknowledges that,

The McGill study confirms earlier British studies showing that in normal use asbestos safety garments can release concentrations of asbestos fibers in excess of permissible limits.

(Gibbs' findings were published the next year: "Fibre Release from Asbestos Garments," *Ann. Occup. Hyg.* 18:143-149, 1975)

May 5, 1975 J. Marsh memorandum to F.D. Bauce and 7 others
Nov. 24, 1976 J. Marsh memorandum to G. Ferrucci
Feb. 16, 1977 J. Marsh memorandum to M.Q. Scowcroft

The first of these memos from the chief of environmental affairs acknowledges the danger of "high dust levels" in brake repair and the need to assure that warnings reach the small shops. The second, marked "CONFIDENTIAL," notes that, "exposure to excessive levels (of asbestos) for a few months or even a few weeks can result in the appearance of disease many years later." This memo also stresses the importance of preventing workers from taking dust home on their clothes. The last memo advises against telling customers that asbestos products can be used safely. "(W)e cannot use the word safe simply because we do not know what a safe level of exposure is."

Nov. 24, 1976 J. Marsh memorandum to F.S. Daly
Mar. 31, 1978 J. Marsh memorandum to R.B. Sims

These refer to the hazard of surface dust on asbestos-containing friction materials, and the use of caution labels on packages of automatic transmission plates.

July 14, 1978. Plant Manager memorandum to "All RMFM Employees"

Refers to recent televised publicity about asbestos.

It is important for you to understand that workers in shipyards and on construction sites were exposed to extremely high dust concentrations. In most instances dust control equipment and respiratory protection were not provided and work was frequently carried on in confined spaces which greatly increased the risk. In contrast, in our manufacturing plants you are protected by extensive dust control systems, respiratory equipment, and medical surveillance programs.

Raymark Annual Report 1984.

Notes that the company had continuously purchased products liability insurance coverage since 1941, totaling \$395 million. As of December 31, 1984, \$360 million of this amount had still not been used. The company had won suits making its insurers liable for all defense costs until the limits of coverage are exhausted.

This company was also a party to the censorship of all references to cancer in the report of industry-sponsored asbestos research at Saranac, published by Vorwald in 1951 (See "Early Saranac Laboratory Cancer Tests with Asbestos" in Chapter 2). Raymark was forced into bankruptcy court in 1989, after trying to restructure to protect assets from liability in asbestos claims (See "Asbestos Litigation" in Chapter 11).

OWENS-ILLINOIS (O-I)

Animal testing of dust from the insulation product "Kaylo" was initiated at Saranac in 1945, following discussions which took place as commercial introduction of Kaylo was proceeding. Note: Items 1,2,4,5,7,9 and 10 were in the Kaylo file of the old Saranac Laboratory, retained at the Trudeau Institute, Saranac Lake, New York.

1. Feb. 12, 1943 U.E. Bowes (O-I Director of Research) letter to L.U. Gardner (Saranac Laboratory).

(The health hazard) should be considered from the standpoint of employees working in the plant where the material is made or where it may be sawed to desired dimensions, and also considered from the standpoint of applicators or erectors at the point of use.

2. Mar. 12, 1943 Gardner letter to U.E. Bowes.

The fact that you are starting with a mixture of quartz and asbestos would certainly suggest that you have all the ingredients for a first class hazard.

3. *Ninth Progress Report On Studies of Kaylo* to Owens Illinois Glass Co. from Arthur D. Little, Inc. (May 16, 1947); including letter of transmittal (p. 1) to U.E. Bowes, same date. From the Introduction:

Since from a merely sales point of view there may be a resistance towards the inclusion of an organic material in Kaylo, it is assumed that the use of paper pulp is contemplated as a substitute only when and if the amount of suitable asbestos grades available are insufficient. Accordingly, it was endeavored to develop formulae for the incorporation of paper pulp which will not necessitate any change of the present plant procedure, as well as the least possible change in slurry characteristics and batch formulation. It is believed that we have achieved this aim for Kraft pulp as a substitution material, even though we are fully aware of the fact that the final test will reside in pilot plant tests. (p. 3)

4. Nov. 16, 1948. A.J. Vorwald (Saranac) letter to U.E. Bowes on animal (guinea pig) inhalation tests of Kaylo dust.

In all animals sacrificed after more than 30 months of exposure to Kaylo dust unmistakable evidence of asbestosis has developed, showing that Kaylo on inhalation is capable of producing asbestosis and must be regarded as a potentially-hazardous material.

The letter ends,

I realize that our findings regarding Kaylo are less favorable than anticipated. However, since Kaylo is capable of producing asbestosis, it is better to discover it now in animals rather than later in industrial workers. Thus the company, being forewarned, will be in a better position to institute adequate control measures for safeguarding exposed employees and protecting its own interests.

5. Attached to the Nov. 16, 1948 letter was a report, *Interim Report Regarding the Biological Activity of Kaylo Dust* to the Owens-Illinois Glass Company, Toledo, Ohio by A.J. Vorwald, Saranac Laboratory (Oct. 30, 1948).

From the Introduction:

...Kaylo is capable, on prolonged inhalation, of producing asbestosis in the lungs of guinea pigs (and) it should be handled industrially as a hazardous dust.

The experimental conditions:

The animals were exposed to atmospheric suspensions of Kaylo dust for eight hours daily, five and one half days a week throughout the experiment. The dust concentration, which varied somewhat from time to time, has averaged 116 million particles per cubic foot of air over the entire course of the experiment to date.

Results:

(All) nine animals sacrificed subsequent to thirty months in the present experiment ... have developed true fibrosis of a type characteristic of the response of guinea pigs to asbestos.

While the lesions up to 30 months showed no fibrosis, certain aspects of them were compatible with a preliminary stage in the development of asbestosis. These aspects were masked by the inert type of reaction to the materials other than asbestos in the dust.

Conclusions:

Kaylo, because of its content of an appreciable amount of fibrous chrysotile, is capable of producing asbestosis and

should be handled as a hazardous industrial dust.

This report also noted that "very small numbers of fibers are capable of producing asbestosis" (See "The American Conference of Governmental Industrial Hygienists TLVs," in Chapter 4).

Over the next few years, subsequent studies on Kaylo were reported to Owens-Illinois, and the above results were repeatedly referred to in overall summations of the work by Saranac.

6. "New Thermal Insulating Material Combines Light Weight and High Strength." *Materials and Methods* 29:63 (April, 1949).

"New materials preview" showing a man wearing a respirator using a power saw to cut a block of Kaylo insulation. (Not an advertisement.)

7. Dec. 12, 1950. Willis G. Hazard (industrial hygienist, Owens-Illinois) letter to A.J. Vorwald.

Some time ago we mentioned to you that our Kaylo Division wants to gather together in brochure form material on the health aspects of Kaylo dust, and wants to consider the possibility of publishing some of your experimental findings.

8. Dec. 9, 1952. C.W. Howard, intra-company correspondence to George White (O-I).

Attaches draft of proposed pamphlet "on the health aspect of Kaylo," acknowledges the assistance of Mr. Hazard and Dr. Shook as well as "people in Sales." Describing the Saranac experiments, the proposed pamphlet says:

(T)here is no danger of developing Asbestosis with normal handling of Kaylo products. Test showed that continued exposure to concentrated Kaylo dust inhaled over a long period of time was capable of producing in animals increased tissue growth typical of Asbestosis. The reaction was milder than what pure asbestos dust would produce.

General Conclusions:

Experience in the factories and field and research findings have proven that normal handling of Kaylo products is safe

from a health standpoint. The usual precautionary measures taken for any product containing asbestos are needed in a continued exposure to heavily concentrated Kaylo dust.

No brochure about Kaylo's health hazards was ever issued by O-I.

Author's Comment (BC):

It is very significant that Dr. Vorwald's guinea pig experiments were not construed *by him* as showing that any level of exposure to Kaylo dust was safe for *humans*. Exposure at only one test concentration doesn't even provide dose-response information for the guinea pigs; i.e., perhaps an adverse reaction would have occurred at half the dose tested or less, but there is no way of knowing from the results of experiments at one dose level. Equally important is the impossibility of quantitatively extrapolating from guinea pigs to humans, given the possibility that humans could be the more susceptible species to the adverse effects of a given concentration of asbestos in air.

9. *Report, Kaylo Division Plant Owens-Illinois Glass Co. Sayreville, New Jersey by Saranac Laboratory (May 29, 1951).*

Total dust counts in various areas of the plant where Kaylo was produced ranged from 2.2 to 8.3 MPPCF—with a high percentage of asbestos and free silica (most samples had an asbestos content in the 10-50% range).

Although the dust counts of the seven impinger samples were all below 10 million, and therefore relatively low, the rather high quartz or asbestos content of the air-suspended material tended to create in certain areas a condition which might be hazardous, or at least one which approached the maximum allowable limit established by code ... Also, the concentration of asbestos dust inside the boxcars probably exceeded safe limits. (estimated concentration of airborne dust in boxcars being loaded with Kaylo material: 50 MPPCF)

Respirators were recommended for workers loading boxcars. Vorwald advised against reliance on compliance with government and industry standards as complete protection against the threat

of occupational disease (See also "The American Conference of Governmental Industrial Hygienists TLVs," in Chapter 4).

10. Feb. 7, 1952 A.J. Vorwald letter to W.G. Hazard

Encloses final report (Jan. 30, 1952) on *The Capacity of Inhaled Kaylo Dust to Injure the Lung*. Four copies enclosed, and a note that another had gone to Dr. Shook (the Corporate Medical Director of O-I).

... Kaylo dust is capable of producing a peri-bronchiolar fibrosis typical of asbestosis. The dust also has a slightly unfavorable influence upon a tuberculous infection. Although extrapolation from animal to human experience is difficult, nevertheless the results of the study indicate that every precaution should be taken to protect workers against inhaling the dust.

Vorwald expressed desire to publish the findings, first sending the final manuscript to O-I.

Reference will be made only to hydrous calcium silicate and not to 'Kaylo'; thus the interest of your company will be safeguarded.

The enclosed final report observed (p. 2):

(S)ince experiments with animals have shown that both amosite and chrysotile are causing asbestosis, it is unlikely that the substitution of one mineral for the other in Kaylo would cause a significant change in the toxic properties of the final product.

11. E.C. Schuman. "Hydrous Calcium Silicate Heat Insulation." *Petroleum Eng.* C-55 to C-62 (April, 1952). Schuman was Director of Research at O-I. The article generally promoted Kaylo for use in refineries and similar plant applications.

The story of how this company researched and developed the non-glass insulating material... is an inspiring example of the American Way. Without the vision, resources, and technical know-how of 'big business,' this material would not be on the market today.

Photograph shows insulator sawing a length of molded pipe insulation using a shipping carton as a bench. There is dust on the carton and floor, and the man wears no respirator. The carton reads: Handle With Care. The article comments:

Applicators appreciate the fact that hydrous calcium silicate is non-toxic and 'easy on the hands.'

An advertisement in the same magazine also described Kaylo as "non-toxic." Patrick Heffernan, in a letter to the *British Medical Journal* (Toxicity of Asbestos, June 18, 1960), pointed out that the Greek words from which terms like "toxic" are derived refer to bows and arrows, and are "singularly apt" for asbestos.

12. Deposition of Everett C. Shuman, State College, Pennsylvania, in the *Gilmore* case, Aug. 19, 1980. (attorney for the plaintiff: Conard Metcalf of Boulder, Colorado.)

Mr. Shuman had only recently seen copies of reports to his company from the Saranac Laboratory on the adverse effects of inhaled Kaylo dust. However, he had been told something about the tests by Mr. Hazard in 1952 or 1953. He worked at the company's Berlin, N.J. plant in research and development of calcium silicate thermal insulation, during which time (1944-1949) he was not told of any health hazard from inhaled asbestos.

Owens-Illinois got all of its asbestos from Johns-Manville and had concerns about long-term availability of asbestos raw material.

Explaining his use of the expression, "non-toxic," in the 1952 *Petroleum Engineer* article, Shuman said:

(T)he word toxic as I was brought up in chemistry was poison and there was no known poisons in the lime and silicate and the silica had reacted so that they were a calcium silicate, not either a lime or silica. So there was no known poison substances in the material.

The Berlin, N.J. plant was insulated with Kaylo, and workers applying it in "closed areas" were provided with respirators. Kaylo contained 18 percent (chrysotile and amosite) asbestos.

13. May, 1952. Seventh Saranac Symposium (unpublished). This was attended by Willis Hazard of Owens-Illinois. There was considerable discussion of asbestosis and cancer at this confer-

ence. (See also "The Seventh Saranac Symposium," in Chapter 2; "Archives and Collected Papers of Scientific Researchers," in Chapter 10.)

14. Oct. 5, 1955 W.G. Hazard to M.M. Olander and Dr. C. F. Shook (Owens-Illinois).

Dr. Vorwald's successor at Saranac, Dr. Schepers, had just published the Kaylo findings without first showing the report to Owens-Illinois officials ("Effect of Inhaled Commercial Hydrous Calcium Silicate Dust on Animal Tissues." *Arch. Indust. Health* 12:348-360, 1955). The article was written in highly technical language and did not identify the substance tested as a common thermal insulation product.

We had felt (publication of the research) would be the proper procedure for the long run, even though the experiments did *not* show Kaylo to be lily-white. They showed, to be specific, that Kaylo dust could cause asbestosis, an incurable lung condition; and they showed the dust could reactivate tuberculosis ...

Hazard commented that Kaylo was not more hazardous than universally used heat insulation, and noted:

The names 'Kaylo' and 'Owens-Illinois' appear nowhere in the article. It's completely anonymous.

Hazard said he was glad to see this research reported in the open literature and was ordering 50 reprints.

15. F.W. Sehl and J.M. Robinson, "Special Hazards Survey/Dust Survey," Apr. 28 and May 2, 1958, prepared for Owens-Illinois Kaylo Division, by Aetna Life Affiliated Companies.

Impinger dust counts in the Berlin, N.J. plant ranged from 4.0 to 91.8 MPPCF, with all but one of the 12 samples over 5 MPPCF, half the values exceeding 10 MPPCF. The authors considered 10 MPPCF the maximum acceptable concentration of dust. Recommendations were given to bring the respirator program "up to Owens-Illinois' standards" and bring about the other industrial hygiene improvements.

On May 1, 1958, Owens-Illinois sold substantially all assets of the Kaylo Division to Owens-Corning Fiberglas Corp. Owens-

Corning had been the primary purchaser of Kaylo since 1953. Documentation of Kaylo testing at Saranac was also provided to Owens-Corning. Owens-Illinois Vice President F.W. Sherwood and attorney A.C. Hirth were instrumental in organizing the Industrial Hygiene Foundation (See "Rising Tide of Compensation in the 1930s," in Chapter 3.). Hirth served on the I.H.F. Board of Trustees at least until 1957. OCF President Harold Boeschstein, who received a memorandum referring to asbestosis in 1942, was then also on the Board of Directors of O-I, which owned half of OCF. O-I's public relations director from 1954-1958 was Edward C. Ames, who had learned about asbestos hazards in a similar job at OCF (See "Owens-Corning Fiberglas Corp.," this chapter). O-I's industrial hygiene library contained numerous writings on asbestos, in the *Journal of Industrial Hygiene and Toxicology* (1928-1949), *Archives of Industrial Hygiene and Occupational Medicine* (1950-1954), *Archives of Industrial Health* (1955-1958), *British Journal of Industrial Medicine* (1949-1958), *Industrial Medicine and Surgery* (1949-1958), and Merewether's 1956 text, *Industrial Medicine and Hygiene*.

ARMSTRONG CORK

(now Armstrong World Industries)

Armstrong was in the insulation contracting business and manufactured asbestos-containing insulation products starting in the first decade of this century. Starting in about 1939, Armstrong also sold and installed many asbestos-containing insulation products made by other companies. There were numerous contract unit workers' compensation claims for occupational asbestosis and cancer against Armstrong and other companies. The main list of such claims against firms manufacturing asbestos insulation products was produced by Armstrong in legal discovery (See "Claims by Insulators Against Contracting Divisions of Asbestos Product Manufacturers," in Chapter 3.).

Armstrong also used asbestos in making vinyl flooring. An internal memorandum (C.W. Sanderson to J.H. Morrison, "Silicosis Cases," Mar. 31, 1948) acknowledged that, "There are

ten known cases of silicosis or asbestosis among employees actively employed in the Floor Plant as of today." The writer recommended payment of partial disability, citing moral though not legal responsibility on the company's part. "The company was negligent, in our opinion, in permitting such exposure."

The next year, a memorandum, "Men with abnormal chest findings," included two with asbestosis and possibly others among those with more ambiguously stated diagnoses (April 29, 1949, no author, Armstrong Cork General Offices, Lancaster, PA).

At OSHA hearings on March 14, 1972, Armstrong Vice President Louis Bibri stated that the company had conducted periodic chest X-rays over the preceding 25 years at the firm's manufacturing facilities, for an average of 770 employees. Despite his precision regarding the number of workers, Bibri erroneously reported,

Neither these X-rays nor any other examination or notification to the company indicates that there has been or presently exists any case of asbestosis among our employees.

Bibri went on to protest OSHA's proposed warning labels for products including vinyl asbestos flooring. In the event that OSHA chose to require warning labels, Bibri proposed this language:

Caution to Installer: If subfloor preparation requires machine sanding of previously installed floor tile or an asbestos-type sheet backing, do not breathe the resulting dust.

Mesothelioma from floor tile sanding had been reported the year before (Murphy, R.L. *et al.*, "Floor Tile Installation as a Source of Asbestos Exposure," *Am. Rev. Resp. Dis.* 104: 576-580 1971).

FIBREBOARD CORPORATION

(formerly Paraffine Companies, Pabco Products,
Fibreboard Paper Products Corporation, and Plant Rubber & Asbestos)

This company obtained the entire capital stock of Plant Rubber and Asbestos Works in 1928. In addition to manufacturing asbestos insulation products (and gaskets, packings, shingles, and other products), the company was in the insulation contracting business. Compensation claims for asbestosis were filed against Fibreboard by the following individuals employed by the company as insulators (or their survivors):

H. Kish	1953
J. Cuthbertson	1954
J.W. Riley	1957
E. McCarrell	1959
L. Streithorst	1960
S. Gilivich	1961
J. Wyss	1962
E. Meyer	1962
A. Miller	1962
P. Greischar	1962
E. Novak	1963
R. Goans	1963
J. Faulkner	1963

All these claims were filed with offices of the California Industrial Accident Commission (See "Claims by Insulators Against Contracting Divisions of Asbestos Product Manufacturers," in Chapter 3). Mr. Meyer was diagnosed with asbestosis and lung cancer, and his physician filed a report listing many medical papers on cancer from asbestos (L. Lewis, Apr. 23, 1963, IAC Claim No. SF-199-141).

Another claim for compensation for asbestosis was filed against Fibreboard by John Peretti, a foreman at the insulation manufacturing plant in Emeryville, California, in 1961. Compensation for partial disability was awarded in 1962.

Former Emeryville plant manager Edmond Torbohn has testified that he never relied upon Threshold Limit Values to

determine whether asbestos dust conditions were safe or unsafe. He never heard of the "Fleisher-Drinker report" published in 1946, until it came up in litigation decades later. Fibreboard did not test products for harmfulness before 1966, he said (deposition in *Dartez v. Owens-Illinois et al.*, U.S. Dist. Court, E. Dist. of Texas, Beaumont Div., C.A. No. B-81-227, Feb. 6, 1989).

Pabco Products was a member of the Magnesia Insulation Manufacturers Association in the 1950s, and Fibreboard was a member of the National Insulation Manufacturers Association in the 1960s.

OWENS-CORNING FIBERGLAS CORPORATION (OCF)

OCF was organized in 1938 and initially manufactured fiber-glass ("Fiberglas") insulation, a competitor of asbestos-containing insulation materials. OCF used asbestos and fiber-glass to make insulating cement from 1940-1951. OCF made a number of other products with asbestos, including coating for acoustical tile (in the 1960s) and roofing cements. In the mid-1950s, OCF was a major customer for "Kaylo," an asbestos-containing insulation made by Owens-Illinois. In 1958, OCF bought the Kaylo business outright and continued to use asbestos in Kaylo until 1972. OCF was also active in the insulation contracting business. The following material consists of internal communications produced by OCF in discovery and contract unit workers' compensation claims (filed by insulation workers).

Internal Communications, Etc.

Jan. 20, 1941. Legal and Patent Dept. letter to L.U. Gardner (Saranac Lab).

It is indeed good news to hear that you do not feel you will encounter any evidence of an asbestos-like reaction since none of the (glass) fiber reaches the interior of the lungs.

May 23, 1941. "Trip Report." (memorandum to Harold Boeschstein, who later became President of OCF).

Describes meeting of OCF representatives with Mr. Bartley, a union attorney and consultant, who was interested in the health

effects of fiber-glass, particularly respiratory dangers. Mentions a meeting with union representatives in which the low workers' compensation insurance rate for fiber-glass manufacturers was contrasted with the rates for asbestos manufacturers, magnesia manufacturers, etc. At the meeting with Asbestos Workers Union (union of insulation installers) representatives, OCF officials read from Gardner's report on fiber-glass ("These findings may allay any skepticism as to the theoretical hazard involved from the handling of a glass wool ... "). This memorandum also discusses meetings at American Industrial Hygiene Association and interest expressed by the National Safety Council in fiber-glass safety.

June 16, 1941. E.C. Ames memorandum to H. Boeschstein, "Investigation of Health Aspects of Fiberglas by Dr. W.J. Siebert."

Discusses research and writing by Dr. Siebert in St. Louis, a pathologist considered reliable by the Asbestos Workers Union. Dr. Siebert questioned Gardner's implication that there was no health hazard because the glass fibers were too large to get into the lungs, and wanted to see Gardner's slides.

1941. OCF brochure featuring a letter from J. Hill (Aetna) saying workers' compensation insurance for fiber-glass was cheaper than coverage for asbestos, etc. (Industrial Health Foundation files)

Sept. 8, 1941. OCF legal and patent department letter ordering government reprints of the asbestos industrial hygiene reports of Page and Bloomfield, Lanza *et al.* from *Public Health Reports*.

Jan. 7, 1942. Ed Ames memorandum to Harold Boeschstein, President of OCF.

Jan. 7, 1942. Ed Ames memorandum to E.J. Marshall.

These describe a plan to "take the offensive" in 1942, by going to the Asbestos Workers Union with documentation on asbestosis. To further make fiber-glass an attractive alternative to asbestos, OCF considered offering the assurance that product safety was, in effect, "certified," by low-cost product liability coverage purchased by OCF from the insurer, Aetna (See "The Owens-Corning Fiber-glass Itch Documents" in Chapter 3).

Mar. 13, 1943. L.U. Gardner letter to E.C. Ames.

Reports on examination of pre-employment chest X-rays, notes that R. Smock "shows a reaction strongly suggestive of asbestosis," urges rejection for employment at OCF.

Dec. 27, 1943. Ed Ames memorandum to C.E. Gregory. "Public Relations Angles in Branch and Division Post War Survey."

In formulating our policy on admixtures with asbestos, we should keep on the alert because otherwise *we will run the risk of smearing Fiberglas with the hazards of exposure to asbestos.*" (original emphasis)

Talks about premium rates charged by insulators to handle fiberglass, discusses "the itch" as a marketing obstacle.

Nov. 21, 1944. Dr. A.E. Canfield letter to Ed Ames

Nov. 22, 1944 Ed Ames letter to Dr. Canfield.

Undated letter from Dr. Canfield to Ed Ames

Jan. 21, 1946. Don Hanna letter to Medical Department (copy from OCF files).

Discusses asbestosis in insulation worker Albert Baumgardner. After a claim was filed, Ohio state officials attributed the man's dust hazard to asbestos, with exposures in the "range of from 5 to 10 M."

Aug. 29, 1945. Ed Ames memo to J.A. McKay. "Todd Ship Yard Erie Basin." Says in part:

The asbestos fiber is the only silicate that has been determined by lung pathologists to involve a lung hazard ... The asbestos fibers of certain particle size and in certain concentrations can penetrate into the respiratory passages and cause havoc when they reach the alveoli of the lungs where they set up a chemical reaction with body fluids, similar to that found in silicotics.

April 7, 1947. A.R. Morrison (OCF Laboratories, Newark, OH). Memorandum for the Record. "Dust Counts".

Reports on dust counts in OCF Insulation Cement Dept. taken for the purpose of determining the "extent of an asbestos dust hazard." Total dust counts were made and reduced to account for

average asbestos fractions, with the result that the "asbestos concentrations" calculated were 7 to 12 MPPCF (first floor) and 12 to 25 MPPCF (2d floor). This was contrasted by the OCF laboratory author with the 5 MPPCF limit for asbestos set by the Ohio Dept. of Health. Possible control options listed were substitution of asbestos, installation of exhaust ventilation, and continual use of respirators by the workers.

Dec. 6, 1955. T.S. Rogers memorandum to H. Boeschstein. "New Health Hazard Research Fine Fibered Fiberglass Products."

Describes Schepers' report of old Saranac studies ("An Experimental Study of the Effects of Glass Wool on Animal Lungs." *Arch. Indust. Health* 12:276-279, 1955) commenting on adverse effects of small-diameter fibrous glass. Memo warns of potential resulting liability and advises that \$15,000 is available for a "defensive" research contract.

Feb. 6, 1956. G.W.H. Schepers (Saranac Laboratory) letter to M. Burch (OCF Director of Personnel and Industrial Relations).

Feb. 8, 1956. John D. Black memorandum to Dr. Charles Bishop.

Schepers urges OCF to sponsor research to see if fiber-glass is carcinogenic. Asbestos "fairly well incriminated as a carcinogen." Attorney Black disappointed that the requested letter was "certainly nothing that we could show customers or a union."

July 27, 1956. G.W.H. Schepers (Saranac Laboratory) letter to M. Burch (OCF Director of Personnel and Industrial Relations). Informs OCF that fiber-glass does not produce fibrosis of the lungs as asbestos does.

Oct. 11, 1956. W.L. Bowes memorandum to John Black (OCF). "Asbestos Workers Union."

Oct. 16, 1956. J.D. Black memorandum to W.L. Bowes. "Asbestos Workers Union."

Nov. 20, 1956. Ira I. Brought (consultant) letter to M.D. Burch (OCF).

These documents discuss union concerns about occupational lung disease hazards, and OCF officials' fears that fibrous glass may be implicated as a cause.

May 9, 1957. Brought letter to H. Boeschstein (President of OCF).

Quotes minutes of western states conference of the Asbestos Workers Union, mailed out to thousands of union members. The minutes announced that due to the recognition that "a large number of men" in the trade had definite symptoms and concern that a number of deaths in one local might be job-related, the international union was "compiling facts and figures on this matter." The diseases asbestosis and silicosis were named and lung ailments were blamed on "fibrous materials."

May 23, 1957. K.S. Johnson (OCF) memorandum to M.D. Burch (OCF). "Asbestosis."

Refers to notice in *Asbestos Worker* that a motion carried at the union's western states conference to "investigate the causes of Asbestosis and allied lung ailments caused by fibrous materials ... " Expresses concern that the union may again ask a premium to handle Fiberglas. "I am sure that everyone in our company is conscious of the interest of the Asbestos Workers in the problems of Asbestosis and allied diseases."

1960-1963. Union-Management Committee meetings, monthly, Berlin, N.J. plant.

Frequent and repeated mention is made of excessive dust from mechanical saws in the plant making Kaylo insulation. Almost every month, the union complained about the dust, and various control options were discussed.

May 11, 1961. B. Roy (Aetna). Special Hazards Survey, Owens-Corning Fiberglas, Berlin, NJ.

Reports that the TLV for "mineral dusts containing asbestos" of 5 MPPCF was not exceeded on a daily average basis, although exposures in some non-continuous operations were 8.4 and 11.2 MPPCF.

Sept. 17, 1963. William A. Lots (OCF, Newark Product Devel. Lab) memorandum to A.J. Pearson, "Health Hazard Kaylo vs. GPL-400."

Acknowledges that asbestos in Kaylo "when breathed into the lungs causes asbestosis which often leads to lung cancer." Notes that "all insulations are dusty and insulators seldom complain except when the dust is particularly irritating to them."

April 13, 1964. Dr. Robert Kehoe (University of Cincinnati, consultant to OCF) letter to F.H. Edwards. From Kehoe Archives, Univ. of Cincinnati.

Reports that Kehoe was too late in contacting the editor of the *Journal of the American Medical Association* to see what the article by Selikoff, Hammond, and Churg said about fibrous glass hazards. Kehoe concluded that the just-published paper dealt solely with asbestos, however.

No reference is made directly or indirectly to fibrous glass or to "Fiberglas," and so far as I can see the evidence presented and its interpretation is not biased or unreasonable.

August 12, 1964. F.H. Edwards memorandum to C.G. Staelin. "Labeling of Asbestos-Containing Products by Johns-Manville Company."

This acknowledges advance notice from Dr. K.W. Smith at Johns-Manville that his company had decided to begin using warning labels on shipping cartons of thermal insulation products containing asbestos.

The question before us is whether or not Fiberglas' Kaylo should protect itself against more stringent and punitive health laws and the possibility of third party actions by following the J-M lead.

Nov. 29, 1965. F.H. Edwards one-page memorandum and 4-page report to J.M. Briley.

Report assembles information on Dr. Selikoff's background. Included are such details as: the statement from the Asbestos Workers' Union President that Selikoff conducted the study published in 1964 without compensation, as a humanitarian project; and reference to Selikoff as an "immigrant" (he was really from New York but received his medical training in Scotland) who "was not approved to practice medicine in the United States after his first application."

The cover memo explains:

Our present concern is to find some way of preventing Dr. Selikoff from creating problems and affecting sales. A direct approach might be more damaging than helpful, and I am

only suggesting that we explore, at this time, all avenues open to us.

This cover memo goes on to mention going to Mt. Sinai Hospital officials about Selikoff.

Aug. 8, 1966. F.H. Edwards memorandum to J.M. Briley. "Kaylo Dust—Bath Iron Works."

After noting that Kaylo is 12-18% asbestos, he says:

Asbestos is recognized as a health hazard causing asbestosis. The threshold limit value set by ACGIH is 5 million particles per cubic foot. However, Dr. Selikoff has stated that only one fiber in the body can cause cancer ... At this point, I believe there is reason to question the ACGIH threshold limit... Again, I suggest that we consider the labeling of our Kaylo products in the same general way that J-M labels their Thermobestos ...

June 21, 1967. R.F. Shannon memorandum to J.H. Thomas. "Kaylo—Replacement of Asbestos."

Asbestos replacement program in "low gear" and expresses hope that it will receive increased emphasis later in the year.

Oct. 16, 1967. R.F. Shannon memorandum to F.W. Swank. "1968 Projects."

The program directed toward the replacement of asbestos will be accelerated in 1968. The program at the moment does not offer any direct sales growth potential and/or manufacturing cost savings, but must be carried out so that in the event the health hazard aspect of asbestos fibers becomes a major national and/or political hot potato, OCF will have an alternate fiber to switch to so as to stay in business.

Oct. 23, 1967. R.F. Shannon memorandum to J.H. Thomas. "Kaylo Product Development."

To the best of our knowledge, the only asbestos free (high-temperature insulation) product on the market in recent years was OCF's Multitemp. Do we attempt to improve Multitemp? My answer would be no. The Multitemp concept of post impregnating a prebonded product was ill conceived. It does not lend itself to adequate profit margins.

Feb. 9, 1968. Dr. J.L. Konzen memo to Robert L. Logan (OCF Corporate Legal Dept.)

Refers to interrogatories sent to Dr. Selikoff in the lawsuit brought by Claude Tomplait in Texas. After noting that Tomplait had been an insulation installer for 25 years, Konzen confronted the implication that "asbestosis was a well-known entity to industrial medical practice over the entire period that Mr. Tomplait handled asbestos insulation." He concluded, "the condition was well known and well documented in the literature during the entire time that Mr. Tomplait used the insulation." No distinction was made between asbestosis from product use and product manufacture by the OCF Corporate Medical Director.

Apr. 10, 1968. W.C. Taylor memorandum to M. Hardwick. "Crocidolite Asbestos."

Notes the use of crocidolite in Kaylo on rare occasions either because it was accidentally included in an amosite shipment or purchased at a good price. Passes on request from Dr. Konzen that crocidolite not be used because of its prominence as a cancer causing agent.

Apr. 30, 1968. R. F. Shannon memorandum to W.R. Hibbard, Jr. "Corporate Planning."

Reports that program to replace asbestos in calcium silicate insulation "is temporarily on the shelf" due to shortage of manpower.

Asbestos, the current reinforcing fiber for calcium silicates, is reported to cause cancer. Because of adverse publicity, possible court actions, and for the protection of our position in the calcium silicate market, it is necessary for OCF to eventually remove asbestos fibers from Kaylo.

Aug. 16, 1968. John Vyverberg memorandum to R.S. Grant. "Berlin—Dust Conditions."

Apprehensive that Dr. Selikoff might get involved and publicize plant neighbors' complaint to N.J. state health officials about asbestos air pollution.

To date we have been relatively successful in confining the problem to *applicators* of products containing asbestos. (original emphasis)

Mar. 10, 1969. Dr. J.L. Konzen memorandum to J.M. Briley. "Medical Services Department—Status Report."

In discussing Threshold Limit Values, Konzen says that Paul Gross, on the TLV Committee, "is representing the interest of the fibrous glass manufacturers in an attempt to get the current limit raised to that of an inert dust."

May 9, 1969. R.F. Shannon memorandum to A.J. Pearson. "Multi Temp."

Multi Temp is completely free of asbestos...it is our hope and plans to have an asbestos-free calcium silicate (Kaylo) product on the market in about a year...

When Multi Temp was dropped several years ago, two reasons were given. One was the refusal on the part of our distributor to inventory and handle two lines of high temperature insulations for the same market; the second was the relatively low gross margins being achieved as well as projected for Multi Temp pipe insulation. Recent discussions with Marketing indicate the real reason for dropping Multi Temp was low gross margins.

OFC has acknowledged that GPL-400, or Multi Temp, was marketed for one year in the 1960s.

May 29, 1969. D. Bradshaw memorandum to L. W. Saxby. "Asbestos-Free Insulation."

It appears that it should be possible to go to non-asbestos insulation systems at about present costs ... 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.

Oct. 30, 1969. E.B. Engel (Aetna). Special Hazards Survey, Owens-Corning Fiberglas, Berlin, NJ.

Notes that 8 of 12 samples taken exceed the current TLV (5 MPPCF of total dust, "regardless of the amount of asbestos present") and all 12 exceeded the proposed TLV (2 MPPCF).

Control of asbestosis hazard possible through asbestos replacement or environmental controls.

Aug. 13, 1970. G.D. Clayton (Clayton & Associates) letter to Dr. Jon Konzen (OCF Medical Director). And attached report.

Reports excessive exposure to asbestos fiber and isocyanate vapor at OCF's Bloomington, IL plant, recently purchased from Unarco. ACGIH and British standards were described as based on data that was "not ideal." Construction of an entirely new plant was recommended, and asbestos exposures were described as "unbelievably bad."

September 21, 1970. J.P. Kern memorandum to Dr. John Konzen. "Asbestos-Labeling."

Reference is made to your memo of September 15 regarding the warning label that should appear on Kaylo. Are you saying that *we have* to do this now? I naturally would like to delay this requirement as long as possible. Please advise. (original emphasis—entire text of memorandum).

September 25, 1970. J.L. Konzen reply to J.P. Kern. "Asbestos-Labeling."

From a health standpoint I feel that we should label the product at this time. By copy of this letter I suggest Mr. Logan comment concerning the legal need for such a label. (entire text).

It appears that identical warning labels were put on packages of all OCF thermal insulation products in 1970, acknowledging explicitly that the dust could be harmful.

Oct. 28, 1971. R.F. Shannon memorandum to G.T. Faherty. "Wood Fibers—Calsi-crete."

"D" Day is upon us. Two of our competitors have introduced asbestos-free calcium silicates. So far, we have determined the reinforcement in the GAF (Ruberoid) product to be fibrous wood.

Oct. 1, 1973. Jim Summer memorandum, "Kaylo Asbestos Containing Inventory."

Announces reduced-price offering of remaining inventory (over 2000 cartons) of asbestos-containing Kaylo products, itemized on attached 5-page listing.

Workers' Compensation Claims Brought by Insulation Workers Against OCF and its Subsidiary Contracting Divisions. OCF was joined as a defendant in claims filed by Fred Strickland (1957), James Whitcomb Riley (1958), E.O. McCarrell (1959), Harvey Curtis (1959), Clifford Harding (1961), John Gronenthal (1961), John Wyss (1962), John Staples (1962), Paul Greischar (1963), and Robert Goans (1963) (See also "Claims by Insulators Against Contracting Divisions of Asbestos Product Manufacturers," in Chapter 3).

In addition to these claims, OCF and Johns-Manville were defendants in a claim brought by insulator Dean Templeton. The claim was filed with the Michigan Workmen's Compensation Department in 1960, and a settlement was approved in 1961 (produced in discovery by R.B. Von Wald, Corporate Counsel of Johns-Manville Sales Corp., in 1982).

In 1990, OCF acknowledged that it had records of hitherto undiscovered compensation claims by contract insulation workers alleging injury from asbestos. Those predating 1964 were:

Paul Gratishire	1962	Oakland, CA
Burton Kramer	1960	Washington (state)
Leroy C. Winters	1959	Albuquerque, NM

Another 20 such claims were filed by OCF employees in the years 1966-1970 (Amended Answers to Interrogatories, U.S. Dist. Court, Dist. S.C., Columbia Div., Mar. 13, 1990).

OCF was also named as a defendant in 1961 in the product liability suit brought against insulation manufacturers by G. Faciane (See "Lawsuits by Product Users Against Asbestos Manufacturers," in Chapter 3).

Joint advertisements by OCF and O-I in October, 1956, continued to describe Kaylo insulation as "non-toxic," in the manner previously introduced by O-I (See "Owens-Illinois," this chapter).

OCF was a member of the National Insulation Manufacturers Association, and OCF businessman John Vyverberg coauthored the 1968 NIMA brochures with Clifford Sheckler of Johns-Manville (testimony of Dr. Jon Konzen in *Hicks v. OCF* Bloomington, IL, Nov. 1, 1995. See also "Industry Trade Associations and Research Organizations" in Chapter 10).

UNARCO

(formerly Union Asbestos & Rubber Company;
since 1980, UNR Industries)

This company made "Unibestos" insulation initially at a plant in Cicero, Illinois in 1926. Another Unibestos manufacturing plant was opened in Paterson, New Jersey, in 1941; this was moved to Tyler, Texas in 1954. Unarco also operated a Unibestos manufacturing plant in Bloomington, Illinois, starting 1951. Amosite asbestos from South Africa used by Unarco was supplied by Cape Asbestos.

In 1942 or 1943 officials of Unarco became aware that employees of their firm were developing asbestosis. A meeting was then set up with top executives of Johns-Manville Corporation to discuss the problem and measures taken to deal with it (See "A Lobster Lunch with Vandiver Brown" and "Saranac Compensation Reviews for Manufacturers" in Chapter 3, and opening quote to this chapter). Unarco Vice President R.E. Cryor received a report from the Saranac Laboratory in 1948 concerning an employee who had died with moderately advanced asbestosis and lung cancer. Dr. Vorwald at Saranac reviewed other cases for the company around that time (Vorwald patient files P-48-430, P-48-435, P-49-445, and IM-10).

In April, 1950, Unarco's Texas plant was inspected by the Safety and Claims Service, Inc. of Chicago. "The dust hazard there was described as serious although an exhaust system is in operation. Until a satisfactory dust collection system could be installed, the inspection report recommended the use of respirators by all employees in dusty areas." (from "Proposed Findings of Fact" submitted by the U.S. Department of Justice to U.S. District Court Judge William Steger in Civ. No. TY-78-104-CA, *Asbestos Litigation Reporter* June 24, 1983)

In 1952 Unarco paid the widow of a longtime employee compensation, after the man died with asbestosis and intestinal cancer (See "Cancer" in Chapter 3).

Unarco was one of the sponsors of Dr. Gardner's asbestosis research at the Saranac Laboratory starting in 1937 and was a member of the Asbestos Textile Institute in the 1950s, attending meetings where carcinogenicity of asbestos was discussed. E.A. Hayes, Unarco Personnel Director, attended the Seventh Saranac Symposium in 1952 (See "The Seventh Saranac Symposium" in Chapter 2). In September, 1952, Unarco sent a number of chest X-ray films of Illinois employees to Saranac for review (in "Proposed Findings of Fact," cited above).

This company was also a party to the censorship of all references to cancer in the report of industry-sponsored asbestos research at Saranac, published by Vorwald in 1951 (See "Early Saranac Cancer Tests with Asbestos" in Chapter 2).

PITTSBURGH-CORNING CORPORATION

Pittsburgh-Corning began manufacturing amosite asbestos insulation (Unibestos) after purchasing the business from Union Asbestos and Rubber Company (Unarco) in 1962. The manufacturing plants were in Tyler, Texas, and, starting in 1964, Port Allegany, Pennsylvania.

Previous to acquiring this business, in 1961, Pittsburgh-Corning officials met with Dr. Richard Gaze, chief scientist of Cape Asbestos and seller of the amosite raw material. Dr. Gaze described the manufacturing process and the precautions that ought to be taken to protect employees from the asbestos dust hazard. To further acquaint the Pittsburgh-Corning people with the manufacturing process and engineering controls, Dr. Gaze arranged to take them for an immediate plant tour. They flew to Canada and observed the plant owned by Holmes Foundry, another customer of Cape Asbestos making amosite asbestos insulation. Dr. Gaze has testified that he consulted with Pittsburgh-Corning "continually" over the next ten years. (Deposition of Richard Gaze, in *H. Yandle et al. v. PPG Industries, Inc. et al.* U.S. Distr. Court, Eastern Dist. Texas, Tyler Div. Civil Action No. TY-74-3-CA, June 4-5, 1975).

Upon its purchase of the Unibestos business, Pittsburgh-Corning turned to the Pittsburgh Plate Glass Company (which, together with Corning Glass, had set up Pittsburgh-Corning as a joint venture in 1937) for information on asbestos hazards. In all, 10 such articles were sent to Pittsburgh-Corning Vice President Karl Baumler by PPG Manager of Plant Safety Clyde C. Ruddick (attached to letters dated May 16 and 25, 1962). Ruddick also offered to obtain information from PPG's occupational medicine consultant, Carey McCord. Dr. McCord had described asbestos dust as "a menace to health and life" in the 1930s ("Hazards of Industry," *Modern Home Medical Adviser*, M. Fishbein, Ed., Garden City Publ. Co., 1937).

Ronald K. Francis, assistant works manager at the Port Allegany plant, visited the Cape Asbestos manufacturing plant and met the company physician in England in 1965. When he returned to Pennsylvania urgently recommending the installation of engineering dust controls to prevent asbestosis and cancer, he was personally turned down by Pittsburgh-Corning President Russell Brittingham. Brittingham said the plant was already making a poorer return on capital investment than money deposited in a bank (Videotape deposition of R. Francis, in *T.D. Lyons and D. Lyons v. GAF Corp. et al.*, Civ. No. 83-1634, U.S. Dist. Court, W. Dist. of PA, taken in Pittsburgh, Sept. 28, 1983).

In the years 1964 to 1971, Pittsburgh-Corning and Pittsburgh Plate Glass hired industrial hygiene engineering consultant Morton Corn to examine conditions at both the Port Allegany and Tyler plants. In both cases, Corn identified extremely hazardous asbestos exposures and recommended specific engineering control measures (sometimes in combination with the use of respirators). Corn's recommendations were mostly not followed. At Port Allegany, where a ventilation system was eventually installed, no steps were taken to provide an enclosed conveyor to remedy the practice of workers continuously shoveling asbestos scrap from a collection bin (Depositions of Morton Corn in *H. Yandle et al. v. P.P.G. Industries, Inc., et al.* Civ. No. TY-74-3-CA, U.S. District Court for Eastern District of Texas, Tyler Div., taken in Washington D.C. Sept. 21, 1976; and *A. Barber et al. v. United States of America* Civ. No. 80-321, U.S.

District Court for Western District of Pennsylvania, taken in Baltimore, Dec. 1-2, 1983).

The equipment in the Tyler plant was dismantled and buried following the plant closing. A book was written by *New Yorker* journalist Paul Brodeur about the hazardous conditions in this plant (*Expendable Americans*, Viking Press, 1974). The class action brought by 445 Tyler plant employees was settled out of court for \$20 million in 1977. Pittsburgh-Corning paid \$8.1 million, Union Asbestos and Rubber Co. paid \$1.0 million, Cape Industries paid \$5.2 million, and the U.S. government paid \$5.7 million. Pittsburgh-Corning had previously made non-asbestos insulations, and was a member of the National Insulation Manufacturers Association during the years 1960-1964.

EAGLE-PICHER INDUSTRIES

Eagle-Picher began producing "Super 66" asbestos-containing insulating cement in 1938. Another product line, "One-Cote Cement," was added in 1950. The company also manufactured asbestos-free, mineral wool insulation products.

As early as 1932, the hazards of asbestos were pointedly noted in a report to the company by the U.S. Bureau of Mines. In a report of lung fibrosis among employees at the company's plant in Joplin, Missouri, where rock wool and asbestos were used, the mixing room was described as "a particularly dusty place." The report continued, "It is now known that asbestos dust is one of the most dangerous dusts to which man is exposed." Dust control was recommended throughout the plant by the author of the report, Dr. F.V. Meriwether (F.V. Meriwether report and letter of transmittal to Dr. R. R. Sayers, March 11, 1932; Bureau Director Scott Turner letter to Erbon Mahon, Safety Engineer, Eagle-Picher Co., Picher, OK, March 21, 1932. U.S. National Archives documents). Glen Christner, who began work for Eagle Picher in 1931 and retired as Vice President of the insulation division in 1963, recalls having heard about the early Bureau of Mines report at the plant when it arrived (testimony in *Kitsap Co. Cases of Shroeter, Goldmark, and Bender*, No. 81-2-00669-0, Port Orchard, WA, Nov. 1, 1984).

In 1942, a salesman reported from Texas that health officials

had made unfavorable comments about "Supertemp" to a customer, Humble Oil and Refining Company. The salesman, H.M. Aber, also reported that a 1938 article, "Asbestos" (written by Gloyne and Merewether and published in the 1938 *Supplement* to the encyclopedia, *Occupation and Health*, by the International Labor Office) showed asbestos to be more dangerous than mineral wool. (See also Table 8 in Chapter 5) Aber communicated a state health official's offer to "make any reasonable test on Supertemp relative to its being injurious to workmen." (H.M. Aber. "Texas State Board of Health." Eagle-Picher Sales Co. Industrial Contact Report, April 8, 1942)

Eagle-Picher advertised its "Super 66" in the same issue of *Southern Power and Industry* that carried the article "Industrial Hygiene Importance of Dust" (Nov. 1946). The article, by N.V. Hendricks of the Georgia Dept. of Public Health, repeatedly referred to asbestos as a threat to health warranting engineering controls and exposure monitoring.

The Research Library of the Eagle-Picher firm accumulated the following documents relating to asbestosis:

Document	Year Received	Comments
Drinker, P. and T. Hatch. <i>Industrial Dust</i> New York: McGraw-Hill Book Co., (1936).	1938	section on asbestosis pp. 32-34
Johnstone, R.T. <i>Occupational Medicine and Industrial Hygiene</i> St. Louis: C.V. Mosby Co., (1948)	1953	Chapter 30 on asbestosis notes that occupational exposure occurs in the insulation trade
Sax, N.I. <i>Handbook of Dangerous Materials</i> New York: Reinhold Publ. Co., (1951).	1951	notes that occupational exposure occurs in insulation work, p. 34

Eagle-Picher was the primary defendant in the product liability case filed by the widow of insulator C. Faciane in 1960. (See "Lawsuits by Product Users Against Asbestos Manufacturers," in Chapter 3).

Correspondence of officials of the company also dealt with the subject of health hazards of Eagle-Picher insulations.

July 8, 1960. R. Beaudry letter to Eagle Picher Sales Co., and July 21, 1960 reply from Glen Christner (V.P. Insulation Div.).

Insurance claims adjuster writes that E-P mineral wool products used in 1946-1948 are suspected of contributing to asbestosis in an insulator. Christner reply says products sold in those years contained no asbestos.

April 6, 1965. P.L. Losse letter to R. Alexander (Sun Shipbuilding and Drydock Co. Chester, PA).

Notes that "minor amounts" of asbestos and other materials were used in the products. "(W)hile each of these added ingredients could be a health hazard if exposure were to a high concentration, such is not the case." After mentioning occasional dermatitis problems, Losse concluded: "In view of the above relative minor hazard potential for the materials we manufacture, we do not have any medical reports relative to this matter."

May 22, 1968. P.K. Maitre letter to F.J. Hess (Shell Oil Co. Wood River, Illinois.)

The above Eagle-Picher products (Super 66 and One-Cote cements) do not contain any toxic ingredients. Therefore, no antidotes are needed.

Subsequent to the filing of a civil claim against Eagle-Picher in 1963, attorneys employed by and representing the company met with Johns-Manville Medical Director K.W. Smith. A memorandum of these discussions observed that:

Dr. Smith gave us an example of samples taken of a man who was exposed approximately 5 minutes an hour who sustained a serious asbestosis in a working period of only a few months.

The use of warning labeling was also discussed. This memorandum was withheld for years under the claim of attorney-client privilege ("Conference Feb. 19, 1964, Eagle-Picher Insulation Plant, Joplin, Missouri"; and Affidavit of E-P Vice President James Ralston in *Heathman*, Case No. 87-C-1934, Brazoria Co.,

TX, March 25, 1988; and videotaped deposition of E-P corporate representative, R. Bochstaller, by former insulation worker, attorney Lawrence Madeksho, of Houston, TX, in *Heathman* case, Mar. 2, 1989). The document's existence was revealed after it was inadvertently produced by E-P in discovery, in a lawsuit E-P had filed against the U.S. government.

An internal memorandum about the size of printing to use in labeling product hazards reflects the dominance of commercial considerations over concern for the consumer's awareness of health risks. Placement and design of health warnings predictably prevented their notice by many workers handling labeled insulation products.

This is large and clear enough type face to be completely legible, yet does not 'shout CAUTION from the roof tops.'

(W.F. McCarthy, E-P Advertising Dept. memorandum to Alton L. Jones, Joplin Insulation Plant, "Type Face for 'Caution' Notice, June 19, 1964.")

In a letter July 20, 1970, Dr. Irving Selikoff urged Eagle-Picher President W. Atteberry to market asbestos cement products in plastic bags to facilitate lower worker exposures by enclosed mixing (as opposed to mixing in open troughs).

Retired Eagle-Picher engineer Herman Lee Huelster has testified that, although asbestos was used in the company's insulating cements from 1942 to 1971, it was never needed. He attributed the use of asbestos to pressures from the company sales department, and characterized this as a "sales gimmick." Huelster had always objected to spending "big money for an ingredient that we did not manufacture ourselves and (which) did nothing to improve the insulating qualities of the product." He attributed the requirement for asbestos in some Naval specifications for insulating cements not to technical purposes, but rather to "clout" of firms with major interests in asbestos (deposition taken Aug. 28, 1980 in *Zsamba v. State Insulation Corp. et al.* Superior Court of New Jersey, Middlesex County, No. L-32392-770).

Eagle-Picher was a member of the Industrial Hygiene Foundation during the years 1936–1961, and thus received the *Industrial Hygiene Digest* abstracts on industrial medicine and hygiene. The company was also a member of the National Insulation Manufacturers Association in 1960, when NIMA considered the possibility of a health program and rejected it.

UNITED STATES GYPSUM COMPANY

U.S. Gypsum has manufactured a wide range of building products in which asbestos is used. These include trowel-applied and sprayed acoustical plasters, sprayed insulation, block insulation, ceiling tiles, and paints.

The company was associated with the Saranac Laboratory from the early 1930s, when tissue samples from employees were examined for pathological effects of gypsum dust. After purchasing the National Asbestos Co. plant (in Jersey City, NJ), USG had the Saranac Laboratory conduct a survey. Loading and packing asbestos cement were among the most hazardous jobs, with exposures of 261 MPPCF. Asbestosis was diagnosed in 5 workers and suspected in the cases of 5 others. The findings were transmitted to USG Vice President W.L. Keady ("Report of Dust Survey at National Asbestos Co. Plant of United States Gypsum Co. at Jersey City, NJ," by L.U. Gardner, Saranac Laboratory, May 25-June 2, 1936; and "Dust Survey—Jersey City," 3-pp. memorandum to W.L. Keady from General Service Manager, Aug. 13, 1936). The memorandum characterized the asbestos dust hazard as "serious."

USG was one of the contributors to the series of asbestos experiments started at Saranac in 1937 (See "Raybestos-Manhattan, Inc.," this chapter.) The company received progress reports on Saranac asbestos experiments from Vandiver Brown at Johns-Manville. USG was also a party to the censorship of all references to cancer in the report of industry-sponsored asbestos research at Saranac, published by Vorwald in 1951 (See "Early Saranac Laboratory Cancer Tests with Asbestos" in Chapter 2).

On September 16, 1937, sales manager C.G. Scharwath wrote that a suit had been filed by a "former assistant bookkeeper of the old National Asbestos Company, whose desk (was) at least more than 200 feet away from any machinery; as well as being segregated in the office from the factory." USG's Assistant to the President, J.S. Offutt, responded by letter September 29, 1937, that General Counsel attorney Charles Price would be in touch regarding the alleged asbestosis suit. Further details were included in a note to Price from Jersey City lawyer J.J. Cuneo on October 8, 1937. Mr. Wetzel, the plaintiff, had worked for 3 or 4 years and on occasion entered the area of the plant where manufacturing took place. Price replied on Oct. 28, 1937 that USG had never defended a case brought for asbestosis and recommended that Saranac be requested to conduct a physical examination with chest X-ray and render an opinion.

An internal operations bulletin of the company listed substances to which excessive exposure was hazardous, including asbestos (1948). In 1954, a similar company document noted, "Operations involving manual handling of asbestos in any plant shall be considered an area in which employees shall be required to wear adequate respiratory equipment" ("Elimination of Dusty Conditions," No. 2-5, Feb. 11, 1954).

Published literature accumulated at the company's research center library in Libertyville, Illinois, includes: a copy of the article by H. Pancoast and E. Pendergrass, "A Review of Pneumoconiosis," *Amer. J. Roent.* 26: 556-614 (1931), and notes complimenting Dr. Pancoast's work as a defense medical expert in compensation proceedings; *The Pneumokonioses (Silicosis)*, Vol 1 (see "Abstracts," in Chapter 10); the 1938 Public Health Service Bulletin on asbestosis by Dreessen and co-workers; and the text *Industrial Dust* (1954 edition), by Drinker and Hatch, with the British statistics linking asbestosis and cancer of the lung in the chapter on asbestosis.

In 1949, a former employee at a shingle plant of USG died from asbestosis. His son, Ben Miriello, wrote a bitter letter to the company (June 8, 1950) describing his father's suffocating terminal condition and his mother's illness following the death of his father. He enclosed a copy of his father's death certificate naming asbestosis as the cause of death. In December of 1950,

Mr. Miriello wrote again and received a reply (Dec. 27, 1950, signature illegible) acknowledging receipt of both his letters. The reply, from corporate headquarters in Chicago, assured that it was company policy and practice to safeguard the health of employees. Mr. Miriello was invited to visit the Jersey City USG plant where his father had worked in the Thirties and see for himself.

USG manufactured "Spraydon," a spray-applied acoustical plaster, for Sprayon Research Corporation. In 1969, the Sprayon firm applied warning labels because of the asbestos hazard from this product, and in 1970 the product was reformulated to eliminate asbestos. In the meantime, USG continued to manufacture "Audicote," another spray-applied acoustical plaster with asbestos it had sold since the 1950s but which did not carry warning labels until 1973. In that year, this class of products was, in effect, banned by the U.S. Environmental Protection Agency as an air pollution hazard (*Fed. Reg.*, April 6, 1973).

USG was represented at a Sept. 19, 1967 meeting of the Gypsum Association where a report of "lung cancer" cases in the neighborhood of an asbestos plant was discussed. In 1970, USG was among the members of the Asbestos Cement Products Association willing to warn the public that sawing asbestos-cement products would create a "health risk"—if agreement could be reached within the industry (See "National Gypsum Company" later in this chapter).

In 1973, U.S. Gypsum placed asbestos health warning labels on "Durabond" joint compound rather than convert to an asbestos-free formulation of the product. One commercial customer was the manufacturing homes division of Westinghouse, where two-thirds of the work force walked off the job in protest of the health hazard. USG official C.M. Howard, Jr. reported what happened after that ("Asbestos Pollution" memorandum to J.T. Allen, Jr., July 23, 1973):

Our reaction to this was to offer Westinghouse an asbestos-free DURABOND formula—a more costly formula, but one which had been successfully field tested. Westinghouse's reaction to this was to accept the non-asbestos formulation

and to fire an agitator and the entire work force that left their jobs.

In view of its history, jurors were surprised by USG's sworn Answers to Interrogatories to the effect that the company's first awareness of a relationship between asbestos and asbestosis dated from 1975 (signed by J. Hernan, *Lexington County, South Carolina School District v. U.S. Gypsum*, No. 82-2072-0, trial in April, 1984).

SOUTHERN TEXTILE CORPORATION
(Southern Asbestos, H.K. Porter, Thermoid)

The original Southern Asbestos Company was incorporated in 1927 in Charlotte, N.C. A manufacturer in Charleston, S.C., Thermoid Corporation, purchased the fixed assets of Southern Asbestos in 1941. H.K. Porter Company acquired Thermoid Corporation by merger in 1958. A few years earlier (1954), Porter had acquired the Laclede Christy Works in St. Louis, where high-temperature insulating cements and blocks were made. In the early 1960s, Porter also took over Carolina Asbestos Company and Russell Manufacturing Company. H.K. Porter formed a subsidiary, Southern Asbestos Company, in 1974, and this was renamed Southern Textile Corporation in 1979 (Thomas H. Hart, III, Blatt and Fales, Barnwell, S.C.).

Southern Asbestos was the object of an exposé in the *Philadelphia Record* in 1935 (See "Newspaper Articles," Chapter 10). Thermoid Corporation and Southern Asbestos were two of the original industrial sponsors of Dr. Gardner's asbestos experiments at Saranac. Thermoid was also a party to the censorship of all reference to cancer in the report of industry-sponsored asbestos research at Saranac, published by Vorwald in 1951 (See "Early Saranac Laboratory Cancer Tests with Asbestos" in Chapter 2).

"Many" of the asbestotics described in Shull's report ("Asbestosis: A Roentgenologic Review of 71 Cases," *Radiology* 27:279-292, 1936) were Southern employees (G. Fabel, President of Southern Asbestos, letter to Sumner Simpson, Raybestos-Manhattan, Dec. 18, 1936). The company was also an active member of the Asbestos Textile Institute starting in the mid-

1940s, and had no medical monitoring program for its employees at the time of the Hemeon report to A.T.I. in 1947 (See "Industry Trade Associations and Research Organizations," in Chapter 10).

Dr. O.A. Sander was the medical consultant representing Southern Asbestos Company at the Oct. 6, 1954 meeting of the Asbestos Textile Institute at which Dr. Schepers presented a review of the literature on asbestos and cancer. Sander also authored a report in which "moderately well developed asbestosis" was described in a plumber's helper. The man's work history involved less than 10 years of this work, sawing pipe coverings, "usually in confined basement rooms." But the emphasis of this presentation was that doctors should be careful to not scare workers, producing "doctor-induced disability." ("Asbestosis as Differentiated from Other Pneumoconioses." *Arch. Indust. Health* 12:208-211, 1955) In an article for surgeons, Sander reported:

The pessimism of the past is being replaced by the realization that a diagnosis of silicosis or asbestosis is compatible with good health and a feeling of well-being. ("Silicosis and Asbestosis." *Amer. J. Surg.* 90:115-119, 1955.)

Shortly after H.K. Porter acquired Thermoid Company, the manager of the Thermoid plant in Charleston, S.C. published an article about their historic problem with asbestosis and efforts in dust control (J. Mitchell, "Health Progress in an Asbestos Textile Works," *Arch. Environ. Health* 3:37-41, 1961). Conditions in 1936 and 1960 were compared, including narrative descriptions and dust counts for both periods. The 1936 figures were all in the 45-210 MPPCF range, and the 1960 ones were all less than 5 MPPCF (See also "Asbestos Air Pollution in the Community" in Chapter 7).

Documents obtained in discovery describe reactions at the time of the New York Academy of Sciences conference on asbestos in 1964.

Nov. 6, 1964. John A. Brown (President, Asbestos Textile Institute) letter to J.T. Griffis (H.K. Porter Company).

I am attaching three copies of news releases A, B, and C which

were supposed to have been released to the press during the conference on the Biological Effects of Asbestos at the Waldorf Astoria several weeks ago. Fortunately, due to the alertness of Mr. Edward Shuman of J-M and Mr. Robert Cryor, of North American Asbestos Company, these releases were discovered before their release, and the resultant objections that arose in the meeting, because of the sensationalism of the material held up their issuance ...

I also feel that this subject should not be brought to the attention of other than management of our several companies, as any discussion on this situation by sales personnel with users of our products could possibly aggravate the situation and result in individual opinions which could be damaging.

Nov. 4, 1964. Dr. Hillis L. Seay (chest physician and plant physician to H.K. Porter in Huntersville, N.C.) letter to J.T. Griffis.

Notes that Seay had attended the international conference on asbestos disease at the request of H.K. Porter Company. This 4-page report includes findings, quotes from presentations, and recommendations.

KEENE CORPORATION

(Ehret Magnesia, Baldwin-Hill, Baldwin-Ehret-Hill)

Insulation manufacturers Ehret Magnesia and Baldwin-Hill merged to form Baldwin-Ehret-Hill in 1959, which in turn was taken over by Keene Corporation in 1968.

In 1930, Ehret ran monthly advertisements in *Asbestos* magazine on the inside back cover. In the March issue, there was also an article on pulmonary asbestosis. The company hired a sales clerk in 1936 named Dwight Satterthwaite, and within one month he learned that asbestos was a dangerous dust (Deposition of D.L. Satterthwaite, *In Re: All Asbestos Cases*, C.P. 77-1, U.S. Dist. Court E. Dist. VA, Aug. 29, 1983).

In 1952, Ehret Magnesia hired chemist John D. McAllister, who had worked for Owens-Illinois, to develop a calcium silicate insulation product. Employees in the pilot plant set up in the 1950s were required to wear respirators, and dust control equipment was used in the process. When the process was expanded and a commercial scale plant built, McAllister

examined respirators on the market and bought enough to make them available plant-wide. Around this time, the company's insurer conducted air sampling in the plant. In the late 1950s, McAllister recalls that there was considerable discussion over the deaths of three Ehret workers from lung cancer and nonmalignant lung conditions (Deposition of J.D. McAllister, same case as Satterthwaite deposition).

E.R. Stevens, President of Baldwin-Ehret-Hill from 1959-1968, has testified that the use of asbestos in insulating cements was unnecessary, and the use of a small fraction of asbestos in "Monoblock" (1940-1968 or later) was just a "sales gimmick." Stevens was among industrialists attending presentations by Dr. Selikoff in 1964, where hazards to insulators were discussed (E.R. Stevens deposition in *Bade et al. v. Armstrong World Industries et al.* Superior Court of NJ, Middlesex Co. Docket No. W-000026-87, Jan. 24, 1989).

Baldwin-Hill patents in the 1950s stressed that insulations whose use entailed "a minimum of dusting" would have "practically no industrial health hazard." These patents also demonstrated that mineral wool could be used instead of asbestos (Patent No. 2,633,433, granted in 1953; and No. 2,732,295, granted in 1956).

On February 9, 1976, within months after the U.S. Environmental Protection Agency banned asbestos-containing molded insulation, Keene's Joseph Saville wrote to a Miami firm about liquidating Keene's inventory of calcium silicate insulation. He offered to discount material with a "list value" of \$70,000, for export "outside of the continental United States." (letter to Edgar Gerber, Multi-Trades Inc.)

In 1982, samples of warehoused insulation at Amerada Hess' giant oil refinery in St. Croix were analyzed to see if they contained asbestos. A sample of Thermacil calcium silicate from Keene Corporation, labeled asbestos-free on the bag, was found to have 20-25% amosite asbestos. Orders were sent to the refinery to remove the material and dispose of it (O.W. Henderson memorandum to W. Jones, "Asbestos Samples," Jan. 19, 1983).

Ehret Magnesia was a member of the Magnesia Insulation Manufacturers Association in the 1950s, and Baldwin-Ehret-Hill

belonged to the National Insulation Manufacturers Association in the 1960s.

UNION CARBIDE CORPORATION

Union Carbide operated chrysotile asbestos mines in California from 1963 until 1985. So-called "Calidria" asbestos is short grade fiber, and has been used as a filler, reinforcing agent, opacifier, and thickening agent in such products as drywall patching compounds, plastics, and paints.

One country where sales resistance was soon encountered was the United Kingdom. Media stories and anticipated pressures from unions and government inspectors prompted "over 20 potential customers" to request assurance that Carbide's material would not endanger their employees. Dockers were refusing to handle imported sacks of asbestos in London and Liverpool.

Union Carbide's New York headquarters issued at least two internal communications on asbestos hazards in 1966. A rather thorough 19-page report was then prepared by I.C. Sayers of the Alloys Division of Union Carbide U.K. Limited (*Asbestos as a Health Hazard in the United Kingdom*, 1967). This last report was located at the library of the Quebec Asbestos Mining Association in Montreal (now called Asbestos Institute; document no. 3095), where the index card on it read, "Confidential—not circulated."

Sayers' review describes the 1965 mesothelioma epidemiology study of Newhouse and Thompson. It has separate sections on asbestosis, lung cancer, and mesothelioma. Mesothelioma is described as the "most disturbing" effect because it could occur after only brief exposure. The 1938 TLV of 5 MPPCF is described as an arbitrary choice having no experimental foundation. "There is a growing feeling that the quoted 'Threshold Limit Value' is no longer tenable." In a section entitled "Moral Issues" the report states:

On the basis of present evidence we are not entitled under any circumstances to state that our material is not a health hazard. What is more, if it is believed that a potential customer would use our material 'dangerously,' and that he

is unaware of the toxicity question, then it must surely be our duty to caution him and point out means whereby he can hold the asbestos air float concentration to a minimum.

Union Carbide sacks of asbestos did not bear warning labels until late 1971 or 1972.

On August 15, 1975, Dr. Arthur Rohl and co-workers at the Mt. Sinai School of Medicine published a report in *Science* on the high levels of airborne asbestos exposure entailed by mixing, sanding, and sweeping up after applying drywall spackling and joint compounds. The Natural Resources Defense Council then petitioned the Consumer Product Safety Commission to ban asbestos in such products. Throughout 1977, Union Carbide led the opposition to the ban. The day before the ban order was published in the *Federal Register*, Union Carbide reiterated its objection, on the basis that "consumer" exposure (as distinct from occupational exposure) did not entail an "unreasonable risk" (H.B. Rhodes and J.F. Collings, Union Carbide Corp. Metals Div. letter to R.D. Pittle, Consumer Product Safety Commission, Dec. 14, 1977).

Dr. Hans Weill had been a medical consultant to asbestos companies for years by the time the asbestos litigation loomed large in the United States. The Board of Directors of the Asbestos Information Association turned to him to identify medical experts for use in defense of civil suits (AIA Board minutes, Dec. 9, 1976).

Union Carbide hired Dr. Weill to fly to Bhopal, India, in the wake of the catastrophic chemical release in that city on December 3, 1984. Dr. Weill, who also serves as an expert witness in asbestos product liability suits, has testified (*Timm v. Raymark*, Solano County, CA Case No. 85911, Jan. 14-15, 1985) that he was correctly quoted in the *New York Times*, which reported on December 15, 1984:

Dr. Weill said that the victims who had survived to this point "have an encouraging prognosis" and that most would probably recover fully.

This extraordinarily optimistic outlook was not shared by the editors of the prestigious journal, *Lancet*, who stated that

longterm lung effects "can be expected" (Dec. 15, 1984). Nor has it been borne out by experience. In March, 1985, Indian doctors reported that pulmonary fibrosis had developed in approximately 20,000 people, diagnosable by chest X-ray and pulmonary function tests.

Even before the purchase of the asbestos mines, Union Carbide (Chemicals Co.) was aware that asbestos dust was hazardous and conducted tests to determine the relative exposures from Johns-Manville and Owens-Corning thermal insulation products (See 1962 Peele study in Table 8, Chapter 5).

Union Carbide played a leading role in the National Safety Council in the 1930s and in the Industrial Hygiene Foundation in the 1940s, having representatives on the executive boards of these organizations. Carbide sent three representatives to the Seventh Saranac Symposium in 1952, where asbestosis and cancer were discussed repeatedly (See "The Seventh Saranac Symposium" in Chapter 2). As a major chemical company, Carbide would have made use of *Chemical Abstracts*, which contained numerous citations on asbestos disease (See "Abstracts," in Chapter 10).

GEORGIA-PACIFIC CORPORATION

Georgia-Pacific made asbestos-containing drywall patching compounds from 1965 until the products were banned in 1977. Previous to that time, the products were made by Bestwall Gypsum Company, which G-P acquired in 1965. Bestwall had made wall and finish plasters as a division of Certain-Teed Products Corporation previous to becoming an independent business entity in 1956. The following documents came from G-P's files.

As a member of the Gypsum Association, G-P was represented at discussions of: 1) government investigations of asbestos-caused lung disease and possible claims (Minutes, Sept. 20, 1966); and 2) cases of cancer attributed to neighborhood exposure to asbestos released into the atmosphere by an asbestos factory (Minutes of Sept. 19, 1967). In 1973, before any such data were published in the scientific literature, the

Gypsum Association tests on drywall product asbestos exposures showed 30-minute exposures as high as 35 and 43 f/cc from sanding after application. Workers' daily time-averaged exposures with all products tested approached or exceeded the OSHA limit of 5 f/cc, issued in 1972, and scheduled to be lowered to 2 f/cc on July 1, 1976 ("Evaluation of Exposure to Asbestos During Mixing and Sanding of Joint Compounds," report of testing for Gypsum Association by George D. Clayton and Associates, Nov. 19, 1973).

Mt. Sinai Medical School examinations of drywall joint finishers came to the attention of G-P officials in 1970 (E.F. Fatz memorandum to M.F. Fink, June 3, 1970). On September 15, 1971, William Hunt, President of G-P, was invited to attend a meeting at the Asbestos Information Association, where plans were being made for dealing with expected regulations from the Environmental Protection Agency (letter from A. Fay, National Gypsum). After the meeting, which did not include anyone from G-P, Hunt was advised by Albert Fay, Vice President of National Gypsum, that "Our tests indicate that sanding of joint treatment products and particularly the spraying of wall finishes offers some substantial potential hazards." (Sept. 24, 1971) G-P was then selling over 50,000 tons per year of asbestos-containing joint compounds and interior surfacing textures (C.W. Lehnert, memorandum to W.J. Hunt, Oct. 7, 1971).

A health officials' survey at G-P's plant in Quanah, Texas, described excessive exposures and visible dust in some operations. A 13.7 f/cc sample was reported at the operation of joint compound sack stacking ("Industrial Hygiene Survey" attached to letter from Texas State Department of Health, Austin, to Bill Howard, G-P Safety Superintendent, Sept. 21, 1972). The next year, OSHA, the New York State Department of Labor and fiber supplier Union Carbide conducted tests at G-P's Akron, New York plant, whereupon the company developed a control plan (J.D. Rauch, "Asbestos Hazard Control," memorandum to E.B. Hollingsworth, April 26, 1973). An engineer reported areas "ankle-deep in dust" at Akron (E.A. Harvey, letter to George Turner about "Bag Slitter Dust System/Akron, N.Y. Plant," May 12, 1973).

OSHA cited the Akron plant for numerous violations of requirements of the 1972 asbestos standard within months (OSHA citation dated June 13, 1973 and J.D. Rauch, memorandum to E.B. Hollingsworth, "OSHA Inspection—Akron, N.Y. Plant," June 18, 1973). G-P had affixed the OSHA warning label to bags of powder joint compounds in August of 1972, but had not placed such warnings on containers of ready-mix joint compounds (K.S. Freeman, memorandum to J.N. Walker, "Caution Labels for Joint Compounds," Aug. 17, 1973). In May of 1974, G-P was cited by an OSHA inspector for not putting warning labels on cans of Ready-Mix (M.F. Fink telex to K.W. Brown, May 10, 1974). This led to the use of warning labels on that product.

Some Akron employees were soon afterwards diagnosed as having pulmonary abnormalities, including chest X-ray evidence of pulmonary fibrosis (R.L. McCallister, memorandum to L. Ryder, "Akron NY—Chest X-rays & Ventilation Study," Apr. 26, 1974. And attached letter from Dr. M.L. Amdur, Mar. 24, 1974). G-P officials noted the report of cases of chest X-ray evidence of fibrosis, from work with drywall taping and spackling compounds, in New York painters (O.E. Burch memorandum to G.E. Wilson, May 17, 1974, and attached article, "Asbestos Danger Cited," *Walls & Ceilings*, May, 1974).

Further discussions of warning labels noted G-P attorneys' concern "over recent findings of asbestosis in workers in the construction industry which is a result of working with joint system products." (J.R. Hurd, "Asbestos Caution Labels," memorandum to W.A. Nalbone, June 7, 1974).

OSHA meanwhile cited G-P's Chicago plant for widespread violations of the asbestos standard (G.E. Wilson, "OSHA Regulations—Joint Cement," May 20, 1974). Numerous asbestos violations were also identified by OSHA at G-P's Marietta, Georgia plant in 1975 (Citation dated July 31, 1975).

The week after the Mt. Sinai researchers published their widely reported article in *Science*, showing high exposures from drywall patching compounds in mixing, sanding, and post-application clean-up, new asbestos-free formulas were sent out to G-P plants, along with "asbestos-free" labels. It was noted that "Pricing of this product will be higher than the asbestos

formula." (D.C. Corkill, "Asbestos-Free Ready-Mix," memorandum to E. Hollingsworth, Aug. 21, 1975; also, F. Cerra, "Spackling may harbor dangerous asbestos level," *Evening Times*, Trenton, NJ, Aug. 29, 1975)

G-P continued making asbestos-containing drywall patching compounds, and one company official wrote, "We are benefiting from various manufacturers' attempts to get asbestos free." He said competitors were losing customers because their asbestos-free formulations were less satisfactory in their application than the products they replaced.

Let's keep this in mind when we come to ours and not market an asbestos free type from Acme until and unless it is such that the working qualities are so similar that a product user couldn't tell the difference. This way we won't suffer the loss of business the other mfgs are going thru now (W.D. Brooks memorandum to Dave Corkill, Nov. 17, 1975).

On March 30, 1976, G-P documents reflect that instructions were given to not manufacture asbestos-free products at any locations except Akron and Acme. Four months later, the Natural Resources Defense Council petitioned the Consumer Product Safety Commission for a ban on asbestos-containing drywall patching compounds.

When a consumer wrote to the company about the danger from asbestos in G-P Ready-Mix Joint Compound, he was told, "you need not concern yourself over the possibility of harm." G-P General Sales Manager Oliver Burch went on to state,

To our knowledge, there is no known case of harm from Joint Cement containing Asbestos Fiber, even after prolonged exposure, numbered in many years (letter to Craig Burningham, Jan. 21, 1977).

Within weeks, a talc salesman sent in a copy of an article reporting that X-ray abnormalities characteristic of asbestos exposure were found in chest films of 37 out of 63 workers using spackling compounds (D.P. Leet, Winsor Minerals, letter to Bill

Gettel, Feb. 3, 1977, enclosing "Asbestos: Still Some Problems," from *Construction Dimensions*, Jan. 19, 1977).

The Consumer Product Safety Commission announced its intention to ban asbestos-containing drywall patching compounds in April of 1977 ("Products containing asbestos banned as cancer-cause suspects," *Dallas Morning News*, Apr. 29, 1977). Regional G-P managers around the United States were informed of this and told to sell the asbestos-containing products to contractors and dealers supplying contractors; the asbestos-free was to be sold to retail outlets for consumer use (D.C. Corkill, telex to Regional Gypsum Managers, May 2, 1977).

A man doing a remodeling project on his home wrote to the company and was reassured by Gypsum Division Personnel Manager Jim Hurd.

To our knowledge, Mr. Udavcak, there is no known case where harm has come to someone from their use of our Ready-Mix joint compound containing asbestos fibers, even after prolonged exposure numbered in many years (letter to Robert Udavcak, May 20, 1977).

W.R. GRACE & COMPANY

W.R. Grace bought Dewey & Almy Chemical Co., which had made asbestos brake linings, in 1954. In 1963, Grace purchased the Zonolite Company, which operated the world's largest vermiculite mines (in Libby, Montana). Zonolite made "Mono-Kote" fireproofing cement and asbestos-containing acoustical plaster.

The Dewey & Almy Chemical Company had numerous compensation claims brought by employees of its "Multibestos" plant, which closed in Massachusetts in 1936. Bradley Dewey, the firm's president, was interested in the subject of asbestosis and corresponded with a state official and others about it (See "Rising Tide of Compensation in the 1930s" in Chapter 3). Some asbestosis cases at the Multibestos plant were reviewed at the Saranac Laboratory in the mid-1930s (Vorwald Patient Files, Nos. P-31-37, P-35-85, P-34-101, P-35-129, and P-36-124, Armed Forces Institute of Pathology, Washington, DC).

The Montana operation was originally called the Vermiculite and Asbestos Corporation when mining began in 1919 (both minerals were present in the deposit). Large-scale production began in the 1930s, as vermiculite-expanding factories were built in Spokane, Chicago, and Detroit. The vermiculite was used just in insulation at first, then in concrete mixes in the 1950s.

Montana State Board of Health industrial hygienist Benjamin Wake visited the Libby mine and mill in 1956 and took atmospheric dust samples. Total dust counts averaged 40 MPPCF. Relying on company records saying the dust was 8-21% asbestos, Wake estimated that the maximum concentration of total dust should not exceed 25-30 MPPCF. Numerous recommendations were made to management to improve dust control in the mill.

Wake returned to the plant in 1958, again taking air samples (average total dust: 23.8 MPPCF) and making even more extensive recommendations for dust control. He again called attention to asbestos as a respiratory hazard. Conditions were still poor in 1962, with 20 dust counts averaging 43.3 MPPCF. Based on an analysis indicating that 40% of the airborne dust was tremolite asbestos, Wake suggested a maximum of 12 MPPCF to limit the pure asbestos exposure to 5 MPPCF. There was no improvement in 1963, either.

Wake's reports were all marked, "This report is confidential and is not for distribution except to the management of the Zonolite Company." The reports were all titled "Report on an Industrial Hygiene Study of the Zonolite Company Libby, Montana" (Aug. 8-9, 1956; Jan. 12, 1959; Apr. 19, 1962; and Apr. 11, 1963. Montana State Board of Health reports).

Documents produced in discovery relate to conditions from the standpoint of management:

- Oct. 15, 1954. Letter from C.A. Pratt to Dr. George Ziegler (Zonolite Laboratory, Evanston, IL) cites bond failure, the fall-off of Zonolite acoustical plastic after application, as a factor causing the loss of "terrific quantities of business."

- Aug. 9, 1955. Memorandum from J.B. Myers to D. Prouty and J.A. Kelley refers to a disability claim for asbestosis arising at the Sacramento plant.
- Dec. 21, 1955. Memorandum from J.B. Myers to John Huxley (Chicago) stresses the danger of exposing employees to asbestos while manufacturing acoustical plastic, calls for design of engineering dust control systems for standard plastic mixing equipment in use around the country.
- June 14, 1961. Letter from E. Lovick (assistant to Libby plant manager) to C.A. Pratt (VP, Western Mineral Products Co.) acknowledges that asbestosis is a matter of concern based on "many studies." The 1956 report from the Montana State Board of Health is quoted as saying asbestos dust is "of considerable toxicity." A 19-year mill employee was very disabled and sent to a TB sanitarium where he was diagnosed as having "questionable asbestosis." Montana's inclusion of occupational disease coverage in the workers' comp. law in 1959 was accompanied by the company's decision to institute an employee X-ray program. Doctors' reports are said to have been inconclusive on the question of whether there was a lung disease hazard in the plant. Asbestos in concentrates shipped to vermiculite expanding plants should give rise to "very small" amounts of it in the dust in expansion plants. "Dust Foe" respirators provided.
- Aug. 11, 1961. Letter from Pratt to Lovick states that Western Mineral Products (WMP) also has pre-employment X-rays and appreciates any effort to lower the asbestos content of the ore.
- Sept. 15, 1961. Letter from Pratt to J.A. Kelley (Zonolite) mentions that Minneapolis Health Dept. has expressed concern about dust in vermiculite plants.
- Apr. 2, 1964. Letter from Pratt to Kelley mentions a claim for total disability compensated in Minneapolis; and another worker seen by a Dr. Park who was advised to leave the employ of WMP.
- Aug. 25, 1964. Letter from Dr. W. Nelson in Libby to J. Kelley (President, Zonolite Div. of W.R. Grace) asks for expenses to go to a medical center and obtain clinical training in occupational lung diseases. He notes that his 1959 X-ray study showed "an unusually high incidence of basilar fibrosis," at Zonolite. The

survey was repeated in 1964, and "the consensus of local medical opinion was that an important increased incidence of chronic respiratory disease existed in Zonolite employees who had prolonged exposure to dust." Preliminary analysis showed "distinct and important change in respiratory function and pathology." He had not charged for his services but now requested assistance to consult and make time for a competent analysis of his data.

- Oct. 8, 1964. *Chicago Daily News* story, "Suspect Asbestos a Cancer Source" referred to "JAK," describes lung cancer and mesothelioma in insulation workers reported by Selikoff and co-workers.
- Oct. 21, 1964. Letter from Dr. Siemens (Alberta Dept. Pub. Hlth.) to T.A. Williams (Grant Industries) reports that 7/9 workers examined had abnormal forced breathing curves and 2 had fibrosis, recommends respirators. Attached is a note from H. Buchwald (16 Sept. 1964) calling attention to the use of asbestos in "Mono-Kote." Asbestos is described as a "well known cause of lung fibrosis ... It is most important that dust respirators be worn when any work is done with ground asbestos."
- Nov. 20, 1964. Letter and attached two-page report from Dr. Woodrow Nelson to J.A. Kelley describes "serious hazard of pneumoconiosis" at Libby. A "moderate but distinct decrease in respiratory function" was reported for the entire work force of 140 men. The 30 workers with "definite pneumoconiotic changes on X-ray" had an average Forced Vital Capacity of 75% of standard values for their height and age, compared with 90% for the 110 without such X-ray changes. Similarly, those with positive X-rays had 72% of standard values for forced expiratory volume in one second, versus 88% among those without radiologically evident pneumoconiosis.
- Dec. 2, 1964. Letter from Williams to Dr. Siemens assures that no adverse health effects had been seen among U.S. Zonolite plant workers. It does acknowledge a danger from asbestos and the need to use respirators.
- Dec. 8, 1964. Letter from N. Bushell (Grant Industries) to J.A. Kelley encloses all the above Williams-Siemens correspondence.

- Dec. 29, 1964. Letter from L. Park (MD Casualty) to F.W. Rupp (WRG-Zonolite) suggests respirator use and maintenance program to follow.
- Jan. 2, 1965. Memo from R.A. Bleich (Libby plant) to J.A. Kelley (WRG headquarters) comments on reports from Montana State Board of Health and says, "I can only say it presents a very sorry record."
- Jan. 2, 1965. Memo from Lovick (Libby) to J.A. Kelley, "Dust at Libby," reviews events. The doctors' findings in the 1959 health survey were described as equivocal. A 1964 follow-up exam had pulmonary function tests in addition to chest X-rays: 30/143 showed emphysema or fibrosis, and in 14 there was progression in the serial X-rays since 1959. Of 39 hourly workers with over 10 yrs. employment, 18 were classed as abnormal. One 19-yr employee with severe impairment was ultimately diagnosed as having "questionable asbestosis." In 1962 a Wyoming doctor said his patient, a former employee, had progressive fibrosis resembling asbestosis. In 1961, a Spokane doctor told the company that another former employee had extensive bilateral pneumoconiosis with definite progression. "These cases were referred to Chicago and handled by our insurance carrier." There had been other cases, too. Attachments listed included a survey report by Dr. Nelson and medical reports on 4 employees with 7-19 years' employment.
- Feb. 4, 1965. Bushell asks Kelley if Zonolite had contacted the Alberta Health Dept. and notes that 2 employees were being sent to a chest clinic at the dept.'s recommendation.
- Feb. 9, 1965. O.F. Stewart (WRG headquarters) reply to Bushell acknowledges that the presence of asbestos in Libby vermiculite, and says there have been reports of "men having pulmonary trouble," at Libby and WMP. Letter details steps being taken to control dust and disease at WRG plants. Attachments speak to growing public concern, and letter says to anticipate increasing government regulation in designing dust control into plants.
- Mar. 5, 1965. Memorandum from J.A. Kelley to George W. Blackwood reports, "we have obtained an 'asbestosis' rider on our workmen's compensation insurance to take care of any possible contingency."

- Oct. 4, 1965. Report by Dr. Wiley (Los Angeles Co. Div. Occup. Health) says CA Zonolite plant had no apparent hazard—even though breathing zone of operator "mixing Mono-Kote, asbestos side" was 7.7 MPPCF.
- Oct. 28, 1965 and Mar. 31, 1966. Letters from Benjamin Wake to R.A. Bleich (Libby plant manager) encloses publications about asbestos as a cause of occupational cancer.
- Jan. 5, 1968. "Personal and confidential" memo from P. Kostic to R.W. Sterrett (WRG Zonolite Div.) summarizes meetings with Johns-Manville environmental specialists E. Fenner and C. Sheckler. The main focus is on 32 Libby workers with abnormal chest X-rays, and the need to attain exposures in the plant of no more than 5 MPPCF total dust. "Fenner and Sheckler emphasized that Threshold Limits should be used as guides ... and should not be regarded as fine lines between safe and dangerous conditions."
- June 27, 1968. Memorandum from Earl D. Lovick reports that U.S. Public Health Service investigators Jeremiah Lynch and Ken Kronoveter had visited Libby, requesting names and Social Security numbers of past employees, for studies of mortality of workers exposed to tremolite asbestos. This was followed by a letter from Lynch to Lovick, June 10, 1968.
- July 26, 1968. R.W. Sterrett memorandum to Lovick rebuffs a second request to consider cooperating with the government epidemiologists: "We have run this through Cambridge again, and the answer is still the same. They do not choose to divulge this information." Lovick so informed Lynch by letter dated August 1, 1968.
- Dec. 10, 1968. Letter from N.F. Bushell to R.W. Sterrett encloses a Workmen's Compensation Board Report on Paul Annon, an 18-year employee in Winnipeg with asbestosis. The letter observes that a *New Yorker* article on asbestos had just appeared. Bushell was concerned about a continuing hazard to the workers: "I want to urge you to put someone on this subject before we get closed down or slapped with some pretty large claims."
- Mar. 11, 1969. Memorandum from P. Kostic to R.W. Sterrett advises warning labeling of products containing vermiculite, to aid in defense of product liability cases. Attached article describes introduction of "Asbestos Safety Bill" in Congress and reports

of mesothelioma in household contacts of asbestos workers and neighbors of asbestos plants.

- Aug. 28, 1969. "Highlights of Meeting Between Representatives of U.S. Public Health Service and Construction Products Division W.R. Grace & Co." reports statement by J.R. Lynch that his air samples at Libby mine and mill "showed that asbestos fiber counts were far in excess of recommended threshold limits."
- Nov. 28, 1969. Memo from T.F. Egan to R.W. Sterrett describes a presentation by Dr. Irving Selikoff on the hazards of sprayed asbestos insulation. "The officials of the international unions were there along with the contractors and I know it landed like a bomb. We must go all out to get asbestos out of Mono-Kote at once."
- Dec. 1, 1969. Memorandum from T.F. Egan to V.H. Dodson describes building pressure against the use of asbestos in sprayed fireproofing in New York and Philadelphia, spreading rapidly across the country, urges substitution for business and ethical reasons.
- July 15, 1970. Report by W.C. Cooper, J.L. Balzer, and D.P. Fowler, *Asbestos Fiber Concentrations in Air from Spray Fireproofing Operations Using Zonolite Products*, Tabershaw-Cooper Associates, Berkeley, CA. Samples of exposures to workers applying sprayed fireproofing of vermiculite-asbestos cement were taken at several construction sites. The highest exposures were spray gun operators', 2.5 to 8 f/cc. Other members of spray crews were exposed to 0.5 to 1.9 f/cc. Exposures on other floors than those being sprayed and in the neighborhood of buildings where spraying was being done were less than 0.01 f/cc.
- Nov. 23, 1970. Memorandum from C. Wendel to K. Harrison, the month that Grace introduced Monokote 4 (asbestos-free) to replace Monokote 3, explains that the new product using (wood) cellulose fiber costs 23 cents per bag more than the asbestos composition of MK-3. Wendel claims to be very pleased with the working qualities of MK-4 "and if it were not for the increased cost we would swing over to it as soon as possible."
- Dec. 1-2, 1971. Minutes of Meeting of Plaster & Fireproofing Committee, WRG, says of Monokote 3, "continue to use where possible." Committee discussed the growing list of municipali-

ties that had banned the spraying of all asbestos-containing fireproofing materials.

- Mar. 27, 1972. W.V. Culver (WRG, Auburn WA) letter to R.B. Moral (President, Texas Vermiculite Co., Dallas) notes that, "We are still using MK-3 locally ... and would just as soon not have any reference made to MK-4."
- July 20, 1972. Memorandum from T. Feit says EPA ban of products including MK-3 has been delayed. "For those of you making MK-3, keep a good inventory position (asbestos and MK-3 bags) until at least mid-September and make plans for the changeover."
- Mar. 30, 1973. Memorandum from M. Moran (Texas Vermiculite Co.) to H.A. Eschenbach (WRG Construction Products Division, Cambridge) mentions that an OSHA inspector called attention to the lack of warning labels on MK-3 bags the company was still using.
- Apr. 3, 1973. Eschenbach's response to Moran says EPA is about to ban sprayed products containing more than 1 percent asbestos "in a few days," acknowledges that a decision to label MK-3 had not yet been made.
- Apr. 11, 1973. Memorandum from Tom Egan to District Managers announces that EPA ban has been published, and, allowing 90 days for the regulations to take effect, concludes that MK-3 can still be applied in the U.S.A. until July 4, 1973.
- Oct. 8, 1974. Memorandum from B.R. Williams to R.M. Vining asks for a decision on whether WRG should continue selling MK-3 in Canada, weighing lower cost against the risks of critical publicity, regulation, and other potential business problems.
- Feb. 18, 1977. Memorandum from H.C. Duecker to J. Yang acknowledges possibility that there might be tremolite asbestos in "Verxite" expanded vermiculite, and that tremolite might be carcinogenic in the digestive tract of humans or animals. Verxite was sold as a food additive for livestock and poultry feeds and dogfood. (Food grade vermiculite had been tested in bread baking in laboratory research—"Zono-Bread".)
- June 30, 1977. Memorandum from R.H. Locke to H.C. Duecker discusses sending MK (Monokote) samples to outside laborato-

ries in California for analysis. Locke observes that results of such analyses requested by Grace would be subject to discovery in litigation over MK in California. However, by involving defense counsel in handling the sample requests, the test results would not have to be disclosed unless they were favorable to the company:

I believe, however, that if a client were to ask an attorney to undertake such an investigation of the subject area, he on his own judgement might ask laboratories to make such analyses. The resulting data would probably be held to within the attorney: client relationship and would not be discoverable unless the client agreed to waive the relationship.

July 14, 1977. Memorandum from J.C. Yang to H.C. Duecker notes letter from Dr. William Smith that a 50-50 tremolite-vermiculite combination injected into hamsters caused mesotheliomas.

Nov. 4, 1981. Memorandum from W.J. McCaig to Jack Wolter records decision to increase size of caution labels on bags of Monokote, "to be printed on the very bottom of the back of the bag."

Mar. 24, 1983. Letter from H.A. Eschenback (Director of Health, Safety, and Toxicology) to U.S. Environmental Protection Agency reports that, of 109 known deaths of Libby mine and mill employees, 16 were from lung cancer and 2 from mesothelioma. Letter concludes by stating that conditions have been much better since 1976, and all new employees are required to be non-smokers.

As a major chemical company, WRG would have made use of *Chemical Abstracts*, which contained numerous citations on asbestos disease (See "Abstracts," in Chapter 10).

W.R. Grace Senior Litigation Counsel Richard Finke has contributed to the scientific literature on industrial hygiene (M. Corn, B. McArthur, and M. Dellarco, "Asbestos Exposures of Building Maintenance Personnel", *Appl. Occ. Environ. Hyg.* 9: 845-852, 1994). Finke oversees W.R. Grace's defense of asbestos property damage suits which typically charge that extraordinary abatement measures are needed to protect maintenance workers. He provided the authors of this paper with exposure measurements in maintenance logs obtained from plaintiffs

suing WRG in property damage cases, for 5 buildings. WRG expert witness Morton Corn and his co-authors reported that the highest recorded exposure was in one-hour electrical/plumbing jobs in one building, ranging from 0.19 to 0.59 f/cc and up to 1.0 f/cc for running cable. Daily average exposures were calculated on the optimistic (and in at least some cases erroneous) assumption that the workers experienced no other asbestos exposures on the days they were doing those jobs, yielding average values usually well below the 1994 OSHA permissible exposure limit of 0.1 f/cc. The only higher 8-hour (time-weighted-average) figure estimated in the report, disregarded in the Conclusions section, was 0.214 f/cc.

These results suggest that, fortunately, the concern for maintenance personnel exposure to asbestos has been prudent, but exaggerated.

The article's abstract concluded,

If minimum (operations-and-management) procedures are followed by knowledgeable, careful workmen, their TWA exposures to asbestos-in-air from asbestos-containing fireproofing while they work above the ceiling are well below the Occupational Safety and Health Administration's 8-hour permissible exposure limit (of 0.1 f/cc) for the period of their work.

Among the first to seek relief from this work was another client of Dr. Corn's, Turner & Newall, on whose behalf the article was presented by Corn on the eve of its publication. When pressed by attorney Martin Flumenbaum representing Chase Manhattan Bank, Corn admitted that Finke had not expressly told him that he had no other data sets that related to maintenance workers. Corn also admitted that he might have dropped some recorded measurements himself "if a filter was overloaded beyond the guidelines of (OSHA) for analysis." (deposition of M. Corn in *Chase v. T&N*, 87 Civ. 4436, U.S. District Court, S. Dist. of NY., Nov. 21, 1994).

Others have criticized both the reporting of data and the method of extrapolating daily-average exposures in this article.

Ewing and Keyes have written that the actual data were in some cases higher than reported by Corn and his co-workers, and that there were alarming inconsistencies in the building records data base itself (*Appl. Occ. Environ. Hyg.* 10: 510-512, 1995). These authors, who also had familiarity with this database through litigation, noted that the exposures recorded for maintenance tasks represented, in at least some cases, exposures with comprehensive operations-and-maintenance safeguards, not typical of those jobs performed without special protective measures. They suggested that perhaps some of the records produced by the owners of one of the buildings to W.R. Grace were not provided by the firm's lawyers to Dr. Corn (*Ibid.*, 10: 885).

There is a fundamental problem with a lawyer managing a corporation's defense against multimillion-dollar damage suits being the source of the (second-hand) data used in this "too-good-to-be-true" contribution to the scientific literature. The lawyer can resolve his duty to "do no harm" to his client's case (the lawyers' counterpart to the Hippocratic oath) with science's search for truth, only if the truth happens to be helpful to W.R. Grace. Skeptics may be pardoned for also noting that W.R. Grace has pled guilty to felony charges, for lying to the Environmental Protection Agency about its discharge of hazardous wastes (See "Criminal Sanctions and Personal Responsibility," in Chapter 11).

As a major chemical company, WRG would have made use of *Chemical Abstracts*, which contained numerous citations on asbestos disease (See "Abstracts," in Chapter 10).

GAF CORPORATION
(Ruberoid)

Ruberoid Company operated asbestos mines in Vermont starting in 1936 and made asbestos insulation and shingles. Ruberoid also manufactured asbestos-cement panels and siding. It was taken over by GAF Corporation in 1967.

Ruberoid had a full-page advertisement in the March, 1930, issue of *Asbestos* magazine that carried an article on asbestosis.

In the 1930s, employees of a Ruberoid plant in St. Louis sued

the company, claiming they suffered respiratory impairment from their exposures to dust. The plaintiffs charged that management had been negligent in not posting warnings of the dangers, not installing exhaust ventilation equipment, and failing to provide respirators and medical examinations to the workers (Samuel Robertson and Alexander Smith suits against Eternit, U.S.A., which became part of Ruberoid in 1930, and Ruberoid Co., Circuit Court of City of St. Louis, both filed in 1934). The outcomes of these cases are not known. GAF has acknowledged that 3 more similar cases were filed against Eternit and Ruberoid in 1935, and has stated that these cases were dismissed. Board of Directors' minutes of May 28, 1935, noted, "difficulty in insuring ourselves against occupational diseases."

The Occupational Disease Law enacted in Vermont in 1951 required chest X-ray examinations of all workers employed in places with a hazard of silicosis or asbestosis. This was to be done annually under the supervision of the state government. In November of 1951, the Vermont Commission of Industrial Relations informed Ruberoid management that two asbestos mine workers had asbestosis. In passing this along, the mine superintendent observed that the state had failed to diagnose the condition in a third worker who had been identified as having asbestosis by a company doctor.

The State Health Department have promised me that they will not send out reports to the employees or their doctors at least not this year. Under the law we could ask for waivers on the above two employees, however, this would mean revealing the reports and I recommend we do not ask for them.

The law allowed an employee to request a waiver of his right to compensation if affected "though not actually disabled" by an occupational lung disease. But such requests would have had to be in writing, and securing them would have meant telling the workers they had asbestosis. This confidential memorandum was sent to Ruberoid executives including the Chairman and President, Herbert Abraham. (M.J. Messel, "State of Vermont—Occupational Disease Law," memorandum to F.E.

Byrnes, copies to Messrs. Abraham, Behre, Cowan, and Limerick, Nov. 14, 1951)

In 1952, a workers' compensation claim was filed against Ruberoid by another worker at the Missouri plant, Fee James, who claimed he was totally disabled with asbestosis and silicosis. The workers' compensation claim was then withdrawn and a damage suit filed in its place. James' deposition recounted the extremely dusty conditions he worked in as a "beaterman" at Ruberoid's shingle plant, dumping asbestos and other materials into mixing tanks, etc. A settlement was reached in the case in 1953 (*Fee James vs. Ruberoid Co.*, U.S. Dist. Court, E. Dist. MO, Cause No. 8864).

In 1954, a damage suit was filed against Ruberoid following the death of another worker in the St. Louis plant. Opil B. Reed had worked in the asbestos room and warehouse from 1944 until his death in 1953 from a respiratory condition. Damages were sought by his family, which charged the company with negligence along similar lines as Robertson and Smith had done twenty years earlier. The outcome of this case is not known (*Gloria D. Reed et al. vs. Ruberoid Co.*, U.S. Dist Court, E. Dist. MO, No. 9875).

A Ruberoid Calcilite Insulation brochure stated that this (asbestos-containing) product contained "no harmful ingredients." The brochure was issued sometime during 1948-1960, the years that Calcilite Insulating Cement (another product mentioned) was offered for sale.

Ruberoid was also named as a defendant in the product liability suit brought by the widow of Clarence Faciane in 1961-62 (See "Lawsuits by Product Users against Asbestos Manufacturers" in Chapter 3).

A sales official, L.B. Farrell, sent a memorandum, "Asbestos—Potential Cause of Cancer," to Ruberoid President E.J. O'Leary and others on March 2, 1966, attaching news reports of interviews with Dr. Selikoff. Selikoff was quoted as warning that the dangers extended to bystander construction trades workers and their families. Farrell was concerned that the publicity could cause "substantial employee relations problems for us." The next month, Ruberoid's R.W. Henry and other company representatives on the Executive Committee of the National

Insulation Manufacturers Association decided to form a Health and Safety Committee "to combat adverse opinions relative to the health hazard of insulation products." (NIMA Minutes, Apr. 11, 1966). The NIMA pamphlet finally issued in 1968 said nothing about the health risks from asbestos insulation (See also "National Gypsum Company," item 5, later in this chapter).

GAF President Jesse Werner was personally invited to join a "working group" on asbestos insulation industry hazards by Dr. Irving Selikoff (letter dated April 12, 1968). At a May 19, 1970, meeting of the Asbestos Cement Products Association, GAF was in the majority on a 4-3 vote against including explicit acknowledgement of a health risk from sawing, drilling, or machining asbestos-cement products (in a brochure for the public—See "National Gypsum Company" later in this chapter). Former Ruberoid chemist and research chief Phillip Bettoli has testified that GAF never put a warning on asbestos-cement products (*Baltz v. Johns-Manville et al.*, deposition Apr. 25, 1980).

Ruberoid joined the Industrial Hygiene Foundation in 1953. The *Industrial Hygiene Digest* listed the 1953 Threshold Limit Values published by ACGIH in the October, 1953 issue, giving 5 MPPCF as the TLV for asbestos dust. In December of 1953, the *Digest* published a table of state occupational disease statistics, including one case of "Asbestosis—cancer (dust, asbestos)" occurring in Connecticut in October of 1953.

As noted above, Ruberoid was also a member of the National Insulation Manufacturers Association. A Ruberoid representative participated in discussions wherein a NIMA health program was rejected in 1960, and the text of the Johns-Manville insulation shipping carton warning label was presented in 1964. On June 4, 1970, GAF insulation marketing manager R.W. Henry wrote to NIMA executive secretary J.M. Barnhart that caution labels would be printed on "Calsilite" insulation products.

Primarily a chemical company, GAF would have made use of *Chemical Abstracts*, which contained numerous citations on asbestos disease (See "Abstracts," in Chapter 10).

WESTINGHOUSE ELECTRIC CORPORATION

Westinghouse sold turbines and made cables insulated with asbestos, and manufactured "Micarta" board containing asbestos. The company's medical director, T. Lyle Hazlett, and industrial hygienist, Edgar C. Barnes, were among the occupational health specialists of the Konicide Club, which met during the years 1932-1940 (T.F. Hatch and E.P. Pendergrass, *J. Occup. Med.* 19: 351-353, 1977). Westinghouse was a member of the Industrial Hygiene Foundation, where Dr. Hazlett served as a member of the Medical Committee and Joseph Dilworth was on the Board of Trustees in the 1940s; Westinghouse received the *Industrial Hygiene Digest* from 1937-1967. Westinghouse was also a member of the National Safety Council, where Dr. Hazlett served as a member of the Executive Committee by 1943.

Dr. Hazlett wrote a number of articles in the 1940s about industrial medicine, including "The Practice of Industrial Health" (*South. Med. J.* 34: 1127-1130, 1941), in which he emphasized worker education through pamphlets, posters, talks by the medical personnel, the plant magazine, etc. Hazlett's 1947 book, *Introduction to Industrial Medicine*, stated that asbestos produced serious effects, that asbestosis was a progressive disease that could develop in 7-9 years with exposure to high concentrations.

Barnes warned management at the company's South Philadelphia Works that worker protection against asbestos, used in heat insulation for steam turbines, "can hardly be called suitable or adequate." (Jan. 11, 1946) Barnes noted that, "in several cases," workers in the area had been found to have lung conditions that might be associated with exposure to the dust. Barnes said that ventilation over the table where workers filled and sewed insulation blankets was not satisfactory, that wind entering the room each time the door was opened "stirs up all the dust on the floor and tables." An exhaust hood was also recommended over the area where a dry asbestos composition was mixed with water several times each day. Specifications and drawings were also supplied by Barnes.

Elsewhere, Barnes called attention to the hazard of asbestos dust from a saw used for cutting asbestos materials, also

recommending exhaust ventilation. He warned that considerable care be taken to minimize the asbestosis hazard (Memorandum to Trans. and Generator Div., Apr. 30, 1948).

The company printed a Safe Practice Data Sheet called "Asbestos" in 1953. This stated that the Maximum Allowable Concentration where workers could breathe the dust was 5 MPPCF, except that if the exposure was for less than one hour per day, "a slightly higher concentration may be permitted but must not exceed 10 (MPPCF)."

Another hazard identified at the South Philadelphia Works arose from cutting asbestos cloth. Though exposures in this operation had been measured at less than 5 MPPCF, headquarters industrial hygienist Wilbur Speicher nonetheless expressed concern that exposures were variable and urged improved ventilation. He also warned that, "When sheet material is being thrown from one bench to another, the concentrations of asbestos fibers in the breathing atmosphere of the sewer in particular would appear to be potentially hazardous." As Barnes had done earlier, he pointed out that compensation claims for occupational lung diseases were a possibility (Memorandum to W.E. McKeldin, June 11, 1954).

Speicher also advised plant personnel to install exhaust ventilation with a dust collector on a circle saw, where the operator was simply provided with a respirator and dust was scattered on the floor. "Possible exposure to surrounding workmen" was also noted. Serious hazards from fumes, solvents, noise and radiation were also described (Memorandum to James McClimans, July 24, 1957). Dust from the boring and facing of asbestos casing was the subject of air monitoring on another occasion: "The dust concentration became so great that the operator could not remain at the machine during the operation." The air samples showed that the Maximum Allowable Concentration was "considerably exceeded." (W.E. Piros, memorandum to Harry Mower, Transportation and Generator Division, Mar. 27, 1961)

Speicher and his associate, E.J. Hlavarty, reported that ceiling concentrations were "excessive by a factor of two" when asbestos cloth was torn by hand in 1973, compared with the OSHA short-term limit of 10 f/cc, and urged that a substitute be

found (H.W. Speicher memoranda to W. Craig, Jan. 29, 1973; Hlavarty memorandum to Craig, Feb. 7, 1973; and Speicher memorandum to Craig, Feb. 16, 1973).

Corporate industrial hygiene sampling showed that machining a one inch slab of Micarta board with a circular saw produced 17 f/cc, compared with the OSHA limit of 5 f/cc, and engineering controls were advised to capture the dust (E.J. Hlavarty, memorandum to D.L. Collier, Mar. 19, 1973). In an area where Micarta sheet and asbestos gasket materials were cut on a circle saw, Hlavarty found 2 of 8 air samples were above 10 f/cc "by a statistically significant amount." Engineering controls were recommended. "Common work practices ... which should be very strongly discouraged" included use of a compressed air gun for personal and work station clean-up, as well as dry brushing and shaking out of clothing and aprons. Vacuuming was advised (J.F. Adams, Headquarters Industrial Hygiene, memorandum to E.J. Hlavarty, Apr. 24, 1973).

By 1973, it was contemplated that warning labels would soon be required for all products containing asbestos, and a label was designed. The Manager of Insulation Design Engineering noted that the Industrial Products Division would "delay as long as possible using the labels," and solicited comment on the effect labeling would have on the people in the shop (J.C. Botts, "Asbestos Based Micarta," to G.M. Shelby, Apr. 30, 1973).

Workers using U.S. Gypsum "Durabond" joint compound in the Westinghouse manufacturing homes division walked off the job in 1973, when they were informed by warning labels that the product contained asbestos. Through Westinghouse was able to obtain an asbestos-free substitute from USG, the company retaliated by firing the entire work force that had left their jobs (See "United States Gypsum Company" in this chapter).

Machining Johns-Manville "Marinite" board produced grossly overloaded air samples, and quantitative evaluation of the samples was not even attempted. Headquarters industrial hygienist John Adams added that he hoped testing of a non-asbestos substitute would be successful. "If it is not, we strongly agree with your commitment to 'farming out' the work" (memorandum to T.J. Katner, May 7, 1973).

The Westinghouse Micarta Division, Hampton, South Carolina, was cited by OSHA in 1976 for failing to monitor employees' exposure to asbestos, as required under the 1972 OSHA standard (South Carolina Dept. of Labor, issued Jan. 12, 1976). Later that year, worker asbestos exposures in a raw material storeroom were measured at 35 f/cc and 123 f/cc, well above the OSHA ceiling limit of 10 f/cc. It was agreed to "terminate this operation at once and (have the) work subcontracted to an outside vendor until such time as a satisfactory substitute can be found" (J.F. Adams, memorandum to E.S. Bober, Mar. 22, 1976).

The Micarta Division decided to cease making asbestos-containing products July 1, 1976, as a result of more stringent OSHA limits (C.R. Ruffing, "Asbestos in LRA Progress Report," Large Rotating Apparatus Div., Aug. 24, 1976).

In 1980, OSHA issued a standard on employee access to records on exposure and medical monitoring. Even before that, Westinghouse had been sued by NIOSH for refusing to provide employee medical records for health studies. The company had lost the NIOSH suit and was appealing it, and then declared the OSHA standard illegal as well (P. Palmieri and H.B. Burr, "OSHA Access to Employee Exposure and Medical Records Rule—1910.20," July 25, 1980). OSHA cited Westinghouse's Lester, Pennsylvania plant in 1980 for not notifying workers that their chest X-rays showed abnormalities consistent with asbestosis (Willful violation).

Sensitivity about records disclosure was not limited to requests from the federal government and employees. In 1987, Westinghouse officials reviewed historic company records dating back to the 1930s from the standpoint of potential damage they might cause if disclosed in legal proceedings.

The majority of the documents in Industrial Hygiene's files are *potential* "smoking gun" documents...The files are filled with documentation which critiques and criticizes, from an industrial hygiene perspective, Westinghouse manufacturing and non-manufacturing operations.

It was noted that it was usually impossible to determine what Industrial Hygiene Department recommendations had been implemented. Follow-up was not documented, and the Indus-

trial Hygiene Department's authority was described as "very limited." No records usually existed to show what, if anything, had been done to protect workers and the public from the hazards described.

The officials went on to thoroughly explore how early recognition of hazards, failure to document control measures, and measurements of hazardous conditions might be used as "smoking gun" documents in damage suits. It was recommended that plant correspondence files before 1974 and records "editorializing" about hazards in other files be discarded. It was also noted that the records were of no present use to the corporation and were not required to be maintained by any law. Attorney Jeffrey Baier and Corporate Industrial Hygiene Manager C.W. Bickerstaff concluded that toxic tort litigation imposed on Westinghouse the imperative of "well reasoned and conceived document retention and destruction programs." It is interesting that this document survived (document number MWBB-0032997, 22 pp.). Bickerstaff confirmed that it was decided to destroy plant correspondence files before 1974 and historical files on the Industrial Hygiene Department (memorandum to J.W. Fisch, Jan. 29, 1988).

On May 3, 1991, Westinghouse was cited by OSHA for "serious" violations in removing over 40,000 square feet of asbestos insulation.

Westinghouse exposed the workers to friable asbestos over a prolonged period of active concealment of the severe risk. No monitoring equipment, training, notice of risk, or hazard communication were provided. There were over 30 employees exposed to the risk at various times.

Later that year, a public interest group listed Westinghouse as having the second highest number of OSHA citations, during the period 1977-1990, among the nation's largest manufacturing companies (James Donahue, *Workers at Risk*, Essential Information, 1991).

Acts of Westinghouse such as those described here may not be subject to media exposés on "60 Minutes." As the new owner of CBS, as well as dozens of radio stations, Westinghouse became the largest broadcaster in the United States in 1995.

COMPANIES MINING ASBESTOS IN QUEBEC, CANADA

There is a body of knowledge that may be ascribed to Canadian asbestos mining companies, generally. The largest asbestos mining operation in Quebec was that of Johns-Manville (sold by Manville Corporation to former employees in 1983), in the town of Asbestos. Others are located not far away, most near the town of Thetford Mines. These others include, or in the past years have included:

Company	Relevant History
Bell Asbestos Mines	Subsidiary of Keasbey & Mattison Co. which itself was bought by Turner & Newall, Ltd. (U.K.) in 1934. Sold in 1980 to the Quebec government company, Société National de l'Amiante.
Asbestos Corporation, Ltd.	Formed by the consolidation of many smaller mines in 1925; General Dynamics Corp. (U.S.) obtained a 54% interest in 1969 and sold it to Société National de l'Amiante in 1981.
Johnson's Company	Obtained by Asbestos Corp. Ltd. in 1964.
Nicolet Asbestos Mines, Ltd.	Operated by Nicolet Industries, Inc. (U.S.) from 1939-1969.
National Asbestos Mine	Operated by National Gypsum Company from 1958-1973 and sold to Lake Asbestos.
Lake Asbestos (Lac d'Amiante du Quebec, Ltee.)	Subsidiary of Asarco, Inc. (U.S.), in operation since 1958.
Flintkote Mines, Ltd.	Subsidiary of Flintkote Company (U.S.), in operation from 1946 until around 1970.
Quebec Asbestos Corp.; Carey Canadian Mines	Subsidiaries of Philip Carey Manufacturing Company (U.S.), which in turn has become succeeded by Glen Alden, Rapid-American Corporation, Panacon, and Celotex, part of Jim Walter Corp. (U.S.). The first of these operations closed and the second began in the late 1950s.

Cooperation among asbestos mining companies in Quebec dates from 1930 or before, on the subject of asbestosis. In that year, an article on asbestosis appeared in *Asbestos* magazine amidst advertisements by Philip Carey Manufacturing Company, Johns-Manville, Keasbey & Mattison, Asbestos Corporation Ltd., and others. Other material on asbestos hazards known to mining firms in Quebec includes the following items:

1. Health surveys were undertaken under the auspices of the Metropolitan Life Insurance Company in 1930 by Drs. Frank Pedley and A.J. Lanza. Their findings were contained in a report by Dr. Geroge Wheatley, medical director of Metropolitan Life. This obscure 1944 report, *Tuberculosis and Asbestosis*, included data from a 1930 survey of 195 asbestos miners in Asbestos and Thetford Mines. Of this number, 42 had asbestosis. The Wheatley report also noted that asbestosis was a compensable disease in the Province. According to a memorandum by Quebec Asbestos Mining Association lawyer I. Sabourin (attached to the back of the report), the report had been sent to compensation officials and pulmonary experts in Quebec at the time it was prepared (See also "Asbestosis in Canada" in Chapter 1).

An unpublished report to Metropolitan Life Insurance Company identifies the companies surveyed in Thetford Mines as Asbestos Corporation, Keasbey & Mattison, and Johnson's Mine (Frank Pedley. *Report of the Physical Examinations and X-ray Examinations of Asbestos Workers in Asbestos and Thetford Mines, Quebec*, 15 pages, Nov. 1930).

2. Burton LeDoux report, "Asbestosis," and the asbestos strike of 1949.

Pierre Elliott Trudeau's book, *The Asbestos Strike* (Toronto: J. Lorimer & Co., 1974, originally published in 1956) says that LeDoux had previously written exposés of silicosis in Quebec, creating a scandal in 1948 (pp. 241-242, 274). His investigation of the asbestos mines was written entirely about Quebec Asbestos Corp., Ltd. a subsidiary of Philip Carey. LeDoux' account was printed in the newspaper *Le Devoir*, an indictment that filled several full pages of the newspaper. It was entitled, "Asbestosis at East Broughton—A Village of 3,000 Suffocated by Dust," and appeared in print on January 12, 1949.

LeDoux' account was also printed in English. It describes case histories of workers disabled by asbestosis, local doctors who were afraid to tell them so, estimates of how much profit Carey

mined out of the town, descriptions of asbestos air pollution in town, commentary on the "ample and authoritative medical literature...that the disease is incurable and fatal"; and culminates with what LeDoux called "proof of company and government responsibility" starting in 1944. This was a thorough, piercing, investigative report.

Le Devoir let hardly a day pass for the next month without adding reports and editorials on asbestosis. One of the reporters of this scene, Gerard Pelletier of *Le Devoir*, is the raconteur of the chapter of Trudeau's book about press coverage of the strike. He described the workers of Carey's East Broughton mining operation as "preeminently the victims of asbestosis," and yet the only unionists who did not join the five-month strike in the asbestos mines that began in February, 1949.

3. F. Lathe, "Associate Committee on Asbestos" (Aug. 11, 1936); and D. Wolochow, "Asbestos" (June 3, 1938).

Canadian government officials who attended meetings of the Quebec Asbestos Producers Association in the 1930s referred to discussions of asbestosis by the industry trade association (renamed Quebec Asbestos Mining Association in 1948).

4. O.C. Smith (Bell Asbestos Mines, subsidiary of Turner & Newall, U.K.), "Report to Quebec Asbestos Mining Association re Pulmonary Cancer and Supplementary Memorandum re Cancer Research" (Dec. 19, 1950).

Memorandum enclosing review by Dr. John Knox of T&N about the U.K. Factory Inspectorate's statistics linking asbestosis and pulmonary cancer. Addressed to representatives of the following companies: Asbestos Corporation Ltd., Flintkote Mines, Canadian Johns-Manville, Nicolet Asbestos Mines, and Quebec Asbestos Corp.

5. A.J. Vorwald, *First Interim Report Asbestosis and Pulmonary Cancer*. Saranac Laboratory, report to Q.A.M.A. (May 7, 1952).

The Saranac Lab was commissioned by the Quebec Asbestos Mining Association to test Canadian chrysotile asbestos in mice by inhalation. By May 1952, this preliminary report of 14 months' testing appeared, showing a trend toward positive findings, and shortly thereafter funding of the study was apparently halted (See "The Saranac Lab's Cancer Studies for the Quebec Asbestos Mining Association," in Chapter 2).

6. P. Cartier, Reports of Cancer among Asbestos Miners at Thetford Mines, 1952-1955.

Pathology reviews of tissues were done at the Saranac Laboratory for the mining companies starting in 1942, and a number of pulmonary cancer cases were already recorded by 1949 (See "Dr. Schepers' Visit to America," in Chapter 2). Dr. Cartier, of the Thetford Industrial Clinic, periodically reported on these cancer cases (See "More Reports and Reviews" and "The Seventh Saranac Symposium," in Chapter 2).

7. D.C. Braun, *An Epidemiological Study of Lung Cancer in Asbestos Miners* prepared by Industrial Hygiene Foundation for Quebec Asbestos Mining Association (Sept. 1957). D.C. Braun and T. Truan, "An Epidemiological Study of Lung Cancer in Asbestos Miners," *Arch. Indust. Health* 17: 634-652 (1958).

These and other documents describe research sponsored by Q.A.M.A. on lung cancer in asbestos miners (See "The Industrial Hygiene Foundation Cancer Study," in Chapter 2).

8. "Minutes of the 89th Meeting of the Quebec Asbestos Mining Association," held Oct. 14, 1964 at the St. George's Club, Sherbrooke, Quebec.

Q.A.M.A. decided to contribute toward the expenses for the international conference on asbestos sponsored by the New York Academy of Sciences.

9. "Minutes of the Special Meeting of the Quebec Asbestos Mining Association Held on March 28 and 29, 1968, at the Grand Bahama Hotel and Country Club, G.B." And "Special Meeting, Grand Bahama Hotel and Country Club, G.B."

The first of these mentions a proposed health warning label for bags of asbestos "to release the producers from possible legal responsibility." The text was to be checked by "member company counsels" for review at the next Q.A.M.A. meeting.

The second refers to the TLV Committee of the American Conference of Governmental Industrial Hygienists.

The Committee has potent legal standing in theory, but not in practice. It was emphasized that adequate information is not always available to this Committee; for instance, standards for the asbestos industry are not up-to-date.

10. *Montreal Star* (March 20, 1975).

Contains two front-page stories about the Thetford clinic's failure to inform asbestos miners that they had asbestosis, over a period of decades.

The minutes of the Quebec Asbestos Mining Association (founded in 1931) have never been made available for inspection in discovery proceedings.

PHILIP CAREY MANUFACTURING COMPANY
(later Glin Alden, Panacon, Celotex, Jim Walter Corp.)

The Philip Carey Company of Cincinnati, Ohio, boasted that it had been supplying asbestos and asbestos products for over 50 years in an ad appearing in *Asbestos*, in March, 1930 (this issue also carried an article about asbestosis). Carey was in the insulation contracting business as well.

Publicity over asbestosis among Carey's Quebec mine employees led to a historic asbestos strike in the Province (See "Compensation at the Asbestos Mines in Canada," in Chapter 3, and "Companies Mining Asbestos in Quebec, Canada," this chapter). Carey's ownership of the Quebec Asbestos Corporation was recorded in *Moody's Manual of Investments* (1950). Q.A.M.A. lawyer Ivan Sabourin communicated the initial report and findings of the industry-sponsored cancer epidemiology study to Ed Broadway of Quebec Asbestos Corp. on Nov. 11, 1957 (See "The Industrial Hygiene Foundation Cancer Study," in Chapter 2).

The following documentation relates directly to Carey:

1. National Industrial Recovery Administration, Hearing on Code of Fair Practices and Competition, Presented by Asbestos Industry, Oct. 19, 1933.

Carey President George Crabbs and Johns-Manville President Lewis Brown, accompanied by representatives of 3 other asbestos companies, testified at hearings on a proposed code that would have excluded minors under age 18 from employment in occupations with exposure to "asbestos dust... in injurious quantities." Brown presented a list of companies that had signed the proposed code (including American Brakeblok, Carey, Ehret, Garlock, J-M, Keasbey & Mattison, Ruberoid, Southern Asbestos,

Thermoid, Union Asbestos & Rubber) and a list of "members of the asbestos industry which have not signed the proposed code" (including Armstrong Cork & Insulation, Plant Rubber & Asbestos Works, and Firestone Tire & Rubber Co.). Brown and Crabbs were followed by Waldo C. Holden of the AFL-CIO, who expressed concern about children exposed to a health hazard from asbestos dust (See also "1931-1935: Taking Account of Asbestosis," in Chapter 1).

2. *Heating and Ventilating* magazine, June, 1944.

Contained an article by Hutchinson ("Dust as an Industrial Health Hazard") noting the asbestosis hazard to insulation workers and others; also an advertisement by Philip Carey Manufacturing Company for "all-asbestos" Careyduct. (See "Trade Journals," in Chapter 10.)

3. In late 1944, a Carey plant worker in Ohio died, and Dr. Robert Ritterhoff diagnosed asbestosis at autopsy. This was pathologically confirmed by Dr. Gardner at the Saranac Laboratory. When Gardner requested details about the man's exposure to dusts, Ritterhoff replied that the company had been "uncooperative." He explained, "They have not permitted me to visit the plant, nor have they given in detail his occupational history" (letter dated Dec. 23, 1944). Dr. Ritterhoff eventually did visit the company and discuss this case with a company official. "The purpose of the visit was to tell someone at Philip Carey that their employee, Mr. Scobie, died of asbestosis," Dr. Ritterhoff recalls. He was informed by his co-worker, Dr. John Skavlem, that the company had "privately" compensated Mr. Scobie's widow. (Deposition of Dr. Ritterhoff, *State of Maryland v. Keene Corp. et al.*, Civ. No. 1108600. Circuit Court Anne Arundel Co., MD, taken Jan. 30, 1986; and Vorwald Patient File No. P-44-326, Armed Forces Institute of Pathology, Washington, DC.)
4. Following the death of Carey employee Len R. Hope in 1953, a workers' compensation claim was filed in Ohio by his widow. This went through various appeals and was ultimately resolved by pathologist Kenneth M. Lynch's report in 1956, to the effect that the man's death was caused by asbestosis. Compensation was awarded on Jan. 24, 1957 (Len Hope file from archives of K.M. Lynch, Ohio Industrial Commission No. OD 79998).
5. Contracting Division Compensation Claims by Insulation Workers.

Carey was named as a defendant in claims brought by Swartout, Riley, Gilivich, and Onofrio, with notice to Carey dated from 1956-1963 (See "Claims by Insulators against Contracting Divisions of Asbestos Product Manufacturers," in Chapter 3); and Latto in 1961-1962 (See "The Mancuso Documents," in Chapter 3).

6. Carey was named as a defendant in 1961 in the product liability suit brought against insulation manufacturers by G. Faciane (See "Lawsuits by Product Users Against Asbestos Manufacturers," in Chapter 3).

7. The Mancuso Documents, 1962-1964

Carey's group life insurance carrier, Metropolitan Life, tallied numerous death claims due to lung cancer and other respiratory conditions during the years 1957-1962 (J.R. Lynch, letter to Karl Krieg, Philip Carey, April 16, 1963).

At the direction of actuaries, Carey hired Dr. Thomas Mancuso as Consulting Medical Director for the entire company. Mancuso reported directly to top management about the urgent need for measures to protect employees, customers for Carey asbestos products, and neighbors of Carey facilities exposed to asbestos air pollution (See "The Mancuso Documents," in Chapter 3). Dr. Mancuso's services were terminated by Carey in 1964, following his report on the New York Academy of Sciences conference on asbestos disease (T.F. Mancuso, letter to J.T. Cantlon, Oct. 26, 1964; and L.A. Pechstein, letter to Cantlon, Dec. 8, 1964).

8. L.A. Pechstein (Secretary and General Counsel, Philip Carey Corp.), letter to T. Lindsey (John T. Cantlon & Associates), Nov. 4, 1969.

Notes that Carey was a defendant in a common law asbestosis suit in Texas, in which the plaintiff had posed interrogatories. One asked, "Do you agree that the State of Ohio had a Workmen's Compensation Law covering the occupational disease of asbestosis beginning in the year 1939?" Pechstein wrote,

We would appreciate your suggestion for a short, somewhat evasive answer to the interrogatory.

9. Harold Plate (Sales Mgr., Carey Canadian Mines, Quebec), letter to Kermit Hayden (California Portland Cement Co.), May 8, 1970. Responds to health concerns about asbestos.

We've been in the asbestos business since 1918 and can find no reported conditions of asbestosis or lung disease claims they have been trying to associate with asbestos.

The Philip Carey Manufacturing Company apparently never did place health warning labels on its asbestos products, which contained amosite and chrysotile asbestos (deposition of Arthur P. Mueller in *Goad v. Johns-Manville Corp. et al.* U.S. Dist. Court for S. District of Ohio, Western Div., Case No. C-1-82-127, Feb. 13, 1985). Upon incorporation by merger into Celotex at the time that (OSHA) workplace asbestos standards were issued in the United States, newly required warnings were placed on asbestos products by the company in mid-1972. Celotex had been in the asbestos business starting in the 1940s or earlier, manufacturing such products as "Cemesto" structural insulating panels and "Acousti-Celotex Perforated Asbestos Board." These products were described in Celotex annual reports in the 1940s and 1950s, as well as in *Moody's Manual of Investments*, etc. Celotex also made asbestos-containing products in the United Kingdom in the 1950s (deposition of Donald Gibson, *In re Master Asbestos File*, Civ. Action M.A.D. 100, U.S. Dist. Court, Southern Dist. of TX, Houston Div., Feb. 6, 1987).

Complete information on product lines may be contained in *Celotex' History of Insulation Products* and *Philip Carey's History of Asbestos Products*, which were sent by Jim Walter Corporation's Legal Department to Celotex defense counsel in Texas in 1978. The letter of transmittal noted that information handled between corporate lawyers and outside defense counsel offered "less chance of this information being subpoenaed or subject for production." (Dec. 26, 1978). Sure enough, the histories described were not produced to plaintiffs until 1990, under order of Judge Neil Caldwell of Brazoria County, TX. The judge declared that the company had committed "a fraud upon the Plaintiffs and this Court." (Order of Feb. 14, 1990 in *Searls v. Owens-Corning et al.* Dist. Court of Brazoria Co., TX, Case No. 88-C-0615).

ASBESTOS CORPORATION LIMITED (ACL)

This company was set up in 1925 and nationalized in the 1980s (incorporated into the Quebec government company, Société Nationale de l'Amiante).

A dust survey of the firm's King mine and mill was conducted in 1944 by Metropolitan Life Insurance Company, and the brief report of the findings was on file (Document No. 1178) at the Institute of Occupational and Environmental Health, in Montreal (I.O.E.H. was a part of the Quebec Asbestos Mining Association until its library was merged into the Canadian Asbestos Information Centre in 1982, now the Asbestos Institute). The report notes that a similar survey had been conducted in 1930. Dust concentrations ranged from 11.6 to 26.6 MPPCF in the five operations evaluated. The plant was not running at full production, and the windows were open in most areas at the time samples were taken. Improved housekeeping and the covering of conveyors, in addition to the above factors, were given as reasons for the "much lower" dust concentrations measured in 1944 than in 1930. In terms of plant design, very little had changed:

No changes have been made in the mill operations since the first survey. The only effort at dust suppression consisted in covering some conveyors.

The Metropolitan Life report recommended that efforts be made to lower exposures to a maximum concentration of 5 MPPCF. In this connection, the report of the U.S. Public Health Service (Dreessen *et al.*, 1938) was cited. Reprints of two papers by Dr. Lanza and his co-workers at Met Life (1935, 1936) were attached to the King Mine survey report.

Starting in 1943, numerous cases in which asbestosis was suspected among ACL employees were referred to the Saranac Laboratory. Many of these people had been seen by Dr. Cartier's Thetford Industrial Clinic, and compensation claims had been filed in at least 17 of the cases reviewed by Dr. Gardner and Dr. Vorwald between 1943 and 1957. In a 1946 case where a death claim had been filed, the asbestosis was extensive and was accompanied by lung cancer (Vorwald Patient

File P-46-372). The Treasurer of ACL, whose exposure consisted only of office work starting in 1920, died from pleural mesothelioma in 1949 (Vorwald Patient File IM-573). Details of these cases beyond those in the Vorwald files are unavailable from the Quebec government and the mining companies in Quebec, due to the Quebec Records Concerns Act, which bars the transfer of certain types of records out of the Province, even as photocopies.

ACL was a member of the Industrial Hygiene Foundation from Dec. 1, 1953 until Dec. 31, 1960. ACL was an "associate member of the Asbestos Textile Institute from June, 1952 until ATI was dissolved in the 1970s.

On January 5, 1970, ACL Vice President I.C. Campbell wrote to representatives of other asbestos mining companies that caution labels would be placed on future ACL asbestos shipments. These labels were being placed on shipments "to Canadian and American customers *only*" (original emphasis):

This bag contains chrysotile asbestos fibre. Persons exposed to this material should use adequate protective devices as inhalation of this material over long periods may be harmful.

JOHNS-MANVILLE CORPORATION
(renamed Manville in 1981)

This company was the asbestos industry leader in the United States, with mines in Canada. Its founder was Henry Ward Johns, who patented inventions for roofing and insulation products. Johns started his own company at the age of 21, and died 40 years later of a chronic lung condition, in 1898. (His death certificate lists the cause of death as "phthisis pulmonalis.")

The company's continuous concern about the problem of asbestosis apparently dates from the late 1920s. Lanza, in his 1935 publication, acknowledged that "officials representing the asbestos industry in the United States" had approached him to conduct a health survey in 1929.

J-M also presumably knew that Company doctors and Pedley examined workers at their mine in Asbestos, Quebec, and identified 18 cases of asbestosis there in 1930 (See "Asbestosis in Canada," in Chapter 1).

A 1930 report by J-M Sales Promotion Department (Market Analysis Section) contained factual summaries of British medical reports published in 1929. This is one of the few documents of interest produced in discovery by Johns-Manville to plaintiffs in civil litigation (from files of the J-M Waukegan, Illinois plant). Discovery conducted by the U.S. Department of Justice in the mid-1980s, in connection with a suit brought by J-M against the government, unearthed files of Vandiver Brown and others that had been preserved on microfilm.

Lawsuits were filed against Johns-Manville by employees claiming disability from lung diseases at least as early as 1929. The corporation's Board of Directors approved of a settlement of asbestosis lawsuits in New Jersey in 1933 (See "Asbestos Compensation in the Early Years," in Chapter 3).

Aided by Dr. A.J. Lanza of Metropolitan Life Insurance Company, J-M found that 29 percent of its Manville, NJ plant employees, including 2 watchmen and 2 shipping clerks, had pneumoconiosis (See "1931-1935: Taking Account of Asbestosis," in Chapter 1). Lanza advised against putting up health warning signs in J-M's Waukegan, IL plant in 1933, because of concern over lawsuits (See "Asbestos Compensation in the Early Years: Damage Suits," in Chapter 3).

Johns-Manville's early involvement in matters relating to the health hazards of asbestos seems to have been handled primarily by corporate attorney Vandiver Brown in the years 1930-1950. Shortly after 1950, Brown was summarily retired, and until his death in 1983 he resided alternatively in Scotland and Waco, Texas. Plaintiffs' attorneys were surprised to discover that he was still living, having been told in Johns-Manville's Answers to Interrogatories that Vandiver Brown was dead. Brown's doctor and banker (financial guardian) then testified that he was completely senile and in such poor health that he could not safely undergo a deposition. Brown never was prevailed upon to add to the documentary record of his years at Johns-Manville.

Brown's activities in the 1930s are known largely through the Sumner Simpson Papers (See "Raybestos-Manhattan," this chapter; and Chapter 3). These activities included making editorial suggestions to Dr. Lanza on galley proofs of his paper published in 1935; discouraging the trade magazine *Asbestos* from running stories on asbestosis and dust control; and representing asbestos companies sponsoring research at the Saranac Laboratory. In this last capacity, Brown vigilantly watched for any violation of the laboratory director's contract forbidding publication without approval of the industry sponsors. He also received in 1943 an annotated outline of a monograph that Dr. Gardner intended to write. This contained evaluations of human and unpublished Saranac animal test data, to the effect that in both cases the evidence was suggestive but not conclusive that asbestos was a carcinogen. Brown and representatives of other companies pressed Saranac to omit all mention of cancer in the published report of Gardner's research (See "Early Saranac Laboratory Cancer Tests with Asbestos," in Chapter 2).

Vandiver Brown was the asbestos industry representative who joined with representatives of other industries to launch the Air Hygiene Foundation, soon after renamed Industrial Hygiene Foundation.

Brown and the Johns-Manville president (Lewis Brown) met with Charles Roemer and officials from the Union Asbestos and Rubber Company in 1942 or 1943. According to Mr. Roemer, Brown explained that it was company policy to not tell employees their medical examinations showed they had asbestosis. Brown went on to explain the financial reasoning behind this policy (See "A Lobster Lunch with Vandiver Brown," in Chapter 3, and opening quote to this chapter).

In 1947, Brown criticized the lacking of scientific basis of the tentative threshold limit first proposed for dust in asbestos plants by the U.S. Public Health Service (See "Unsteady Movement Toward Numerical Exposure Limits," in Chapter 4).

In 1950, Brown demanded that Dr. Gerrit Schepers suppress a report Schepers had prepared for the South African government about the asbestos problem in the U.S. and Canada. Brown objected particularly to Schepers' reference to cancer at

the Canadian mines and the extreme dustiness of two Johns-Manville asbestos plants (See "Dr. Schepers' Visit to America," in Chapter 2).

In late 1950, Page Woodard, another J-M executive, met with Dr. Vorwald, Dr. A.J. Lanza, and Quebec Asbestos Mining Association attorney Ivan Sabourin to negotiate terms for an animal inhalation test on the carcinogenicity of asbestos. The funding for the test was apparently interrupted before completion, and none of the findings were published (See "The Saranac Lab's Cancer Studies for the Quebec Asbestos Mining Association," in Chapter 2).

Another key figure in the Johns-Manville response to the health threat of asbestos was Dr. Kenneth W. Smith. At the company's large mine and mill complex at Asbestos, Quebec, he conducted a survey of 708 employees in the late 1940s and considered 59 "probable compensation claims." None of the employees were informed that they had asbestosis (See "Compensation at the Asbestos Mines in Canada," in Chapter 3). Even before 1949, Smith recalled that Johns-Manville's top medical official at Asbestos, Quebec was concerned that the town was downwind of J-M's mining activities (See "Asbestos Air Pollution in the Community," in Chapter 7).

In 1950, Dr. Gerrit Schepers met Dr. Smith and discussed with him the pathological records of cancer on file at the Saranac Laboratory from eleven Canadian asbestos mine and mill workers (See "Dr. Schepers' Visit to America," in Chapter 2). But even before 1950, Dr. Harriet Hardy recalls, Dr. Smith was discreetly trying to interest doctors at the Massachusetts General Hospital in the issue of asbestos carcinogenesis. Even though this suggestion was well received, Smith later told Hardy he was not allowed to follow up because of J-M executives' objections.

Smith recommended warning labels for asbestos as early as 1952, the year he became corporate medical director. He testified as follows shortly before his death about the fate of that recommendation:

The reason why the caution labels were not implemented immediately, it was a business decision as far as I could

understand. Here was a recommendation, the corporation is in business to make, to provide jobs for people and make money for stockholders and they had to take into consideration the effects of everything they did and if the application of a caution label identifying a product as hazardous would cut into sales, there would be serious financial implications. And the powers of be (sic) had to make some effort to judge the necessity of the label versus the consequences of placing the label on the product.

(K.W. Smith deposition in *Louisville Trust Co. v. Johns-Manville, Corp.* Jefferson Circuit Court, Common Pleas Br. 7th Div. of Kentucky, Case No. 174-922, April 21, 1976.)

Labels warning that breathing asbestos was dangerous were not placed on J-M asbestos (insulation) products until 1964; not on sacks of J-M asbestos fiber from Canada until 1969 (See also "The Charges: Failure to Test, Failure to Warn," in Chapter 5). Apparently, most if not all others in the industry did not begin to label their products as hazardous until Johns-Manville did so; and some lagged years behind.

The company policy of not informing J-M employees when their medical examinations revealed asbestosis has also been described by Wilbur Ruff, former manager of the company's Pittsburgh, California manufacturing plant. Ruff testified that this "hush-hush condition" persisted as company policy at the plant he managed until 1971 or 1972. Ruff himself had been told asbestos caused lung disease in the late 1940s from C.B. Burnett, who went on to become the company's president in 1960 (Sworn Statement of Wilbur L. Ruff, Jan. 11, 1978, at law offices of Marrs A. Craddick, Walnut Creek, California).

At the corporate level, safety engineer Hugh Jackson worked closely with medical director Dr. Kenneth Smith. Even before Smith arrived at the corporate offices in New York, Jackson dealt with health problems at the plants, even arranging for lung tissue slides to be sent to Saranac Laboratory. In 1948, he verified that a plant foreman had died of asbestosis from breathing the general atmosphere in the plant, and expressed concern to Dr. Vorwald at Saranac that such exposure could

produce such severe lung disease (See "Saranac Compensation Reviews for Manufacturers," and "Cancer," Chapter 3).

In 1954, Jackson wrote to an official at the Waukegan plant that compliance with threshold limit values for employee exposure to asbestos did not assure protection for all the workers: "... no guarantee of full protection can be assumed at any level of exposure." (See "The American Conference of Governmental Industrial Hygienists TLVs," Chapter 4).

A management "compensation committee" held regular meetings at the large Manville, New Jersey, manufacturing plant in 1957-1958. Kenneth Smith, Clifford Sheckler, and others decided whether to inform workers whose medical examinations had turned up lung disease, whether to transfer affected workers to less dusty areas of the plant, and how to handle the affected individuals so that they would not file workers' compensation claims. Similar practices were followed by J-M management elsewhere, in the 1960s (See "Corporate Compensation Meetings at Manville," in Chapter 3).

A construction contracting firm owned by J-M was sued in 1933 by a workman, Bernard Dugan, who said he was totally disabled with lung disease from mixing asbestos-containing materials used in construction. In 1957 and 1961, Johns-Manville was named in damage suits in New Jersey by insulators Frederick LeGrande and Fred Wenham. Both plaintiffs received out-of-court settlements. Johns-Manville was also named in the product liability suit filed by G. Faciane in 1961 (See "Lawsuits by Product Users Against Asbestos Manufacturers" in Chapter 3).

Workers' compensation claims were also filed against Johns-Manville by insulation workers employed in J-M construction contracting divisions in the 1950s. Based mainly on a list of claims involving Armstrong Cork, it was possible to ascertain that J-M was joined as a co-defendant in the following cases:

Harry Kish (1953)
Edward Campbell (1954)
James Riley (1957)
Harry Haake (1957)
John Swartout (1958)

Ervey McCarrell (1959)
Lewis Munger (1959)
Harvey Curtis (1961)
Anthony Onofrio (1962)
Robert Goans (1963)

(See "Workers' Compensation Claims by Insulators against Contracting Divisions of Asbestos Product Manufacturers," Chapter 3.) J-M was also a defendant in the claim of Dean Templeton in Michigan in 1960 (See "Owens Corning Fiberglas," this chapter).

Johns-Manville also referred a number of asbestosis cases to the Saranac Laboratory for review. In the case of one worker who had asbestosis and died from lung cancer, Safety Engineer Hugh Jackson at corporate headquarters arranged to have the plant documents and chest X-rays sent to Saranac. He wrote to Dr. Vorwald on July 28, 1950, "As you know, Johns-Manville is considerably interested in the relationship of asbestosis and lung carcinoma" (Vorwald Patient File P-49-455). Two other cases of lung cancer and asbestosis were reviewed by Saranac for Johns-Manville in 1950 and 1951; one of these men had worked at the Waukegan, Illinois plant, and the other had worked at the company's Quebec asbestos mine (Vorwald Patient Files P-50-495, P-51-542).

By 1954, Johns-Manville operated a clinic in Asbestos, Quebec, with the capability to perform microscopic analyses of airborne dust samples. In addition, an annual survey was conducted with dust samples shipped to the Travelers Insurance Company for analysis (H. Rozovsky. "Air Handling and Dust Control at the Jeffrey Mine of Canadian Johns-Manville Company." *Canad. Mining J.* 75:59-65, 1954).

Johns-Manville was a member of the Asbestos Textile Institute, the National Insulation Manufacturers Association, Industrial Hygiene Foundation, Quebec Asbestos Mining Association, and the Asbestosis Research Council, among others. Through special studies, meetings, and publications of these organizations Johns-Manville was continually dealing with the problem of asbestos disease (See "Industry Research and Trade Associations," in Chapter 10).

In 1968-1970, J-M was among the members of the Asbestos Cement Products Association willing to warn the public that sawing asbestos-cement products would create a health risk (See "National Gypsum Company," next in this chapter)—if others in the industry would also do so.

NATIONAL GYPSUM COMPANY

National Gypsum owned interests in asbestos mining (National Asbestos Mine in Quebec) and manufacturing (plants in Louisiana and New Jersey). This company made "Gold Bond" drywall joint compounds and asbestos-cement panels.

Another product under development at the firm's research labs in 1949 was a sprayed acoustical treatment. Several different compositions were tested using various combinations of mineral wool, asbestos fibers and "floats," etc. The test materials were applied to the ceiling of a school auditorium in Ohio and evaluated. The first recommendation in the report was:

The floats should be removed from the formula since the increase in dust and the possibility of Asbestosis out-weigh the slight increase in surface smoothness.

It was also recommended that the amosite asbestos content be raised to offset the effect of removing the short fibers (floats). (F.M. Stumpf and B.O. Stewart, "On the Job Application of Spraying Wool for Acoustical Treatments," File No. 6a-6004, Rept. No. 391, June 28, 1949).

On March 11, 1953, National Gypsum Director of Safety M. Pollard wrote to Dr. L.W. Spolyar, Director of the Indiana Division of Industrial Hygiene. He listed amosite asbestos as a constituent of "Thermacooustic" spray-applied insulation, and recommended that operators mixing it for use wear a respirator approved for pneumoconiosis-producing dusts "because of the asbestos used in the product." Pollard suggested that respirators might be necessary for applicators, too, "if there is dust present." The same day, Pollard also sent an internal memorandum to others in the company, saying that asbestosis was a respira-

tory disease "with results usually worse than those produced by silicosis."

One recipient of these communications was G.W. Handy, who replied to Pollard that his letter was "full of dynamite." He speculated that if respirators were required for the job, the contractor would not be able to find men to apply the product. He concluded by urging that the letter be retrieved before mailing and reference to respirators be deleted.

I am concerned that the National Gypsum Company is on record to Dr. Spolyar that Thermacoustic is hazardous business. If this snowballs, we are out of the Thermacoustic business.

A handwritten note on this (Mar. 12, 1953) memorandum states, "Handy succeeded in stopping ltr to Spolyar. Will be modified."

Pollard had further discussions with company officials and mailed the letter, explaining (Mar. 16, 1953) to Handy:

I very much appreciate your thinking in this matter and I want to reassure you that the Indiana State Division of Industrial Hygiene uses no information to the detriment of any manufacturer. I purposely kept my reply on an objective basis because Mr. Willis thought this would be to our greatest advantage.

Pollard later wrote to a company official in New Orleans about various industrial health problems and observed,

We know that you will never lose sight of the fact that perhaps the greatest hazard in your plant is with men handling asbestos. Because just as certain as death and taxes is the fact that if you inhale asbestos dust you get asbestosis.

He went on to recommend dust control systems to get exposures within the state's maximum allowable limits ("Hazardous Pigments" memorandum to B.L. Kiernan and others, Sept. 22, 1958; "Personal and Confidential").

Several months later, Peter Paul Armenti, a 30-year National Gypsum employee, was awarded worker's compensation for 66 2/3 percent permanent disability from asbestosis, by the New

Jersey Division of Workmen's Compensation (Jan. 27, 1959, Norris County District).

During the years 1953-1972, employees' chest X-rays were regularly examined by Dr. George Wright, a radiologist formerly employed at the Saranac Laboratory. In at least one case, Dr. Wright went beyond the traditional physician's role and offered advice to the company on a matter of personnel policy.

I suspect that (he) has more of a problem with his heart than he either knows about or is willing to talk about. In all probability the abnormalities in the basal portions of his lung are related to the heart disease but the possibility that he may have inflammation and changes in the pleura of the lung which might be related to asbestos exposure should be kept in mind. I don't believe that at this point it should be pointed out to him.

It is my impression that you have done as much as management needs to do since you have called to his attention the fact that he has an abnormal film. From my own past experiences I would not advise making a stronger approach to either (him) or his physician.

(G.W. Wright letter to Timothy D. Tolin, National Gypsum Personnel and Safety Supervisor, Millington, N.J. "Re: Film No. 27530 Taken on 10/4/68.")

Other documents, most of them obtained in discovery from National Gypsum, describe a meeting by asbestos-cement producers on April 3, 1968, and subsequent events.

1. March 27, 1968 C.L. Sheckler (Manager, Occupational Environmental Control, Johns-Manville) letter to Frank Zimmerman (Director of Safety, National Gypsum).

This was an invitation to a meeting of representatives from Johns-Manville, Certain-teed, General Aniline and Film (GAF had just purchased the Ruberoid Co.), Flintkote, and Owens-Corning. The letter noted that contact had been made already between the President of J-M (C.B. Burnett) and a Vice President of National Gypsum (A.H. Fay). "We are currently preparing a booklet entitled 'Recommended Health and Safety Practices for Handling and Applying Asbestos-Cement Products'."

2. April 17, 1968 F.H. Zimmerman letter to Clifford L. Sheckler.

In the Council meeting of April 3, 1968 held in your conference room, it was agreed that I would advise you by April 19, 1968 of National Gypsum Company's position relative to the printing and distribution of the booklet entitled, "Recommended Health and Safety Practices." Our position is that we strongly oppose the publication and distribution of the booklet. Our reasons are:

- a) No risk has been shown to the general public from exposure to asbestos cement products manufactured for use in the building and construction industry.
- b) The proposed booklet points to dangers to health from the handling of corrugated and flat asbestos sheets when there is no scientific evidence of such dangers.
- c) The booklet creates fear in the minds of buyers, users, and workers without justification. These fears would be damaging to the entire industry.

The letter affirmed that,

This strong opposition to the publishing of the booklet has the full concurrence of the top executives of our company, including the Chief Executive Officer.

3. May 8, 1968 Sheckler letter to Zimmerman.

I have received tentative approval of the booklet as written in draft form from Certain-teed, General Aniline and Film, and Johns-Manville. It would be extremely advantageous to have unanimous agreement of the council members concerning any publications dealing with health. This is especially desirable in view of the continuous adverse publicity and attacks on various materials.

Sheckler proposed that Mr. Fay come to another meeting in June, 1968, to try to work out points of disagreement concerning the booklet.

4. November 7, 1968 Zimmerman memorandum to A.H. Fay (Vice President, National Gypsum), entitled "Recommended Practices Booklet."

The memorandum summarized changes recommended by Zimmerman in the draft booklet. This was provided to Fay in advance of the first meeting of the Asbestos Cement Products

Association, Health and Safety Council, on Nov. 14, 1968. The gist of the recommended changes was to downplay the language and narrow the content of the draft version of the booklet.

COVER SHEET: Title changed from 'Recommended Health and Safety Practices' to 'Recommended Practices.'

CONTENTS Page 2—Removed section headline, 'For Health and Safety's Sake' ...

INTRODUCTION Page 3—Did considerable rewriting in this area to change statements which could be used against the industry in compensation or law suits. Have attempted to take 'scare' wording from the booklet.

The rest of the recommended changes followed the lines of the first three, above.

5. November 14, 1968 Minutes of the Meeting of the Health and Safety Council/ACPA:

C.L. Scheckler of Johns-Manville opened discussion of the proposed pamphlet on health and safety practices for handling and applying asbestos-cement products. Representatives of Flintkote, Certain-teed, GAF, U.S. Gypsum, National Gypsum, Supradur, Philip Carey, and Atlantic Asphalt & Asbestos were in attendance.

Mr. Scheckler stated that the proposed pamphlet was designed to supplement two booklets already issued by the National Insulation Manufacturers Association. One of these booklets concerned thermal insulation products containing mineral fibers and the other concerned thermal insulation products containing asbestos fibers. The intent of issuing these booklets to contractors by the members of NIMA was to protect their employees and themselves legally. The present draft booklet on handling and applying asbestos cement products has been delayed until this Council was organized. Mr. Scheckler noted that the booklet was designed for contractors and those at job sites who handle asbestos cement materials. He noted that the booklets prepared by NIMA were not intended for workers per se although the unions concerned were given copies. Mr. Scheckler stated that the proposed booklet on asbestos cement products might be given to job foremen.

6. April 10, 1969 Zimmerman memorandum to E.J. Killian (Vice President).

This stated that Johns-Manville wanted to print the booklet about asbestos-cement products but apparently had not yet done so. At this time, the development of a booklet that would be acceptable industry-wide had been passed on to a committee of the new Asbestos Cement Products Association. Zimmerman anticipated, "many federal regulations controlling the health and safety aspects of asbestos workers."

7. May 19, 1970, Minutes of the Seventh Meeting of Health and Safety Council/ACPA.

The company representatives discussed 9 publications on asbestos health hazards and regulation. The revised pamphlet, now called *Recommended Practices for Fabricating, Handling, and Applying Asbestos Cement Products in the Building and Construction Industries*, had been held up pending votes from Supradur, U.S. Gypsum, Cement Asbestos Products Company, and Philip Carey (which was going out of the business). A representative from Supradur, K. Schwarz, revived the idea of a health warning by proposing to add this sentence:

The handling and installation of solid pieces of asbestos-cement products do not normally present a health risk unless sawing, drilling, or other machining of the product is required.

This was voted down by 4 to 3, with Johns-Manville, Supradur, and U.S. Gypsum in favor and Certain-teed, Flintkote, GAF, and National Gypsum against. The brochure published later that year recommended dust controls and discussed respiratory protection without making any explicit statement that breathing the dust could cause lung disease.

National Gypsum was also a member of the Gypsum Association, whose minutes of Sept. 19, 1967 include reference to "lung cancer" causes that had been reported in the neighborhood of an asbestos plant.

National Gypsum Vice President Albert Fay invited William Hunt, President of Georgia Pacific Corporation, to a meeting of the Asbestos Information Association on Sept. 15, 1971, to discuss state and federal government regulation. After the meeting, which Hunt did not attend, Fay wrote:

Our tests indicate that sanding of joint treatment products and particularly the spraying of wall finishes offers some substantial potential hazards.

In 1980, a "Region Report" stated that the year's sales of asbestos products exceeded \$12 million. The memorandum concluded by emphasizing that the company was "still in the business of making and selling asbestos products ... The sales dollars are good as long as they last!" (J.E. Jones, "Asbestos Sales," memorandum, Jan. 16, 1981).

Most of the above documents have been identified by National Gypsum representative Russell Ward in deposition (*Athens City Board of Education v. National Gypsum et al.* U.S. Dist. Court, E. Dist. TN, D. Div., C.A. No. 1-85-355, Jan. 23, 1987).

TURNER & NEWALL, LTD.
(After 1987, T&N)

Turner & Newall was founded in 1920 by the merger of four companies primarily in businesses using asbestos. Soon afterward the company obtained asbestos mines in southern Africa. In 1934-1938, Turner & Newall purchased the Keasbey & Mattison Company, in Ambler, Pennsylvania. The American company made asbestos-cement products, shingles, and insulation, using fiber from its Bell Mine in Quebec. Bell in turn acquired an interest in Cassiar Asbestos Corporation, which owned chrysotile mines in western Canada. With the liquidation of Keasbey & Mattison in 1963 and sale of its asbestos-cement operations to Certain-teed Products Corporation, Turner & Newall became the largest single stockholder in Certain-teed. Though mainly an "asbestos giant" in the 1960s, the firm was diversifying into plastics, fiber-glass, and mineral wool products as well (Corporate history in *Turner & Newall Limited/The First Fifty Years 1920-1970*, copyright by Turner & Newall; and a series of articles on the British asbestos industry in *Asbestos* magazine, 1966-1967).

According to Robert R. Porter, President of Keasbey & Mattison from 1957 to 1962:

T&N had 100 percent control over decision making on policy matters for Keasbey and were in no sense passive stockholders. T&N possessed and exercised the ultimate control and dictated the manner in which the company's capital and resources should be employed...T&N had complete control over Keasbey asbestos fiber supply and control as to which products Keasbey made at its various plants...Because T&N operated other companies in Canada, including Atlas Asbestos Company, Keasbey was prevented from selling asbestos-containing products in Canada.

(Affidavit of Robert R. Porter, filed with Commonwealth of Pennsylvania, County of Philadelphia, April 5, 1983)

T&N participated in the formation of international cartels to promote the growth of world asbestos use starting in the late 1920s. After purchasing Keasbey & Mattison in North America, the company became involved in a price-fixing scheme with U.S. producers of asbestos insulation that was eventually broken up by the Federal Trade Commission (See "Cartels Spur Asbestos Expansion," in Chapter 1).

The woman described in Cooke's 1924 case report was an employee of T&N (See "Case Reports in Medical Journals," in Chapter 1).

When the British government moved to issue the first regulations for the asbestos industry, T&N was involved in assuring that industrial hygiene measures would only be required in asbestos manufacturing plants and not in end-product use. Likewise, T&N played an important role in getting the government to exclude insulation workers from the legal provisions requiring regular medical examination of asbestos workers. Workers who unloaded asbestos and bought it into the factory were also excluded from the medical monitoring requirement. The company managers expected that these workers were at risk and decided to change the people thus employed every few years. When government doctors determined that workers engaged in warehousing, packing, and shipping of asbestos products were at risk of asbestosis in 1932, T&N and other companies nonetheless persuaded government

representatives that amendment of the regulations to include these workers would not be necessary. Sprayed asbestos insulation, a process introduced by T&N's J.W. Roberts subsidiary a year after the Asbestos Industry Scheme was published in 1931, was likewise not included in the regulations. Even some remedial work the regulations did require to be provided with exhaust ventilation was not brought into compliance by T&N (See "Early British Factory Surveys and Standards," in Chapter 4).

In Britain, coroners' inquests were sometimes held to determine if workers' deaths were occupation-related; by 1930 and thereafter, T&N officials and doctors regularly attended those proceedings involving the firm's deceased employees. In 1934, a coroner concluded that asbestosis had contributed to the death of a cashier for the J.W. Roberts subsidiary (See "Earliest Recognition of the Potential for Bystander Disease," in Chapter 7). T&N records show that there were deaths from lung cancer (and asbestosis) at least as early as 1932 at the Turner Brothers Asbestos plant in Rochdale, and as of 1942 the work force at TBA had sustained 8 deaths from lung cancer and 2 from pleural mesothelioma. This was about equal to the world medical literature, of autopsied cases of asbestosis involving pulmonary cancer, in 1942 (See "Coroner's Inquests at Rochdale," in Chapter 2).

In 1943, Leroy Gardner reported his studies and opinions to the asbestos industry in an outline which went to T&N via Porter's predecessor Ernest Muehleck at Keasbey & Mattison Company. The report contained unpublished animal data on asbestos carcinogenicity, and Gardner's repeated assertion that both human and animal data were "suggestive but not conclusive." Attached letters indicated concern about the cancer issue. Muehleck was a party to the censorship of all references to cancer in the report of industry-sponsored asbestos research at Saranac, published by Vorwald in 1951 (See "Early Saranac Laboratory Cancer Tests with Asbestos," in Chapter 2).

The company defrayed the costs of a 1948 review and animal research on asbestos disease by J. MacLean-Smith, E.J. King, and I.D.P. Wooton of the Postgraduate Medical School in London ("Asbestosis"—unpublished). The review included numerous references to cancer and concluded that the reports

were "suggestive of an etiological relationship between asbestosis and carcinoma."

There were also cases of asbestosis among insulation workers employed by the Newalls Insulation subsidiary, starting in the 1930s. When these workers or their family members arranged certification by the Pneumoconiosis Medical Board or made claims for disability compensation, company strategy on the cases was often managed by T&N Secretary John Collins. In 1943-45, government inspectors raised concerns about the hazards of sprayed asbestos and asbestos insulation removal with T&N officials; the company was reluctant to agree to any safeguards not legally required, and did not concede that anything was needed besides respirators for the sprayers. At the end of World War II, the government sent out a circular urging that safeguards be instituted to protect insulators, sprayers, and workers in the vicinity of shipyard spraying and insulation removal. Collins replied that these measures were unnecessary, asserting that there had never been a case of asbestosis in Newalls' insulation workers. The government went on to propose shipyard asbestos regulations in 1950, and Collins again said there had been no asbestosis at Newalls and none among sprayers. By this time, there had been at least 14 cases of asbestosis recorded among the company's insulation workers, despite the firm's failure to subject these workers to regular examinations under the Medical Arrangements Scheme. This number was almost as great as the insulator asbestosis cases published in the world medical literature. The government took another 10 years to issue regulations for the protection of shipyard workers from asbestos, dropping the requirement for protection of "bystander" trades so vigorously resisted by T&N (See "The British Shipyard Asbestos Regulations," in Chapter 4).

A number of employees of T&N's Bell Asbestos Mines in Quebec were diagnosed as having asbestosis in the 1940s and 1950s. At least 5 former Bell employees or their survivors were identifiably involved in workers' compensation proceedings starting in 1946. Lung cancer in combination with asbestosis was seen in Bell workers in 1950, and at least one of these was the subject of a workers' compensation claim in which Dr.

Lanza testified for the company to "debunk" British data linking asbestos to cancer (Vorwald Patient Files P-50-475 and P-550-500). These cases were generally referred by QAMA attorney Sabourin or Dr. Cartier to the Saranac Laboratory, where pathologic materials were examined and reports rendered.

Doll's 1955 study showing an excessive incidence rate of lung cancer in asbestos textile manufacturing workers was based on experience at a Turner & Newall plant. Though the company had originally asked Doll to analyze the data, it tried to block their publication. The company medical officer, J.F. Knox, did not dispute the positive association demonstrated in Doll's report (See "1955: Doll's Study and Other Events," in Chapter 2).

T&N executive assistant David Hills observed in 1955 that the American TLV of 5 MPPCF of dust was groundless ("There is no significance to be attached to this figure at all."); and that "complete safeguard to health is only obtained by having no dust at all." ("Subcommittee on Dust Sampling," Nov. 21, 1955)

Turner & Newall subsidiary Keasbey & Mattison was named as a defendant in 1961 in the product liability suit brought against insulation manufacturers by G. Faciane (See "Lawsuits by Product Users Against Asbestos Manufacturers," in Chapter 3).

The major conference of the New York Academy of Sciences in 1964 took place after the asbestos-cement manufacturing facilities of Keasbey & Mattison had become the property of Certain-teed Corporation. Plant officials met with representatives of Turner & Newall at the New York conference, at which time they were told that the British firm was "years ahead of the U.S. in awareness of the medical problems associated with asbestos." A memorandum of this discussion continues,

Dr. Knox (T&N medical officer) said that U.S. Industry, in general, does not want to accept the fact that asbestos is very hazardous and they will accept any doctor's view if he intimated that it is not hazardous.

The memorandum also notes that Turner & Newall officials were convinced that the 5 MPPCF guideline cited in the U.S. was "too high" (Memorandum from L.D. Horowitz to M.S.

Davis, Jr. on Conference on Biological Effects of Asbestos/New York Academy of Sciences, Nov. 10, 1964).

Keasbey & Mattison was a member of the Asbestos Textile Institute from its founding in 1944, and was a member of Industrial Hygiene Foundation from 1937-1962.

The hazards of sprayed asbestos were publicly criticized by medical authorities in the early 1930s, when the technology was introduced by T&N. Asbestosis in a Canadian worker applying sprayed asbestos insulation came to the attention of T&N officials in 1949. As of 1956, T&N was aware of additional cases of asbestosis in sprayers in Britain, Australia, and India, where the company marketed Sprayed Limpet Asbestos. That year, cases of asbestosis in sprayers began to be published in the medical literature. Though mineral wool substitution for asbestos was shown to be promising in 1957, the company did not have sufficient incentives to replace asbestos with mineral wool formulations until 1975 (See "Sprayed Asbestos," in Chapter 5).

Mesothelioma investigator Dr. J. Christopher Wagner told T&N and Cape Asbestos executives (and T&N's Dr. Knox) about his findings in South Africa, in 1958. By then, T&N records show, there had been 7 deaths attributed to pleural and peritoneal mesothelioma among the workers at T&N group companies in Britain, 1 of which had been publicly disclosed (See "More Reports of Lung Cancer, Mesothelioma, and Other Cancers from Asbestos," in Chapter 2).

T&N was instrumental in setting up the Asbestosis Research Council in 1957, with several other asbestos companies. ARC's purpose was to provide a vehicle for conducting selected scientific research, while also maintaining editorial control over the text of research published (See "Asbestosis Research Council," in Chapter 11). As public concern about asbestos grew in the mid-1960s, T&N joined with other British firms to set up the Asbestos Information Centre in 1967, with guidance from the public relations firm, Hill & Knowlton (See "Public Opinion and Public Health Policy," in Chapter 11).

Following highly publicized reports that mesothelioma was occurring in the neighborhoods of asbestos plants and the households of asbestos workers, concern arose about the

hazards of asbestos products in buildings, particularly sprayed "Limpet," ceiling tiles, and asbestos insulation generally. The Northern Ireland Hospitals Authority had issued a directive in July, 1966, to the effect that the use of asbestos should be avoided, since even light and occasional contact entailed a cancer risk. Turner & Newall representatives, meeting with the Belfast hospital people (including Dr. Peter Elmes) in 1968, were able to allay concerns over "possible air contamination in buildings," with new survey data (J.F. Knox and S. Holmes, "Visit to Northern Ireland Hospitals Authority, Belfast, 29th May, 1968").

The survey, conducted by T&N and Cape Asbestos employees, had utilized optical microscopy only. The report as published concluded:

In our present state of knowledge, the dust concentrations found in completed buildings incorporating asbestos-based products in their construction are not considered likely to constitute a hazard to the health of the occupants.

(J.C. Byrom, A.A. Hodgson, and S. Holmes. "A Dust Survey Carried Out in Buildings Incorporating Asbestos-Based Materials in Their Construction." *Ann. Occup. Hyg.* 12:141-145, 1969).

Johns-Manville environmental control chief, wrote to Stephen Holmes at T&N to inquire if any sample evaluations had been done using the more powerful electron microscopy (Nov. 18, 1969). Holmes replied (Jan. 19, 1970) that only phase-contrast optical analyses had been done on the building samples. He admitted:

It is reasonable to assume that those asbestos fibers which remain airborne in the general atmosphere are very fine indeed and may well be individual fibrils. The electron microscope is therefore our only means of looking at them...

The U.K. asbestos standard developed in the late 1960s was critically based on chest X-ray readings by T&N's Dr. John Knox. His successor, Dr. Hilton Lewinsohn, published an article in 1972 strongly indicating that asbestotic X-ray changes must

have been much more common in that work force in 1966 than Knox had reported. Since an asbestos standard was also being issued in the United States, based largely on the British model, Dr. Selikoff pressed for independent reading of the 1966 X-rays upon which the British standard had been based. Selikoff was rebuffed in this effort by doctors at T&N, the Medical Research Council (Gilson) and the Trades Union Congress (Murray). However, Lewinsohn did have a look at the 1966 chest X-rays of the workers in that cohort still employed at T&N in 1972. His findings, disclosed in a letter to a Johns-Manville executive, were that asbestotic chest X-ray abnormalities were present in 31 percent of the workers, in contrast with Knox's figure of less than 3 percent (See "Standards in the United Kingdom and Sweden," in Chapter 4).

T&N reluctantly followed other asbestos companies in deciding to put health warning labels on its sacks of asbestos and asbestos products in the period 1969-1977. Caution labels introduced in Britain in the late 1970s and later in other countries were sufficiently mild to have no effect on sales of T&N asbestos. In Swaziland, where T&N mined asbestos, a T&N official was able to persuade management at the television station to not broadcast "Alice, A Fight for Life"—which had had a tremendous effect in Britain when it was produced in 1982. A British Broadcasting Company radio documentary found that T&N's operations in Africa and India operated at a lower standard of industrial hygiene than would have been required in Britain, in the 1970s and 1980s (See "Worldwide Proliferation of Asbestos Disease," in Chapter 11).

Much of T&N's history remained undisclosed until discovery was conducted in the company's 10-million-page repository by attorneys for Chase Manhattan Bank in the 1990s.

CSR

Colonial Sugar Refinery, as CSR used to be known, has become one of Australia's dozen largest corporations. One of its subsidiaries was a crocidolite asbestos mine and mill that operated at Wittenoom, in remote Western Australia, from 1943-1966. The mining business was called Australian Blue

Asbestos (ABA), and, after 1959, Midalco. This operation had commercial dealings with Johns-Manville, whose operations were visited by managers of the Australian mine in the 1940s and 1950s.

Internal company documents evidenced an awareness of asbestos dust as a health hazard as early as 1943, and signs of asbestosis in a mill foreman were discussed by management in 1946. In 1948, Eric Saint, a British-educated "Flying Doctor," began to visit Wittenoom, and repeatedly warned the management about the dangers of uncontrolled asbestos dust. Dr. Saint deplored conditions at the mine, which he predicted would yield "the richest and most lethal crop of cases of asbestosis in the world's literature." His notes of meeting with the mine manager, Joe Broadhurst, recorded criticism of the manager as having the mentality of Goebbels and Mussolini.

The Australian Workers' Union also complained about the dust's serious danger to health, in letters to the State Mining Engineer, in 1948.

In 1949, CSR received the *Annual Report of the Chief Inspector of Factories for the Year 1947*, containing powerful evidence of a cancer hazard in Britain's asbestos industry.

CSR's Dr. Rennie attended an I.L.O. pneumoconiosis conference in Sydney in 1950, where international authorities discussed asbestosis and cancer from asbestos.

Dust in the underground mine and the mill were, from an industrial hygiene point of view, essentially uncontrolled. One of the immigrant workers lured to the mine from war-devastated Europe, Carlo Finnamore, was hospitalized from an injury he received walking into machinery he could not see through the dust in the air. The immigrants recruited to work in the hot desert gorge came mostly with expectations of better working conditions; and the average employee worked there less than 6 months. Bagging of fiber was done by workers scooping asbestos in their arms and then packing it down with mallets. Little was done to control exposures, but some workers with the worst jobs were paid a "dust money" premium on their wages.

Government mine and health inspectors repeatedly called attention to the dust hazard at the mine and mill in the 1940s and 1950s. In the late 1950s, health official James McNulty

came to again advise management to control asbestos dust. Dr. McNulty soon afterward reported that one of the asbestos miners had developed mesothelioma (*Medical Journal of Australia* 2:953-954, 1962).

Mesothelioma as an occupational cancer received worldwide attention after Wagner's presentation at the I.L.O. conference on pneumoconiosis in Johannesburg in 1959. South Africa was one of the few places besides Australia where blue asbestos was mined. Starting in 1959 and continuing until the mine closed, CSR's mining operation purchased liability insurance coverage applicable for employees' occupational disease claims from the State Government Insurance Organization in Western Australia. The State Government Insurance Commission reacted to 1988 court decisions by declaring its policy covering CSR subsidiary Midalco inoperative.

Within months after the publication of "Complications of Asbestosis" in the *British Medical Journal* (P. Hugh-Jones *et al.*, Apr. 30, 1960), a typed verbatim extract was sent by the Wittenoom mine manager to ABA's Managing Director in Sydney (June 24, 1960). Mesothelioma was described in the extract as a new tumor that "may draw attention to the fact that a patient has worked in asbestos dust." The mine manager, Ozzie Allan, was diagnosed with asbestosis later that year.

Victims of asbestos disease do not include only (approximately 7000) former mine employees and their families, but also such people as a man who delivered meats to Wittenoom and carried back sacks of asbestos in his truck.

Australia is one of the very few countries where negligence on the part of an employer is grounds for a civil suit by an injured worker in general industry (i.e., workers' compensation is not an exclusive "remedy" for injured workers to recover damages against their employers). In 1988, a judge in Western Australia and a jury in Melbourne held the mining company responsible in separate cases.

The Perth trial held both CSR and its paper subsidiary mining company Midalco responsible. This case took the better part of a year to try, during which time one of the two plaintiffs (both had mesothelioma) died, precipitating a massive street demonstration by unions in Perth. One of the witnesses for CSR was

Dr. Robert Murray, who had worked with Dr. Merewether at the U.K. Factory Inspectorate from 1947-1956. Murray's challenge in this case was to help justify what was politely referred to as an extremely conservative approach. The judge found it "rather difficult to understand" that Murray said he would not have called attention to the cancer risk, if asked for advice on asbestos, prior to the publication of Doll's report in 1955.

The jury in the Melbourne case, in an unprecedented decision, assessed punitive damages against the mining subsidiary, whose robust defense was underwritten by CSR. On appeal, the Full Court of Victoria said a strong case had been made supporting a finding of recklessness and continuing, conscious, and contumelious disregard for the employee's right to be free from risk of disease. Punitive damages were also awarded against CSR in Pascagoula, Mississippi, in 1993 (*Abrams*).

A number of books have been written that describe the tragedy at Wittenoom, most recently Ben Hills' *Blue Murder* (Macmillan Co. of Australia, 1989) and Jock McCulloch's *Asbestos/Its Human Cost* (Univ. of Queensland Press, 1986).

RAILROAD COMPANIES

In the United States, some transportation industries including railroads never made legal provision for workers' compensation. As a result, employees who develop occupational diseases must bring suit against their employers in an appropriate legal forum. In the case of railroad workers, there has been intense exposure to asbestos insulation dust in roundhouses where locomotives were overhauled. The old steam locomotives were equipped with large quantities of asbestos insulation. Severe asbestos exposure in railroad maintenance work is apparently a thing of the past in the United States, with the replacement of steam locomotives by diesels and the substitution of asbestos-free railroad brake shoes. However, the toll of disease from past years is great (T.F. Mancuso. "Mesothelioma among Machinists in Railroad and Other Industries," *Amer. J. Indust. Med* 4:501-513, 1983).

Medical directors of the railroad companies held annual meetings starting in 1921 under the auspices of the Association of American Railroads. The meetings of the Medical and Surgical Section, as the group was known (or simply the Medical Section in later years), were often concerned with occupational health and safety, and proceedings of the working sessions were published and distributed to the membership. The members of various committees and the attendees of each meeting were duly recognized in the proceedings, with each doctor's company affiliation designated.

The following notes of the meetings through 1958 relate to the foreseeability of asbestos hazards by the medical officers of the railroad companies. The documents were located in the library of the Interstate Commerce Commission in Washington, D.C. (Proceedings of the Medical and Surgical Section of the Association of American Railroads). Relevant page numbers are noted in parentheses.

1932 Committee on Occupational Diseases and Rehabilitation reported on "Dust as an Industrial Hazard" (60-62), discussing pneumoconiosis at length. It was noted that chest X-rays were diagnostic of fibrous tissue. Many symptoms of pneumoconiosis are cited, hypersusceptibility to infection in the lung is noted. Wetting and ventilation are offered as control methods. Asbestos not explicitly mentioned.

1933 Report of the same committee by same title, recommends respirators in addition to the above measures as controls. Asbestos not mentioned. (72,77).

1935 Report of the same committee now has a subtitle "Pneumoconiosis" (89-90). "Asbestosis is not a common condition but it causes extensive pulmonary fibrosis and takes on a more rapid course than does silicosis." Following, "(A)s railroad surgeons (we) are undoubtedly more interested in silicosis and asbestosis than in the other types." Examinations upon hire were advised to include complete history and physical, with chest X-ray "for diagnosis and future record."

For old employees with a history of working in dust and having the classical clinical symptoms, we suggest:

1. To make a change in his occupation.
2. To make an X-ray of his chest for lung tissue.

In the way of prevention it becomes necessary

1. To educate all concerned.
2. Get rid of dust.
3. Sprinkle the working area with water.
4. Have employees wear inhalers. (sic)
5. Have frequent analyses made of the dust content of the air at different times during the working hours.

1937 Discussion of occupational disease (compensation and prevention) laws enacted in Illinois, with mention of extended statute of limitations for asbestosis and silicosis claims. (19) Concern expressed that state distribution of pamphlets would "create a fear complex" with resulting unjustified workers' compensation claims. (20)

Silica, asbestos, and lead are the principal substances generating toxic dusts to which railway employees may be exposed. (20)

Pre-employment physicals and histories are again recommended, as well as periodic physical examinations of employees "in occupations in which known hazards exist." (21) Control measures discussed include: exhaust ventilation of dusty processes, substitution of safer materials and methods of handling, and use of personal protective equipment such as respirators approved for the intended use by the U.S. Bureau of Mines. (21-22) It is reiterated at the end that asbestosis and silicosis are dust diseases and can be contracted only by breathing asbestos or silica dust. (22)

Report of the Committee on Disability and Rehabilitation has a lengthy section, Pneumoconiosis. (72-76) This is almost entirely on silicosis, until the mention of the Illinois law provisions where asbestosis is mentioned.

1939 Report of Committee on Disability and Rehabilitation (CDR) noted the emergence of the Air Hygiene Foundation (name changed to Industrial Hygiene Foundation in 1941) with its interest in pneumoconiosis, noted that (37) CDR Chairman had attended AHF meetings and summarized AHF presentations. Summaries deal with industrial hygiene, compensation laws;

Lanza quoted as saying that instead of removing men from dust hazards the dust should be removed. (38)

1940 CDR report again consists of review of presentations at AHF meeting. (28) "(M)any details are brought out at (AHF's) annual meetings which can be made of immense value to the Railroads." (29) Nothing on asbestosis here, but such items as Drinker's presentation on preventive engineering clearly had broad application.

1941 CDR Chairman again attended the AHF meeting but had nothing new to report on pneumoconiosis. (37,46)

1951 CDR report section on Pneumoconiosis contains the same 1952 language all three years. Opens with, "The Committee ..." 1953 mentioned "silicosis and asbestosis as forms of the disease most interesting to railroad surgeons." (38 in 1951; 35 in 1952; 34 in 1953) Exam at time of hire to include history and chest X-ray, "particularly in those occupations where unusual quantities of silica or asbestos dust have been encountered or are contemplated as a routine occupational exposure." Periodic exams of such workers also recommended, with X-ray, and those presenting symptoms to be considered for removal and counseling. Indexes in 1952 (42) and 1953 (41) list all years (of Medical Section published proceedings) in which the Committee previously discussed pneumoconiosis.

1957 CDR adds to and deletes some of its previous statements, adding that periodic X-ray examinations should be done "annually" on employees exposed to dust. (24)

1958 The entire Medical Section of the Association of American Railroads hosted Dr. Alton Ochsner, a lung cancer surgeon from New Orleans. He had been affiliated with Illinois Central and Southern Pacific. (81)

There is very good proof that asbestos is a cause of carcinoma. This is seen in individuals working with asbestos, particularly miners. It is also seen among plumbers who work with asbestos, seamfitters (sic) particularly. (81)

He said "Heuber" (Hueper) did a study "in which he showed there was a higher incidence of cancer among the operating staffs of the railroads than among the non-operating staffs." Ochsner attributed this finding to a preponderance of males in operations

and females in offices (there was a well-recognized difference in incidence of the disease between the sexes).

He said people in these occupations with which an increased risk of cancer has been shown—who develop cancer themselves—are usually heavy smokers, and the smoking is the cause, not occupation. He noted that the only doctors who doubted smoking caused cancer worked for tobacco companies or smoked themselves. (84) Railroad doctors were advised to check smoking histories and tumor cell types of workers filing for compensation for lung cancer.

If they have an adenocarcinoma, it has not been produced by smoking because it is not related to smoking.

Hueper had reported that lung cancer cases were more than three times as numerous among "operating" railroad workers (engineers, firemen, brakemen, conductors, switchmen, and roundhouse personnel) than "non-operating" workers. Yet the former group made up only about 25 percent of the work force. Hueper suspected oil and coal combustion products as a cause of occupational cancers (*A Quest Into the Environmental Causes of Cancer of the Lung* Washington: Public Health Service Publ. 452, 1955, p. 16).

Railroad companies operating in Illinois looked into the industry's asbestos problem and other occupational disease threats following enactment of workers' compensation legislation in Illinois in 1936. A group of management representatives called the General Managers Association developed these guidelines in 1937 (documents produced by Illinois Gulf Central Railroad Co. in 1987):

REVISED RECOMMENDATIONS COVERING RULES AND INSTRUCTIONS FOR PREVENTION OF ASBESTOSIS. THESE RULES TO SUPERSEDE THOSE ADOPTED BY THE SHOP AND ENGINEERING COMMITTEE ON JAN. 18, 1937.

1. Respirators should be furnished by the Company and they should be worn at all times by employees handling asbestos. Attention

is called to some of the specific instances where respirators are required:

Loading or unloading shipments of asbestos.

Mixing asbestos.

Removing lagging from boilers.

Removing lagging from pipes.

Breaking up or grinding asbestos.

2. Before removing lagging from a boiler, either locomotive or stationary, asbestos must be sprayed with water sufficiently to lay the dust.
3. Removal of lagging from locomotive boilers should be done when there is the least number of men working in the vicinity, and all such men should be protected by wearing approved respirators.
4. Grinding asbestos causes excessive dust. Where such operations are performed and facilities are equipped with exhaust systems, employees should also be required to wear approved respirators. When exhaust systems are not provided, employees so engaged should be required to wear air masks or helmets with clean dry air furnished from an outside source.
5. Each employee required to wear a respirator should be furnished one for his individual use or one that has been sterilized if previously used by any other person.
6. To insure maximum protection from respirators, only those that have the approval of the U.S. Bureau of Mines should be furnished.
7. Foremen should make periodical checks to see that respirators fit properly, and to note that they are in good condition.
8. Foremen should be held responsible for seeing that respirators are worn in accordance with instructions.
9. It is suggested that the above recommendations be communicated directly to the foremen involved. Publicity on the above might suggest the making of claims.

Railroad claims agents also discussed asbestosis at meetings and in their journals in the 1930s (P. Folger, "Legal and Other Aspects of Dust Hazards," *Minutes of the 45th Annual Meeting of*

the Association of Railway Claim Agents, held in May, 1934, pp. 27-48; O.G. Browne, "Silicosis," *The Bulletin* 19:281-284, April, 1935; E.R. Hayhurst, "Common Occupational Diseases and Their Differential Diagnosis," *Minutes of the 48th Annual Meeting of the Association of Railway Claim Agents* held in May, 1937, pp. 31-41). In 1960, asbestos was listed as one of 7 materials which had been "suspected as lung carcinogens" in an article by Dr. I. Kaplan of the Baltimore and Ohio Railroad ("Relationship of Noxious Gases to Carcinoma of the Lung in Railroad Workers," *J.A.M.A.* 171:2039-2042, Dec. 12, 1959, reprinted in *The Bulletin* 44:511-520, 1960).

At least one railroad, the Norfolk & Western, had an asbestosis claim decades ago. The man had worked in the engine shop of the railroad, frequently handling insulation materials made with asbestos. He claimed he was totally disabled with asbestosis and had suffered pleural effusion as well (*Ancel Wheeler v. Norfolk & Western*, U.S. Dist. Court S. Dist. Ohio, W. Div., Civ. No. 2740; and Dr. Allen Barker's letter to Dr. W. R. Whitman, Chief Surgeon for N & W, Aug. 18, 1951 describing the X-ray findings as "compatible with asbestosis").

METROPOLITAN LIFE INSURANCE COMPANY

Metropolitan Life has been a defendant in asbestos litigation on the basis of conspiracy with asbestos companies to suppress and distort information provided to workers, doctors, and the scientific community about the hazards of asbestos. Met's group life insurance policyholders in 1944 included Johns-Manville, Fibreboard, Keasbey & Mattison's Bell Asbestos Mines, Philip Carey, Flintkote, Johnson's Company, Thermoid, Raybestos-Manhattan, Eagle-Picher, Ruberoid, Celotex, Eternit (St. Louis), Gatke Corporation, Armstrong Cork, Vermont Asbestos Corporation, Asbestos Textile Company, Asbestos Manufacturing Company, National Gypsum, CertainTeed Products, refractory manufacturers A.P. Green and Harbison-Walker, and a number of makers of packing and gaskets.

Met's activities in the field of occupational health were largely directed by Dr. Anthony J. Lanza, who was salaried as a full-time Met employee from 1926 through 1948.

Metropolitan founded an industrial health clinic at McGill University in 1926 and worked with this group to conduct health studies of asbestos miners at Met policyholder companies in 1930. The McGill group found asbestosis in 42 workers, more than half the number included in their survey with 10 years or more employment, and repeatedly expressed the desire to publish the information in communications to Metropolitan. The McGill group never did publish this material. But Lanza repeatedly wrote in the open scientific literature that asbestos mine and mill workers did not get asbestosis (See "Asbestosis in Canada" in Chapter 1). During this period, Met's Canadian actuaries noted that there were many claims for death and disability from lung disease among asbestos mining company policyholders; Met paid these claims and set premiums accordingly (See "Asbestosis in Canada" in Chapter 1).

Metropolitan had knowledge of a high rate of asbestosis at Johns-Manville's large factory in Manville, New Jersey, as early as 1932. However, Met prevented an inspection of unhealthy working conditions there in 1945 by assuring government officials that the asbestosis hazard was adequately controlled. This was inconsistent with the confidential medical findings (20 percent prevalence of asbestosis) and reported dustiness of the plant in the 1947 Hemeon report (See "Unsteady Movement toward Numerical Exposure Limits" in Chapter 4), and Met's own high dust counts (J.E. Begert, "Dust Counts at Manville Factory," memorandum to V. Brown, Feb. 3, 1947). Met has acknowledged that, "During 1941, 1942, and 1943, requests for plant surveys and information were made by and given to Johns-Manville." However, the insurer says records of those communications are no longer in its files.

When Dr. Lanza was asked in 1933 by a plant physician at Johns-Manville's Waukegan, Illinois plant whether he agreed with the idea of making workers aware of the asbestos health hazard by means of warning posters, Lanza discouraged that because of the "legal situation" (See "Asbestosis Compensation in the Early Years: Damage Suits" in Chapter 3).

Lanza privately acknowledged in 1933 that concern over damage suits was the reason that a major study of asbestosis conducted by his group at Met Life had been withheld from

publication. When it suited the asbestos companies to get this work into print, for lobbying purposes, Lanza acceded to the requests of J-M corporate counsel Vandiver Brown to make important editing changes downplaying the asbestosis hazard (See "Industry 'Editing' of Medical Publications: Lanza's Surveys" in Chapter 3). In this survey, no cases of extensive pulmonary involvement and marked physical disability were reported, and thereafter Lanza would proclaim that the health problem was being well controlled by a responsible asbestos industry ("Asbestosis," *JAMA* 106: 368-369, 1936; "Public Health and Economic Aspects/United States," *Silicosis and Asbestosis*, 1938, p. 420).

Lanza was also centrally involved in the 1935-36 formation of the Air Hygiene Foundation, later renamed Industrial Hygiene Foundation, by business interests concerned with the "industrial dust problem" (See "Rising Tide of Compensation in the 1930s" in Chapter 3). Lanza was on the Foundation's Board of Trustees and was Chairman of its Medical Committee into the 1950s. IHF services to the asbestos industry included: the unpublished Hemeon report to the Asbestos Textile Institute in 1947 (See "Unsteady Movement toward Numerical Exposure Limits" in Chapter 4); and the Braun & Truan report for the Quebec Asbestos Mining Association (See "The Industrial Hygiene Foundation Cancer Study" in Chapter 2).

Met experts assisted policyholders including Raybestos-Manhattan in the defense of workers' compensation suits and claims. In at least one situation, it appears that Dr. Gardner at Saranac read more pneumoconiosis pathology in asbestos workers' chest X-rays than did Met doctors Lanza and McConnell (See "Rising Tide of Compensation in the 1930s" in Chapter 3). In 1951 and 1952, Lanza was a defense witness for Met policyholder Bell Asbestos Mines in opposing the compensation claim by an employee with lung cancer (See "Compensation at the Asbestos Mines in Canada" in Chapter 3).

Metropolitan Life was a "mainstay" of the Saranac Laboratory in establishing the lab's program for testing industrial dusts on experimental animals during the years 1929-1933 (See "Industry 'Editing' of Medical Publications: Lanza's Surveys" in Chapter 3). Met Life doctors Lanza and McConnell were consulted by

Sumner Simpson and Vandiver Brown, when the industrialists were making plans to sponsor experimental animal studies by Dr. Leroy Gardner at Saranac with the restriction that nothing the sponsors did not approve of could be published (S. Simpson letter to F.H. Schluter, President of Thermoid Rubber Co., Nov. 10, 1936; and V. Brown letter to L.U. Gardner, Nov. 20, 1936. See also "Raybestos-Manhattan, Inc." in this chapter).

Dr. Gardner's positive experimental studies on the carcinogenicity of inhaled asbestos were withheld from publication during his lifetime. Immediately following Gardner's death in 1946, Dr. Lanza became a member of the Board of Trustees of the Trudeau Foundation, parent organization of the Saranac Laboratory. He then met with Johns-Manville executives and was a central figure in managing the asbestos industry sponsors' effort to get some of the Saranac findings published—without reference to cancer or tumors (See "Early Saranac Laboratory Cancer Tests with Asbestos" in Chapter 2). In reporting that Lanza had agreed to get Saranac to make the revisions in its report desired by the asbestos companies, J-M executive J.P. Woodard observed,

(T)his is just another instance where Dr. Lanza is freely giving his time and effort in helping us along on this program, and I think he deserves the thanks of all of us.

Lanza also worked closely with Johns-Manville to suppress the report of Dr. Gerrit Schepers to the South African government on health problems Schepers had observed in the U.S. and Canada in 1949-50 (See "Dr. Schepers' Visit to America" in Chapter 2).

As Dr. Vorwald's sponsor-approved manuscript of Gardner's experimental asbestos studies was sent off for publication, Saranac arranged to receive a grant from the Quebec Asbestos Mining Association to conduct another experimental study of the carcinogenicity of chrysotile asbestos. Here, Lanza was brought in from the beginning, as Trudeau Trustee and consultant to the asbestos companies. These tests were positive, but Vorwald and his co-workers never published them or disclosed the fact that they had been conducted (See "The Saranac Lab's

Cancer Studies for the Quebec Asbestos Mining Association" in Chapter 2).

Lanza continued to oppose the idea that asbestos was a cancer-causing substance: at the First National Cancer Conference (See "Negative Opinions on Asbestos as a Cause of Cancer" in Chapter 2); conferences in New York (See "More Reports and Reviews Linking Asbestos and Cancer" and "The Seventh Saranac Symposium" in Chapter 2); and in relations with Dr. W.E. Smith at New York University (See "1955: Doll's Study and Other Events" in Chapter 2). Lanza's denials that there was a cancer problem in the asbestos industry in North America influenced others, including toxicologist Herbert Stokinger, a key member of the Committee on Threshold Limits of the American Conference of Governmental Industrial Hygienists (See "The Industrial Hygiene Foundation Cancer Study" in Chapter 2).

In 1947, a medical and engineering study of the silicosis hazard at Johns-Manville's Lompoc, California diatomaceous earth facility was planned by state and federal governmental health agencies. This was never done because of assurances by Dr. Lanza that Johns-Manville had the dust problem under control, and that medical data supporting this claim would soon be published by J-M's plant physician and consultant Dr. Reginald Smart. Lanza and Met Life Vice President Dr. William P. Shepard later gave the same assurances to Dr. Herbert Abrams of the California Department of Public Health, even as investigations showed that there had been numerous workers' compensation claims for silicosis at that plant. Lanza and Shepard continued to vigorously oppose disclosure, independent study, and calls for control of the silicosis hazard at the Lompoc plant (Testimony of Dr. Abrams, *In Re Asbestos*, Circuit Court, Kanawa Co., Civ. Action 92-C-8888, 1994; and Abrams, "Some Hidden History of Occupational Medicine," *Environ. Research* 59: 23-35, 1992).

Lanza was also instrumental in preventing Dr. Hueper at the National Cancer Institute from conducting epidemiological studies to demonstrate the carcinogenicity of substances that Hueper was identifying as carcinogenic in his review articles. The immediate beneficiaries of Lanza's intervention with the

Surgeon General were Metropolitan Life group policyholders, Mutual Chemical and Diamond Alkali, two of the chromate manufacturers. It appears that Met recognized that claims for lung cancer "due to chrome" were problems for at least one policyholder as early as 1948, and that Met paid these claims while assisting the policyholder with industrial hygiene services. Met policyholder Philip Carey Manufacturing Company was beset in 1957-1962 by death claims for lung cancer, as well as non-malignant respiratory disease—definitely including cases of asbestosis, according to death certificates (See "Muzzling Dr. Hueper and Ensuring Hazardous Industries" in Chapter 2). Here again, as with lung disease at Met's asbestos mining policyholders in earlier years, it appears that Met paid the claims rather than demurring on grounds that these were cases of occupational disease that should be adjudicated through workers' compensation proceedings (and covered by workers' compensation insurance or self-insurance by the companies).

In summary, Metropolitan's involvement with asbestos companies and others with chronic occupational health hazards took a number of forms. Met sold group life insurance to the companies, covering both death and disability claims for occupational diseases. Accident and health coverage was additionally offered to some companies, with an extra loading for asbestos mining firms (e.g., Johns-Manville) over rates for non-hazardous industries (40 percent in 1939). Met doctors additionally assisted asbestos company policyholders in defending workers' compensation claims and civil suits, even though Met was not providing insurance for such claims. Met's experts were also available as consultants to policyholders on matters of industrial medicine and hygiene, providing technical services and strategic advice, and even using this relationship to deflect government concerns over health hazards (Manville, 1945). Through the establishment and control of institutions, the Industrial Health Clinic at McGill University and the experimental program at the Saranac Laboratory, Met created the means for private interests, including policyholders in the asbestos industry, to obtain high-quality occupational health knowledge on confidential terms. Met's Dr. A.J. Lanza was centrally involved in industry efforts to establish and operate

the Industrial Hygiene Foundation, another source of confidential technical information on occupational health. Perhaps the most extraordinary "service" of all, however, was the manipulation of scientific literature and the influence on the scientific community by Lanza (and others through the influence of Lanza) for the benefit of policyholders including the asbestos companies.

There evidently were other insurers who knowingly paid claims for occupational disease under coverage other than workers' compensation insurance, where company doctors simply wrote up the cases as non-occupational. There is this excerpt from the October 6, 1954 minutes of the Asbestos Textile Institute, Air Hygiene Committee meeting:

Dr. Theodos in the past, with our company (Asten-Hill) and with American Asbestos, has classified the diagnosis to be pulmonary fibrosis. When completing the hospitalization forms, this has worked out in every case and the Insurance Company has paid the claims without comment. Also in these cases, one question is to be answered on the insurance form; "Is accident, illness, or disease caused by occupation?" and we have always answered, "No." It has never been challenged by the Insurance Company.

Industrial hygiene and related technical services were performed for Asten-Hill in the mid-1950s by American Mutual Liability Insurance Company.

Metropolitan has had remarkable success in keeping a low profile in the asbestos litigation. In cases where a plaintiff's lawyer has seemed serious about focusing on Met in trial, the insurer has repeatedly moved to settle the cases of all plaintiffs represented by that attorney or law firm before the end of trial. As of mid-1995, Met has almost always been able to avoid facing jury verdicts while settling lawsuits for \$5000 per person or even more trivial amounts.

10

Historical Research on Toxic Substances

INTRODUCTION

This research on asbestos disease history is more extensive than any ever done on a toxic substance. It has involved thousands of hours of library and patent searches, translations, depositions, and examinations of corporate and government records. Access to corporate files and sworn testimony could only have been gained in the context of litigation.

The basic historical picture about asbestos disease was assembled and summarized by the author in 1977. This required only a few months' time, and a minimum of clerical and editorial assistance (*The Development of Knowledge about Asbestos Disease*, 93 pp., unpublished, 1977). The more complete historical mosaic since assembled still follows the chronology pictured in the 1977 report. The motivation to "leave no stone unturned" arose largely as a consequence of finding such an extensive and accessible published body of medical literature.

Legal discovery has documented the perception of the historical medical literature held by various people and companies. Only corporate documents and testimony of the individuals involved could recreate events as they emerged "from the inside." This inside story was developed at enormous expense by attorneys representing plaintiffs in asbestos litigation. It could not have emerged as fully by any other means. Though many of the attorneys involved are motivated by "the pot of gold at the end of the rainbow," nonetheless their work has vitally informed the public on major issues of public policy and social justice. This is invaluable for legislators and

society at large, facing the aftermath of past failures to control asbestos.

Just as the asbestos litigation has broken new ground in setting legal precedents, the scientific research on asbestos disease history has wide applicability. There is a similarly vast body of knowledge on other substances such as lead and benzene, which have also been foci of occupational and environmental damage suits in the United States.

Synthetic chemicals have not been used as pesticides for quite so long, but their power as human poisons has been far better recognized by manufacturers than by some users of these products. Long-delayed, deadly diseases are steadily following society's increasing use of toxic substances. As the chronic effects of excessive exposure to these products becomes increasingly manifest as clinical disease, the question will be asked: could this reasonably have been foreseen and prevented?

In the context of historical research on toxic substances several questions are posed: what was scientifically known about the health effects and means of preventing them; when was the knowledge available; and what was actually known and done by the producers of these hazardous products? The process of seeking answers to these questions will be described, using the asbestos research experience as a guideline.

Index Medicus

A classical method of searching the medical literature is to use the *Index Medicus*. This has been in existence since 1879, and lists articles from periodicals by author and subject from all over the world. It has also been called *Quarterly Cumulative Index* (1916-1926) and *Quarterly Cumulative Index Medicus* (1927-1956). This source has proved to be far from all-inclusive on the subject of asbestos disease; but it is nonetheless quite comprehensive and useful for doing searches for the years in which an industrial health hazard first began to achieve recognition. The *Index Medicus* is particularly helpful for the era before the development of computerized medical retrieval services.

Computerized Indexes

Computerized indexing of medical articles is a relatively recent occurrence. Until the 1960s, there was no such means for gaining access to the literature. The National Library of Medicine in the U.S. has introduced a number of computerized literature retrieval services including:

Name of Service	Years Covered	Type of Service
Toxline/Toxlit	1965 on	toxicology, epidemiology, mutagenesis, teratology (2.5-3.0 million citations)
Medline	1966 on	contains over 6 million citations to biomedical journals
Cancerlit	1963 on	Carcinogenesis: articles, proceedings, monographs, theses, government reports (over 700,000 citations)

Use of these services is reasonably inexpensive and widely accessible in the United States. Through the use of appropriate key words, computer retrieval services can be used to summon citations and, in some cases, summaries of the contents of each article.

This sort of access is helpful for learning the current state of knowledge and its recent origins. However, more tedious and conventional methods must be used to reach back to the earliest published origins of the knowledge if these pre-date the 1960s.

Reviews—NIOSH Criteria Documents and Other Reports

It is best to start a search with an exhaustive review article on the hazards of the substance or occupation in question. The

National Institute for Occupational Safety and Health (Cincinnati, Ohio) has published a large series of Criteria Documents on particular substances, as well as special reports of other kinds. NIOSH Criteria Documents make excellent starting points for historical research on most substances covered. Although the main purpose of these documents is to justify and recommend a standard to OSHA, these documents typically trace the recognized hazards of a substance from the principal early reports and usually include at least some mention of all the adverse effects that have been attributed to the material.

Alphabetical Listing of NIOSH Criteria Documents

NIOSH Publication Number	Subject
76-195	Acetylene
77-112	Acrylamide
78-116	Acrylonitrile
77-151	Alkanes
76-204	Allyl Chloride
74-136	Ammonia
78-216	Antimony
74-110	Arsenic, Inorganic
75-149	Arsenic, Inorganic (Revised)
72-10267	Asbestos
77-169	Asbestos (Revised)
78-106	Asphalt Fumes
74-137	Benzene
+ (1976)	Benzene (Revised)
77-166	Benzoyl Peroxide
78-182	Benzyl Chloride
72-10268	Beryllium
77-122	Boron Trifluoride
76-192	Cadmium
77-107	Carbaryl
78-204	Carbon Black
76-194	Carbon Dioxide
77-156	Carbon Disulfide
73-11000	Carbon Monoxide
76-133	Carbon Tetrachloride

Alphabetical Listing of NIOSH Criteria Documents

NIOSH Publication Number	Subject
76-133	Carbon Tetrachloride (Revised)
76-170	Chlorine
75-114	Chloroform
+ (1976)	Chloroform (Revised)
77-210	Chloroprene
73-11021	Chromic Acid
76-129	Chromium (VI)
78-191	Coal Gasification Plants
81-131	Coal Liquefaction Volume I - Summary
81-132	Coal Liquefaction Volume II - Assessment
78-107	Coal Tar Products
82-107	Cobalt
73-11016	Coke Oven Emissions
80-106	Confined Spaces, Working in
75-118	Cotton Dust
78-133	Cresol
77-108	Cyanide, Hydrogen, and Cyanide Salts
77-193	Decomposition Products of Fluorocarbon Polymers
78-115	Dibromochloropropane
78-215	Diisocyanates
78-131	Dinitro-ortho-cresol
77-226	Dioxane
76-128	Emergency Egress From Elevated Work Stations
76-206	Epichlorohydrin
77-221	Ethylene Dibromide
76-139	Ethylene Dichloride (1,2 Dichloroethane)
78-211	Ethylene Dichloride (1,2 Dichloroethane) (Revised)
77-152	Fibrous Glass
76-103	Fluorides, Inorganic
77-126	Formaldehyde
79-133	Furfuryl Alcohol
78-166	Glycidyl Ethers
72-10269	Hot Environments
78-172	Hydrazines
76-143	Hydrogen Fluoride
77-158	Hydrogen Sulfide
78-155	Hydroquinone
75-126	Identification System for Occupationally Hazardous Materials

(continued)

Alphabetical Listing of NIOSH Criteria Documents

NIOSH Publication Number	Subject
76-142	Isopropyl Alcohol
+ (1976)	Kepone
78-173	Ketones
73-11010	Lead, Inorganic
78-158	Lead, Inorganic (Revised)
76-188	Logging-From Felling to First Haul
76-205	Malathion
73-11024	Mercury, Inorganic
76-148	Methyl Alcohol
77-106	Methyl Parathion
76-138	Methylene Chloride
77-164	Nickel, Inorganic
76-141	Nitric Acid
78-212	Nitriles
76-149	Nitrogen, Oxides
78-167	Nitroglycerin and of Ethylene Glycol Dinitrate
73-11001	Noise
77-115	Organotin Compounds
79-190	Parathion
78-174	Pesticides Manufacturing and Formulation
76-196	Phenol
76-137	Phosgene
77-225	Polychlorinated Biphenyls
77-192	Refined Petroleum Solvents
75-120	Silica, Crystalline
76-105	Sodium Hydroxide
83-119	Styrene
74-128	Sulfuric Acid
74-111	Sulfur Dioxide
77-121	1,1,2,2-Tetrachloroethane
76-185	Tetrachloroethylene (PERC)
78-213	Thiols: N-Alkane, Mono, Cyclohexane, and Benzene
78-179	o-Tolidine
73-11023	Toluene
73-11022	Toluene Diisocyanate
76-184	1,1,1-Trichloroethane (Methyl Chloroform)
73-11025	Trichloroethane
77-227	Tungsten and Cemented Tungsten Carbide
73-11009	Ultraviolet Radiation
77-222	Vanadium
78-205	Vinyl Acetate

(continued)

Alphabetical Listing of NIOSH Criteria Documents

NIOSH Publication Number	Subject
+ (1974)	Vinyl Chloride
77-140	Waste Anesthetic Gases and Vapors
75-168	Xylene
76-104	Zinc Oxide
+ No NIOSH Publication Number is assigned.	

(See also "U.S. Government Documents," this chapter, for more on NIOSH)

Abstracts

Not only were there journals specializing in industrial hygiene and medicine since the early years of this century, but there were also periodicals offering abstracts of the literature. In the United States, the *Journal of Industrial Hygiene* first appeared in 1919. After 1935, it was called the *Journal of Industrial Hygiene and Toxicology*, and it continued until 1949 (at which time it was replaced by the *AMA Archives of Industrial Hygiene and Occupational Medicine*).

A regular feature of this journal was a very lengthy supplement (at the end of each volume, with separate numbered pages) called *Abstract of the Literature of Industrial Hygiene*. Here appeared excellent summaries of key European and U.S. reports on asbestosis and other occupational diseases. The Annual Reports of the Chief Inspector of Factories (U.K.) were also summarized, as were legislative developments in industrial hygiene and compensation. The journal also benefited from the flight of Dr. Ludwig Teleky from Germany in the late 1930s. Teleky had been an editor of the *Archiv für Gewerbepathologie und Gewerbehygiene* published in Berlin. See, for example, his abstracts of the articles on asbestosis and cancer by Nordmann and Hornig (*Abstr. Literature Indust. Hyg. Tox. Suppl. to J. Industr. Hyg. Tox.* 20:184, 1938). The articles and abstracts sections of this journal were continuously indexed. In 1947 the publisher issued a cumulative index for the years 1936-1945, which contained reference to more than 50 abstracts on asbestos disease (*Cumulative Index/Journal of*

Industrial Hygiene and Toxicology. Williams and Wilkins Co., Baltimore, MD, p. 60, 1947).

From England, there was the *Bulletin of Hygiene* during the years 1926 to 1967. It was afterwards incorporated into *Abstracts of Hygiene*. This journal included only abstracts of articles, and was perhaps the best single source of abstracts in English on non-English European publications dealing with asbestos diseases. Abstracts were contributed by renowned figures in the field of industrial medicine not only in Great Britain but elsewhere in Europe. In 1956, for example, large-scale reports on asbestosis in insulation workers were published in Denmark, Italy, and Sweden. Abstracts of all three promptly appeared in the *Bulletin of Hygiene*.

Abstracts of 1956 Reports of Asbestosis
in Insulation Workers

Authors of report, journal	Bull. Hyg. cite	Abstract Author
Frost, Georg, and Møller (Danish Medical Bulletin)	32: 260 (March, 1957)	E.L. Collis
Molfino and Zannini (Folia Medica)	32: 1168 (December, 1957)	E. Vigliani
Ahlborg and Hansson (Svenska Läkartidningen)	32: 1115-1116 (November, 1956)	C. Lillingston

One of the most remarkable achievements of this journal was the timely and uninterrupted publication of abstracts during World War II. One might expect that British pathologist S. Roodhouse Gloyne would have had some difficulty obtaining and reading current German asbestosis articles during the war. Yet the 1942 articles on asbestosis by Böhme and on asbestosis/cancer by Welz in *Archiv für Gewerbepathologie und Gewerbehygiene* were abstracted by Gloyne in the *Bulletin of Hygiene* the following year (Vol. 18, p. 651). And Wedler's landmark report on cancers of the lung and pleura with asbestosis, published in the *Deutsche Medizinische Wochenschrift* in August of 1943, was summarized by Gloyne nine months later in the *Bulletin of Hygiene* (Vol. 19, p. 362).

The *Bulletin of Hygiene* abstracts of the papers by Welz, Böhme, and Wedler were reprinted in full in the abstracts section of *Journal of Industrial Hygiene and Toxicology* (Vol. 26, pp. 8, 183, 1944). The 1941 paper by Linzbach and Wedler, "Occupational Cancer among Asbestos Workers," was abstracted in *Journal of Industrial Hygiene and Toxicology* by Teleky (Vol. 24, p. 40, 1942).

Pneumoconiosis Abstracts was an offshoot of *Bulletin of Hygiene*. Volume I was comprised of reprinted *Bulletin of Hygiene* abstracts for the years 1926 to 1938. It was published in London (by Sir Isaac Pitman & Sons, Ltd.) in 1953. Volume II covered the years 1939 to 1950 and was published in 1954. Volume III covered 1951-1955 and came out in 1959. Each volume had a special section on articles that dealt primarily with asbestosis.

The *Bulletin of Hygiene* was not the only source of medical abstracts from Great Britain. The British Medical Association began to issue *Abstracts of World Medicine* after World War II. This carried a few abstracts of literature on asbestos, including one of the article, "Asbestosis with Pleural Calcification among Insulation Workers" (by J. Frost and co-workers, *Dan. Med. Bull.* 3:202-204, Nov. 1956). The abstract opens by describing the pneumoconiosis hazard to insulators as having been "established" by "experience in many countries." (A. Meiklejohn, *Abstr. World Med.* 21:359, May, 1957). So, occasionally, an abstract contained commentary that went beyond the mere summarizing of individual research findings.

In the Netherlands, Excerpta Medica Foundation began publishing a range of abstracting periodicals in 1948 in the English language. Excerpta Medica publications were subdivided into numerous "sections" covering different types of medical subjects. Abstracts of papers on asbestosis prior to 1965 appeared most often in the *Excerpta Medica* sections on 1) Chest Diseases and 2) Public Health, Social Medicine, and Hygiene. It was common for abstracts appearing in one section of the *Excerpta Medica* series to later be reprinted in another section with overlapping interests. *Excerpta Medica* sections on Cancer, Occupational Health and Industrial Medicine, and Pharmacology and Toxicology are among the 50 sections of *Excerpta Medica* now produced. Since 1959, these abstracts have also

been published in New York and other cities in addition to Amsterdam.

A remarkable source of articles on dust diseases was *The Pneumoconioses (Silicosis)*, issued as three volumes in 1934-1937 (by G.G. Davis, E.M. Salmonsens, and J.L. Earlywine, Chicago Medical Press). This compilation includes well-indexed citations of over 80 scientific articles on asbestosis from all over the world. Included as well are abstracts of then-current articles from insurance industry and engineering publications. These offer a fascinating glimpse of the ferment existing at that time over civil suits and the applicability of workers' compensation statutes for occupational diseases. In addition, there are extensive descriptions of applicable laws in the various states of the U.S. and provinces of Canada.

The Industrial Hygiene Foundation, founded as the Air Hygiene Foundation in 1936 and renamed in 1941 (called Industrial Health Foundation since 1971), has published *Industrial Hygiene Digest* monthly since 1937. Copies were automatically sent to member industrial and insurance companies, which numbered 300 by the end of 1946 (the published *Transactions* in these years listed member firms and "special subscriber" institutions). Thus, in 1946, asbestos companies including American Brake Shoe Company, Eagle-Picher Company, Johns-Manville Corporation, Keasbey & Mattison Company, Owens-Corning Fiberglas Corporation, Owens-Illinois Glass Company, Raybestos-Manhattan, and Union Asbestos and Rubber Company, obtained current abstracts of worldwide literature on workplace illnesses. Ruberoid Co. and Asbestos Corporation, Ltd. joined I.H.F. in 1953. The Decennial Index of the *Digest* for 1945-1954 had 43 entries under the headings asbestos and asbestosis. As of 1944, I.H.F.'s *Digest* regularly reviewed more than 200 medical journals from around the world, and a comparable number of trade, engineering, and science journals. By 1958 this *Digest* provided more than 1500 abstracts annually to subscribers.

The *Asbestos Bulletin/Abstracts of Recent Articles and Patents* was available by subscription starting in 1960 from Astex Publishing Company in England. Under the heading, "Miscellaneous" appeared a very brief abstract of the case report on

asbestosis and cancer in an insulation worker by Anderson and Campagna (Vol. 1, p. 96, 1960), and mere references to other titles by Keal and others in England and Germany (Vol. 2, p. 96, 1961).

Less specialized sources of medical abstracts on subjects like asbestosis contain less information. The *Journal of the American Medical Association* periodically carried abstracts on industrial medicine, as did the *American Review of Tuberculosis*, but the specialty journals (as opposed to general medical journals) were clearly the main repositories of such abstracts.

Chemical Abstracts, which is mainly about technology, not medicine, nonetheless carried several dozen abstracts of early articles on the pathology and other aspects of asbestosis. The earliest of these were writings of Stewart and Haddow in 1929 (CA 23:2482) and Gloyne in 1930 (CA 24:2791) and 1931 (CA 26:2499). The U.S. Public Health Service reports of Page and Bloomfield (CA 32:1009) and Dreessen *et al.* (CA 33:6471) were also reviewed. A number of pre-1960 articles describing the cancer hazards of asbestos were also summarized in *Chemical Abstracts*:

Author (Year) of Article	Chemical Abstracts Cite
Nordmann (1938)	32: 711
Teleky (1938)	35: 3732
Nordmann and Sorge (1941)	36: 2006
Mottura and Fagiano (1940)	36: 3581
Linzbach and Wedler (1941)	37: 2844
Boemke (1947)	42: 9002
Hueper (1949)	44: 5037
Perry (1947)	45: 9773
Owen (1950)	46: 6291
Boemke (1953)	47: 4471
Doll (1955)	49: 9195
Schmähl (1958)	53: 22414

Citations of articles on asbestos and asbestosis were easily accessible, using decennial indexes published by *Chemical Abstracts* since the 1930s.

Other technical abstracts also included references to writings on asbestosis. *Ceramic Abstracts*, for example, included summaries of the historic government publication in Britain of Merewether and Price (*Cer. Abstr.* 10:531, 1931); articles on pneumoconioses by Drinker and by Clark (16:137, 1937), McConnell and Middleton (16:138, 1937), Gardner (19:205, 1940; 23:132, 1944), Williams (20:135, 1941), and others; asbestosis papers of Sayers and Dreessen (18:168, 1939), Stone (19:149, 1940), Vigliani (19:226, 1940), and Noro (26:190, 1947); Lanza's 1938 text, *Silicosis and Asbestosis* (19:81, 1940); also reference to government reports in the U.S. and elsewhere on the subjects of air sampling, industrial hygiene engineering, etc. The British counterpart, *Transactions of the Ceramic Society Abstracts*, similarly reported on the seriousness of the health hazard from asbestos dust (36: 51A, 1937; 39: 89A, 1940). This appears to have been succeeded by *British Ceramic Abstracts*, which noted publications on dust diseases in the 1950s by McLaughlin, Holt, and others.

Medical Textbooks

Downstream of the primary medical literature are specialized medical textbooks. For asbestos diseases, one finds mention in books on chest diseases, preventive medicine, pathology, industrial hygiene/toxicology, occupational medicine, and, of course, pneumoconioses. Some of the earlier books on occupational health are shown in the table (See also "Other Sources of Information on Asbestos and Cancer," in Chapter 2).

EARLY TEXTBOOKS ON OCCUPATIONAL HEALTH (In English)

1. Ramazzini, Bernardino. *Diseases of Workers (De Morbis Artificum)*. Translated from Latin original (1713). New York: Hafner Publ. Co., 1964.
2. Thackrah, C.T. *The Effects of the Principal Arts, Trades and Professions, and of Civic States and Habits of Living, on Health and Longevity, with Suggestions for Removal of Many of the Agents which Produce Disease and Shorten the Duration of Life*. London: Longman, Rees, Orme, Brown, and Green, 1831.
3. McCready, B.W. *On the Influence of Trades, Professions, and Occupations in the United States, in the Production of Disease* (1837). Baltimore: Johns Hopkins Press, 1943.

4. Reese, J. *Textbook of Medical Jurisprudence and Toxicology*. Philadelphia (1891).
5. Arlidge, J.T. *The Hygiene, Diseases, and Mortality of Occupations*. London: Percival, 1892.
6. Oliver, Thomas. *Dangerous Trades*. London: E.P. Dutton, 1902.
7. Kober, G.M. *Industrial and Personal Hygiene*. Washington: President's Homes Commission, 1908.
8. Oliver, T. *Diseases of Occupation*. London: Methuen & Co., 1908 and 1916.
9. Greer, W.J. *Industrial Diseases and Accidents*. London: J.W. Arrowsmith, 1909.
10. Price, G.M. *The Modern Factory*. New York: J. Wiley & Sons, 1914.
11. Thompson, W.G. *The Occupational Diseases*. New York: D. Appleton & Co., 1914.
12. Hayhurst, E.R. *A Survey of Industrial Health Hazards and Occupational Diseases in Ohio*. Columbus, Ohio: F.J. Heer Printing Co., 1915.
13. White, R.P. *Occupational Affections of the Skin*. New York: Paul Hoeber, 1915, 1920, 1923, and 1934.
14. Mock, H.B. *Industrial Medicine and Surgery*. Philadelphia: W.B. Saunders Co., 1920.
15. Collis, E.L. and M. Greenwood. *The Health of the Industrial Worker*. London: J. & A. Churchill, 1921.
16. Clark, W.I. *Health Service in Industry*. New York: Macmillan Co., 1922.
17. Hope, E.W., W. Hanna and C.O. Stallybrass. *Industrial Hygiene and Medicine*. New York: W. Wood & Co., 1923.
18. Kober, G.M. and E.R. Hayhurst. *Industrial Health*. Philadelphia: P. Blackiston's Son & Co., 1924.
19. Hamilton, Alice. *Industrial Poisons in the United States*. New York: MacMillan Co., 1925, 1929.
20. Hackett, J.D. *Health Maintenance in Industry*. Chicago: A.W. Shaw Co. Chicago, 1925.
21. Henderson, Y. and H.W. Haggard. *Noxious Gases*, New York: Chemical Catalog Co., later Reinhold Publ. Corp., 1927, 1943.
22. Price, G.M. *Labor Protection in Soviet Russia*. New York: International Publishers Co., 1928.
23. Haslam, J.F.C. *Recent Advances in Preventive Medicine*. London: J. & A. Churchill, 1930.
24. Goldberg, R.W. *Occupational Diseases*. New York: Columbia University Press, 1931.

25. McCord, C.P., and Allen, F.P. *Industrial Hygiene for Engineers and Managers*. New York: Harper & Bros., 1931.
26. Bristol, L.D. *Industrial Health Services*. Philadelphia: Lea & Febiger, 1933.
27. Legge, Thomas. *Industrial Maladies*. London: Oxford University Press, 1934.
28. Hamilton, A. *Industrial Toxicology*. New York: Harper & Bros., 1934.
29. Clark, W.I. and P. Drinker. *Industrial Medicine*. New York: National Medical Book Co., 1935.
30. Browning, Ethel. *Toxicity of Industrial Organic Solvents*. London: H.M. Stationery Office, 1937.
31. Drinker, P., and T. Hatch. *Industrial Dust*. New York: McGraw-Hill, 1936 and 1954.
32. Ling, T.M. and J.A. Nixon. *Recent Advances in Industrial Hygiene and Medicine*. Philadelphia: P. Blackiston's Son, 1937.
33. McNally, W.D. *Toxicology*. Chicago: Industrial Medicine Publishing Co., 1937.
34. Gonzales, T.A., et. al. *Legal Medicine and Toxicology*. New York: D. Appleton-Century, 1937.
35. Chenoweth, L.B. and W. Machle. *Industrial Hygiene: A Handbook of Hygiene and Toxicology for Engineers and Plant Managers*. New York: F.S. Crofts & Co., 1938.
36. Lanza, A.J. (ed.) *Silicosis and Asbestosis*. London: Oxford University Press, 1938.
37. Lanza, A.J. and J.A. Goldberg (eds.) *Industrial Hygiene*. New York: Oxford University Press, 1939.
38. Vernon, H.M. *Health in Relation to Occupation*. London: Oxford University Press, 1939.
39. Alden, J.L. *Design of Industrial Exhaust Systems*. New York: Industrial Press (1939).
40. Sappington, C.O. *Medicolegal Phases of Occupational Diseases*. Chicago: Industrial Health Book Co., 1939.
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Carcinogens—See Hueper, IARC

The subject of industrial carcinogenesis was encyclopedically reviewed continuously by Dr. Wilhelm C. Hueper for nearly three decades starting in 1942. Hueper's monumental book, *Occupational Tumors and Allied Diseases* (Charles C. Thomas, Publishers), came out in early 1942. From that time on, Hueper published hundreds of medical articles, editorials, books, and experimental reports announcing the emerging knowledge on asbestos, arsenic, benzene, chromates, beryllium, nickel, aromatic amine dye intermediates, and numerous synthetic materials whose industrial use was soaring. His experimental work covering a wide range of materials is not included in the list which follows.

Though Hueper was considered by some to be quick to designate a substance as carcinogenic, it is noteworthy that he was several years behind some German writers in coming to the conclusion that asbestos definitely caused lung cancer. And well into the 1950s, Hueper referred to "asbestosis lung cancer,"

noting that the literature had not shown that lung cancer from asbestos occurred unless asbestosis had developed first. Hueper was extremely accurate in identifying industrial carcinogens, and there is little if any evidence that he raised false alarms by unjustified pronouncements.

His Public Health Monograph No. 36 on environmental cancer of the lung was sent to Turner & Newall in 1957, and this reply came back from the English firm:

It seems to us that (Hueper) is very fair in stating the views of those authorities who still doubt the relationship between asbestosis and lung cancer, as well as those who consider the connection to be established.

(Letter from John Waddell to R.R. Porter, Keasbey & Mattison Co., Oct. 28, 1957)

REVIEWS ON ENVIRONMENTAL CANCER
BY DR. WILHELM HUEPER

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Current information on carcinogens is available from the International Agency for Research on Cancer (IARC). The IARC is a part of the World Health Organization and is located in Lyon, France. IARC publications are locally sold in 70 countries. IARC has published monographs on the evaluation of the Carcinogenic Risk of Chemicals to Humans and separately numbered Scientific Publications. The monographs published since 1971 number more than 60 to date. They summarize the state of knowledge on carcinogenicity of selected substances. Volume 14, on asbestos, is quite good, and the IARC Monographs are of high quality in general. Separate IARC "Scientific Publications" now number more than 40, and cover a wide range of topics in cancer epidemiology, experimental pathology, environmental occurrence, carcinogenic screening tests, methods of chemical analysis, etc. Two of the Scientific Publications deal with asbestos (No. 8, 1973; and No. 30, a two volume collection of brief reports in 1980).

Anyone who has read this far cannot help but be impressed with the degree to which public health scientific literature is deformed by the stresses imposed by commercial interests. The recognition and regulation of carcinogens is the most bitterly contested area of occupational health field today. The IARC consensus Monographs on cancer have been widely acclaimed for their quality, but they also "receive serious consideration by regulatory agencies and courts throughout the United States and indeed the rest of the world," according to a "leading chemical industry consultant."

The consultant was concerned about an in-press IARC Monograph evaluating benzene. The chemical industry had just fought a brutal battle to the Supreme Court to maintain OSHA's allowable concentration of benzene in the workplace air at 10 parts per million (ppm). The IARC scientific panel report contained a sentence to the effect that workers exposed to 10 ppm of benzene would have three times the normal rate of leukemia. But then pressures were brought by a main source of IARC's funding, the U.S. National Cancer Institute (NCI), after a meeting with distraught industry representatives. IARC dropped the offending sentence from the Monograph published in July, 1982 (No. 29). The deletion was made by IARC Director Lorenzo Tomatis without informing the expert scientific panel that wrote the Monograph. Dr. Tomatis may still have been shaking after rejecting an NCI proposal that would have allowed NCI to select the researchers invited and the chemicals to be studied in IARC's carcinogenic risk assessment program ("Benzene and 'Risk Assessment'—One Little Sentence was Deleted," *The Sun*, Baltimore, Aug. 6, 1982; also M. Sun, "Risk Estimate Vanishes from Benzene Report," *Science* 217:914-915, 1982).

This incident should serve as a reminder that even the best public health scientific documents cannot be uncritically relied upon.

International Agency for Research on Cancer—Monographs

Vol.	Subjects
1	Inorganic Substances, Chlorinated Hydrocarbons, N-Nitroso Compounds, Aromatic Amines, Natural Products
2	Some Inorganic and Organometallic Compounds
3	Certain Polycyclic Aromatic Hydrocarbons and Heterocyclic Compounds
4	Some Aromatic Amines, Hydrazine and Related Substances, N-Nitroso Compounds and Miscellaneous Alkylating Agents
5	Some Organochlorine Pesticides
6	Sex Hormones (I)
7	Some Anti-Thyroid and Related Substances, Nitrofurans and Industrial Chemicals
8	Some Aromatic Azo Compounds
9	Some Aziridines, N-, S- & O-Mustards and Selenium
10	Some Naturally Occurring Substances
11	Cadmium, Nickel, Some Epoxides, Miscellaneous Industrial Chemicals, and General considerations on Volatile Anaesthetics
12	Some Carbamates, Thio-Carbamates and Carbazides
13	Some Miscellaneous Pharmaceutical Substances
14	Asbestos
15	Some Fumigants, the Herbicides 2,4-D and 2,4,5-T Chlorinated Dibenzodioxins and Miscellaneous Industrial Chemicals
16	Some Aromatic Amines and Related Nitro Compounds—Hair Dyes Colouring Agents and Miscellaneous Industrial Chemicals
17	Some N-Nitroso Compounds
18	Polychlorinated Biphenyls and Polybrominated Biphenyls
19	Some Monomers, Plastics and Synthetic Elastomers, and Acrolein
20	Some Halogenated Hydrocarbons
21	Sex Hormones (II)
22	Some Non-Nutritive Sweetening Agents
23	Some Metals and Metallic Compounds
24	Some Pharmaceutical Drugs
25	Wood, Leather and Associated Industries
26	Some Antineoplastic & Immunosuppressive Agents
27	Some Aromatic Amines, Anthroquinones, and Nitroso Compounds and Inorganic Chlorides used in Drinking Water and Dental Preparations
28	Rubber Industry
29	Industrial Chemicals and Dyestuffs
30	Miscellaneous Pesticides
31	Some Food Additives, Feed Additives, and Naturally Occurring Substances
32	Polynuclear Aromatic Compounds, Part 1, Environmental and Experimental Data

International Agency for Research on Cancer—Monographs

Vol.	Subjects
33	Polynuclear Aromatic Compounds, Part 2, Carbon Blacks, Mineral Oils, and Some Nitroarenes
34	Polynuclear Aromatic Compounds, Part 3, Industrial Exposures in Aluminum Production, Coal Gasification Coke Production, and Iron and Steel Founding
35	Polynuclear Aromatic Compounds, Part 4, Bitumens, Coal Tars and Derived Products, Shale-oils and Soots
36	Allyl Compounds, Aldehydes, Epoxides and Peroxides
37	Tobacco Habits Other than Smoking; Betel-Quid and Areca-Nut Chewing; and Some Related Nitrosamines
38	Tobacco Smoking
39	Some Chemicals Used in Plastics and Elastomers
40	Some Naturally Occurring and Synthetic Food Components, Furocoumarins and Ultraviolet Radiation
41	Some Halogenated Hydrocarbons and Pesticide Exposures
42	Silica and Some Silicates

Medical Conference Proceedings

Conferences on occupational diseases are not always published in the scientific periodicals. Sources of information on asbestos and other toxic substances include these conferences, the proceedings of which appeared as unique publications:

Industrial Commission of Wisconsin—1932

Effects of Dust upon the Respiratory System

International Labor Office-1930, 1938, 1950, 1971

Pneumoconiosis conferences in South Africa, Switzerland, Australia, Romania

South African Council for Scientific and Industrial Research—1959, 1969, 1977

Pneumoconiosis conferences.

American Cancer Society and National Cancer Institute 1949, 1952, 1956, 1960 ...

National Cancer Conferences

Permanent Commission on Occupational Health (Accident Medicine, Occupational Diseases, etc.)

—fourteen held between 1906 and 1963

International Congresses on occupational health (exact title varies) held in European cities.

Saranac Laboratory for Research on Tuberculosis (Trudeau Institute)

—seven held by 1952

Symposia on pneumoconioses and other occupational diseases held in New York. Seventh Saranac Symposium (1952) never was published.

Association of American Railroads, Medical Section, 1921 on Annual meetings on subjects of interest to railroad industry physicians.

Transcribed discussions at these conferences sometimes contain anecdotal material not found in carefully prepared medical journal reports. Meiklejohn, for example, described some of his experiences in maintaining that "asbestosis is a clinical condition, not a pathological or radiological one." He told of wartime complaints by asbestos workers, who were persuaded not to strike by the government. Doctors then came to visit the plant every month to conduct some exams and to be available for consultation. The doctors always came on pay days when there was a band and dancing. "The doctors danced with the girls and incidentally learned whether they were short of breath."

Further emphasizing the clinical aspects of asbestosis, Dr. Meiklejohn explained how he learned about finger clubbing from a worker:

A workman refused to be examined. He said he knew quite well how to diagnose asbestosis. He took me to the factory and asked the workers to hold out their hands. He picked out those with 'clubbing' and said that these had the disease. I followed this up and found it to be correct. (*Proceedings of the Pneumoconiosis Conference, Held at University of Witwatersrand, Johannesburg, A.J. Orenstein, ed. Boston: Little, Brown & Co., 1960, p. 389.*)

Additional information could also be found in conferences on more general medical subjects (e.g., cancer).

International Labor Office Publications

The I.L.O. is headquartered in Geneva, Switzerland, and is constituted as a tripartite organization: management, labor, and government from a large number of countries are represented. Since its founding in 1919, the I.L.O. has been a source of documentation on the effects of toxic substances.

The two-volume I.L.O. Encyclopedia of Occupational Health and Safety was first issued in 1930 and has undergone revision ever since. A supplement to the encyclopedia from 1938 and the original encyclopedia were good state-of-the-art documents on asbestosis. Early editions of the encyclopedia were published in English and French. In 1932, the I.L.O. published a bibliography including 70 references to asbestos (*Pneumoconiosis/Essai Bibliographies Études et Documents Série F, Hygiène Industrielle*, No. 15, pp. 34-37).

Over the years, the I.L.O. has published conventions and recommendations dealing with occupational diseases and their prevention (lead poisoning, 1919-1921; occupational diseases, 1925 and 1934; medical exams, 1946; ionizing radiation, 1960; benzene, 1971). Various reports of I.L.O. Industrial Committees covered coal mining, the petroleum industry, chemical industries, iron and steel industries and textiles. The early chemical committee reports included remarks on the subject of warning labeling. At least one such report has been illustrative of the recognition of an asbestosis risk in shipyard insulation work (Metal Trades Committee, Seventh Session, "Working Conditions and Safety in Shipbuilding and Ship Repairing," 1962).

Starting in 1960, I.L.O. has issued abstracts on occupational safety and health literature at the rate of about 2000 per year in English, French, and German. The service was computerized in 1974, and these ("CIS") abstracts cover books, journal articles, regulations, guides, manuals, dissertations, and conference proceedings. This abstracting resource, with its annual index, offers one of the shortest routes to current scientific literature in occupational health.

There is also an "Occupational Safety and Health Series" of over 40 titles which has emerged since around 1960. Information on asbestos is contained in the following:

No. 22 *ILO/UC International Classification of Radiographs of Pneumoconioses* (1971)

No. 27 *Safety and Health in Shipbuilding and Ship Repairing* (1972)

No. 30 *Asbestos: Health Risks and Their Prevention* (1974)

Historic I.L.O. pneumoconiosis conference proceedings (1930, 1938, 1950, and 1971) also contain valuable information on asbestos.

Unfortunately, I.L.O.'s recent activities on asbestos are disappointing compared with the organization's past record. In October of 1983, I.L.O. convened an "Experts' Meeting on the Safe Use of Asbestos." The draft I.L.O. "Code of Practice" infuriated leading trade unionists and government authorities in Sweden and Finland. One of the panelists, Ms. Nancy Tait of the Society for the Prevention of Asbestosis and Industrial Diseases, walked out in protest over the dominant presence of the asbestos industry on the panel. I.L.O. published its code of practice, called "Safety in the Use of Asbestos," in 1984.

INDUSTRY TRADE ASSOCIATIONS AND RESEARCH ORGANIZATIONS

Industry trade associations and the periodicals, reports, and other documentation they produce are surprisingly numerous. Over the years there have been about a dozen trade groups representing the asbestos industry in the United States, and similar groups have long existed in other countries. In recent years, the world asbestos industry has been formally united through the Asbestos International Association, headquartered in London with member firms in more than 30 countries.

Aside from published reports, the larger industry trade and research groups have spawned committees on such topics as industrial hygiene, workers' compensation, and warning labeling. The minutes of committee meetings, and the recollections of those who were present, can offer candid glimpses into the historic awareness and attitudes of the various members of the industry. Manufacturers' groups have also sponsored research that in many cases was not all published or even

alluded to in the published literature. Here, again, the recollections of "old timers" along with whatever documentation can be unearthed is of enormous value.

The principal research contractors used by the asbestos industry were the Saranac Laboratory for Research on Tuberculosis and the Industrial Hygiene Foundation. The Saranac Laboratory was started as an adjunct to the sanatorium of Edward Trudeau in the Adirondack Mountains of upstate New York. Having set up facilities for animal experimentation on dusts to study the synergistic effects of silicosis and tuberculosis in 1921, the laboratory was well prepared to investigate the effects of other dusts as well. The earliest published work on asbestos at Saranac (published 1931) was supported by the asbestos industry (Testimony of Johns-Manville executive J.B. Jobe at 1972 OSHA hearing on workplace asbestos standard). The "Sumner Simpson Papers" contain correspondence showing that a research contract was arrived at in 1936 involving a number of asbestos firms, and this was re-funded every year for about ten years. Positive experimental findings on asbestos carcinogenicity were reported to the industry in 1943. Other animal studies to investigate asbestos' carcinogenicity were initiated at the end of 1950 for the Quebec Asbestos Mining Association. Saranac did pathologic and radiologic consultation on pneumoconiosis cases for asbestos companies starting in 1942. The Saranac Lab also tested the dust from the Owens-Illinois thermal insulation, "Kaylo," for nearly a 10-year period starting in 1943. The Saranac Lab was closed in 1956, but the Trudeau Institute still remains and has made available for inspection the surviving records of the Saranac Laboratory.

The Industrial Hygiene Foundation, as it is called throughout this book, was founded in 1936 under the auspices of the Mellon Institute by a cross-section of large industrial companies. In the effort to launch this organization, Vandiver Brown promoted it as "the creature of industry and the one institution upon which employers can rely completely for a sympathetic appreciation of their viewpoint." (Brown letter to C.J. Stover, publisher of *Asbestos*, Dec. 4, 1936. Sumner Simpson Papers) It was first called Air Hygiene Foundation (1936-1941), then Industrial Hygiene Foundation (1941-1971), and is presently

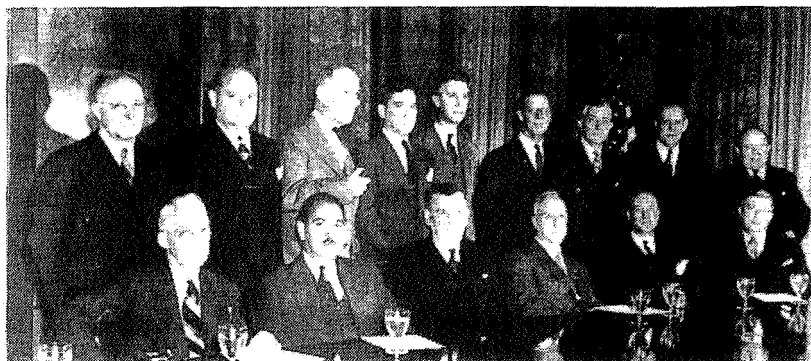
called Industrial Health Foundation (1971-present). I.H.F. is located in Pittsburgh and has been induced in the course of legal discovery to open its surviving records for inspection.

I.H.F. conducted industrial hygiene and medical surveys for Raybestos-Manhattan in 1944 and the members of the Asbestos Textile Institute in 1947. I.H.F.'s proposal to conduct a cancer epidemiology study for the Asbestos Textile Institute was refused in 1957, but a similar proposal was funded by the Quebec Asbestos Mining Association and completed in 1957. The findings were edited and reviewed by Q.A.M.A. and Johns-Manville, and published in 1958. In 1953, I.H.F. announced that a total of more than 600 "special studies" had been made for its member companies. IHF's copies were destroyed in 1979.

The Industrial Hygiene Foundation also arranged closed informal medical meetings among members in particular industries. The proceedings contain only fleeting mention of such meetings, such as one planned for 1948 "for physicians associated with the asbestos industry." (*A Better Place to Work*, I.H.F. Transactions Bull. No. 9 of Annual Meeting Nov. 20, 1947, p. 5) Some IHF members are listed on p. 708.

There were regular published I.H.F. medical, engineering, and legal conferences. The annual legal meetings contained published discussions of workers' compensation laws and significant court decisions. Through vehicles such as confidential industrial hygiene surveys, annual conferences, and the *Industrial Hygiene Digest* (see also "Abstracts," this chapter), I.H.F. provided a full complement of services to member companies. I.H.F.'s annual meetings were not only covered by industry trade magazines, but also such prestigious newspapers as the *Wall Street Journal* and *The New York Times*, as well as the national wire services Associated Press and United Press International (*Foundation Facts*, Nov. 1947).

Industry trade groups also had overlapping memberships. In I.H.F.'s 1946 "Summary of Conference on Chemistry and Toxicology" appears a reference to warning label manuals just developed by the Manufacturing Chemists' Association. One concern was frankly stated in the I.H.F. summary:



May, 1945 Industrial Hygiene Foundation Trustees' meeting held in the Board Room of Johns-Manville Corporation in New York.

Seated, left to right, are: Dr. C.D. Selby, General Motors; A.C. Hirth, Owens-Illinois Glass; J.W. McLaughlin, Bakelite and Union Carbide & Carbon; Dr. A.J. Lanza, Metropolitan Life; Andrew Fletcher, St. Joseph Lead and Chairman of the Foundation's Board; John F. McMahon, Managing Director. *Standing are:* W.E. Mack, Carborundum Co.; T.C. Waters, Mullikin, Stockbridge & Waters; Dr. L.U. Gardner, Saranac Laboratory; Vandiver Brown, Johns-Manville; W.C.L. Hemeon, Foundation engineer; Joseph Dilworth, Westinghouse Electric; J. Dewey Dorsett, Assn. Casualty & Surety Executives; Dr. R.R. Sayers, U.S. Bureau of Mines; and W.P. Yant, Mine Safety Appliances.

Under no circumstances should chemicals be overlabeled, i.e., the degree of hazard should not be exaggerated.

(*Health in Industry*, Transactions Bull. No. 8 of Eleventh Annual Meeting of Industrial Hygiene Foundation, Inc. Nov. 7, 1946, p. 36).

In the records of the following trade and research groups, valuable historical information has been found with respect to the recognition of asbestos hazards:

Asbestos Textile Institute (founded 1944): Minutes of meetings describe: Air Hygiene Committee started in 1946; I.H.F. survey in 1947; U.K. firms ahead of U.S. in dust control (1949); Criticism of Conklin article naming asbestos as a carcinogen in *Scientific American* (1949); redrafting of government specifications (1953); 5 to 11 percent prevalence of asbestosis in plants, use of forced breathing therapy, air

pollution control equipment (1953); health insurance used to cover asbestosis, no comp. claims (1954); recognition of cancer in the industry and concern about publicity in such popular literature as *Consumer Reports* (1955); acknowledgment of publicity on asbestos and cancer (1956); concern about Dr. Hueper's publications saying asbestosis and lung cancer could possibly occur among asbestos plant neighbors (1956); ATI's refusal to fund an animal study on carcinogenicity ("There is a feeling among certain members that such an investigation would stir up a hornet's nest and put the whole industry under suspicion"—1957); H. Jackson's discussion of various respirators (1957); advance notice of Selikoff's paper presented in 1963 on cancer among asbestos insulation workers, with increasing concern leading up to the New York Academy of Sciences Conference in 1964; Quebec Asbestos Mining Association seeking "alliance with some university such as McGill, for example, so that authoritative background publicity can be had" (1965); ATI lawyers sent to talk to *Chemical Week* staff after "irresponsible article" in 1966; Dr. Selikoff a "dangerous" man, pressure on the Mt. Sinai School of Medicine mentioned (1971).

Minutes of Sept. 26, 1945 list the following members of ATI: Johns-Manville, Raybestos-Manhattan, Keasbey & Mattison, Carolina Asbestos, Southern Asbestos, Philadelphia Asbestos, and J. Franklin Burke & Co. By 1952, Union Asbestos and Rubber Co., Asten-Hill Manufacturing Co., American Asbestos Textile Corp. (later Amatex), and the British firm Small and Parkes, Ltd. were added.

Magnesia Insulation Manufacturers Association (founded 1944)—MIMA published the 85% Magnesia Insulation Manual in 1949 (90 pp.) and issued a revised edition in 1955 (74 pp.). The manual was originally prepared "to provide designers and users of insulation with *comprehensive* information on the use of 85% Magnesia" (emphasis added). The first edition advised that, "The material can be shipped, stored, and handled without any special precautions ... " (p. 4). The second edition said that 85% magnesia insulation "is easily cut and fit ... and offers no hazard to the workman" (p. 13). Members of MIMA listed on page one of the second

edition were: Philip Carey Manufacturing Co., Ehret Magnesia Manufacturing Co., Johns-Manville, Keasbey & Mattison, Mundet Cork, and Pabco Products, Inc. With the increasing use of calcium silicate and other alternatives to 85% magnesia, the trade association became the National Insulation Manufacturers Association.

National Insulation Manufacturers Association (later Thermal Insulation Manufacturers Association)—Establishment of an industry health program was brought up in January, 1960, and rejected in May of that year. Represented: Mundet Cork, Keasbey & Mattison, Pittsburgh-Corning, Refractory and Insulation Corp., Baldwin-Ehret-Hill, Johns-Manville, Pittsburgh Plate Glass, Owens-Corning, Union Asbestos and Rubber Co., Forty-Eight Insulations, Gustin-Bacon Manufacturing Co., and Eagle-Picher. The text of Johns-Manville's new warning label on shipping cartons of asbestos insulation products was quoted in the minutes of the April 14, 1964 meeting (full text of warning in Chapter 5).

Following another round of adverse press reports featuring Dr. Selikoff and research by his group, NIMA's Executive Committee decided to form a Health and Safety Committee "to combat adverse opinions relative to the health hazards of insulation products." (April 11, 1966 minutes). The products of this new committee included two *Recommended Health and Safety Practices* brochures, one each for thermal insulations containing asbestos and mineral fibers. The asbestos brochure advised housekeeping measures to keep the dust down and even recommended occasional reliance on respirators approved for pneumoconiosis-producing dusts. The word pneumoconiosis was not defined, nor did the words asbestosis, cancer, or disease appear anywhere in the brochure. Johns-Manville official Clifford Scheckler (who, along with Owens-Corning's John Vyverberg, authored the brochures) would later explain that,

The intent of issuing these booklets to contractors by the members of NIMA was to protect their employees and themselves legally...the booklets prepared by NIMA were not intended for workers per se although the unions were given copies. (Nov. 14, 1968 Minutes

of Meeting of the Health and Safety Council, Asbestos Cement Producers Association).

Saranac Laboratory.—Files of asbestosis/cancer cases and names of persons or companies submitting the tissues for examination (1942-). Letters from Dr. Gardner describing preliminary positive cancer findings and requesting funding for studies from National Cancer Advisory Committee (Dr. Hektoen). Expresses concern over asbestos hazards in naval shipyards (1943). Correspondence between Gardner and Dr. R. Ritterhoff about asbestosis in the Philip Carey employee, Herbert Scobie (1944). Confidential report to Johns-Manville on earlier studies (1949). Reports and correspondence with Owens Illinois regarding tests for pulmonary reactions from "Kaylo" dust in animals, 1943-1952. Annual reports of Saranac lab list research sponsors and funding provided.

Industrial Hygiene Foundation.—an empty file folder titled, "Preliminary Dust Investigation for Asbestos Textile Institute" (copy of the report was in the Sumner Simpson Papers); memorandum to H. Jackson (Johns-Manville) proposing epidemiological study on the connection between pulmonary carcinoma and asbestosis (1953); I.H.F. letters and proposals to ATI citing published literature on asbestos carcinogenicity and proposing to do a cancer study (1956, 1957); letter to H. Jackson of Johns-Manville passing on an inquiry received from J. Kane of the International Association of Heat and Frost Insulators and Asbestos Workers union inquiring about occupational lung disease risks in the trade (1955); statements by President A. Fisher and H. Jackson of Johns-Manville about a manufacturer's responsibility for warning consumers about safe practices for use of commercial products (1955-published); Dr. K.W. Smith's letter to Q.A.M.A. attorney I. Sabourin regarding critical changes in the pre-publication version of the I.H.F. study on lung cancer in asbestos miners, and the text of the pre-publication version of that investigation itself (1957). I.H.F. has maintained a file of its historic membership since its founding, and was ordered to produce this in litigation in Pennsylvania.

Asbestosis Research Council—Set up by the industry in the U.K. in 1957, this organization has supported research and issued codes of practice and safety guides. Its founding has been attributed to the recognition that asbestosis was occurring in "people who had joined the industry since the dust control measures were introduced and ... certain users of asbestos products, such as thermal insulation ..." (M.L. Bentley, *Control of the Use of Asbestos-Containing Friction Materials. Ann. Occup. Hyg.* 13:31-32, 1970). By 1969, Bentley reported, this group's Environmental Control Committee had established a "working group" concerned with the use and replacement of friction materials. The industry has been criticized for naming this organization in a manner that would be confused by the public with respected national scientific councils. Some ARC documents have been found in the files of Turner & Newall (see "The Asbestosis Research Council," in next chapter).

Asbestos International Association—Minutes of labeling committee on delaying the use of warning labels in countries where they are not required, because of adverse effect on sales (1978). This was produced in discovery by Raybestos-Manhattan. AIA has never been subject to discovery and has even refused to identify the members of the labeling committee (only Mr. Van der Rest of Eternit in Belgium is identified in the minutes). This organization has published position papers on asbestos-cement products and asbestos waste disposal, etc.

Quebec Asbestos Mining Association—Files (1931 to date) are retained in Quebec, Quebec: access to these records has so far been blocked. Some QAMA documents have emerged from the files of Johns-Manville and other sources (See "Companies Mining Asbestos in Quebec, Canada," in Chapter 9). The group was called Quebec Asbestos Producers Association until 1948. QAMA's library and research arm since 1966, the Institute of Occupational and Environmental Health, has been a source of some useful reports: the Wheatley report (see "Other Events of 1930" in Chapter 1); I.C. Sayers' report on the asbestos situation in Britain in 1967 (see "Union Carbide" in Chapter 9); Metropolitan

Life's report on the King Mine (see "Asbestos Corporation, Ltd." in Chapter 9); and fine translations of early medical articles on asbestos from non-English journals. In 1982, resources of this institute were combined with others to create the Canadian Asbestos Information Centre, located in Montreal and involving participation by the government of Canada. In 1985, this institution was reorganized and named the Asbestos Institute.

Resilient Floor Covering Institute—Independent investigators had reported mesothelioma in a floor tile installer in 1971 (Murphy *et al.*, *Am. Rev. Resp. Dis.* 104:576-580, 1971). The trade group R.F.C.I. hired S.R.I. International to monitor asbestos exposures when vinyl-asbestos flooring was removed by typical techniques. Time-weighted-average exposures (in f/cc) were: 0.08 to 0.16 for vinyl flooring removal; 0.41 for wet scraping of felt backing adhering to the floor; 0.83 to 2.02 for dry scraping of the floor (R.J. Walcott and J.C. Warrick, *Monitoring for Airborne Asbestos Fibers: Sheet Vinyl Floor Covering, Wet Versus Dry Scraping*, SRI International, Arlington, VA). R.F.C.I. issued a brochure, *Recommended Work Procedures for Resilient Floor Coverings*, in 1980. Members of R.F.C.I. were given as: American Biltrite, Inc.; Uvalde Rock Asphalt Co.; Congoleum Corp.; Flintkote Corp.; GAF Corp.; and National Floor Products Company.

Other trade groups of asbestos manufacturers include: Asbestos Cement Products Association (See "National Gypsum" in Chapter 9) and its successor since 1973, A-C Pipe Producers Association; Friction Material Standards Institute (1949-present); and Asbestos Information Association (1968-present). Others that existed decades ago include: Asbestos Paper Manufacturers Association, Asbestos Brake Lining Association (formed in 1923).

In the United Kingdom, there is the Thermal Insulation Manufacturers Association, which requested 70 copies of the Factory Inspectorate's warning about asbestosis dangers in ship repair yards in 1945 (See Table 8 in Chapter 5). Another group in London at that time was the Magnesia-Asbestos-Glass Insulation Manufacturers Council. The Asbestos Information

Committee was created for public relations purposes around 1967, with assistance from Hill & Knowlton, a firm that had provided similar services to cigarette companies. In West Germany, the Asbestos Trade Association was formed in more recent years. And around the world, the South Pacific Asbestos Association was set up in 1979.

Also of interest are industry organizations not centered on asbestos but dealing with occupational health hazards generally. These include the National Safety Council and the Chemical Manufacturers Association.

National Safety Council—The National Safety Council was set up in 1912 as management's response to the industrial safety issue, with its associated problems of disability compensation and labor unrest (Dan Berman, *Death on the Job*. New York: Monthly Review Press, 1978). Among the Council's publications dealing with asbestos were:

General Classification of Respiratory Devices. "*The Industrial Supervisor*" (July 15, 1936), pp. 12-13. Describes the three main types of respirators, including Type A for pneumoconiosis-producing dusts including asbestos.

Compounding Materials Used in the Rubber Industry. Industrial Safety Series No. RU-3 (1938). Notes that asbestos was used in packing and gasket rubber products. "Suitable exhaust systems or respiratory protective equipment are usually needed to prevent the inhalation of dust by the workers."

W.E. Lawrence. "Fume Control in Shipyards." *Nat. Safety News* (April, 1944), pp. 16-17, 90-92. Notes that a water-repellent asbestos insulation had become available for ship work. "For protection against dust or possible asbestosis, it is recommended that such material be dampened wherever possible, and that dust respirators be worn in addition to the provision of special ventilation. Periodic medical examination of those exposed is also necessary."

National Safety News, the main periodical of the National Safety Council since 1919, ran a number of articles dealing with asbestosis in the 1930s (C.O. Sappington, "Industrial Health,"

46 and 76-77, May, 1931; C.O. Sappington, "Are All Dusts Hazardous?" 18-20, Feb. 1932; L.U. Gardner, "Inhaled Mineral Dusts," 34-36, Jan. 1933; A.S. Johnson, "No Half Way Measures in Dust Control," 17-18 and 48-51, Sept. 1935; R.B. Hunt, "Lesser Known Facts about Occupational Diseases," 34-38, Nov. 1936; H.B. Meller, "Air Contaminants that Affect Health," 43-46, Dec. 1936; R.R. Sayers, "Dusts That Harm," 51-52 and 82-84, Jan. 1938; J.M. Roche, "Settling the Dust Problem," 18-19 and 72-74, May, 1939).

The National Safety Council held annual congresses, and the published "transactions" of these meetings were automatically mailed to the industrial members of the Council. (N.S.C. originally claimed that its membership records were privileged information. Upon having to reveal the names of members, N.S.C. asserted that the surviving records indicate only the identities of present members and the years of their continuous membership to date.) Leading figures in industrial medicine and hygiene made presentations at the annual congresses. Some examples from the 1930s that relate especially to asbestos are:

Dr. Leroy Gardner of the Saranac Laboratory described the lung tissue response to asbestos in 1932 and again in 1934. In the latter he acknowledged that asbestos was "generally recognized as a cause of severe pulmonary injury." Asbestos hazards received passing mention in discussions by: W.S. Ash of U.S. Tire Company, on dust problems in the rubber industry (1934); R.R. Sayers of the Public Health Service, on dust disease investigations of the Service (1934); Liberty Mutual experts on exhaust ventilation systems (1934); F.R. Jones, insurance executive, on workers' compensation (1935); and E. Mayer of New York, on dust diseases (1935). Dr. R.B. Hunt, Medical Advisor to American Mutual Liability Insurance Company, described asbestos work as offering "another type of dust which may cause fatalities among workers." He also talked about metals, benzene and chlorinated hydrocarbons. Hunt concluded with an urgent plea for employers to demand more information from the manufacturers of products they used regarding health hazards: "The manufacturer should be held

responsible for the ills produced by his product and unless he can guarantee its safety, it has no place in industry." (1936)

Dr. A.J. Lanza of Metropolitan Life presented a paper called "Dust Diseases as They Affect the Construction Industry." He said, "(In) construction material, asbestos is usually combined with other substances which, by reducing the amount of asbestos in the dust, tend to mitigate the hazard." He described asbestosis. Asbestosis was also mentioned in a paper on dust control by the managing director of the newly formed Air Hygiene Foundation of America, Incorporated, H.B. Meller (1936). Papers on industrial dust hazards and control were presented by Dr. R. R. Sayers (U.S. Public Health Service), A.S. Johnson (American Mutual Liability Insurance Co.), A.D. Lazenby (Maryland Casualty Co.), and R.C. Starr (U.S. Department of Labor), at the National Safety Congress of 1937.

Henry Sayer offered an insurance executive's view on occupational disease compensation, remarking that liability for dust diseases was a matter of great controversy. He mentioned asbestosis and noted that fibrosis of the lungs was permanent and incurable. Dr. Carey McCord criticized the widespread practice of selling products by trade names without any indication of their hazardous ingredients (1938). A panel on occupational disease control included W.G. Hazard of Owens-Illinois and Dr. O.A. Sander. Medical surveillance, exhaust ventilation, and respiratory protection were among the subjects discussed (1939).

The Chemical Manufacturers Association and Others—The main trade group of the chemical industry is the Chemical Manufacturers Association (CMA) in Washington, until 1979 called the Manufacturing Chemists Association. This group issued Manual L-1 (a guide for the Preparation of Warning Labels for Hazardous Chemicals) in 1945 and revised it over the years. The label advised for harmful dusts (1946) read, "Caution! Harmful Dust/Avoid repeated breathing or skin contact. Wash thoroughly before eating or smoking. Keep away from food or food products."

Chemical Industry Associations

Acrylamide Producers Association*
 Acrylonitrile Group***
 Adhesives Manufacturers Association
 Adhesive and Sealant Council
 Alkyl Amines Council*
 American Coke and Coal Chemicals Institute
 American Industrial Health Council
 American Petroleum Institute
 American Pharmaceutical Association
 Aniline Association*
 Association of Solvent Recyclers
 Basic Acrylic Monomer Manufacturers Association*
 Cadmium Council
 Canadian Agricultural Chemicals Association
 Canadian Chemical Producers' Association
 Chemical Advertisers Group of New York
 Chemical Coaters Association
 Chemical Corps Association
 Chemical Fabrics and Film Association
 Chemical Market Research Association
 Chemical Public Relations Associations
 Chemical Specialties Manufacturers Association
 Chemical Toilet Association
 Chemical Warfare Association
 Chlorine Chemistry Council
 Chlorine Institute, Inc.
 Chlorobenzene Producers Association*
 Coal Association of Canada
 Coal Fuel Mixtures Association
 Composites Institute
 Compressed Gas Association, Inc.
 Council of Chemical Associations
 Cultured Marble Institute
 Degradable Plastics Council
 Diethylenetriamine Producers/Importers Alliance*
 Drug Chemical and Allied Trade Association
 Dry Color Manufacturers Association
 Electronic Chemical Mfgs. Association*
 Epoxy Resin Formulators
 Ethylene Oxide Industry Council
 Fertilizer Institute
 Fire Retardant Chemicals Association
 Formaldehyde Institute*
 Glycerine Producers Association

Chemical Industry Associations

Halogenated Cleaning Solvent Association
Halogenated Solvent Industry Alliance
Hazardous Waste Services Association
Hazardous Waste Treatment Council
* Independent Battery Manufacturers Association
Independent Liquid Terminals Association
Independent Lubricant Manufacturers Association
Industrial Biotechnology Association
Industrial Specialty Chemicals Association***
Institute for Polyacrylate Absorbents*
Institute of Makers of Explosives
Institute of Paper Chemistry
International Ozone Association
International Pesticide Applicators Association
Isobutylene Task Force*
Lead Industries Association
Man-Made Fiber Producers Association Inc.
Methacrylate Producers Association*
Methyl Chloride Industry Alliance
Methyl Tertiary Butyl Ether Task Force*
National Agricultural Chemicals Association
National Association of Chemical Distributors
National Association of Solvent Recyclers
National Coal Association
National Chemical Credit Association
National Fertilizer Solutions Associations
National Lime Association
National Paint and Coatings Association
National Pest Control Association Inc.
National Petroleum Refiners Association
National Pharmaceutical Council
National Solid Waste Management Association
Nitrobenzene Association
Oxygenated Fuels Association*
Pesticide Producers Association
Phosphate Chemicals Export Association Inc.
Polystyrene Safety Group
Polyurethane Manufacturers Association
Process Equipment Manufacturers Association
Pulp Chemicals Association
Rigid Insulation Board Group
Sales Association of the Chemical Industry
Semiconductor Industry Association
Silicones Health Council*

Chemical Industry Associations

Society of American Wood Preservers, Inc.
 Spill Control Association of America
 Styrene and Ethylbenzene Association*
 Sulphur Development Institute of Canada
 Synthetic Amorphous Silica and Silicates Association
 Synthetic Organic Chemical Manufacturers Association
 Textured Yarn Association of America
 Thermoforming Institute
 United Pesticide Formulators and Distributors Association
 United States Shellac Importers Association Inc.
 Urethane Institute
 Vinyl Institute**
 Weed Science Society of America
 Western Agricultural Chemicals Association

* Synthetic Organic Chemical Manufacturers Assn. project

** Society of the Plastics Industry division

***May no longer exist or may have changed names

REFERENCES

National Trade and Professional Associations of the United States and Canada and Labor Unions, Fifteenth Annual Edition, Columbia Books, Inc., Washington, (1980). And 20th Ed. (1985).

Encyclopedia of Associations Volume 1 National Organizations of the U.S. 13th Edition, Gale Research Company, Detroit, (1980).

Environmental Defense Fund, Washington, D.C. (1982)

Washington, D.C. telephone book (1982).

"Trade Groups Feel the Pinch, Too." *Chemical Week* (Jan. 12, 1983), pp. 11-12.

Chemical Manufacturers Association, Washington, D.C.

Society of the Plastics Industry, New York.

Synthetic Organic Chemical Manufacturers Association, Washington.

In recent years, U.S. chemical manufacturers have formed increasingly specialized groups to deal with Congress and the federal regulatory agencies. Some new groups form as *ad hoc* committees and others as permanent units under the umbrellas of established trade groups. CMA has spawned about 50 "panels" of companies focused on specific chemicals, under CMA's "Chemstar" program (e.g. butadiene, diisocyanates). The Synthetic Organic Chemical Manufacturers Association has 24 groups to deal with specific interests (e.g., the Methacrylate Association), and the Society of the Plastics Industry claims 27 "operating units" (e.g., the Vinyl Institute). At the same time, other new trade groups are being formed independently (e.g., the Pesticide Producers Association). This proliferation of narrowly focused manufacturers' associations will continue.

The concerns shared and the actions taken by such groups are indicative of what member firms know about the hazards of their products and processes.

Chemical industry councils also exist at the state level, largely for the purpose of legislative lobbying and "industry defense" in general. By 1983, about half the states in the U.S. had chemical industry councils ("Chemical Industry Councils," *Chem. Week* June 1, 1983, pp. 28-32).

Unions

The International Association of Heat and Frost Insulators and Asbestos Workers, also known as the Asbestos Workers' union, has issued *The Asbestos Worker* magazine since the 1920s. The magazine contained a reprinted medical article on asbestosis in 1930 (see "Other Events of 1930" in Chapter 1). No subsequent mention of asbestos hazards was published in this magazine until the mid-1960s, by which time the union was assisting Dr. Selikoff in conducting epidemiologic studies of member locals in New York and New Jersey.

The Oil, Chemical, and Atomic Workers Union has been a leading force in bringing about worker safeguards in the U.S. over the past 20 years. In 1989, OCAW Secretary-Treasurer Anthony Mazzocchi established the Alice Hamilton Library at the union's headquarters in Denver. This is intended to serve as a resource in occupational and environmental health for labor

and for the community. One purpose of the library is to serve as a repository for materials of historic interest.

Engineering Journals

The journal *Insurance Engineering* began in 1901, changed its name in 1913 to *Safety Engineering* and from 1950-1956 became *Safety Maintenance and Production*. It was simply called *Safety Maintenance* from 1956-1969. As concerns about health hazards from dusts and chemicals were intertwined with safety considerations, the health aspects received regular attention in *Safety Engineering*.

As early as 1931, an article for managers (Dr. F. Willson, "The Very Least an Employer Should Know About Dust and Fume Diseases," vol. 52 [November 1931]: 317-318) provided a stern assessment of the hazard of asbestos dust in "every operation in which it is used." Continuing in this vein, the journal carried a story about pneumoconiosis contracted by workers mixing asbestos and silica flour in an asphalt roofing mixture: "Had the management known what the outcome might be, not a man among them would have allowed his employee to work in such a condition." ("Silicosis in Odd Places," vol. 81 [May, 1941]: 39) In an article on welding hazards, Ziemke described the use of filter type respiratory protection for welders exposed to toxic and fibrogenic dusts ("A Second Look at Welding Hazards." *Safety Maint. Prod.* 108 [Oct. 1954]: 22-24, 86-87).

Over the years, *Safety Engineering* carried articles by Dr. A.J. Lanza ("Occupational Diseases," 57 [May 1934]: 210-212), Dr. Leroy Gardner ("The Pathology of Various Dust Diseases." 57 [March 1934]: 109-112), and other authorities on occupational diseases. Annual reports of the Chief Inspector of Factories in Great Britain were also summarized for some years, including the early 1930s. There were also editorials and news articles on workers' compensation and medical supervision for occupational diseases.

Engineering and *The Engineer* are venerable British journals. At the time of the 1930 survey of the asbestos textile industry and in the years that followed, both of these journals carried articles about asbestosis and means to prevent it. Legislative actions regarding dust control standards and workers' compensation

were also covered (e.g., "Miscellanea," *The Engineer* 151 [October 14, 1931]: 77, and "Regulation for the Asbestos Industry," *Engineering* 133 [1932]: 107). *The Engineer*, in particular, asserted the importance of educating workers to "a sane appreciation of the risk" and not having a false sense of security from reliance on the "partial ... protection afforded by respirators." ("Notes and Memoranda" 149, [April 4, 1930]: 379, and "Miscellanea." 154 [Oct. 14, 1932]: 381.) By using the indexes of the journals, these articles are easy to locate.

Engineering Inspector of Factories, Charles W. Price, addressed the Institute of Heating and Ventilating Engineers shortly after completing his surveys with Dr. Merewether. "(T)he men and women in the asbestos factories were not slack in the matter of wearing respirators where provided," he said. Price readily acknowledged that the controls then urged by the Factory Department were "not a complete resolution." ("Exhaust Ventilation in an Asbestos Textile Works," *Inst. Heat. Vent. Eng. Proc.* 30:158-179, 1932.)

The American Society of Mechanical Engineers' journal, *Mechanical Engineering*, carried five papers on occupational diseases and dust control presented at the Society's 1934 annual meeting (all in Vol. 57, 1935):

- F.R. Jones. "Occupational Diseases/The Problems of Their Practicable Prevention in Industry." pp. 90-91.
- A.S. Gray. "The Administration of Occupational Disease Control." pp. 92-94.
- R.C. Stratton. "Toxic Dusts/Their Origin and Sources in Various Industries." pp. 95-98.
- T. Hatch. "Dust Control." pp. 154-156.
- R.R. Sayers and J.M. Dallavalle. "Prevention of Occupational Diseases Other Than Those That Are Caused by Toxic Dust." pp. 230-234.

The Stratton article contained a section on the asbestos industry and many others. Drinker contributed an article, "Uses and Limitations of Respiratory Equipment" the following year (Vol. 58: 171-176, 1936).

U.S. GOVERNMENT DOCUMENTS

This is an enormous collection of information sources. It includes both published material and unassembled information available in government files.

*U.S. Department of Health and Human Services
(formerly Health, Education, and Welfare)*

The NIOSH Criteria Documents on specific substances have already been cited as good initial sourcebooks for historic research. NIOSH has also issued *Current Intelligence Bulletins* since 1975, on relatively new discoveries. Hazard alert notices were also issued on asbestos (brake repair work, Aug. 8, 1975) and other occupational health hazards. In addition, NIOSH publishes special reports, guidelines, occupational hazard assessments, and conference proceedings (listed in NIOSH *Publications Catalog*, issued by Div. Standards Development and Technology Transfer, tel. 513-533-8302). Notable among these is *Workplace Exposure to Asbestos*, report of the NIOSH-OSHA Asbestos Work Group (DHHS/NIOSH Publication 81-103, 39 pp., 1980) calling for lowering the workplace asbestos limit 20-fold to 0.1 f/cc.

Prior to the establishment of NIOSH under the Occupational Safety and Health Act of 1970, a predecessor existed, the Bureau of Occupational Safety and Health, also within the U.S. Public Health Service in the Department of Health, Education, and Welfare. Reports on occupational health hazards were published by the PHS in *Public Health Bulletins* (1881-1949) and continued as *Public Health Monographs* (1950-1971). Notable among these on the subject of asbestos were *Bulletin No. 241* by Dreesen *et al.* (1938) and *Monograph No. 36* by Hueper (on lung carcinogens, 1955). Selected subjects covered by these reports are shown in the table.

One consequence of the involvement of Public Health Service employees in the American Conference of Governmental Industrial Hygienists (ACGIH) was the accumulation of documentation files on toxic substances by the government.

Public Health Bulletins		
<i>Bulletin No.</i>	<i>Short title</i>	<i>Date</i>
71	Garment workers, and workshop illumination	1915
73	Tuberculosis among workers	1916
76	Health insurance	
78	Influence of occupation during adolescence	
81	Gas-heated appliances and workshop air	1917
85	Miners' consumption	1918
92	Color blindness	
99	Medical and surgical care of workers	
106	Fatigue and working capacity	1920
116	Lead poisoning in pottery trades	1921
117	Physiology of fatigue	
135	Railroad malaria surveys	1923
140	Illumination, visual defects and efficiency	1924
144	Tests of instruments of determining atmospheric dusts	1925
150	Carbon-monoxide literature	
157	Health hazards of brass foundries	
158	Tetraethyl lead gasoline	
162	Health of ten thousand male workers	1926
163	Tetraethyl lead gasoline	
165	Economic status and health	
176	Health of workers in Portland cement plant	1928
177	Efficiency of painters' respirators	
181	Illumination, ocular efficiency and fatigue	
184	State industrial health activities	1929, 1932, 1943
185	Methyl bromide and other esters	1929
186	Automobile exhaust gas	
187	Silicious dust in granite industry	
195	Review of carbon monoxide poisoning	1930, 1936
202	Pneumonia among iron and steel workers	1932
205	Lead poisoning in storage-battery plant	1933

Public Health Bulletins		
<i>Bulletin No.</i>	<i>Short title</i>	<i>Date</i>
207	Health of workers in textile plant	
208	Health of workers in dusty trades	
210	Mortality of coal miners	
215	Skin hazards in American industry, Part 1	1934
216	Industrial-hygiene problem in industrial area	
217	Determination and control of dust	1935
218	Daylight in buildings	
221	Anthracosilicosis among hard-coal miners	
224	Atmospheric pollution of American cities	1936
229	Skin hazards in American industry, Part 2	
234	Mercurialism in hatters' fur-cutting industry	1937
236	Industrial-hygiene problem of State	
238	Cement, clay, and pottery industries	
241	Asbestosis in asbestos textile industry	1938
244	Silicosis and lead poisoning in potteries	1939
246	Dermatitis among plate printers	
247	Manganese poisoning in ore crushing mill	1940
249	Skin hazards in American industry, Part 3	1939
250	Pneumoconiosis, mica and pegmatite workers	1940
253	Toxicity of lead and its compounds	
255	Toxicity of hydrocarbons	
259	Survey of industrial-hygiene problem in United States	1941
260	Illness among workers and housewives	
262	Lead hazard in storage-battery industry	
263	Mercurialism in felt-hat industry	
265	Fatigue of truck drivers	
266	Occupational and related dermatoses	
267	Lead arsenate exposure of orchardists and consumers	
269	Health of granite workers	
270	Soft-coal miners' health	
271	Aromatic amino and nitro compounds, toxicity	
272	Toxicity of nitrous fumes	
277	Health of nonferrous-metal miners	1942

Public Health Bulletins		
<i>Bulletin No.</i>	<i>Short title</i>	<i>Date</i>
278	Carbon monoxide in Holland tunnel	
279	Toxicity of toluene	
281	Toxicity of aliphatic alcohols	1943
282	Toxicity of penta-erythritoltetranitrate	1944
284	Occupational and related dermatoses	
285	Toxicity of trinitrotoluene	
289	Bibliography of industrial hygiene	1945
290	Carbon monoxide, mechanism of action	1944
291	TNT in bomb and shell-loading plant	1945
293	Toxicity of molybdenum	
297	Respiratory disease and cotton dust	1947
298	Welders in steel ship construction	
299	Sodium fluoride at open hearth furnaces	1948
301	Industrial hygiene problem in Bolivia, Peru, and Chile	1949
306	Smog episode in Donora, Pa	

Public Health Bulletins	
<i>Monograph No.</i>	<i>Description</i>
1.	A methodology for environmental and occupational cancer surveys. W. C. Hueper. (Public Health Service Publication No. 12) 1950. 37 pages.
36.	A quest into the environmental causes of cancer of the lung. W. C. Hueper. (Public Health Service Publication No. 452) 1955. 54 pages. Illustrated. [Published concurrently with <i>Public Health Reports</i> 71: (1); see pages 94-98 for interpretive article.]

Some of these files are still retained, and are known as the historic toxicology files. They were located in the Cincinnati Offices of NIOSH and ACGIH. Sensitive and confidential documents appear to have been filed elsewhere or retained in the personal files of members of the ACGIH threshold limits committee.

The Public Health Service also published an *Outline of Lectures on Industrial Disease for Medical Students*. The "revised edition" in 1951 listed under Asbestos, "nature of the material, sources of exposure, and clinical disease." There were 13 references provided, 5 specifically listed as cancer articles. Similarly, hundreds of references to articles on industrial diseases were included with the outline in this slender volume.

Government conferences on environmental and occupational health hazards are held often by the National Institute of Environmental Health Sciences, with the conference proceedings published in *Environmental Health Perspectives* (about 84 volumes issued so far, starting in 1973).

In the past, such meetings were not always published as government reports. There is no system for indexing such material, and files for meetings held before 1960 can be very hard to track down. One "Conference on Environmental Carcinogens" coinciding with the 1955 American Medical Association meeting was summarized, and a mimeographed copy was found in the unpublished papers of Dr. Wilhelm C. Hueper (National Library of Medicine, History of Medicine section). Panelists discussed the state of knowledge and compiled "score sheets" on various suspected and presumed carcinogens including asbestos (See "Other Developments in 1955" in Chapter 2), arsenic, chromates, nickel, beryllium, petroleum cutting oils, coal tar dyes and intermediates, radioactive materials, and ultraviolet radiation.

The National Library of Medicine has done relatively recent literature searches on a number of subjects, including asbestos. *Asbestos Toxicity* (LS 77-14) and its sequel, *Asbestos Toxicology* (LS 82-6) include literature published from 1970 on. Some of the literature searches offered by the Library are listed below.

Literature Searches Available from
the National Library of Medicine

No.	Title
77-4	Bismuth toxicology. January 1975 through July 1977. 54 citations.
77-5	Ozone toxicology. January 1975 through July 1977. 87 citations.
77-9	Saccharin. January 1970 through July 1977. 109 citations.
77-14	Asbestos Toxicity. 1970-1977. 698 citations.
78-1	Patient package inserts. January 1975 through December 1977. 38 citations.
78-22	Sarcoidosis. (Updates L.S. 76-31.) June 1976 through August 1978. 619 citations.
78-23	Smoking and reproduction , pregnancy, and the newborn. January 1972 through July 1978. 241 citations in English, French, Spanish or German.
78-24	Cadmium and the environment. January 1976 through August 1978. 94 citations.
78-27	The physician and malpractice. May 1974 through September 1978. 521 citations in English.
78-29	Adverse effects of prenatal exposure to diethylstilbestrol (DES). January 1975 through October 1978. 163 citations.
80-1	Passive smoking. January 1972 through September 1980. 162 citations.
80-8	Vinyl chloride toxicology. January 1977 through October 1980. 245 citations.
80-9	Benzene toxicology. January 1977 through September 1980. 164 citations.
80-24	Legionnaires' disease. January 1978 through December 1980. 389 citations.
80-26	Toxicology of polychlorinated biphenyl compounds. January 1975 through December 1980. 517 citations.
80-28	Diet and cancer: etiology and prevention. January 1978 through December 1980. 371 citations.
80-30	Agent Orange. January 1972 through December 1980. 99 citations.
80-32	Toxicology of polybrominated biphenyl compounds. January 1977 through December 1980. 124 citations.
81-1	Occupational neurobehavioral toxicology. January 1975 through March 1981. 282 citations.
81-4	Toxic shock syndrome. January 1979 through June 1981. 34 citations.
81-7	Lead exposure in children. January 1977 through July 1981. 354 citations.

Literature Searches Available from the National Library of Medicine	
No.	Title
81-16	Male reproductive toxicology. January 1977 through August 1981. 230 citations.
81-24	Chromium toxicology. January 1977 through September 1981. 250 citations.
81-25	Arsenic toxicology. January 1977 through October 1981. 354 citations.
82-4	Health effects of nuclear radiation. January 1979 through May 1982. 427 citations.
82-6	Asbestos toxicology. August 1977 through May 1982. 597 citations.
82-9	Inhalation injury. January 1977 through June 1982. 133 citations.
82-10	Zinc toxicology. January 1977 through July 1982. 204 citations.
82-11	Formaldehyde toxicology. January 1977 through June 1982. 213 citations.
82-24	Toxic shock syndrome. January 1979 through December 1982. 255 citations.
83-3	Kepone (Chlordecone) toxicology. January 1977 through March 1983. 90 citations and addendum.

Notice of new searches is published in *Index Medicus*. Copies of these literature searches and updated lists of the searches available may be obtained by sending an addressed mailing label to: Literature Search Program, Reference Section, National Library of Medicine, 8600 Rockville Pike, Bethesda, MD 20209.

The Food and Drug Administration has issued regulations to prevent the contamination of intravenous drugs by fiber-releasing filters used in their preparation (*Fed. Reg.* 40: 11865, March 14, 1975). Prior to the creation of the Consumer Product Safety Commission, the F.D.A. banned the use of asbestos in garments other than heat-resistant industrial textiles. This rule was precipitated by the discovery that imported coats from Italy had 8 percent asbestos to reduce import duties for wool content (*Fed. Reg.* 37: 14872, July 16, 1972). F.D.A. also considered regulating asbestos contamination of foods arising from use of asbestos-containing talc in coating rice, etc.—but no final regulations were issued (*Fed. Reg.* 38: 27076, Sept. 28, 1973).

U.S. Department of Labor

In the early years of this century, the Department of Labor produced valuable literature on health hazards in industry. *Bureau of Labor Statics (BLS) Bulletins* covered industrial hygiene and occupational diseases, industrial accidents, safety codes, and workers' compensation. Reviews of Labor Legislation and Decisions of Courts and Opinions Affecting Labor continuously provided supplementary information in these fields. From 1916 to 1933, annual meetings of the International Association of Industrial Accident Boards and Commissions were published as *Bulletins* (they were then continued by the Bureau of Labor Standards). Proceedings of the annual meetings of the International Association of Governmental Labor Officials were also published as *BLS Bulletins* for a number of years from 1920 on.

Outstanding reports by Dr. Alice Hamilton and others covered lead poisoning and other specific hazards in industry. The *BLS Bulletin* (#231, 1918) by insurance statistician Frederick Hoffman had an excellent section on asbestos: citing Murray's case reported to the Parliamentary Committee, quoting Collis from an annual factory inspectors' report in England, and providing the information that asbestos workers were considered unacceptably poor risks by life insurance companies.

Asbestosis was also mentioned in the *Handbook of Labor Statistics* (1929, *BLS Bull.* 491; 1931, *BLS Bull.* 541) and in *Occupation Hazards and Diagnostic Signs* (1933, *BLS Bull.* 582 revised in 1942 as the *Bureau of Labor Standards Bull. No. 41*). These articles summarized early medical reports on asbestosis. The BLS also published *Bulletins* to index its own publications as well as articles in its journal, *Monthly Labor Review* (*BLS Bulletins* 683, 696).

The *Monthly Labor Review* carried articles on the annual reports of state governments on industrial diseases (e.g., Massachusetts, Ohio) and reports from other countries. The *Review* also carried articles on specific hazards in industry. With respect to asbestosis, articles and summaries were published in the early 1930s covering the work of Donnelly, Merewether, Ellman, Oliver, and the International Labor Office. In addition, the annual reports of the Chief Inspector of

Factories in Great Britain were also summarized, and statistics on asbestosis deaths were presented throughout the 1930s.

Some of these articles and others on job hazards to health were reprinted in the *Handbook of Labor Statistics* (1929, 1931).

Some publications of the Bureau of Labor Statistics and the Bureau of Labor Standards are listed below.

Selected U.S. Bureau of Labor Statistics Bulletins		
No.	Title (Author)	Year Issued
104	Lead Poisoning in Potteries, Tile Works, Porcelain Enameled Sanitary Ware Factories (A. Hamilton)	1912
120	Hygiene of the Painters' Trade (A. Hamilton)	1913
127	Dangers to Workers from Dusts and Fumes and Methods of Protection (W.C. Hanson)	1913
141	Lead Poisoning in the Smelting and Refining of Lead (A. Hamilton)	1914
157	Industrial Accident Statistics (F. Hoffman)	1915
165	Lead Poisoning in the Manufacture of Storage Batteries (A. Hamilton)	1915
179	Industrial Poisons Used in the Rubber Industry (A. Hamilton)	1915
188	Report of British Departmental Committee on the Danger in the Use of Lead in the Painting of Buildings (originally issued in U.K. in 1914)	1916
201	Report of Committee on Statistics and Compensation Insurance Cost of the International Association of Industrial Accident Boards and Commissions	1916
205 (rev. 267)	Anthrax as an Occupational Disease (J.B. Andrews)	1917 (rev. 1919)
207	Causes of Death by Occupation (L.I. Dublin)	1917
209	Hygiene of the Printing Trades (A. Hamilton and C.H. Verrill)	1917
216 (rev. 256)	Accidents and Accident Prevention in Machine Building (L.W. Chaney and H.S. Hanna)	1917 (rev. 1919)

 Selected U.S. Bureau of Labor Statistics Bulletins

<i>No.</i>	<i>Title (Author)</i>	<i>Year Issued</i>
219	Industrial Poisons Used or Produced in the Manufacture of Explosives (A. Hamilton)	1917
221	Hours, Fatigue, and Health in British Munition Factories (Reprints of the Memoranda of the British Health of Munition Workers Committee)	1917
231	Mortality from Respiratory Diseases in the Dusty Trades (F. Hoffman)	1918
234	The Safety Movement in the Iron and Steel Industry 1907 to 1917 (L.W. Chaney and H.S. Hanna)	1918
236	Effect of the Air Hammer on the Hands of Stonecutters (R. Meeker)	1918
253	Women in the Lead Industries (A. Hamilton)	1919
212	Proceedings of the Conference on Social Insurance called by the International Association of Industrial Accident Boards and Commissions	1917
251	Preventable Death in the Cotton Manufacturing Industry	1919
280	Industrial Poisoning in Making Coal-Tar Dyes and Dye Intermediates (A. Hamilton)	1921
291	Carbon Monoxide Poisoning (A. Hamilton)	1922
293	The Problem of Dust Phthisis in the Granite-Stone Industry (F. Hoffman)	1922
298	Causes and Prevention of Accidents in the Iron and Steel Industry 1910-1919 (L.W. Chaney)	1922
306	Occupation Hazards and Diagnostic Signs (L.I. Dublin and P. Leiboff)	1922
339	Statistics of Industrial Accidents in the U.S. (L.W. Chaney)	1923
392	Survey of Hygienic Conditions in the Printing Trades (S. Kjaer)	1925
425	Record of Industrial Accidents in the U.S. to 1925 (L.W. Chaney)	1927

Selected U.S. Bureau of Labor Statistics Bulletins

No.	Title (Author)	Year Issued
426	Deaths from Lead Poisoning (F.L. Hoffman)	1927
427	Health Survey of the Printing Trades (F.L. Hoffman)	1927
460	A New Test for Industrial Lead Poisoning (C.P. McCord)	1928
488	Deaths from Lead Poisoning 1925-1927	1929
490	Statistics of Industrial Accidents in the United States to the End of 1927 (L.W. Chaney)	1929
507	Causes of Death by Occupation (L.I. Dublin and R.J. Vane)	1930
512	Code for Identification of Gas-Mask Cannisters (National Safety Council)	1930
541	Handbook of Labor Statistics	1931
582	Occupation Hazards and Diagnostic Signs (L.I. Dublin and R.J. Vane)	1933
625	Occupational Disease Legislation in the United States, 1936	1937
667	Manual on Industrial Injury Statistics (M.D. Kossoris)	1940
700	Industrial Injury Statistics by States (M.D. Kossoris)	1942
758	Industrial Injuries in the United States during 1942 (M.D. Kossoris and F.S. McElroy)	1944
805	Injuries and Accident Causes in the Foundry Industry, 1942 (F.S. McElroy and G.R. McCormack)	1944
834	Shipyard Injuries (F.S. McElroy and G.R. McCormack)	1944
855	Injuries and Accident Causes in the Slaughtering and Meat-Packing Industry, 1943 (F.S. McElroy and G.R. McCormack)	1945
884	Injury and Accident Causes in the Brewing Industry, 1944 (F.S. McElroy and G.R. McCormack)	1946
924	Injuries and Accident Causes in the Pulpwood-Logging Industry, 1943 and 1944 (F.S. McElroy and G.R. McCormack)	1947

Selected U.S. Bureau of Labor Standards Bulletins		
No.	Title (Author)	Year Issued
7	Recent Changes in the Painters' Trade (Hamilton, A.)	1936
13	National Silicosis Conference Summary Reports Submitted to the Secretary of Labor by Conference Committees	1937
20	Inspection Manual	1938
21	National Silicosis Conference Final Reports of the Committees	1938
30	Progress of State Insurance Funds under Workmen's Compensation; a Quarter Century of American Experience (Andrews, J.B.)	1939
34	Occupational Poisoning in the Viscose Rayon Industry (Hamilton, A.)	1940
37	Protecting Eyes in Industry (National Society for the Prevention of Blindness)	1940
41	Occupation Hazards and Diagnostic Signs; A Guide to Impairments to be Looked for in Hazardous Occupations (Dublin, L.I.)	1941, (rev. 1942)
67	Safety Subjects	1944
83	Outline of Occupational Disease Control Through Engineering (Blake, R.P.)	1946
86	Labor Management Safety Committees, How They Work.	1948
103	President's Conference on Occupational Safety, Proceedings (also Bulletins 112, 130, 153, 159, 175, 187, 196, 218, 263)	1948
122	National Conference on Workmen's Compensation and Rehabilitation, Proceedings	1950
129	Machine Tools & Their Hazards (Homan, S.)	1951
133	Reports of the Committee on Engineering 1949/50 President's Conference on Industrial Safety	1950
139	The Operation of Power-Driven Metal-Forming, Punching, and Shearing Machines	1951
197	The Principles and Techniques of Mechanical Guarding (Griffin, W.G.)	1959
198	Occupational Health Hazards, Their Evaluation and Control (Griffin, W.G.)	1958
207	Controlling Noise Hazards	1959

Selected U.S. Bureau of Labor Standards Bulletins

<i>No.</i>	<i>Title (Author)</i>	<i>Year Issued</i>
211	Control of the Physical Environment	1960
212	State Workmen's Compensation Laws/A Comparison of Major Provisions with Rec- ommended Standards	1958
216	Control of Electrical Shock Hazards	1960
219	Mechanical Handling of Materials	1960
222	Chemistry for the Safety Man	1960
226	Respiratory Protective Equipment	1961
227	The Operation of Circular Saws, Band Saws, and Guillotine Shears	1961
231	Personal Protective Equipment	1961
241	Chlorine Handling in Stevedoring Opera- tions (March, Edward C.)	1962
244	Medical Care under Workmen's Compensa- tion (Cheit, E.F.)	1962
246	Maintenance and Safety	1962
247	The Fundamentals of Accident Prevention	1962
256	Static Electricity	1963
259	The Use and Handling of Compressed Gases	1964
265	The Inorganic Acids	1964

Special Bulletin

<i>No.</i>	<i>Title (Author)</i>	<i>Year Issued</i>
5	Control of Welding Hazards In Defense Industries	1941
13	Wartime Working Conditions and Minimum Standards for Maximum Production	1943
14	Protecting Plant Manpower Through the Control of Air Contaminants	1944
18	Atmospheric Conditions in Cotton Textile Plants (Drinker, P.)	1945

Bureau of Labor Statistics Safety Codes

Abrasive wheels, use, care and protection of. Bull. 527 (1930); supplement, 1936.

Dust explosions, prevention of. Bull. 562 (1931); supplement Bull. 617 (1936).

Forging and hot-metal stamping. Bull. 451 (1927).

Foundries. Bull. 336 (1923).

Gas-mask canisters, identification of. Bull. 512 (1930).

Ladders, construction, care, and use of. Bull. 351 (1923).

Laundry machinery and operations. Bull. 375 (1924).

Lighting:

Factories, mills, and other work places. Bull. 556 (1931).

School buildings. Bull. 382 (1925).

Paper and pulp mills. Bull. 410 (1926).

Power presses and foot and hand presses. Bull. 430 (1926).

Power-transmission apparatus, mechanical. Bull. 463 (1928).

Rubber mills and calenders. Bull. 447 (1927).

Textile industry. Bull. 509 (1930).

Woodworking plants. Bull. 519 (1930).

The Occupational Safety and Health Administration (OSHA) is charged with setting standards for worker protection and enforcing them. OSHA rulemaking is a very complicated process, and comprehensive standards have been issued for only about 25 substances since 1970. The records from OSHA hearings contain 1) rather complete compilations of medical literature on health effects and 2) comments by representatives of affected parties. The literature compilations can be most helpful if the substance in question has received more study in the Soviet Union and Eastern Europe (countries whose research is less often translated or cited in English-language sources). In the case of acrylonitrile, for example, English translations of many such articles are in the docket file.

Company comments can be most interesting, especially as in the case of asbestos, where the first OSHA hearings (1972) predated the main wave of product liability lawsuits. In these hearings, Johns-Manville medical consultant Dr. George Wright contended that insulation workers had been exposed to very high peak concentrations of asbestos dust. He believed such

intermittent peak exposures may have been particularly dangerous. He pointed out that the mortality data showed that past exposures in the chrysotile mines and mills were less hazardous than those in the insulator's trade. This explanation runs somewhat contrary to the more current claim that product warnings were not used for years because J-M believed mining, milling, and manufacturing plant workers were more heavily exposed than users of insulating products.

The record includes a statement by J-M Vice President J.B. Jobe that he could remember personally calling on fabricators of asbestos-containing products in the early 1940s to advise them of practices to reduce or eliminate asbestos dust. Jobe, Fred Pundsack (until 1982 President of the company), and Ed Fenner (environmental affairs chief who later died with mesothelioma) vigorously objected to requirements for "unnecessarily frightening" product labels and signs in plants saying "cancer." Linked to their fear of stiff warning requirements was the expressed concern over lost sales and resulting unemployment.

Aside from standards for specific substances, OSHA has proposed (although not adopted) generic rules for regulating carcinogens and pesticides. In the wake of passage of "right to know" laws in many states, OSHA has issued a limited standard requiring identifying labeling of chemicals in the workplace. The hearing records of some of these rulemakings are quite vast.

OSHA also has advisory committees comprised of people in academia, labor unions, and industry. Transcripts of testimony heard by groups like the OSHA Advisory Committee on Construction Safety and Health may contain interesting material. This Committee has in the past considered recommending a separate OSHA asbestos standard for the construction industry, and has hosted industry representatives presenting their views (See for example, Dr. Paul Kotin's comments in "Household Contact Asbestos Disease" in Chapter 7).

In some cases, workers may need to examine company medical and industrial hygiene records relating to the hazards of their jobs. OSHA has regulations which give present or former employees or their representatives access to medical

records, exposure records (including air sampling data as well as biological monitoring data—e.g., blood, urine, hair analyses for toxic substances), and company studies concerning the employee's working conditions. A simple letter invoking OSHA Standard 1910.20 is sufficient for the worker or an authorized representative to gain access to these company records (Full details are in "Access to Employee Exposure and Medical Records." *Federal Register* 45:35212-35303, May 23, 1980).

The Department of Labor also supported research by medical authorities at the Mt. Sinai School of Medicine and economists at Syracuse University into the projected mortality and economic impact of asbestos disease in the United States (Selikoff, I.J. *Disability Compensation for Asbestos-Associated Disease in the United States* [New York: Environmental Sciences Laboratory, Mount Sinai School of Medicine, 1982]. See also "The Economic and Social Cost of Asbestos Disease in the United States," in Chapter 11.)

U.S. Navy

Various Navy documents refer to the hazard of asbestos in shipyards. These include *Minimum Requirements for Safety and Industrial Health In Contract Shipyards* (1943, republished in *Indust. Med.* 12:259-263, 1943), *Safety Review* (Vol. 4, p. 13, Jan. 1947), reports called "Occupational Health Hazards derived from Industrial Health Reports" (Releases No. 27, 1960; and No. 29, 1961), a memorandum of Cdr. V.L. Hetzel (*Long Beach Naval Shipyard Study of Asbestos Workers in Relation to Asbestosis*, June, 1961). Further information on these references is in Chapters 4 and 5.

The article by Fleischer and co-workers on asbestos health risks of shipyard insulation work was done by Navy consultants/officers, and published by permission of the Navy. However, "The opinions and assertions contained herein are the private ones of the writers, and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large." (W.E. Fleischer *et al.*, "A Health Survey of Pipe Covering Operations in Constructing Naval Vessels." *J. Indust. Hyg. Tox.* 28:9-16, 1946) Marr also discussed asbestosis

at a Naval shipyard ("Asbestos Exposure During Naval Vessel Overhaul." *Amer. Indust. Hyg. Assoc. J.* 25: 264-268, 1964).

More recently, the Navy has taken an increasingly detailed look at both the hazards of asbestos and the availability of safer substitute materials. Some of the documents the Navy has produced are:

- Mangold, C.A., R.R. Beckett, and D.J. Bessmer. *Asbestos Exposure and Control*. Bremerton, Washington: Puget Sound Naval Shipyard, 1970.
- Asbestos Elimination/Substitution/Personal Protection Program. NAVSEA Instruction 5100.2. from Commander, Naval Sea Systems Command (4 pp.) Oct. 24, 1975.
- Winer, A. and W.D. Holtgren. *Asbestos—A Case Study of the U.S. Navy's Response to Upgraded Safety and Health Requirements*. Washington: 13th Annual Technical Symposium, Association of Scientists and Engineers of the Naval Air and Sea Systems Commands, Department of the Navy, March, 1976.

By 1978, medical surveillance was extended to 70,000 civilians and 150,000 active duty Naval personnel (*Navy Expands Asbestos Medical Surveillance Program*. News Release 394-78. Office of Asst. Secretary of Defense for Public Affairs. July 25, 1978).

A massive examination of government archives was conducted in connection with industry assertions that the government insisted on the use of asbestos through its military procurement specifications (See also "Patents and Government Publications." in Chapter 6). A related contention of the defendants is that the U.S. Navy was well aware of the hazards of asbestos—and, therefore, should have protected Naval shipyard workers despite manufacturers' failure to warn. Several industrial hygiene surveys and other World War II era government archives documents have been found which indicate Naval consultants' and officers' awareness of asbestos hazards (See Table 8 in Chapter 5).

U.S. Department of the Interior

The Bureau of Mines (in the Department of the Interior) produces statistical and technical reports on all minerals used

commercially in the United States. Regular publications of the Bureau include the *Minerals Yearbook* (annual) and *Mineral Facts and Problems* (issued every 5 years). In addition, there are periodic special reports.

One of the earlier special reports, *The Asbestos Industry*, (Oliver Bowles, Bull. 552, 1955) contains a four-page discussion of "substitutes for asbestos."

U.S. Consumer Product Safety Commission

The Commission has banned asbestos in consumer drywall patching compounds and artificial fire-logs and ashes (*Federal Register* 42:63354, Dec. 15, 1977). Public concern over asbestos linings in the barrels of portable hair dryers led to a voluntary recall and replacement of these appliances by manufacturers—thus preempting regulation by the Commission. In 1983, C.P.S.C. received a report from its outside scientific expert panel responding to questions posed by the Commission. This was a summary of current information on potential hazards of asbestos in consumer products (*Report of the Chronic Hazard Advisory Panel on Asbestos*, July, 1983).

U.S. Department of Justice

The *Attorney General's Asbestos Liability Report to Congress* discussed the issue of manufacturers' liability for the cost of removing asbestos from public schools in the United States (issued by the Land and Natural Resources Division of the Department of Justice, September 21, 1981). The report included a list of 21 manufacturers of sprayed asbestos insulation and their products' names (pp. 13-14).

U.S. Environmental Protection Agency

The EPA has been in existence since 1970, and it primarily regulates air pollution, water pollution, and land disposal of industrial wastes. The EPA has supported much research into the potential hazards of asbestos in drinking water from both natural and manmade sources (an example of the latter being asbestos-cement water supply pipes). The EPA also calls upon the National Academy of Sciences for reports on the state of knowledge about the health risks to the general public from environmental asbestos exposure (*Asbestos/The Need for and Feasibility of Controls*, 1971; *Drinking Water and Health*, Volume

1, 1977, pp. 144-168; and Volume 5, 1983, pp. 123-147; and *Asbestiform Fibers/Nonoccupational Health Risks*, 1984).

Major rulemaking by the EPA includes the following regulations:

National Emission Standards for Hazardous Air Pollutants (*Fed. Register* Apr. 6, 1973; amended October 14, 1975)—curtails asbestos use in sprayed and molded insulation, bans visible emissions from asbestos mills and manufacturing plants and waste dumps, regulates demolition of buildings containing asbestos; bans use of asbestos mine tailings for surfacing roads.

Effluent Limitations Guidelines and Standards (*Fed. Reg.* Feb. 26, 1974, Jan. 9, 1975, Feb. 11, 1975, Apr. 25, 1975, Aug. 29, 1979)—sets limits for total suspended solids in wastewater effluent from plants using asbestos in manufacturing. The "Best Available Control Technology" requirement to be achieved under the law by July 1, 1984 has been set at "no discharge of process wastewater to navigable waters."

More recently, EPA has moved to compile an inventory of commercial users of asbestos. Investigations into the presence of friable asbestos in public schools and the associated health risks have been directed by the EPA. A ban on most uses of asbestos was issued by EPA after years of delays on July 12, 1989. The ban was overturned in court by industry challenge in 1991. The EPA docket on the rule contains extensive material on the substitutability of asbestos in many applications.

The Asbestos Information Association (1735 Jefferson Davis Highway, Arlington, VA 22202) publishes a compilation, *Asbestos/Federal and State Regulations*, which is up-dated periodically.

State and Local Government Documents

As far back as the 1930s, state agencies were actively concerned about asbestosis. A major contribution to the literature was the survey by Fulton and co-workers in 1935, in Pennsylvania (See Chapter 4).

The Massachusetts Department of Labor and Industries (Division of Occupational Hygiene) issued a fact sheet on asbestos in 1949 (Bulletin No. 492). This described the dust as "VERY HARMFUL—May cause asbestosis," and advised use of exhaust ventilation and "approved type dust respirators only as a last resort." Pre-employment medical screening was also advised. A comprehensive survey might well show that other states also issued brief printed notices of this type.

The Massachusetts Division of Occupational Hygiene also retains its old records. Memoranda recording Dr. E.R.A. Merewether's visit in 1942 to Bethlehem Steel's Quincy, Massachusetts shipyard have been preserved (For more details, see Table 8 in Chapter 5).

Perhaps the most important use of state records has been in documenting the compensability of asbestos diseases. State laws on workers' compensation in some cases listed specific occupational diseases, causative agents, or hazardous industries covered. In other states, "blanket coverage" was provided for any disease that could be proven to be occupation-related. The language of these laws and their vintage is available from numerous sources, including the states themselves, Commerce Clearinghouse Inc.'s *Workmen's Compensation Law Reporter*, and proceedings of annual legal meetings held by the Industrial Hygiene Foundation.

While the language of these laws may be helpful, it has proven still more enlightening to get into the actual records of the compensation proceedings. Specific claims, brought by workers handling asbestos insulation products against the contracting divisions of the companies manufacturing those products, have been found in a number of states (for details see Table 3 in Chapter 3). The existence of these early workers' compensation claims, documenting actual knowledge of the mortal risk by the manufacturers of the products, are highly relevant to current product liability claims.

Some of the states also issued periodical publications about industry generally and hazards in industry in particular. Early examples of this are *The Industrial Bulletin* (issued monthly by the Industrial Commissioner of New York State), and *Monthly Review* (issued by the N.Y. State Dept. of Labor). The former

carried an editorial warning "manufacturers or handlers of asbestos products" to take preventive measures against a risk of incurable disease ("Asbestos," in Vol. 13, [1934], p. 95). The latter carried an article on dust hazards warning about the cancer risk from asbestos (J. Silson, "Dust Inhalation in Relation to Pulmonary Disease." Vol. 30 [1951] pp. 5-8). A thorough search of state periodicals such as these has not been carried out, and there may well have been more such publications over the years.

Some state agencies issued media messages on occupational diseases, such as C.W. Chamberlain's "Asbestosis as an Industrial Disease" (Radio Talk No. 209, March 2, 1934, Illinois State Dept. of Public Health—abstract in *The Pneumokonioses Book II*, p. 35).

Government Publications in the United Kingdom

Here again, a comprehensive search has not been attempted. However, certain sources have been checked and proved most helpful.

Annual Reports of the Chief Inspector of Factories have mentioned the hazards of asbestos since the report for the year 1898. In most cases, the report for a given year was published the following year. Though these reports are cited in many places in this book, some notes on asbestos from the Chief Inspector's annual reports appear on the following page (page numbers in parentheses):

No thorough search has been made of legal literature from the U.K. However, *Reported Decisions of the Commissioner under the 1948 National Insurance (Industrial Injuries) Acts* shows that the 1948 workers' compensation law covered people handling asbestos thermal and electrical insulation (See "Published Literature on Compensability of Asbestosis Disability in Asbestos Product Users," in Chapter 3).

Archives and Collected Papers of Scientific Researchers

Inquiries to the institutions where they worked and family members can sometimes lead to memoirs and collected papers of scientists. The "archives" of Dr. Arthur J. Vorwald are particularly informative, as they contain numerous documents which complement the published literature. Vorwald's widow

Annual Reports of the Chief Inspector of Factories, U.K.

Year of the Report	Comment (pages)
1898	The "evil effects of asbestos" particles noted . . . "any where they are allowed to rise and remain suspended in the air of a room, in any quantity, the effects have been found to be injurious ..." (171-172)
1899	Dust controls being developed in a plant making pipe insulation (264)
1901	Application of exhaust ventilation needed in asbestos works both textile and non-textile (174).
1906	No dusty process seen 1906 surpassed in "injuriousness to workers the sieving, preparing, carding, and spinning processes in the manufacture of asbestos." Five cases of illness among women working in these plants briefly described (219-220).
1907	Large asbestos factory employed local ventilation for carding and spinning machines. "In the other factories visited the conditions were not so good ..." (173)
1908	"In a large asbestos factory the women told me that they went home 'quite clean' now" (146).
1910	Dr. Collis describes 5 deaths from "phthisis" (lung scarring) in 5 years among a staff of 40 in one factory where asbestos was woven. Local exhaust ventilation and annual medical exams of workers instituted. Two other large factories had dust control equipment in place (188).
1911	"Very defective provision for exhaust in the dusty processes in asbestos manufacture was found by Miss Whitlock in most of the factories she visited, and in some cases, no provision has yet been made" (based on visits to 24 factories employing 1,075 men and women) (149).
1930	Refers to the completed report of Merewether and Price, and to the convening of a 5-man government-industry committee to take up the matter of dust control in the asbestos industry. The law was changed to include workers' compensation coverage for asbestosis (49-50, 94-95, 112-114).
1936	Continuing a tabulation that had run for the past few years, it is shown that overall, the average age at death for silicotics was 55.7 (avg. duration of employment 34.8 years) versus only 42.8 for asbestotics (avg. duration of employment 13.3 years). (54)
1938	"Among 103 fatal cases in which asbestosis . . . was present, cancer of the lung was associated in 12 cases (11.6 percent)."

 Annual Reports of the Chief Inspector of Factories, U.K.

Year of the Report	Comment (pages)
1945	The corresponding rate for lung cancer with silicosis was 23/943 (2.4 percent). (81) Concern about asbestosis hazard in shipyard led to the mailing of a letter from the Factory Department "to employers' and employees' organizations." The letter said that eventual amendment of the Factories Act Regulations was considered desirable. Deaths attributed to asbestosis averaged about 11 per year from 1940-1945 (13, 14, 79).
1947	"Thirty-one cases of carcinoma of the lungs and pleura were found at autopsy of 235 cases of asbestosis. That is 13.2%. The average age at death of those suffering from carcinoma of the lung was 52.1 year compared with 44.2 years for those with asbestosis alone. Out of 6,884 cases of silicosis at post mortem, 91 (or 1.32%) had carcinoma of the lungs and pleura." (81)
1949	• Describes the spraying of asbestos and special training of sprayers ("in view of the risks to health unless proper precautions are taken"). • Criticizes the packing of imported asbestos fiber in unlined jute bags. It was in violation of the regulations to use such sacks to transport the material <i>within</i> a factory. Use of an approved respirator "very important" when handling packages "which are not impermeable" (145-146).
1951	Deaths from asbestosis averaged just over 15 a year in 1946-1951. Fatal cases of asbestosis averaged less than 16 years' duration of exposure, with as little as a half year (155-156).
1954	Among 344 deaths in which asbestosis was involved from 1924-1954, cancer of the lung was present in 55 (16 percent). Analysis offered in three tables (190-195).
1955	"The proportion of all (365 recorded) cases of cancer of the lung was 17.8 percent compared with 13.2 percent and 16.0 percent in the cases which had come to light by 1947 and 1954 respectively" (206).
1956	"One very hazardous process, to which the Regulations do not always apply, is the removal of old heat-insulation lagging." Companies were still receiving asbestos in permeable sacks, which were often torn (142-143).

donated his archives to the Armed Forces Institute of Pathology, Walter Reed Hospital, Washington, D.C. The first public reference to this material came after its discovery in the course of litigation in 1979.

Vorwald's archives include much unpublished material from his years as Director of the Saranac Laboratory for Research on Tuberculosis (1946-1953). Some examples:

- case file (about 70 pages) on Dominic Bertogliat, foreman at Johns-Manville's Waukegan, Illinois plant, whose wife inquired about compensation after he died of asbestosis (see Chapter 3).
- exchange of letters with J-M's Dr. K.W. Smith (then in Quebec) about Merewether's publication with U.K. asbestosis/cancer statistics in the *Canadian Medical Association Journal* (Feb. 1950). Vorwald mentioned a "storm which is brewing, this time concerning a case of asbestosis and cancer. I am most anxious to get on with the survey of all data available on the subject ..." (April 18, 1950).
- an exchange of letters between Vorwald and J.P. Woodard (Johns-Manville executive). Vorwald noted that Dr. C.F. Shook of Owens-Illinois had complained that "shipping of asbestos in burlap bags is very troublesome as a possible source of an undue amount of dust." He suggested that paper containers would be less dusty to empty asbestos from (July 25, 1950). Woodard replied that

The fibre packaging problem has always been a big one; and the burlap bags are a relatively large item of expense. Considerable engineering work has been done with a view toward improving this situation by using different types of containers, by bailing the material, by shipping it loose in boxcars, and by various other means. So far the burlap bag has not been eliminated; and I believe this same method is used by all producers up to this time." (July 28, 1950)

- reports on animal testing of Kaylo (thermal insulation) dust for Owens-Illinois.

- Vorwald animal study on inhaled asbestos as a cancer agent approved Nov. 7, 1950 at meeting at Saranac Lake attended by A.J. Lanza (New York University), I. Sabourin (Q.A.M.A.) and J.P. Woodard (Johns-Manville). Memorandum by Woodard.
- *Asbestosis and Pulmonary Cancer* interim (14-mo.) report on asbestos inhalation studies in mice ("there does appear to be a trend toward a greater incidence of tumors in the exposed animals than in the control animals ... The experiment is not completed and it is considered likely that, if the ratios of tumor incidence at the next period when animals are killed are similar to those for the 14-month interval, the trend which is now noted may finally be shown to be statistically significant because of the larger total number of animals observed."), May 7, 1952—submitted to Quebec Asbestos Mining Association.
- letter from I. Sabourin (Q.A.M.A. to Saranac Laboratory enclosing \$2,500 for research services for the *last* quarter of 1952 ("Asbestosis and Pulmonary Cancer"), Dec. 23, 1952.
- Case Folder List of patients whose X-rays were on file and an entry for each in column marked "Company or Doctor." Included here are Canadian J-M, Asbestos Corp., Union Asbestos Co., Bell Asbestos Mines, Thetford Industrial Clinic, Dr. Cartier, I. Sabourin.
- lists of workers whose tissues had been examined by Saranac pathologists.
- list of 19 cases of cancer of the lung among employees of various companies (mostly asbestos mining companies).
- correspondence between Vorwald and Dr. Samuel Keller (J-M Waukegan plant physician) and Hugh Jackson regarding possible compensation claim over the death in 1950 of Vernon Hall (lung cancer).
- guest list at Seventh Saranac Symposium, September, 1952 including Drs. Wilhelm Hueper, Paul Cartier, E.R.A. Merewether, J.F. Knox (Turner Bros. Ltd.), K.W. Smith (Johns-

Manville), K. Lynch, A.J. Lanza, O.A. Sander; and Ed Ames (Owens-Corning), W. Hazard (Owens-Illinois).

- Dr. Cartier's presentation at the Seventh Saranac Symposium on asbestosis and cancer of the lung among Canadian asbestos miners at autopsy (further details in Cancer chapter).
- fragmentary transcript of the session "Pneumoconiosis and Pulmonary Cancer" with panelists W.C. Hueper, Paul Cartier, Kenneth M. Lynch, E.R.A. Merewether, and M. Levin at Seventh Saranac Symposium (Sept. 24, 1952).

Starting in the early 1930s and continuing for almost 40 years, Vorwald provided medical consultation services to many companies in connection with workers' compensation claims for occupational diseases. The records he had of these (approximately 2,000) cases were not initially made public with the rest of his papers. Because of questions of medical confidentiality, these records were not obtained until the favorable resolution of a lawsuit brought against the U.S. Army under the Freedom of Information Act.

Vorwald and his colleagues at Saranac were consulted in about 90 cases involving asbestos disease between 1931 and 1961, by mining and manufacturing firms. Pathological and radiological evaluations of suspected asbestosis and asbestos-related cancers in employees of the following firms were among the files from Saranac and Dr. Vorwald's own records after leaving Saranac in 1953: Dewey & Almy Chemical Company's "Multibestos" plant (Dewey & Almy was taken over later by W.R. Grace); Asbestos Corporation, Ltd.; Bell Asbestos Mines; Union Asbestos and Rubber Co.; Johns-Manville; Philip Carey Manufacturing Co.; and American Brake Shoe Company.

Some of the records of Dr. Kenneth M. Lynch were located in Charleston, South Carolina by plaintiffs' attorneys from California. Dr. Lynch's daughter had recovered some papers from Dr. Lynch's desk after he died. The documents relate to efforts by the Saranac Laboratory to get Lynch to write a report on Dr. Gardner's studies for Johns-Manville (See "Early Saranac Laboratory Cancer Tests with Asbestos," in Chapter 2). There

was also documentation of a workers' compensation claim brought by the widow of an employee of Philip Carey Manufacturing Co. in Cincinnati. After obtaining Dr. Lynch's opinion on the case, the Industrial Commission of Ohio decided that the man's death in 1952 had been caused by asbestosis (Claim O.D. 79998 decided on appeal Jan. 24, 1957 in favor of the widow of Len R. Hope).

The unpublished papers of Dr. Wilhelm Hueper are at the National Library of Medicine, History of Medicine Section. Hueper's preference for publishing left little remaining. However, these papers do include a mimeographed review of the conference on environmental carcinogens held by the National Institutes of Health in 1955 and an address presented to labor union leaders in 1958. (See this chapter, "U.S. Government Documents," and Chapters 2 and 3 for details.)

Trade Journals and the Technology Indexes

There are innumerable trade journals in the business world. They commonly have odd names and sound obscure to the average person, but they are important sources of information within the industries they serve.

The trade magazine of the asbestos industry in the United States, *Asbestos*, was published monthly from 1919 until 1983. The magazine printed one article on asbestosis in March, 1930, before imposing a lengthy silence, apparently at the request of members of the industry (See "The Asbestos Magazine Letters," in Chapter 3).

Asbestos continuously monitored the major aspects of the industry: technology and new patents; production and international trade statistics; announcements, openings, expansions, and closings of mining and manufacturing ventures; companies; new products; notices of trade and scientific meetings and publications; summaries of annual reports and reviews of economic conditions. The coverage on these subjects was worldwide and in no way limited to the activities of U.S.-based firms alone. In its later years, *Asbestos* committed increasing amounts of article and advertising space to industrial hygiene technology, environmental regulation, legislation, and litiga-

tion. Editor Doris Fagan was very knowledgeable about the industry and familiar with experts on every aspect of it.

It is not known to what Sumner Simpson referred when he wrote, "There have been a number of articles on asbestos dust control in the British trade magazines. The magazine 'Asbestos' is in business to publish articles affecting the trade, and they have been very decent about not reprinting the British articles" (letter to Vandiver Brown, Oct. 1, 1935). One of the articles referred to by Simpson may have been "Silicosis and Asbestosis," printed the year before in *Chemical Trade Journal*. This report stressed the seriousness of asbestosis and expressed hope that the new U.K. asbestos regulations would "at least reduce very markedly" the incidence of asbestosis (Vol. 95, p. 92, 1934—cited in *The Pneumokonioses Book III*, pp. 341-342). Other British trade publications that issued articles dealing with asbestosis in the early 1930s included *Mechanical World and Engineering Record* (Oct. 30, 1931), *The British Clayworker* (July, 1931), and *The Refractories Journal* (May, 1932 and May, 1934).

A search of the relevant U.K. trade journals of 50 years ago—even the identification of the journals—would be a very difficult task today. However, further efforts along these lines might well unearth additional articles referred to by Simpson.

Quite a few trade and even insurance journals are accessible through the *Applied Science & Technology Index*, the *Engineering Index*, the *Bibliographic Index*, and *Chemical Abstracts*. Each of these indexes monitors hundreds of scientific journals and other primary sources.

The *Applied Science & Technology Index* began in 1913 as the *Industrial Arts Index*; the name was changed in 1958. As the name suggests, its major concern is with the applications of engineering principles and other scientific research. Thus, a broad range of journals, including basic research, trade, insurance and material of general interest, is found in this index.

The *Engineering Index* was first available in 1883. This index contains many trade journals and leans toward engineering applications rather than general interest or basic chemical research.

Another source of technical and medical information is the *Bibliographic Index*. It was first published in 1945 by the H.W. Wilson Company but covers the years beginning with 1937. This index lists bibliographies and thus can be used as a source of accumulated references. As in the other indexes, the bibliography sources are listed under subject headings arranged alphabetically.

Examples of headings in the above indexes in a search on the health effects of asbestos would be: Asbestos; Dust; Workmen's Compensation; Diseases; Industrial Hygiene; and Pneumoconiosis. Examples of headings in a search on thermal insulations or substitutes for asbestos in thermal insulations would be: Asbestos; Glass Fibers; Heat-Insulating Materials; Insulation; Mineral Wool; and Pipe Coverings. The technology indexes were useful in locating articles on asbestos in U.S. trade publications.

Examples of U.S. trade magazine articles dealing with asbestosis are:

Boiler Maker and Plate Fabricator (published in Philadelphia) carried a story "Committee Reports on Dust Control" (Vol. 36, p. 343, Dec. 1936). This summarized the report of P. Drinker of the Air Hygiene Foundation preventive engineering committee. The same issue of the magazine carried an advertisement by Harbison-Walker Refractories Co.

Mill and Factory ("The National Magazine of Management, Production, and Maintenance") ran Dr. C.O. Sappington's article, "Banish the Dust Hazard," in 1936 (Vol. 18, pp. 69-71 and 150-152). The author, a specialist in industrial medicine, remarked that "asbestosis is important because of the increasing modern uses of asbestos products." He described the disease and named some of the products whose use of asbestos was on the increase.

Heating and Ventilating ("A Monthly Magazine for Engineers and Contractors Concerned with Commercial, Industrial, and Institutional Air Conditioning, Refrigeration, Piping, Heating, Ventilation") published an article on dust hazards in 1944. Written by engineering professor F.W. Hutchinson, this article noted the hazard of asbestosis in insulating and in workplaces where asbestos was used for filtration purposes ("Dust as an

Industrial Health Hazard." Vol. 41 [June 1944], pp. 57-61). This same issue of *Heating and Ventilating* carried an advertisement for "Careyduct ... the All Asbestos Acoustical and Insulated Duct," by Philip Carey Manufacturing Company (p. 34). The Carey ad showed pictures of the product installed in Kroger Grocery and Baking Company, Children's Hospital, and a radio station in Cincinnati. Owens-Corning Fiberglas Corporation was another advertiser in the June, 1944, issue of *Heating and Ventilating* magazine.

Modern Packaging described advances by a small manufacturer handling asbestos. "Dummy propelling charges" produced during World War II consisted of cotton bags filled with asbestos. (A) home-made machine evolved by a New York City war plant ... is credited with eliminating a health hazard, increasing production 600% and saving 12-1/2% on materials." The invention in this case was an enclosed assembly line apparatus for weighing out exact amounts of asbestos. ("Filling by Suction ... an Improvised Method." *Modern Packaging* 118 [September 1944] 116-117.)

Southern Power and Industry published N.V. Hendricks' "Industrial Hygiene Importance of Dust" (pp. 61-64, 80, Nov. 1946). This mentioned asbestos repeatedly as a cause of lung disease, urged air sampling and dust control measures. The same issue of the magazine contained advertisements by Eagle-Picher, Garlock Packing Company, Combustion Engineering, and Johns-Manville.

The Petroleum Engineer published A.C. Pabst's "Industrial Hygiene in the Petroleum Industry" (Management Edition, Vol. 28, pp. E-2 to E-8, May, 1955). Compliance with threshold limit values in the industry was stressed, and the five MPPCF limit for asbestos was among those listed. "Nineteen states observe threshold limit values in their laws and regulations, and more are sure to follow."

(See also the 1952 *Petroleum Engineer* article by Shuman described in Chapter 9, in the section on Owens-Illinois.)

Patents

Patents represent the most authoritative source of technical information (for a general description of patents see Chapter 6).

A patent search can be done in several ways. The easiest way is to obtain the services of a patent attorney, a patent agent, or a patent searcher. An overview of the patent search on thermal insulations and substitutes for asbestos in thermal insulations is not beyond the scope of this book, however.

If a particular company or a particular inventor is of interest, all of the patents issued to that company or inventor can be found in the inventors' index at the Patent Office.

If the chemical composition, the structure, or the use is known, patents can be searched after looking up the classification of the type of invention. This classification can be found in the Patent Office's *Manual of Classification*. This manual separates inventions into several hundred main classes, which are further divided into many thousands of subclasses. For example, calcium silicate compositions useful as thermal insulations would be found in Class 106 (Compositions, Coating or Plastic), subclass 120 (Silica-lime mixtures). If a laminated thermal insulation with a certain unique or unusual structure is of interest, Class 428, which deals with structures, would have to be searched. Heat insulations in general could be searched in Class 252 (Compositions) and subclass 62 (Heat-insulating materials). The arrangement of the patents in each subclass is in chronological order and thus details the development of that particular type of invention through the years.

One significant patent can lead to others because most patents list references cited by the patent examiner during the prosecution of the patent application. These references are usually other patents or journal articles that are close in content to the patent invention.

Besides the Patent Office in Arlington, Virginia, there are several other depositories in the United States which have copies of all or most U.S. patents. However, the only one which classifies the patents according to invention is located in Sunnyvale, California. In general, foreign patents can only be searched or copied at the Patent Office. Once a U.S. patent number is known, it can be ordered from the U.S. Department of Commerce, Patent and Trademark Office, Washington, D.C. 20231. The charge for each patent is three dollars.

Insurance Literature

Although no concerted effort has been made to search insurance industry journals, it is clear that this industry has long been concerned about the costs of occupational diseases—silicosis and asbestosis in particular.

Most of the insurance industry journals have no index with which to locate articles on industrial diseases. However, *Industrial Arts Index* can be used for its indexing of articles from *The Eastern Underwriter* and *National Underwriter*.

The *National Underwriter* acknowledged the great reluctance of insurance companies to cover occupational disease risks including "wire insulation" and "asbestos goods manufacturing" on December 15, 1932 ("Occupational Diseases are Not Generally Understood." Vol. 35, p. 28). Asbestos was especially feared (for further details on this and other articles from insurance sources not all cited here, see Chapter 3).

At the end of 1932, the National Council on Compensation Insurance filed an occupational disease "hazard weight program" with a number of states. The extra charges assessed for insuring industries with occupational disease hazards would only be dropped upon evidence of the "entire absence of the hazard." Even then, "removal of occupational disease loading" from the rates charged would only apply for one policy period. Risks that could qualify for removal of the hazard rates included silicosis, lead poisoning, chromium poisoning, benzene poisoning, mercury poisoning, and radium poisoning. "No risks involving asbestosis, anthrax infection, or caisson disease shall qualify for removal of (the hazard rates)." ("Send Out Rules on Disease Coverage." *Nat. Underwriter* 36: 29-33, Dec. 29, 1932).

At that time Travelers Insurance Company classed pipe coverers and asbestos weavers as having comparable hazard classification, with higher risks for pickers and sorters (*Accident Department Manual*, Sec. III Classification Manual, March, 1932).

Rates for occupational disease coverage were prepared by the National Council on Compensation Insurance, upon passage of an occupational disease (workers' compensation) law in Illinois in 1936. Asbestos goods manufacturing rates were exceeded only by: stone cutting and polishing; and flint and spar grinding. Trailing asbestos manufacturing insurance rates in a list of

close to 100 hazardous industries were: foundry work, cleaning outside surfaces of buildings, refractory products manufacturing, (lead) storage battery manufacturing, and "red or white lead" manufacturing ("Disease Rates Under New Illinois Laws are Given" *Nat. Underwriter* 40:29-32, June 25, 1936).

There were a number of other articles in this journal during the Thirties about the problem of occupational disease. Two which specifically referred to asbestos were published on December 1, 1932 ("New Occupational Disease Plan Out." *Vol.* 36, pp. 23 and 32) and June 21, 1934 ("Occupational Diseases—Kind and How Acquired." *Vol.* 38, pp. 37, 43).

Similarly, *The Eastern Underwriter* carried reports on the insurers' fears that "compensation for silicosis and asbestosis will greatly increase costs ... This must be accomplished in a way which will not prove too crushing a blow to industry." ("Many-Sided Occupational Disease Problem Discussed by T.N. Bartlett." *Vol.* 36, pp. 45-46, Oct. 18, 1935)

Eastern Underwriter reported briefly on a decision by the Supreme Court of North Carolina to award workers' compensation for death from pneumonia of a man with "early stages of asbestosis" ("*Blassingame vs. Southern Asbestos Co.*" *Vol.* 33, p. 37, April 18, 1941).

The insurance literature contained many articles expressing concern over the compensability of "the contraction of some disease of ordinary life— ... as pneumonia, common colds followed, perhaps, by tuberculosis ... " ("Occupational Disease Problems Aired." *Eastern Underwriter* 37:30 and 34, Aug. 28, 1936). The insurers' fear was that without a narrowly defined schedule of compensable occupational diseases, they could not estimate the cost of providing workers' compensation insurance. And while tuberculosis was a well-known added risk of silicosis, and pneumonia was a recognized threat to those with asbestosis, these were also common diseases. Litigating numerous claims of this sort would cost the industries and their insurers a fortune, even if they weren't decided in favor of claimants.

The insurers were also keenly interested in measures to abate the hazards of occupational disease. Coupled with their expressions of concern about inestimable costs were statements to the effect that the problem itself needed to be brought under

control. The responsibility of the employer was emphasized by Bartlett of Maryland Casualty, who stressed workers' unawareness of health dangers. He addressed an American Bar Association meeting in 1936:

Many accidents do occur from carelessness of the worker ... But in cases of exposure to occupational diseases there is more likelihood, because of intricate machinery, power driven tools, intensified chemical processes, with their attendant acute hazards, of the worker not having the least knowledge of the risk which he is assuming. He does not contribute to, nor is he knowingly a party to the results.

("Occupational Disease Problems Aired." Article cited above).

In 1940, Dr. A.J. Lanza wrote about "Underwriting Aspects of the Industrial Dust Hazard" in *Weekly Underwriter* (pp. 1412-1420, June 8, 1940). About asbestosis, he said, "(M)ost of the fatal cases have been complicated by other diseases such as cancer and diabetes so that the extent to which the asbestosis was responsible for death is not clear." He concluded that asbestos dust might "possibly" have a sufficient effect on the mortality of workers exposed to it as to require an extra premium charge for life insurance.

Another useful source is the Commerce Clearinghouse's *Workmen's Compensation Law Reporter*. This has been printed since the 1930s, and cited a number of early compensation cases involving asbestosis (See also Table 7 in Chapter 5). The most complete collections located by the author were at Harvard and Yale Law Libraries, and the College of Insurance Library in New York.

One article contributed to the insurance literature by the asbestos industry was written by Kenneth Smith and Hugh Jackson of Johns-Manville. There is an evident effort to downplay the problem ("Many cases with X-ray evidence of advanced asbestosis have been known to carry on their work and live very comfortable lives for several years.") There is also an interesting paragraph that says, at least "several years" before 1957,

anyone who installed insulation materials was called an asbestos worker because asbestos was practically the only material used for this purpose.

The authors concluded that,

Exposure to asbestos fibers does not shorten the life of the worker. Inhalation of asbestos does not predispose the worker to other pulmonary diseases which will shorten his life.

("The Asbestos Industry—Certain Health Experiences among Asbestos Workers." *Proceedings-Home Office Life Underwriters Association* 1957, pp. 187-194.)

The perspective of the insurers, who were refusing to sell life insurance to asbestos workers as early as 1918, is very helpful in understanding the history of asbestosis in society. In recent legal battles between asbestos manufacturers and their product liability insurance carriers, the insurers' contention that they were deceived by the manufacturers was an issue.

Clearly, however, the whole picture will not be available through the published sources alone. At meetings such as the Third Conference on Occupational Diseases, held by the National Bureau of Casualty and Surety Underwriters in New York, there were both public sessions and others restricted to insurance company representatives. These conferences reportedly were "made notable by the presence of everybody of importance in the field of occupational disease." A central figure at these affairs was Dr. Anthony J. Lanza, of Metropolitan Life Insurance Company. ("Medical, Legal, and Insurance Representatives Survey the Problem of Toxic Dusts." *Spectator* 134:30-31, June 27, 1935. Abstract in *The Pneumokonioses III*, [Chicago Medical Press, 1937], p. 117)

Encyclopedias

At one point it was decided to sample the information available on asbestos disease in general subject encyclopedias. Due to their size and longevity, the *Encyclopedia Americana* and *Encyclopedia Britannica* were selected. Copies of these encyclo-

pedias going back many years have been warehoused and were made available for inspection by the Library of Congress.

Articles on "asbestos" tended to be written by geologists and others familiar with the mineral's exploitation and use. Reference to asbestosis was therefore sought under headings like "silicosis" and "pneumoconiosis," and very often the articles on these subjects cited others on related subjects.

These popular encyclopedias carried basic information about industrial health hazards, but usually not until quite some time after the knowledge had appeared in medical journals. One exception to that rule was a full-column summary of the U.S. Public Health Service study, published in the annual supplement to the *Encyclopedia Americana* in 1939. This was listed under the heading "Asbestosis."

The 1939 and 1942 issues of *Britannica Book of the Year* carried paragraphs about asbestosis under the heading "Silicosis," written by Dr. Leroy Gardner of the Saranac Laboratory. In 1940, the *Encyclopedia Britannica* mentioned asbestosis ("a generalized fine fibrosis of the lungs which causes symptoms and disability earlier than silicosis") under the heading "Industrial Welfare and Medicine."

The 1952 *Britannica* listed "Occupational Cancers" as a subheading under "Cancer." Carcinogenicity of asbestos, chrome salts, benzene, benzidine, coal tar, and arsenical compounds was noted.

The 1953 *Britannica* described asbestosis under the heading "Respiratory System, Diseases of."

The *Encyclopedia Americana* mentioned asbestosis in 1957, under the heading "Industrial Hygiene." Here it was mentioned that "there is evidence that asbestosis may be associated with lung cancer."

The *Britannica* carried an article on "Pneumoconiosis" by Dr. Gerrit Schepers in 1960. Among other things, this included a table including insulation workers and "transite pipe workers" as groups at risk of pneumoconiosis. "Transite" was Johns-Manville's trade name for its asbestos-cement products. Two years later, the carcinogenic risk was emphasized under "Dangerous Occupations," an article by Dr. Harriet Hardy

("Evidence strongly indicates that there is a significant increase in lung malignancy in men with asbestosis.").

Newspaper Articles

Newspaper accounts offer vivid glimpses of past controversies involving toxic substances. They are often found by citation in other sources. For example, *The Asbestos Strike*, an account of the historic 1949 strikes at the Quebec asbestos mines, contains a full chapter on the role of the press at the time (Pierre Elliott Trudeau, editor, James Lorimer & Co. Toronto, 1974—translation of *La Grevè de l' amiante*, 1956). With this as a source, it was then possible to go to the Library of Congress and obtain copies of the relevant stories in *Le Devoir* by Burton LeDoux and others.

In general, if health hazards were a public issue even peripherally to some controversy in a community, there is a good chance that this was mentioned in news accounts. Industry records and trade association minutes note such pressures.

The Sumner Simpson papers include a crossing of the swords in the *Philadelphia Record* between John L. Spivak, "noted liberal writer," and George S. Fabel, president of Southern Asbestos Company (Sept. 2, 1935). Spivak wrote of compensation claimants for asbestosis confronted with company doctors; dominance of the mill manufacturers over the political life of the city (Charlotte, N.C.); the employers' use of compulsorily signed papers to the effect that each worker had been provided a respirator. He also referred to life insurance company reports about asbestosis. Mr. Fabel responded that "obviously unconfirmed dramatized tommyrot would be putting it mildly," in describing Spivak's first report (Aug. 19, 1935). "We have had incalculable expense this first half because of 'walking delegates' like Spivak agitating and instilling unfounded fear in the poor Negroes' minds." It was to combat this "rather undesirable publicity" that *Asbestos* magazine approached Sumner Simpson about writing an article on asbestosis a few weeks later. (See Appendix 1)

Dr. Morris Fishbein's Daily Health Service was carried in a number of newspapers, including the Chico, California *Enterprise*. In one column (Oct. 23, 1932), "Most Industrial Dust is

Not Injurious to Lungs of Worker," asbestos is described as causing a "serious if not fatal condition" in the lungs (United States Gypsum Library).

Dr. W.A. Evans' "How to Keep Well" column described "mining and fabricating asbestos" as among the "most harmful trades" in an article on dust hazards (*Chicago Tribune*, Feb. 24, 1933).

Much more recently, exposés in *The Montreal Star* ("Asbestos clinic let sick men work," and "Chief doctor says he tried 'to be human,'" March 20, 1975) described historic practices by the asbestos industry clinic in Thetford Mines, Quebec (See also "Compensation at the Asbestos Mines in Canada," in Chapter 3). This was found at the Institute of Occupational and Environmental Health, the library of the Quebec Asbestos Mining Association in Montreal.

Individuals and unionists who worked in the asbestos industry and somehow became aware of the health hazards can also be helpful in finding news clippings, compensation claims records, etc.

11

The Legacy and the Challenge

"The medico-legal significance of dangerous dusts in industry is beginning to assume the international importance which it has long deserved...a meeting of experts is to be held at Geneva next month with the object of drawing up a preliminary charter to secure compensation for those who suffer damage due to silicosis...It is unlikely that asbestosis, another scourge whose evils have been demonstrated more recently, will as yet be granted international status."

The Differentiation of Noxious Dusts (Editorial). *Lancet* 1:903-904 (1934).

"When life depends on it, you use asbestos."

Asbestos Corporation, Ltd. advertisement picturing the World Trade Center in New York, whose girders were insulated with sprayed asbestos (*Asbestos*, January, 1983).

"In the Developing World asbestos is life, and we should not be shy about saying so."

Michel Gratton, Director General of the Asbestos Institute, Canada (1990).

INTRODUCTION

In the foregoing chapters, it has been shown that the principal U.S. corporations mining asbestos and manufacturing products from it in the 1930's were aware that breathing asbestos caused

a potentially fatal pneumoconiosis. American manufacturers knew of independent investigations and reports of clinicians and government agencies to this effect. Officials representing the asbestos industry in the United States initiated studies at both mines and factories starting in 1929, involving both medical evaluations and air sampling measurements. Leading industry executives, faced with disability compensation claims and civil suits beginning in the late 1920's, took a direct role in dealing with medical researchers thereafter. Through collaborative industry support of medical and industrial hygiene surveys, meetings of industry trade associations, and meetings of industry health and safety organizations, a wide range of industries were informed about the dangers of asbestos. The demonstrable knowledge of specific firms appears to have developed generally in proportion to their involvement in and dependence upon asbestos processing, their overall size, and other factors such as the manufacture of competitive products made from other materials.

The alarming publication of scientific knowledge showing that breathing asbestos caused asbestosis and cancer, during the period 1930-1964, was subject to widespread discussion and independent study by asbestos industry associations. In large part, studies conducted by individual firms, insurers, and contractors to industry trade groups in this era were either withheld from publication or published in an incomplete and misleading form. Contractors often agreed at the outset to keep their findings confidential and/or submit manuscripts to industrial sponsors prior to any publication of their findings.

Industry executives censored mention of the subject of asbestos disease in the trade journal of the industry in the United States, *Asbestos* (read by such people as industry sales representatives), through the 1930s and into the 1960s. The industry leader, Johns-Manville, followed a policy of withholding the findings of medical examinations from its own workers, as recently as the early 1970s. Johns-Manville executives told representatives of another firm (Unarco) in the early 1940s that the financial consequences of informing their workers would be great, in terms of labor unrest and claims for compensation. The existence of similar efforts by other manufacturers is indicated

by the lack of historic demands for either "hazard pay" or the elimination of asbestos hazards and use, and the absence of strikes over the health hazards of asbestos by workers in the United States.

Despite the facts that asbestos had been shown to be a deadly material by 1930, and that this information was promptly available to asbestos mining and manufacturing firms generally, no warning labels were affixed to sacks of asbestos fiber or cartons of asbestos products until the years 1969 and 1964 (or at the earliest, the end of 1962), respectively. Although some manufacturers waited until the 1970s to either put warning labels on their products or eliminate the use of asbestos, the *similarity* of corporate behavior in not warning product users for so long is more striking than the differences between companies, here.

Corporate efforts to withhold knowledge from workers, the scientific community, and the public in general, were paralleled by a dramatic increase in the use of asbestos and the numbers of people endangered by it. The delay in public recognition of the dangers of asbestos caused a long delay in public efforts to regulate the asbestos industry, compensate affected members of society, and ultimately conduct independent, thorough (animal inhalation, epidemiological, and pathological) studies to determine just how deadly asbestos was. The substitution of asbestos by safer materials was likewise long delayed.

The growth of the asbestos problem is better understood in the context of the times in which it occurred. Prior to 1970, the field of industrial medicine and hygiene was dominated by industry. Academic faculty in these areas were largely dependent upon industry grants for research and student scholarships, industry jobs for graduates, and industry consulting for themselves. General medical education was virtually devoid of training in occupational disease recognition. Government research was very limited, and state health and labor agencies had minimal expertise, laboratories, and authority to impose improved industrial hygiene in industry. Most of this has changed dramatically in the last 25 years, with the enactment of federal environmental and occupational health legislation and the establishment of research agencies at the state and

federal levels. These conditions have led to an influx of independent professionals and improved public education and awareness. Public interest environmental and consumer groups, working with trade union health and safety professionals, with technical support from scientists in the government and at universities, have continued to press government agencies, in a climate of continuing media interest and public support.

The asbestos disease catastrophe of today resulted in part because of inadequate social measures to protect the public health. But asbestos is only one of many well-recognized, hazardous materials upon whose use the world appeared increasingly to depend. What we can learn from the example of asbestos could, if implemented, save many lives jeopardized by the widespread mortal threats of which asbestos is but one representative. What we do not learn about prevention from asbestos *and put into practice*, other disasters may well call again to mind.

The grim task of appraising the present situation is therefore necessary if we are to seize a precious opportunity in prevention. This begins with a look at matters in the United States followed by some discussion of the asbestos problem in the world today.

Mortality Estimates (U.S.)

Nicholson and his co-workers have estimated that now approximately 9,700 cancer deaths a year in the U.S. are attributable to past asbestos exposure. This annual toll was projected to rise to 9,700 by the year 1992 and taper to 3,000 by around 2025.¹ (See Table 1) That averages out to about one death per hour for a period of 30 years. Both higher and lower estimates have been offered, and a large degree of uncertainty confounds any attempt to make quantitative predictions of this kind.^{2,3} A more recent estimate, based on mesothelioma death rates, is that 131,000 deaths from asbestos-associated cancer will occur in the U.S. between 1985-2009.⁴

Dr. William Nicholson, one of the authors of the figures displayed in Table 1, believes the cancer death toll from asbestos projected in 1982 is approximately correct. The most

TABLE 1. The Projected Annual Excess Deaths From All Asbestos-Related Cancer in Selected Occupations and Industries, 1967-2027

Industry or occupation	Number deceased in calendar year												
	1967	1972	1977	1982	1987	1992	1997	2002	2007	2012	2017	2022	2027
Primary asbestos manufacturing	237	312	385	445	494	510	491	445	367	278	187	114	60
Secondary manufacturing	236	304	403	507	610	659	674	649	584	489	367	252	149
Insulation work	266	374	497	612	705	742	723	652	578	392	279	173	94
Shipbuilding and repair	1,452	1,865	2,337	2,493	2,710	2,451	1,076	1,659	1,256	919	628	401	219
Construction trades	778	1,135	1,641	2,143	2,593	3,004	3,308	3,390	3,191	2,697	1,996	1,243	669
Railroad engine repair	129	146	162	167	147	130	91	54	28	10	2	0	0
Utility services	149	187	230	267	299	312	310	290	254	207	152	102	59
Stationary engineers and firemen	434	527	631	721	816	865	875	819	728	602	449	304	179
Chemical plant and refinery maintenance	205	269	337	404	457	482	472	437	375	301	217	142	82
Automobile maintenance	176	236	304	384	470	524	578	586	576	538	458	346	222
Marine engine room personnel	39	47	56	63	64	60	55	46	38	27	19	12	6
Totals	4,101	5,402	6,983	8,206	9,365	9,739	9,653	9,027	7,975	6,460	4,754	3,089	1,739

From Nicholson, Perkel, and Selikoff, 1982¹

reliable index of this is the recorded mortality from mesothelioma. Though mesothelioma mortality based on information that appears on death certificates indicates the projections are 15 percent too high, Nicholson believes that this is probably offset by underdiagnosis of mesothelioma, particularly peritoneal mesothelioma.⁵

British epidemiologists predict mesothelioma death rates will continue to rise until 2020, with a peak of around 3000 deaths per year. For British men born in the 1940s, mesothelioma may account for 1 percent of all deaths. The nation's total death rate from asbestos could climb to as high as 10,000 a year.⁶

Most of those persons expected to contract cancer from asbestos were not asbestos mining, milling, or manufacturing workers, nor were they insulation workers. They were persons whose own handling of asbestos was minimal or nil. They include in their number people exposed only as "bystanders." The *exposure* history profile of the bystander population at risk is largely guesswork, owing to the retrospective nature of our interest and the paucity and imprecise nature of historic exposure data. And it is also at the relatively low end of the dose-response curve that we know least about what the *risks* are for given levels of exposure.

Not even counted in these mortality estimates is the unknowable large population with significant histories of "miscellaneous" consumer and environmental contact. The author's own story illustrates how such exposure could occur and easily pass unrecognized or be soon forgotten. In the early 1950s, as a boy of 5 or 6, I often played in the basement of my home. The asbestos insulation on one of the pipes was torn in some places where we climbed on it. I was fascinated by the way the dust would fly when a certain section of pipecovering was slapped or struck with a ball. The fine dust would fly out and appear to magically hang suspended in the air. My younger sister remembers joining me for numerous and lengthy periods of slapping the pipe and standing under or beside it watching the dust cloud—which was for all appearances defying the law of gravity. There was a pile of whitish dust on the cellar floor beneath this place along the hot water pipe, which my mother periodically swept up.

This is not to criticize the projected figures for a lack of precision. On the contrary, whether the number of U.S. asbestos cancer deaths each year is 4,000 or 10,000, all the mortality risk estimates show the asbestos disease legacy to be of epidemic proportions.

With this in mind, one would hope that U.S. asbestos use would now be stringently controlled in order to keep from adding to the toll of preventable disease in future years. Unfortunately, this is not the case. Despite commercial availability of asbestos-free substitutes in every major application, the use of asbestos continues to be permitted, even for products no longer made in the U.S. with asbestos but still imported from other countries. Equally worrisome is the lack of control over exposures from the deterioration of asbestos-containing materials already in place.

Continuing Asbestos Exposure in the United States

U.S. consumption of asbestos fiber has dropped dramatically from the peak level of 1974, most markedly in the 1980s. (See Fig. 1) Little of this has been offset by increased imports of asbestos products.

By 1980, asbestos-free brakes, packings, gaskets, fireproof textiles, and plastics were making significant penetration in historic asbestos product markets.⁷⁻⁹ Asbestos use in molded and sprayed insulation and drywall patching compounds had been specifically forbidden by government regulation.^{10,11} Other uses such as in tobacco products, gas mask filters, dish towels, air-dropped forest fire retardants, grinding wheels, dentistry, and open-heart surgery have apparently been abandoned as inappropriate. Many others among the numerous uses of asbestos have lost markets despite the lack of specific product bans affecting them. Local governments turned to alternatives for asbestos-cement pipes for drinking water supplies and other uses, and at least six asbestos-cement pipe manufacturing plants in North America have been closed.¹²⁻¹⁴ Asbestos-cement products are no longer made in the United States, although they are still imported. OSHA and EPA standards, workers' compensation and product liability considerations, and widespread public concern have all been factors in these market shifts.

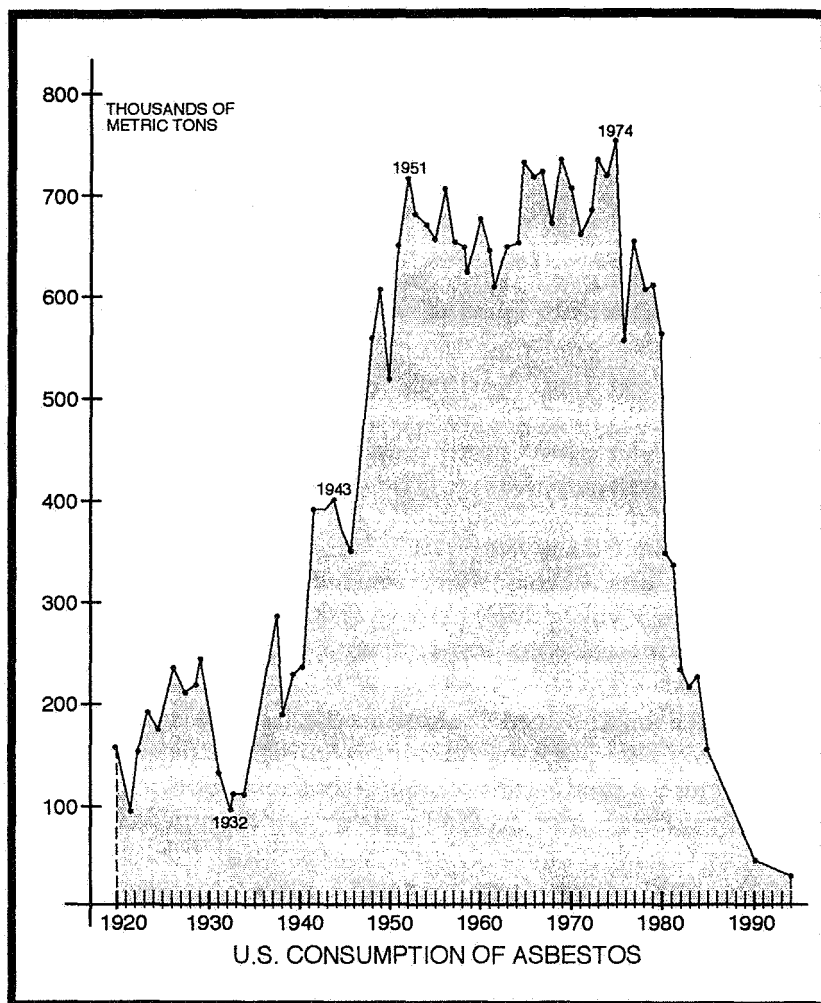


Figure 1. U.S. Asbestos Consumption

Where stiff, durable, fibrous materials of respirable dimensions have been used in place of asbestos, there is concern about a mesothelioma risk. These apprehensions have been supported by experimental data since 1972.¹⁵ One alternative, potassium titanate fiber, developed by DuPont, was abandoned after animal testing showed it could cause mesothelioma by inhalation.¹⁶ Testing and prospective epidemiological study

continue, and asbestos fiber substitutes should be used with care. But it is clear that products made with the most widely used fibrous substitutes for asbestos cannot rival the old asbestos products as health hazards, and the substitution of asbestos will have a very favorable outcome in public health terms.¹⁷⁻²⁰ Manufacturers have the capacity to make synthetic and inorganic fibers of sufficiently large diameters so that they won't be breathed into the lungs—and this would seem to be the surest way to prevent pulmonary disease.

Dr. Anthony Robbins, former Director of NIOSH and President of the American Public Health Association, has said he knows of not one application in which the use of asbestos is essential. Sweden has led in eliminating the use of asbestos, the result of a campaign begun by the trade unions in 1975. Similarly, other countries, including leaders in toxic substances control, have decided that it is better to ban asbestos than to try and control its continued use. The major uses of asbestos, if not all, have been banned in Norway, Denmark, Finland, Switzerland, the Netherlands, Germany, and Italy.

The continuing use of asbestos is opposed not only because of the availability of substitutes but the inadequacy of efforts to control asbestos use. Antiquated standards and discredited technologies have inertia on their side, and it is only with an effort that society replaces them. In the United States, OSHA's mandate requires that standards be "feasible" for employers to attain. In issuing a 0.5 f/cc emergency limit, OSHA also published risk estimates showing that 45 years of exposure at 0.5 f/cc would kill 1.7 percent of the work force through occupational cancer.²¹ After setting a permissible exposure limit of 0.2 f/cc, OSHA was ordered by the courts in 1988 to further lower the limit wherever feasible. Brake repair is one area where more stringent safeguards will be required, with the reduction of the permissible exposure limit to 0.1 f/cc proposed by OSHA on July 20, 1990, and adopted August 14, 1994.

The United States Environmental Protection Agency used its authority to summon information on asbestos use in the early 1980s.²² Until then, there was not even a national inventory of commercial asbestos uses and users.



Figure 2. Snow figures made in 1982 by school children using modeling compound containing 50 percent chrysotile asbestos. "Fibro-Clay" was sold in powder form until 1976 by the Milton Bradley Company, labeled "Non-toxic." (Courtesy of Dr. Arthur Rohl, Mt. Sinai School of Medicine.)

Consumer product regulation, food and drug regulation, and environmental regulation of asbestos (air pollution, water pollution, and waste disposal on land) have all been minimal. This is true despite highly publicized regulatory efforts in the 1970s aimed at asbestos in table salt, intravenous drugs, drywall patching compounds, electric hair dryers, fake fireplace logs, and some women's coats imported from Italy. The Consumer Product Safety Commission has long refused to either make a thorough inventory of asbestos in the marketplace, or ban a number of products in which asbestos is known to *have been used*. It should not be such a shock then that New Jersey schools were still using a children's modeling compound in 1982 made with at least 50 percent chrysotile asbestos (See Figure 2). Similarly, the serious and unnecessary threats to health posed by more asbestos-cement water supply pipes and asbestos-containing brakes have not been prevented by the U.S. Environ-

mental Protection Agency. The yearly addition of over thirty thousand tons of asbestos to the U.S. environment thus continues to this day. That includes about 3,000 tons in imported asbestos-cement sheet and pipe products in 1995, most of it from Mexico.

The EPA finally did issue regulations in 1989 to eventually ban most uses of asbestos (EPA said 94% of asbestos used in products made in the U.S. in 1989). The multi-stage rules applied to manufacture and importation first, followed by a ban on sale of the products in the U.S. one year later (except for stage 1, which applied to nothing made in the U.S., despite EPA claims that it covered 4% of then-current asbestos use). The bans on distribution in commerce were:²³

Stage 1 (Aug. 25, 1992)—flooring felt, roofing felt, pipeline wrap, asbestos-cement flat and corrugated sheet, vinyl asbestos floor tile, asbestos clothing.

Stage 2 (Aug. 25, 1994)—beater-add and sheet gaskets (except specialty industrial gaskets), clutch facings, automotive transmission parts, commercial and industrial friction products, drum brake linings and disc brake pads for light and medium weight vehicles (on new vehicles).

Stage 3 (Aug. 25, 1997)—Asbestos-cement pipe and shingles; commercial, corrugated, and specialty paper; rollboard; mill board; roof and non-roof coatings; brake blocks; drum brake linings and disc brake pads (for replacement on older vehicles of all sizes).

EPA also intended to ban another product no longer made with asbestos in the U.S.—valve and pump packings. However, this was dropped during "review" of the rule by the Office of Management and Budget. Packing manufacturers use this omission to support the claim that their products did not cause injury to plaintiffs suing them for asbestos disease. Other exemptions included missile liners and diaphragms in chlorine manufacturing plants. Given the rate at which asbestos use in the U.S. had been declining, the EPA "ban" may have come to little more than closing the coffin after the industry had died from other causes. Nonetheless, EPA was sued by the A-C Pipe

Producers Association, the Asbestos Information Association, Canadian asbestos interests and the Canadian government, leading to an overturn of the ban in 1991. Even so, U.S. asbestos use has continued to plummet.

There has been a so far small but troubling increase in imports of asbestos cement and brake products, since the EPA ban was thrown out by the court.

The millions of tons of asbestos-containing materials already in place also constitute a great threat to health in the United States today. Hundreds of thousands of maintenance workers in commercial, industrial, and residential buildings are exposed to asbestos regularly. Yet because of the intermittent nature of their exposures to old asbestos thermal insulation and other materials, these people are largely overlooked by health authorities, and many have no idea their lives are threatened. Insulation is ripped out crudely, and contamination of work areas multiplies the extent of the hazard. Positive-pressure, air-supplied respirators are seldom provided for situations warranting their use; and most maintenance workers handling asbestos use no respirators of any kind.

As a result, 43 percent of janitors with 30 or more years of service have chest X-ray abnormalities consistent with asbestosis. School custodians in New York City with at least 20 years' experience have a 28 percent prevalence of similar X-ray abnormalities. New York firefighters with at least 20 years' experience have a 17 percent rate of these X-ray changes. Among construction trades like sheet metal workers and boilermakers, the figures are worse still.²⁴

Equally poorly protected against occupational exposure to asbestos are nearly one million U.S. workers doing brake repair regularly. The EPA bans on asbestos in brakes, if upheld by the courts, would have greatly diminished the amount of asbestos exposure from brake servicing starting in the late 1990s. However, the continuing use of asbestos in brakes and the minimal reluctant regulation of this risk by OSHA have probably led to little improvement in controlling asbestos exposures in brake repair shops all over the United States.

The deterioration of asbestos already in place can be a hazard to the health of building occupants. Lightweight asbestos

formulations have been sprayed on ceilings for acoustical, fireproofing or decorative purposes since the 1930s. Moreover, asbestos-containing sprayed fireproofing was applied to the girders of thousands of residential and office buildings from 1958 until the products were banned in the early 1970s. Recirculating air for many of these buildings passes through air plenums lined with the same friable asbestos material. Building occupants can thus be exposed to considerable indoor asbestos air pollution arising from common conditions of use.^{25,26} We are starting to see reports of mesothelioma in persons whose only known history of asbestos exposure was as an occupant for years in a building with deteriorating asbestos construction materials.^{27,28}

Public concern in the U.S. has focused sharply on the problem of asbestos in school buildings. Here, even cementitious surfaces can be damaged by harsh use coupled with the normal problems of aging buildings. Schools have been summarily closed and localities strapped with enormous expenses for asbestos removal by specialty contractors. In at least some cases, asbestos removal was not carefully performed, and a considerable effort is needed to monitor the contractors. Los Angeles alone expected to incur \$40 million in costs. In 1980, Congress passed the Asbestos School Hazard Detection and Control Act, to assist states and localities in evaluating the dangers and making renovations. One requirement of the law was that the U.S. Department of Justice investigate the feasibility of recovering taxpayers' outlays by suing the manufacturers of the asbestos products. The Attorney General reported in 1981:²⁹

School authorities faced with substantial expenditures in removing or containing friable asbestos should, as a matter of the utmost urgency, consult with qualified counsel to determine whether they should file litigation on their own, as at least three school districts have already done.

It is clearly in the national interest that those school districts ... be able to recover from those who manufactured and sold asbestos products without warning of the dangers of breathing asbestos fibers.

States and municipalities were meanwhile left to *fund* asbestos abatement programs on their own, with the more wealthy political districts doing more and the rest doing less. On October 4, 1983, the Senate rejected a move to provide \$50 million in interest-free loans for asbestos abatement. The U.S. Department of Education withheld a report that 14,000 schools were affected, leading to a cost estimate around \$1.4 billion.³⁰ In 1984, Congress finally provided \$50 million to assist localities in school asbestos removal, the first part of a planned \$600 million, 7-year program. By the time the Asbestos Hazard Emergency Response Act was passed in 1986, EPA estimated that students and school employees in 35,000 schools were potentially exposed to friable asbestos material.³¹

In 1984, the first of the country's school asbestos removal cases came to trial (*Lexington County, South Carolina School District v. U.S. Gypsum and Johns-Manville*). Both sides had presented evidence, and the judge had ruled that the issue of punitive damages would go to the jury, when a settlement was arranged. U.S. Gypsum agreed to pay the full cost of removing asbestos from a school (\$377,000) plus an added sum of \$298,000.

But the problem of asbestos in buildings is enormous and involves much more than schools alone. In the 26-floor Federal Building in San Francisco, for example, asbestos fibers circulated through the ventilation system and were found in the carpeting. The General Services Administration asked Congress to approve a \$15 million plan to remove the asbestos from the building. The work was projected to take several years to complete. Proper removal of hundreds of tons of asbestos from the 66-story Chase Manhattan Bank building in New York City costs over \$1 million per floor of height. There are an estimated 501,000 public and commercial buildings in the United States with damaged friable asbestos materials, 317,000 of which have "significantly" damaged materials, according to a 1988 EPA study.³² And lawsuits demanding billions of dollars have been filed to recover renovation costs from companies that originally sold the asbestos materials.

The common belief that asbestos use and exposure in the U.S. is now carefully controlled thus proves to be erroneous. The

disease and death toll from the past is still growing, with a substantial amount of future disease that we are failing to prevent now.

The Economic and Social Cost of Asbestos Disease in the United States

Studies have been done to determine how the economic loss is borne by families who suffer the premature loss of a father from asbestos disease. The families involved were the survivors of 249 insulation workers who died of asbestos diseases before the end of their expected work lives. The families sustained an average net economic loss of \$101,000 each (much more in cases where death occurred well before retirement age).

The economic loss to survivors here was taken as the worker's wage income, net of taxes and the consumption of the worker. The cost of medical care was not counted in these loss figures.³³

Income in 1979 from all sources (government funds, pensions, workers' compensation, and personal injury suits) combined came to only 22.8 percent of this conservatively estimated economic loss. Fully half of the families in this survey (125) were receiving no income from any source to offset the loss of the breadwinner.³³ Thus, most of these insulation workers' families were drastically impoverished by the occupation-related deaths of the men (See Table 2).

Economists Johnson and Heler estimate the gross income loss to 420,000 workers (expected to die from asbestos diseases) and their families at \$326 billion, over the years 1967-2027. This figure does not include the cost of medical care for these people. Nor does it count the costs sustained by workers disabled with asbestosis who die from causes unrelated to asbestos. The costs to society for the administration of social agencies and courts are also not included in the above figure. Johnson and Heler did not offer any figure for pain and suffering, either, but emphasized the unquantifiable loss nonetheless sustained.³³

Table 2. Economic Loss Replacement Following Deaths from Asbestos Diseases*

<i>Source</i>	<i>Replacement Ratio (Total Cash Benefits: Total Net Loss)</i>
Social Security Survivors' Benefits	6.7%
Veterans' Widows' Benefits	0.7%
Public Assistance	0%
Government Sources, Subtotal	7.4%
Private Pensions	5.4%
Workers' Compensation	6.4%
Tort Awards and Settlements	3.6%
Total, All Sources	22.8%

*Data from Johnson and Heler³³ based on: 249 families of insulation workers whose deaths were caused by asbestos diseases. Replacement income includes cash benefits received during 1979 (base year of study) plus any income in that year that could be imputed to a prior lump sum payment.

The men who died all would *not* have reached the end of their expected work lives prior to 1979. (Loss estimates for 1979 for widows whose husbands would have stopped working by 1979 were "not possible.")

Assuming a rough ratio of medical costs to lost earnings for cancer patients of 0.38, a figure of \$125 billion can be added on as the cost of medical care.³⁴ Adding a continuing cost to society of operating social service agencies and courts at an estimated current outlay of \$0.5 billion annually, the projected cost of the asbestos disease deaths comes to around \$500 billion. Even this staggering amount does not include corresponding costs for persons who develop disability from asbestosis but die from causes unrelated to their asbestos exposures.

It is evident that at least the majority of the companies whose products set this tragedy in motion have unleashed bodily harm on society which, even reduced to tangible economic terms, exceeds all that these firms are worth or insured for.

Asbestos Litigation

Expanding in this virtual vacuum of compensation has been the volume of litigation over the workers' and their families' lost earnings, pain and suffering, and medical expense. In cases that actually came up for a trial by jury, punitive damages have also been awarded on occasion (in addition to compensatory damages). Damage suits have no doubt increased their share from 3.6% of recovered income loss to insulators' families in the years since 1979.

More than two hundred companies and insurers have been sued, plus a few corporate officers and doctors.³⁵ And in 1982, three defendant manufacturers (UNR, formerly Unarco; Manville; and Amatex) took the extreme step of seeking the protection of federal bankruptcy law, largely to at least temporarily stem the litigation costs.

By 1982, the asbestos manufacturers and their insurers had already incurred costs totaling \$1 billion. The average cost to defendants and insurers per closed claim is in dispute, probably \$125,000 to \$150,000 in the years 1980-1982. About 39 percent was received by plaintiffs; the balance went for legal expenses, with defendants paying 1-1/2 times as much as the plaintiff, on the average.³⁶ An Asbestos Claims Facility was set up in 1984 to control defense costs. This unraveled in 1988, and has been replaced by a smaller defense consortium, the Center for Claims Resolution.

A BBC documentary in 1993 examined the toll of asbestos-related liabilities on Lloyd's of London. By then, Lloyd's asbestos-related liabilities were projected to be \$20 billion, and record annual losses were announced. The program claimed that some Lloyd's insiders recognized the threat earlier than others. One leading Lloyd's underwriter, Ralph Rokeby Johnson, was quoted as telling a colleague in 1973:³⁷

do you realize... that the asbestos problem and the paying of claims is going to change the wealth of nations? That Lloyd's will eventually be bankrupted and the Bank of England will have to be called in?

Many Lloyd's "Names" who ultimately bear these liabilities have sued their investment advisors, the newer "Names"

claiming they were never provided with similar warnings when approached as investors in the 1980s.

The risks of jury trials have also increased, as plaintiffs' attorneys have redirected their discovery efforts against other defendants after Manville went into bankruptcy court. Punitive damage awards against the other defendants are an increasingly common result.

For Manville, the disposition of 1,885 claims in 1981 cost an average of \$15,000 each, for a total of \$28 million *excluding legal costs*.³⁸ The company reported that its legal expenses before the bankruptcy filing were about \$2 million per month. Using such data for the purpose of rough estimation, one comes up with a total litigation expense figure of \$52 million for 1981. This was about half of the company's profits in better years. After filing under Chapter 11, Manville reported a profit of \$45.6 million for the first half of 1983.

Manville has paid a price for its refuge in bankruptcy court, however. To minimize the loss of business because of customers' concern about Manville's ability to stand behind long-term product warranties, Manville has had to place funds in escrow or secure special insurance for that purpose. Even then, customers have been reluctant to rely on Manville as a sole or primary supplier; and the company has had to offset this concern by cutting prices to get business. Competitors have exploited their advantage, as in the case of Owens-Corning and PPG Industries gains in the fiber-glass insulation business. The company's ability to borrow funds at competitive rates has also been affected by its Chapter 11 status. Continuity and resources for new product development were reduced. And top echelon executives have sought jobs with other companies. In the meantime, the litigation continued to dominate the attention of top management, distracting them from attending to matters on which Manville's future profitability would depend. Investment analysts saw "underperformance" attributed to the litigation.

Manville's tactic of filing under Chapter 11 in Judge Burton Lifland's jurisdiction of bankruptcy court in New York has undoubtedly achieved some of its objectives. It bought time and temporarily restored some of the profitability of the company. The judge proved willing to grant numerous delays to Manville,

which filed an insulting "reorganization plan" in November of 1983. Under this plan, any asbestos disease claims that could not be paid with the cash Manville made available for them would be paid with unsecured notes redeemable within the next 50 years. Plaintiffs' attorneys' effort to then have the case thrown out of bankruptcy court for "bad faith" filing was rejected by Judge Lifland.

While this went on, thousands of asbestos victims and their families had long-awaited trials delayed for about a year on the average, while courts around the country decided to let cases involving Manville proceed against other defendants not in bankruptcy court. For plaintiffs suing Manville alone, no such option existed. By the end of 1983, heavy dockets of cases were being set for trial, and settlements between plain tiffs and non-Chapter 11 defendants were being arrived at in most parts of the country. Defendants going to trial risked verdicts for total monetary damages, pain and suffering, and in many cases punitive damages; their claims for indemnification against Manville (for Manville's share of the liability) then had to be filed in Judge Lifland's court, where they waited.

In early 1984, Judge Lifland decided to appoint a representative for future asbestos disease claimants, placing him at odds with bankruptcy and district court judges handling the UNR and Amatex Chapter 11 asbestos cases. This introduced the need to invent a formula for setting aside funds to cover future claims, presumably at a loss to those with claims already filed. It also raised the possibility that Manville could emerge "debt-free" from Chapter 11 while a fund set aside for future claimants is rapidly consumed. Higher courts refused to get involved until 1990, after a final resolution of the future claims matter issued from Lifland's court.

On August 2, 1985, Manville's Board of Directors announced an agreement in principle with the appointed representative for future claimants. Under the plan, Manville would operate protected from asbestos lawsuits. A trust to assume all present and future liabilities would initially be funded with at least \$200 million in cash and around \$615 million in insurance settlement proceeds. To this would be added a \$1.65 billion non-interest-bearing bond (payable at \$75 million a year over 22 years

beginning in the fourth year), and 50-80 percent of Manville's common stock (to be determined by the volume of claims). The trust would also be paid up to 20 percent of Manville's profits, starting in the fifth year, as long as needed to pay claims (The firm's profits were \$77 million in 1984). People with health claims could sue the trust if unable to reach agreement by any other means. However, the plan as modified in late 1985 allotted only a token \$5 million for punitive damages and \$125 million for Manville's liability in asbestos property damage claims. The operating Manville company remaining would itself pay banks and other commercial creditors approximately \$550 million owed to them within three years. Manville would reap a tax windfall of hundreds of millions of dollars, deducting its entire costs in funding the trust as a business expense.

Members of the Committee of Asbestos Health Related Litigants, the plaintiffs' lawyers' group in the Manville bankruptcy case, voted 15 to 4 to accept the plan. Dissenters feared that the trust would go through its initial \$800 million or so in funds well before 1991, and would then have to dump its Manville stock at whatever price is available to pay claims. With the stock exhausted, the payments to the trust by Manville (and the U.S. Treasury), on the order of \$100 million a year, would only be enough to pay 4,000 claims at \$25,000 each, both low figures. New asbestos personal injury claims continued to be filed at the rate of 22,000-25,000 per year, and by March 31, 1995, the Manville Trust had received over 250,000 claims.^{39,40} There may well be no way Manville could pay its future health claims; even proponents of the plan agree that the Trusts's capacity won't much exceed 100,000 claims.

What it came down to was a calculated risk between fighting to liquidate Manville (value: \$750 million to \$1 billion) and leaving Manville viable so it could be milked as a "cash cow." The fear remains, however, that the cow will someday be both dry and bullet-proof to Johns-Manville's victims, who feel entitled to its meat if they can't milk it. Explained attorney Shepard Hoffman of Baltimore:⁴¹

Financial markets will not lend Manville money if they believe the operating company can be attacked. In return

for an injunction, we're saying, 'Look, you're entitled to that injunction, and to operate profitably serves our interest.' But if at some point in time, it looks like a choice ever has to be made either for the death of future claims or the death of the operating company, I'm in favor of killing the operating company.

Against this misgiving, other plaintiffs' attorneys countered that:

1. This is the best offer so far made and the best offer likely to be achieved soon. The likely payout is greater than the liquidation value of Manville, and anyway liquidation is not an option in the foreseeable future.
2. The bankruptcy process is the only proceeding that can avoid endless and costly litigation over the property damage claims, which would compete against health claims for available and insufficient funds.
3. The tax windfall will better enable Manville to pay victims and maintain the value of its stock held by the trust.
4. Only by foreclosing any future suits for compensatory and punitive damages against Manville, even taking the risk that the settlement funds will run low, can the value of the company's stock which the trust owns be preserved.
5. It is unlikely that the trust will be able to administer the payment of more than 5,000 claims per year. At \$30,000 per claim, it would take six years before there would be any need to sell stock to pay claims. The people with claims solely against Manville could be given priority relief and the most urgent claims could be thereby settled within the shortest time.

The Manville Personal Injury Settlement Trust was set up as a result of bankruptcy proceedings concluded in late 1988, very much along the lines described. (A separate, smaller fund was set up for property damage claims.) Earliest-filed claims were settled first, as were cases finally coming to trial in 1989-90. In

resolving 22,000 claims by paying and promising to pay a total of \$935 million by the end of March of 1990, the Trust agreed to pay an average of \$42,000 per case. This far exceeded the planned average settlement figure of \$25,000 per case.⁴⁰

The result was that, as the Trust's funds ran down, offers for settlement became more and more stretched out. The Trust issued a schedule for payment in the spring of 1990 that, for example, projected these dates for cases filed in 1986: estimated year for 40 percent payment, 2000; estimated date of final payment, 2005. Plaintiffs' attorneys in Virginia protested that the Trust's settlement offers were analogous to an offer to buy the judge's house for \$1 million, but with payments limited to \$1000 per year. Administrators of the Trust were increasingly unable to come to terms with plaintiffs, and the tragic prospect of trials with the Trust as a defendant came to pass, despite virtually everyone's hope that the trust's limited funds would be used for settlement, not litigation.

In May of 1990, Federal District Judge Jack B. Weinstein and New York State Supreme Court Justice Helen Freedman held a highly unusual hearing, the immediate subject of which was 483 lawsuits arising from asbestos use at the Brooklyn Navy Yard. The judges made it clear that they were dissatisfied with the results of the bankruptcy court's resolution of the Manville case.⁴⁰

They urged that other factors such as the severity of injury, the need for treatment, and the financial wherewithal of claimants be used for setting payment schedules, instead of the mere order in which lawsuits were filed.^{41,43} They urged reductions in fees to the Trust's and plaintiffs' attorneys. The New York judges interpreted the law as permitting the bankruptcy court to lift its injunction barring asbestos victims from suing Manville Corporation; or, the bankruptcy court could increase the company's payments to the Trust.⁴²

In the meantime, Manville Corporation reported record profits of \$197 million for 1989 and was known to be holding about \$1 billion cash and unused credit lines, yet had not declared a dividend.⁴²

The White Lung Association held a demonstration at the Manville Trust's Washington D.C. headquarters to protest the

whole idea of the Trust as a fraudulent solution. Speakers, including union representatives, called for the liquidation of Manville Corporation to compensate victims and castigated the Trust for making no real effort to seek out hardship cases and give them priority.

Since 1982, a number of other companies have filed under Chapter 11 because of asbestos litigation, including Nicolet, Keene, Eagle-Picher, H.K. Porter, Celotex/Carey Canada, Raymark, Pacor, and Forty-Eight Insulation. National Gypsum went into Chapter 11 for other reasons, has now emerged from that, and is one of the companies in the Center for Claims Resolution.

Manville's liabilities have not gone away or been reduced by federal legislation. The company's stock dropped in value from \$34 a share when the Sumner Simpson papers were made public (in late 1978) to \$2-3 in the first half of 1987, then recovered somewhat to \$7 a share by mid-1990.

The Manville Trust paid over \$1.1 billion to settle claims in the years 1988-1994, while running up \$179 million in expenses. Most of the settlements occurred in 1989 and 1994.⁴⁴ Through the Trust distribution process started in March of 1995, the Trust was authorized to offer claims settlements for less than their "liquidated claim value." Offers of settlement were sent out to a large number of people, for 10 percent of the estimated value of claims, based on the Trust's estimate that it will only be able to pay 10 percent of the value of all the claims it will eventually receive. By October 4, 1995, another \$220 million had been paid in settlements to 43,000 claimants under the new distribution plan.⁴⁵ This averages out to only a little over \$5,000 each, compared with about \$36,000 each for the previously settled claims. With claims to the Trust sharply up in 1995, claimants may feel they are better off taking 10 percent offers than appealing the claim values and causing a delay in payment, with the possibility that the payment multiplier will be revised to a figure even lower than 10 percent. In all, the Trust had concluded settlements with over 67,000 claimants by October of 1995.⁴⁵

By October of 1995, the Trust had paid about 450 financial hardship claims, regardless of the order of claim filings. Starting

in February, 1994, the Trust has automatically classed all claims by living persons with lung cancer and mesothelioma as exigent claims, ignoring the procedural requirement for medical affidavits to the effect that the claimants had only months to live. Settlement offers in such cases were expedited, and about 3,500 of these claims had been paid by October, 1995.⁴⁵

At that time, the Trust's remaining assets were valued at \$1.8 to \$2.2 billion. Most of this was in Manville common stock, of which the Trust owned about 80 percent. The Trust's holdings of Manville stock went up by \$456 million in the first half of 1995, with the rise in the stock price from \$9.00 to \$13.75. The Trust also had about \$500 million in cash and marketable securities, much of which came from selling its longterm bonds back to Manville for \$369 million in 1994. Annual operating costs have been \$8-10 million per year.^{44,45,46}

Bankruptcy reorganization of Eagle-Picher similarly was in the final stages in 1995, with asbestos-injured claimants in effect replacing common stockholders as the owners of the company.

It is possible although not likely that corporate defendants in asbestos litigation will avert billions of dollars in liability from the sale of asbestos products. The companies have failed to win suits against the U.S. government for indemnification on the grounds that federal specifications required asbestos, and/or the federal government had the knowledge and responsibility to assure that people handling asbestos under its direct and indirect control were protected. They have also been unable to get Congress to enact asbestos "compensation" legislation favorable to the industry.

Since 1977, defendants in asbestos litigation have supported some of the bills introduced in the U.S. Congress as asbestos disease compensation measures. These proposals would replace the victims' access to the courts with a federally administered system. Funding of the system would be borne by the asbestos litigation defendant companies and perhaps the government as well.

As of 1979, the government provided more than twice as much compensation as the defendants and their insurers to the families of insulators who died from asbestos disease (See Table 2). This is in addition to decreased tax revenues due to the

men's premature deaths, and the enormous administrative costs to taxpayers of public programs to help the families and the operation of courts for handling the burden of litigation. Even Manville's reorganization in bankruptcy court was designed to realize at least a half-billion dollar subsidy from U.S. taxpayers. The cost to society as a whole is thus quite high. This reality contrasts with industry demands that the government "pay its share" under special legislative proposals.

The obvious motivation for legislative proposals on the industry's part is to both limit and stretch out industry costs; however, it is doubtful whether anything so far proposed would improve the claimants' outlook, from the standpoint of eligibility, amount of compensation obtained, and length of time awaiting relief.⁴⁷ A large potential source of funding for such a system is the fortune in legal costs now borne by both sides, obviously.

But the problem lies not so much in conceiving and introducing fair, victim-oriented legislative proposals. The difficulty is in getting such bills enacted over the opposition of enormously powerful and well-organized insurance and manufacturing interests.

Legal/accounting shell games have been tried by some companies to distance their assets from asbestos-related liabilities. This has involved retaining the liable entity in name only while removing assets by a Byzantine corporate restructuring scheme to a holding company owned by former shareholders of Raymark. Federal judge Panner in Oregon held the holding company responsible for Raymark's liabilities, finding that "Raytech" was set up for the "improper purpose of escaping asbestos-related liabilities" (*Schmoll v. AC&S et al.*)

Leveraged buyout subterfuges have been used to separate a Fortune 500 parent corporation (Jim Walter Corp.) from the liabilities of its wholly owned subsidiaries (Celotex, Carey Canada). In this case, the Wall Street brokerage firm that arranged the deal (Kohlberg, Kravis, Roberts & Co.) was also sued by plaintiffs with asbestosis and cancer.

Starting around 1982, Jim Walter Corporation withdrew hundreds of millions of dollars from its Celotex subsidiary. After the leveraged buy-out in 1987, Walter Industries wound up

filing for Chapter 11 bankruptcy court protection at the end of 1989. The suit by asbestos victims against the Walter construction and industrial conglomerate was resolved in the bankruptcy proceedings in 1994. The settlement established a \$375 million fund to compensate personal injury and property damage plaintiffs. Celotex's own contribution, from its assets and insurance, has yet to be determined by the bankruptcy court.

By the time Celotex filed for bankruptcy, the company had had to post bonds for more than 100 plaintiffs awarded damages in jury trials, in the amounts awarded, during Celotex appeals of the verdicts. The judgements were affirmed on appeal, by which time Celotex was in bankruptcy court. There, Celotex opposed these people's right to the bonds, claiming they had been fraudulently issued, and the bankruptcy judge prevented the plaintiffs and their families from collecting on the bonds. As of early 1996, these people were still unpaid by either Celotex or the settlement fund established by the bankruptcy court settlement.

Keene Corporation went to court advancing the position that it had limited funds, about \$100 million, for paying asbestos damage suits, and that the resolution of present and future claims could best be achieved without Keene submitting to provisions of the bankruptcy code. This view was accepted by U.S. District Judge Jack Weinstein but was then rejected by the Second U.S. Court of Appeals. The appeals court found that the solution proposed by Keene mirrored a bankruptcy proceeding but failed to protect claimants as a bankruptcy proceeding would.⁴⁸ Keene filed for Chapter 11 bankruptcy in late 1993.

The federal courts made an unusual move in 1991 to break the impasse of asbestos litigation. A multi-district panel of federal judges arranged for over 26,000 federal cases pending in courts around the country to be transferred to District Judge Charles Weiner in Philadelphia. But Judge Weiner could find no way to resolve the cases—and this could have been anticipated, since the federal courts had previously declined repeatedly to remove all the federal cases to a single court. The transfer thus had the effect of stopping all forward progress, including settlement, in those cases. Plaintiffs' attorneys spent the next four years pleading with Judge Weiner to send cases back to the jurisdic-

tions where they were originally filed, so they could be tried. Only a small number of federal cases had been sent back for trial by late 1995. In the meantime, new cases have been filed in the state courts, where there is a better chance for eventually getting trials scheduled.

The desire of federal courts to experiment with novel approaches to dispose of the asbestos litigation was not lost on the defendants. Late in 1991, the Center for Claims Resolution (CCR), representing 20 of the more financially healthy companies in resolving their asbestos claims, approached plaintiffs' lawyers Ronald Motley and Gene Locks, to resolve present and *future* claims. CCR companies included GAF, T&N, U.S. Gypsum, National Gypsum, Armstrong, Union Carbide, and Certain-teed, and overall their liability in asbestos litigation has run at around 25 percent. By January 14, 1993, CCR concluded settlements of the cases of over 14,000 plaintiffs represented by Locks, Motley, and Motley's co-counsel around the country, for \$215 million. The next day, CCR and the same plaintiffs' lawyers filed a complex series of papers in Judge Weiner's court in Philadelphia, to set up *and* settle a mandatory class action of future claims against the CCR companies.

But the Constitution limits the courts to resolving "cases and controversies," and there is every appearance that the parties in this instance were asking the court to place its approval on a private agreement. As this agreement affects a multitude of people who did not even know negotiations were going on, and who do not yet have any cases or controversies, it is easy to understand why one article on this matter was called, "The Tort That Ate the Constitution."⁴⁹

The plan proposed would limit the remedies available to future asbestos claimants, most of whom were not yet suffering from asbestos health problems and had not, therefore, become involved in the judicial system. These persons would have their claims handled administratively, at a rate less than half as great as the rate of new lawsuits being filed against CCR companies (24,000 cases per year from 1989-1993). CCR would pay an average of \$130 million per year to resolve just under 10,000 claims, an average of \$13,000 per claimant, with no payment at all for persons with non-malignant pleural changes. The

maximum payment for mesothelioma would be \$60,000. A limited number of plaintiffs not satisfied with CCR's offer could seek arbitration or get into the tort system.

Not the least of the problems presented by this scheme was that of providing notice to the people whose claims the class action was intended to resolve. In November of 1993, a three-month campaign including advertisement spots broadcast during football games and written communications to union members and retired unionists was carried on. Millions of members of the public who could someday develop asbestos diseases were thus told they had until January 24, 1994, to send in opt-out notices to the court or be bound by the terms of the CCR deal. Asbestos victims' groups and some unions got busy, too, and an astounding 236,000 people sent in opt-out notices before the deadline. CCR's lawyer then contended that the opt-outs should be voided because of tainted communications from objecting attorneys.

The CCR deal was attacked in court by plaintiffs' attorney Frederick Baron and others. Baron charged that Motley and Locks had gotten a generous settlement of the cases of their 14,000 clients (including individuals with non-malignant pleural changes) and over \$70 million in fees for themselves and their co-counsel, in exchange for an unethical alliance with CCR. Motley and Locks responded that there were no reasons why they could not ethically represent both their 14,000 former clients and the class of future claimants they had not even met, much less been approached by to provide representation.

The asbestos victims' groups and Public Citizen Litigation Group have also opposed the plan, as has a contingent of law professors. Ralph Nader has protested that the class action, which was used over the past 20 years to give plaintiffs leverage against corporate defendants, is now being refashioned to shield corporate defendants. The Oil, Chemical, and Atomic Workers' Union also opposed the CCR plan, while the AFL-CIO favored it. An ethical analysis concluded that "defendants bought off class counsel and other plaintiffs' lawyers, and the district court deliberately turned a blind eye to what was plain for all to see."⁴⁹

Yet another Constitutional question is raised, because the courts are being asked to impose a solution by means that amount to legislation for non-bankrupt corporations. The implications of this case, *Georgine vs. AmChem Products*, go far beyond asbestos, as Columbia law professor John Coffee, Jr., illustrates.⁵⁰

If *AmChem* is upheld, there could come a day when tobacco manufacturers might seek out a cooperative plaintiff's attorney to file a "future claims" action on behalf of every U.S. citizen exposed to secondary tobacco smoke and thus protect themselves from tort claims for the next half century.

Fibreboard Corporation was ensnared in litigation for years with insurers, Continental Casualty and Pacific Indemnity, who had sold Fibreboard coverage in the 1950s with limits on individual claims but no limit on the aggregate total of claims covered. Fibreboard, these insurers, and attorneys (Ronald Motley, Gene Locks, Harry Wartnick, Steven Kazan, and their co-counsel) purporting to represent all people exposed to asbestos products for which Fibreboard may face liability after August 27, 1993, filed a class action for the purpose of settling all future Fibreboard asbestos claims, before Federal Judge Robert Parker in the Eastern District of Texas. Under the plan (*Ahearn vs. Fibreboard Corp.*), Fibreboard itself would contribute only \$10 million, about 5 percent of its net worth, to a \$1,535 billion trust fund mainly funded by the two insurers. This was objected to as an attempt to limit access to the courts and potential recovery of damages by plaintiffs, artificially treating a non-bankrupt defendant and its insurers as a limited fund.

Interestingly, Fibreboard made a contingency plan separately with the insurers, in the event that *Ahearn* is thrown out by the courts. This plan provides a larger fund for Fibreboard to use to settle claims, but has no provision to keep the claims from being tried in the courts instead of being resolved through an administrative plan approved by the courts. The court has issued an injunction against the filing of claims against Fibreboard.

Similarly, in the CCR class action, Judge Weiner has issued an injunction to keep asbestos victims who did not opt out by January 24, 1994, from prosecuting lawsuits against CCR

companies. This was challenged at the U.S. Court of Appeals in Philadelphia in November of 1995. The Fibreboard settlement has been approved by Judge Parker and is set for argument in March of 1996 at the Fifth Circuit Court of Appeals in New Orleans.

Other versions of liability avoidance remain to be attempted. The mettle and gullibility of the courts are being tested, and plaintiffs' attorneys have had to maneuver again and again in unfamiliar terrain to counter such moves by corporate defendants. Should any such dodge be successful, it would open a door in the legal system that corporations could pass through and close behind them on asbestos victims.

As asbestos manufacturing defendants withdrew into bankruptcy courts, more attention has focused on other legally responsible parties. In many cases, workers had worked with asbestos for companies that were in turn hired as contractors by oil refineries, chemical plants, steel mills, power plants, and other large businesses. These large businesses, some of whom deliberately subcontracted out hazardous work, now may face suits charging premise owner liability. Premises owners can be legally held responsible for not informing contract workers they brought onto their grounds about serious, non-obvious hazards.

Asbestos Litigation in Other Countries

There has been some litigation over asbestos disease in other countries. In Australia, a firm that owned an asbestos mine was sued by former miners with asbestosis and mesothelioma (See "CSR" in Chapter 9). The victims' success in the first few cases where liability was addressed has led to the settlement of hundreds of other claims, largely because Australian courts discourage relitigation of issues already settled by trials. Australian courts have awarded damages to an office worker exposed to crumbling sprayed asbestos insulation and a woman whose mesothelioma arose from environmental exposure during infancy in Wittenoom, in 1959-1961.⁵¹ The Australian courts have continued to expand the liability of private and public entities in cases going to trial, on both medical causation and duty-of-care grounds. Product liability actions against James Hardie Industries have also led to many settlements, as the

company evidently hopes to limit the extent of legal discovery and publicity regarding its historic policies on asbestos products sold to consumers.

In New Zealand, personal injury litigation ceased by law in 1974, for all cases arising from subsequent events. As asbestos disease became a matter of public discussion and asbestos victims began to organize in the early 1990s, the government moved to close off all asbestos claims by setting a deadline of April 1, 1993, for filing cases based on pre-1974 exposure. About 200 cases were filed in New Zealand courts, and others may have to be resolved in Australia. The two main asbestos-cement manufacturing firms in New Zealand were Fletcher Holdings, a New Zealand multinational in which Australia's CSR has until recent years had a major holding, and James Hardie, the Australian-based building products firm. Australian lawyers representing New Zealanders have begun to resolve cases against James Hardie, whose representative originally told New Zealanders that the company refused to accept liability in their country.

In 1986, a Tokyo District Court ordered an asbestos manufacturing firm and its parent company (Asahi Asbestos Co.) to pay \$1.2 million in the cases of 10 former asbestos plant employees. The defendants withdrew their appeal to a higher court, and the parent company agreed to pay the damages to prevent financial crisis at the smaller firm. After agreeing to a slight reduction in the court award with the successful plaintiffs, the defense also agreed to pay something to an unsuccessful plaintiff whose case was lost on the grounds of statute of limitations. The government had also been sued, but the court did not hold the government accountable for damages.⁵²

Only 63 asbestos victims in Japan were awarded workers' compensation in the 4 years 1988-1991. The number of individuals granted workers' compensation for lung cancer and mesothelioma from asbestos was 20-23 per year in the next few years. This was despite annual "Emergency Telephone Day" efforts by the Japan Joint Conference Against Asbestos and the Japan Occupational Safety and Health Resource Center in 1991 and 1992 and continuing outreach efforts by these and allied groups in Hiroshima and other cities. Japanese cases of asbestos

disease have been attributed to work at the U.S. Navy yard in Yokosuka as well as privately owned shipyards, automobile manufacturing plants, asbestos plants and in construction work. In at least one case, the correct diagnosis had to be provided by Dr. Yasunosuka Suzuki of the Mt. Sinai School of Medicine in New York.

There has been no asbestos product liability litigation in Great Britain. Even expectations that lower thresholds of proof would be required by U.K. social security industrial injury boards in lung cancer cases have gone unfulfilled, despite changes in the law in 1985 (See "Cancer from Asbestos in the Absence of Asbestosis," in Chapter 4). Symptomatic of official attitudes, the London Medical Boarding Centre (Respiratory Diseases) appointed Dr. Kevin Browne "following his retirement as medical officer to Cape Asbestos" in 1985. The Department of Health and Social Security said Browne would not be asked to adjudicate claims by Cape employees, but he would be consulted in deciding asbestos claims involving others.

The Society for the Prevention of Asbestosis and Industrial Diseases then complained that Browne was still working for Cape and serving as a defense medical expert in handling asbestos disease claims for others; and in addition, that Browne had access to Special Medical Board records. Pressed also by Member of Parliament Frank Dobson, the government finally admitted in 1987 that Browne was still working as a medical "consultant" to Cape up to two days weekly.⁵³ Nonetheless, Dr. Browne was retained on the medical board. With rare exceptions, the medical profession in Britain has shown itself unwilling to testify in support of asbestos victims' claims.

Though there had been a few civil suits over asbestos disease in Britain in prior decades, it was not until the 1990s that relatively large numbers of cases were filed. This arose in part from widespread publicity over Turner & Newall documents obtained by the Chase Manhattan Bank in property damage litigation. T&N was a defendant in 433 asbestos personal injury cases by the end of 1994. In 1995, judgments were also issued against other employers, including British Telecommunications and Imperial Metal Industries, for failing to take reasonable

steps to minimize employees' exposure from working with asbestos since the early 1950s.⁵¹

Damage suits brought by J.W. Roberts' factory neighbors who developed mesothelioma also prevailed in 1995. In those cases in Leeds, the High Court was moved to remark on the unequal struggle between the two women suing the company and T&N, whose lawyers "remorselessly persisted in taking bad points, apparently simply to obstruct the plaintiffs' road." (*June Hancock v. T&N*)

Compensation for victims of asbestos disease is woefully lacking in many European countries. In France, where 400-600 people died each year from mesothelioma in the mid-1980s, only 20-40 cases per year received compensation. Italy is even worse; practically none of the cases of mesothelioma (at least 400/year) were compensated between 1988 and 1995, despite the conversion to a "mixed" compensation system as recommended by the European Union. This system allows for compensation of diseases not included on the official list of occupational diseases, if occupational causation can be established. The lack of compensation through the workers' compensation system has not led to asbestos litigation in these countries, with the result that the costs are placed on the victims and the public even as the rate of these diseases rises.⁵⁴

The Asbestosis Research Council

In Britain, the Asbestosis Research Council was set up in 1957 by Turner & Newall, Cape Asbestos, and British Belting and Asbestos Company. At first, the very existence of this organization was generally not discussed below senior management levels because of company policies to play down asbestosis.⁵⁵

By 1963 and onwards, it was the ARC's policy to require approval by all member companies, of any publication of ARC-funded research. Researchers, including John M.G. Davis, regularly submitted pre-publication manuscripts for review, and they were directed to make numerous changes before approvals were granted. The "payer review" process was not entrusted merely to industry scientists. Papers approved by the ARC Research Committee had to afterwards be approved by the ARC Management Committee before publication was authorized.⁵⁶ At

the same time, as Turner & Newall's John Waddell put it in a candid note to Dr. Lewinsohn as chairman of ARC Research Committee, appearances were very important.⁵⁷

Granted, we as an industry have a difficult task to perform in running the Research Committee, and the challenge for us is to perform the difficult feat of retaining control of the Committee but at the same time, to the outside world, to appear as impartial and thoroughly objective as we possibly can.

As public concern began to surface over the presence of asbestos in completed buildings, a controversial report was prepared by Turner & Newall industrial hygienist Stephen Holmes. The review process netted at least one sentence Holmes was ordered to alter by Turner & Newall executives R.A. Wells and David Hills.⁵⁸ On the other hand, Turner & Newall public relations chief W.P. Howard was pressing Holmes and his co-author J.C. Byrom to publish as soon as possible, for commercial reasons.⁵⁹

The ARC was a center for organizing corporate response at all levels on health issues. Plans were made to send industry representatives to medical conferences, to pay conference attendance expenses of some researchers but not others, and a visit of Turner & Newall's Chairman to the offices of the *Sunday Times* was also noted.⁶⁰

When Dr. C.N. Davies moved to publish a report in 1970 of a medical conference the ARC had arranged to hold without publishing any proceedings, the industry strongly objected to Davies publishing his summary. This protest was voiced despite Davies' protestations that: 1) doctors whose work he'd described without naming names considered his accounts accurate; and 2) the information was of general medical and scientific value. This protest was voiced first as a "simple matter of principle" and finally expressed as a right derived from "our large financial involvement."

In 1971, the ARC was worried that a researcher it had supported and was thinking of dropping, Dr. Paul Holt, had been approached by glass fiber interests. He might wind up making unfavorable comparisons with asbestos, Lewinsohn

advised, "if he is to publish work on glass fibre without it being edited by the ARC." Lewinsohn suggested that ARC continue to support Holt "a little while longer bearing in mind his international reputation and the bargaining position that this lends him."⁶²

Asbestos concentrations in the air outside ARC members' factories were "somewhat higher than expected" in 1972. It was duly agreed that the member companies had every right to withhold this data from publication.⁶⁰

The ARC was seen as a more credible front than the Asbestos Information Centre for attempts to reverse a Dutch government order prohibiting some uses of asbestos.⁶³

Research by Paul Gross, Russell Harley, Margaret Swinburne, and John Davis was put forward in 1974.⁶⁴ The year before, the U.S. Food and Drug Administration had been asked by the Environmental Defense Fund to ban asbestos filtration of foods, beverages, and drugs.

The intention is to publish in an American journal in the hope that adverse publicity against asbestos in foods, beverages, and drugs can be countered.

It is not intended to acknowledge the ARC support for the Davis or Swinburne work.

The F.D.A. decided to regulate asbestos filtration of injectable drugs but declined to restrict asbestos in the filtration of foods and beverages.⁶⁵

A few years later, J.M.G. Davis and associates at the Institute of Occupational Medicine, Edinburgh, submitted a paper which offended the corporate reviewers by using the expressions "polluted" and "contaminated" water supplies. This was accordingly rendered "less emotive" with substitute text about "water supplies containing asbestiform minerals."⁶⁶

When Dr. Peter Elmes at the Medical Research Council was approached in 1978, he criticized the requirement of ARC vetting papers prior to allowing publication of research.⁶⁷

This is a pernicious system which is bad enough when applied by a government funding organization but it is

worse when applied by an industry funded one as there is an implied censorship.

In a reply that said as much about ARC's choice of researchers as it did about the publication process, Dr. Walter Smither of Cape Asbestos reassured Elmes:⁶⁸

I do not believe that any of our researchers would complain of any evidence of censorship in the past 20 years. ... There has never been any question of censorship.

By 1991, the A.R.C. had outlived its usefulness and ceased to operate.

Public Opinion and Public Health Policy

Leaders in the asbestos industry have long realized that their near-term pecuniary interests were best served by having asbestos hazards receive a minimum of publicity. The asbestos mining companies in Quebec maintained continuous public relations campaigns starting in 1954.⁶⁹ The goal of these programs was to create the public perception of asbestos as a miracle mineral and of the companies as good corporate citizens, contributing to Quebec's "prosperity, social development, and culture."

This message was conveyed through the distribution of *The Asbestos Producer*, which stated that asbestos mining was a "healthy occupation." The magazine was sent to the homes of thousands of employees, government offices and legislators, editors of Quebec newspapers, clergy, writers, broadcasters and opinion leaders in the mining communities and throughout Quebec. The Quebec Asbestos Information Service started in 1954, and the media often published the industry's news releases without alteration.⁶⁹ By 1966, it was anticipated that:

This editorial acceptance will serve the industry well when quick and easy access to news editors and broadcasters becomes essential.

The Quebec Asbestos Information Service, QAMA, and the individual companies distributed industry literature to opinion leaders, schools, libraries, and political organizations, both

within Canada and abroad. Distribution of one-minute television films was added in 1966. Also in 1966, QAMA set up a Health Council to fund medical research, complete with advance public relations work in Canada and the U.S. Part of this was a plan to illustrate "the healthful conditions of life in the asbestos country," complete with interviews with local octogenarians and local doctors.⁶⁹

In all material, emphasis should be placed upon athletic prowess of asbestos youth, on healthy and energetic summer and winter activities.

The asbestos industry in the United States had a special public relations problem in Dr. Irving Selikoff, the country's leading medical expert on asbestos disease. Unlike so many of his predecessors, Dr. Selikoff worked closely with trade unions and was not just willing but exceptionably able to get his message across through the media. Turner & Newall representatives came away with this report after meetings at Johns-Manville in 1970.⁷⁰

At present Dr. Selikoff bestrides the U.S. asbestos and health situation like a colossus. Our impression was that most of the top management at Johns-Manville had no clear idea how to deal with him or with the problems created by his statements. A curious air of despondency existed and the general feeling was that nobody, apart from Dr. Selikoff, was listened to when questions about asbestos and health were raised.

As one admiring reporter would later put it, Selikoff was the perfect scientist for television: "He speaks in sound bites." The asbestos industry didn't have any doctors "who seemed willing to debate the controversial sayings of Dr. Selikoff."⁷⁰

As Dr. Selikoff, *New Yorker* journalist Paul Brodeur, and public interest environmental groups began to raise public awareness that asbestos was dangerous, the industry in North America had to adjust to being a focus of controversy. A turning point was reached in 1973, as asbestos use in the United States reached its zenith. Former Johns-Manville writer of position papers and executives' speeches, 30-year-old Matthew Swetonic, director

of the two-year-old Asbestos Information Association (AIA), described the industry's publicity problems at a meeting of the Asbestos Textile Institute that June. He said that the industry faced a growing volume of media reports largely arising from Dr. Selikoff blowing up an essentially occupational problem into a national calamity. Swetonic went on to describe AIA's efforts to (misleadingly) publicize a World Health Organization report as saying the general public was not in danger from asbestos in the environment. Swetonic's experience was that the best he could expect of press accounts would be an inclusion of the industry's views in otherwise "negative" stories.

After acknowledging that media coverage of this type would continue until "the generation of negative news ceases," Swetonic's message to the industry brightened:⁷¹

And the good news is, despite all the negative articles on asbestos-health that have appeared in the press over the past half-dozen years, very few people have been paying attention.

He explained that a national interview survey had shown that only 22 percent of all Americans were aware that asbestos was hazardous to health. Moreover, "A mere 3 percent of those interviewed stated that they considered it a health hazard to the general public." This left open the possibility that, as public awareness of asbestos hazards grew, it could be defused as an impetus for drastic action if the public saw asbestos as a cause of disease confined to only a limited number of very heavily exposed workers (under conditions that no longer exist, now that we know ... etc.)

The British asbestos industry had come in for a lot of publicity following Dr. Newhouse's report in 1965 and dockers' refusal to unload asbestos fiber imports (with advice from Dr. Donald Hunter) in 1967. As the Labor government moved to issue asbestos regulations, the largest asbestos firms hired the public relations consultants, Hill & Knowlton. A press conference was held at which a written statement was circulated. The article was titled, "Asbestos Industry Announces New Measures to Protect Public Health"; separate subheadings followed: "No Risk to the Public," "Asbestos—A Life Saver," and "Successful

Control of Asbestosis." It was announced that Asbestosis Research Council studies "proved" that mortality rates from all causes had been reduced to normal among asbestos workers.

Hill & Knowlton's continuing services were thereafter provided through the new "Asbestos Information Committee" in London. Hill & Knowlton had gathered valuable experience providing similar services to asbestos and tobacco interests in the United States. The structure of the A.I.C. gives some idea of its operations; committees were set up with these titles:⁷²

Press Relations and Advertising

Literature

Architecture and Building

Parliamentary

Within a short time, the effects of this campaign became evident in many ways. The industry lines appeared verbatim in such sources as *Insulation* magazine.⁷³ At least one local reporter who had written "a series of very inflammatory articles in May ... seems to have desisted since our Press Conference," noted A.I.C. chief and Turner Brothers Asbestos chairman John Waddell.⁷⁴

In Great Britain, libel suits and the threat of them were used with force against asbestos industry critics, as public controversy over asbestos increased. Following the publication of *Asbestos Killer Dust* by the British Society for Social Responsibility in Science in 1979, Dr. Robert Murray sued the author, Alan Dalton, for criticisms, including this text reproduced from a publication of the International Federation of Chemical, Energy, and General Workers Unions:⁷⁵

He testified on behalf of management, and in total opposition to the American trade union position in regard to an acceptable cancer policy.

The position of Robert Murray is entirely in line with the most conservative industry policies conceivable and is totally contrary to the position of the entire trade union movement.

Under British libel law, it was not sufficient for Alan Dalton to show that he had correctly quoted the trade union federation. Unable to prove to the court's satisfaction the truth of those statements, Alan Dalton was personally bankrupted to pay Murray's legal costs, and the BSSRS was destroyed. Undistributed stocks of the book had to have the offending page removed. Turner & Newall defense expert Dr. Murray would later be distressed to see an unexpurgated copy of Dalton's book in a California court in 1993. Murray's writings in the *British Journal of Industrial Medicine* in 1990-1991 establish him uniquely as a defender of the asbestos industry for its past and present business conduct.

The U.S. asbestos industry fought a bruising, ultimately losing battle, as medical and public opinion solidified and forced gradual regulatory action, mostly by conservative administrations in Washington. By 1989, asbestos litigation and abatement had become dominant concerns of the companies formerly active in manufacturing asbestos products. Looming large in this picture was a precipitous new deluge of lawsuits for damages exceeding \$100 billion, by property owners removing and planning to remove asbestos materials that were deteriorating. The buildings at issue filled the spectrum—schools, churches, hospitals, apartment houses, legislative houses, banks, huge office buildings, everything.

In the meantime, some disturbing trends were observed by the White Lung Association, the Sheet Metal Workers union, Dr. Selikoff, and others. Asbestos abatement, despite government laws and regulations, was often being done in a shoddy manner. The resulting immediate hazards were sometimes worse than those initially intended to be removed. One contributing factor was the utter failure of the federal government to set standard criteria for asbestos abatement worker training and licensing and work practices; another was the reluctance of the insurance industry to sell coverage to asbestos removal contractors in the years that the abatement industry grew dramatically, 1985-1988.⁷⁶ There were horrible cases of untrained, illiterate, and illegal workers removing asbestos without using the required safeguards. At the same time, some contractors were doing

careful work, thereby demonstrating that asbestos removal could be done using recognized safeguards.

One response to this was local legislation to require: 1) training of asbestos abatement workers and certification of abatement firms; and 2) advance disclosure about plans for asbestos removal jobs, even to the occupants of commercial buildings. It was reasoned that, with more people looking on, the odds were better that the proper safeguards would be applied. The Sheet Metal Workers International Association, Service Employees International Union, and other unions saw the need for aggressive regulation, including criminal prosecution of responsible individuals running businesses in violation of the law.

Another response, however, was to re-open the question of whether removing asbestos from buildings was justified. Examples could be given where removing asbestos endangered workers and building occupants more than leaving it in place probably would have, at least in the short run. And where there were examples, generalizations could be advanced in their wake.

In the midst of great concern and public frustration, the viewpoint was advanced by some that asbestos in buildings was best left alone until it was necessary to disturb, during normal building repair and maintenance. This argument had a broad appeal to powerful sectors of society: building owners, insurance companies, and former asbestos building product manufacturers, for example. The spokesmen for this view, not always willing to acknowledge whose interests it served, could even affect daftness and claim that they were speaking out against the big, bad asbestos abatement contracting industry.

The view that the best asbestos abatement is none at all rests on several assumptions. Most of the asbestos now in place is chrysotile, and assumption number one is that chrysotile is far less harmful than the other (amphibole) asbestos varieties. The second assumption is that, although some asbestos abatement is carefully done, it must nonetheless be assumed that the common practice will always be in violation of laws and regulations, and nothing can be done to change this.

A product of these assumptions is that public exposure to asbestos in buildings is so low as to be essentially safe, *unless* abatement work is done. Taken all together, the public is being told the problem is now limited to only a relatively small number of heavily exposed workers, and anyway it's OSHA's job to protect them. Leave well enough alone, or the general population will be in peril! This has the cynical appeal of pitting public opinion against the most highly asbestos-exposed workers, by letting them continue to be exposed to disease-producing concentrations (maintenance workers, janitors, firefighters, etc.). It also ignores the fact that deteriorating asbestos building materials will remain a largely invisible threat to all building occupants, not just the "blue-collar" workers.

An associated claim is that the billions of dollars needed for asbestos abatement can and should be diverted to other, more cost-effective health and environmental programs, although proponents of this view never seem to point out that such shifts would also entail a fundamental shift in *who* would pay (i.e., the public, not insurance carriers, asbestos companies, or the owners of real estate). For their part, the parties facing the cost of asbestos removal are not yet offering a "peace dividend" to society as the price of a cheaper approach to the problem of asbestos in buildings.

The principal scientific architects of the laissez-faire approach to asbestos abatement are microbiologist Brooke Mossman, physician J. Bernard Gee, and engineer Morton Corn. The first "scientific" effort to support this approach was launched by a select gathering at Harvard University in 1988. Experts on asbestos from Harvard and Mt. Sinai were not invited, as Dr. Selikoff has pointed out. Nor were unions asked to participate. The organizers of the meeting were exclusively associations representing real estate and insurance interests and defendant companies in asbestos litigation, led by the Safe Buildings Alliance.

The "Harvard Symposium report" in turn became a vehicle for media coverage worthy of a great discovery. It was followed by articles in the *New England Journal of Medicine* and *Science* magazine.⁷⁷⁻⁷⁹ Sensationalist new terms were introduced, like "fiber-phobia", "para-toxicology", "Abategate," and "The

Asbestos Removal Fiasco." Newspaper reports by Michael Bennett were the basis for his book, *The Asbestos Racket*, published for the Center for the Defense of Free Enterprise. Bennett characterized Dr. Selikoff as Chicken Little and asserted that in fact there was no massive human health toll caused by asbestos. The book bore the endorsement of Morton Corn as "careful journalistic effort" that should be read by the Members of Congress.

Britain's *New Scientist* reported on April 14, 1990:

Plans to spend up to \$150 billion to deal with dangerous asbestos in the U.S. are hanging in the balance while scientists conduct a bitter argument over just what the dangers are.

The Mossman-Gee paper in the *New England Journal of Medicine* was denounced by Dr. Orn Eliasson as subtly presenting the views of the asbestos industry:⁸⁰

that it is doubtful that asbestos alone can cause lung cancer, that clinical or pathological evidence of asbestosis is required before one can attribute lung cancer to asbestos exposure, that asbestos exposure does not cause gastrointestinal cancers, that pleural disease is rarely if ever associated with impairment of lung function, that chrysotile does not cause mesothelioma, and that the risk of lung cancer in workers exposed to asbestos can be accounted for by smoking and exposure to cocarcinogens.

Eliasson rightly suspected that the authors were active in defense of product liability suits, which he said would be aided by their article:

It was not a coincidence that an attorney representing an asbestos manufacturer presented me with a copy of the article three days before I received my own copy of the *Journal* in the mail.

The *Science* paper received an extraordinary amount of media attention, despite the fact that it presented no new information, only contained an unbalanced review of the key issues, was contradicted on major points by the actions of the EPA, OSHA,

and the National Academy of Sciences, and was mainly authored by people active in the defense in asbestos litigation.

A disgusted Irving Selikoff congratulated the authors of the article and the campaign carried on by the asbestos manufacturers and their advertising agencies to promote the idea that there is no hazard from asbestos in place.⁸¹ His colleague at Mt. Sinai, Stephen Levin, blasted the authors for putting out misinformation and cited one for talking about the "safe" form of asbestos on a radio program. New York health official James Melius criticized the attempt to overturn a social consensus based on a poor scientific review.⁸²

The Service Employees International Union condemned the asbestos industry and its consultants for conducting a highly misleading disinformation campaign attempting to downplay the hazards of asbestos.⁸² The Sheet Metal Workers withdrew their support for research involving Morton Corn's department at Johns Hopkins.⁸³

The articles by Mossman, Gee, and co-workers were greeted with relief by politicians around the country, who wanted very much to believe that they needn't come up with millions of dollars for asbestos removal after all. Rhode Island proposed to slash all funding for the state Asbestos Control Program. Some conservative politicians were also distressed at the volume of lawsuits brought by governmental bodies against industry to recoup the costs of asbestos abatement. Senator Malcolm Wallop introduced a bill to repeal the Asbestos Hazard Emergency Response Act (requiring school districts to look for asbestos in school buildings and to remove it if it is in poor condition), while invoking an obscure news report for the first time blaming the lack of asbestos in O-ring caulk for the 1986 Challenger space shuttle disaster.⁸²

Responses to the scientific and public policy issues raised in the *Science* paper were published in *Science* by Nicholson *et al.*, Dr. Arnold Brody, and EPA chief William Reilly.⁸⁴⁻⁸⁶ Samuels of the AFL-CIO Industrial Union Department noted that at least 4 of the 5 authors of the *Science* paper had "long-term asbestos industry associations."⁸⁷

EPA then announced that it was setting up an expert panel under the auspices of the Health Effects Institute, funded with

\$2 million from EPA and \$2 million from real estate, insurance, and asbestos abatement interests and former asbestos manufacturers. The panel was to advise EPA on scientific issues regarding asbestos in buildings. Plaintiffs' attorney Edward Westbrook promptly noted that 7 of the 15 members of the panel were listed as defense witnesses in asbestos property damage litigation (not counting Brooke Mossman, who has also been a consultant to Owens-Corning, Keene, and U.S. Gypsum). Selikoff wryly observed that the Institute was seeking to repeal the past 500 years of experience that he who pays the piper calls the tunes.

In June of 1990, a 3-day conference on asbestos, with emphasis on the problem of asbestos in place, was convened in New York. No comparable gathering had been held since the New York Academy of Sciences conference in 1978. The four authors of the *Science* paper with backgrounds in biological science were invited, but none of the authors of the controversial report came. From a safe distance, Mossman told the *New York Times* that none of the matters presented and discussed at the conference had been peer-reviewed and published.⁸⁸

The *Science* article's coverage in *Time* magazine initially persuaded one mesothelioma victim's wife that her husband's death must not have been caused by living in a building with asbestos. The widow of Rev. James Schell ultimately sued National Gypsum and U.S. Gypsum, but only after the statute of limitations would normally have run. The plaintiff argued that her case should not be time-barred because of the massive "misinformation" campaign conducted by the Safe Buildings Alliance (and other groups representing past and present asbestos product manufacturers) in the years 1986-1990. Very soon after the plaintiff's brief was filed with the court, the defendants settled the case, precluding a ruling on the question.⁸⁹

In 1994, Corn and co-workers published a 5-building survey purporting to show that "careful" maintenance workers had exposures to asbestos well below the daily average limit set by OSHA (0.1 f/cc). In this unusual paper, all the records on worker exposure were provided to the authors by W.R. Grace's Senior Litigation Counsel. The data published were subse-

quently criticized as incomplete and not representative of maintenance work without special protective measures (See "W.R. Grace & Company," in Chapter 9).

The latest attempt to improve the image of asbestos is the preparation of a report at the International Program on Chemical Safety (IPCS), a group sponsored by the World Health Organization, United Nations Environment Program, and the International Labor Office. The controversy began late in 1993 and continues to the present.

IPCS says several participating institutions were approached for authors for a report on chrysotile asbestos. According to a top official in the U.S. Department of Health and Human Services, "Authors are requested to volunteer their time without reimbursement, and IPCS received no positive responses. IPCS then approached several scientists known for their publications on asbestos."⁹⁰ The panel assembled engendered widespread outrage. One person appointed to the IPCS expert panel was the director of the Asbestos Information Association of North America, Robert Pigg, whose professional association with science has always been opportunistic, from the standpoint of the companies that were members of his trade association.

The U.S. National Institute for Occupational Safety and Health (NIOSH) denounced IPCS for "basing its evaluation of chemicals on work prepared by scientists with close ties to industries involved in the manufacture and sale of the substances under evaluation." NIOSH Acting Director Richard Lemen cited the example of industry influence in an IPCS report on methylene chloride.⁹¹ IPCS had also been criticized for relying on draft reports prepared by manufacturers of chlorofluorocarbon refrigerants and the fungicide benomyl.⁹² The chrysotile panel was the last straw for Lemen, who announced that NIOSH would cease participation in all work with IPCS. This was followed by strong words from the Collegium Ramazzini, which refused to be involved in the review process on the IPCS report, and urged IPCS to defer this report "prepared by scientists with close ties to the asbestos industry."⁹³

Dr. Philip Landrigan at the Mount Sinai School of Medicine in New York wrote to the U.S. Department of State in support of this action by NIOSH. He predicted that the IPCS chrysotile

panel would produce a propaganda document, and that disinformation emanating from it could spur sales of asbestos to Third World countries and threaten World Bank policies against financing the manufacture and use of asbestos-containing products. "The ultimate results will be horrendous, particularly in countries with limited health infrastructure," wrote Dr. Landrigan. He also was concerned that IPCS would undercut the whole process of international environmental protection through its influence on the General Agreement on Tariffs and Trade.⁹⁴

Unions in the U.S. and other countries are continuing to take action to counter the IPCS effort to produce this report on chrysotile. The U.S. Department of State has convened a meeting of U.S. government agencies participating in IPCS and sent recommendations to IPCS detailing procedures that would raise the level of "scientific objectivity" in the production of IPCS reports.⁹⁰ The IPCS report on chrysotile had not yet come out as of early 1996.

Criminal Sanctions and Personal Responsibility

Asbestos manufacturers have not been alone in facing substantial costs in damage suits. The fear of liability outweighs even regulation (to protect consumers, workers, and communities) in restraining some business practices today. But are regulation and *corporate* civil liability for damages sufficient to adequately protect the public? A strong case can be made that they are not.

This book shows that *widespread* abuse of the health of the public occurred over decades in the asbestos industry. That industry was composed of major industrial corporations, whose dominant members "knowingly and recklessly" endangered the health of their workers, their customers, and whole communities in the pursuit of profits. The fact of such business practices being so pervasive, often involving "conspiracy" in addition to misconduct within individual enterprises, stands as an indictment of our social order. This documented *breadth* of misconduct throughout an industry, unlike the comparatively scattered reports of similar acts by companies in other industries, points to a consistent legal, ethical, and corporate failure, not an aberrant one.

Ives has completed a doctoral dissertation based on interviews with the 17 largest chemical and petroleum companies in the U.S. and Great Britain. She found a high degree of consistency in the way the U.S. companies responded to regulation and other external pressures relating to occupational and environmental health. "My American consensus model of corporate response includes resistance, defiance, and loyalty to the Company and industrial colleagues," she concluded, going on to catalog the corporate mechanisms used to resist and defy external threats from environmental and societal constituencies.⁹⁵

The truth of the cliché, "crime does not pay," is based on the real threat of severe punishment for acts that society aggressively prosecutes as crimes. The utter lack of criminal prosecution for the patently criminal conduct of some asbestos industry executives—and their counterparts in other industries—is society's unspoken invitation for continued abuses. The competitive pressure of the marketplace, the limited-term business outlook, and the short-term personal financial incentive schedules of corporate executives have left society with long-term health problems. The continuing record of abuses of power and knowledge points to the inadequacy of existing social deterrents. Moderate increases in government regulation or the cost of product liability insurance coverage (dictated by current trends in civil litigation) can hardly be expected to bring about major changes in corporate conduct.

Through litigation brought by injured persons in civil suits or by government regulatory authorities, actions highly detrimental to public health by business executives have been exposed in a wide range of industries. Wholesale endangerment of the public through the knowing sale of defective products (Ford Pinto cars; Firestone Radial 500 tires; unsafe and ineffective drugs including thalidomide; herbicides contaminated with deadly dioxin compounds; Dalkon Shield intrauterine devices, etc.), illegal environmental dumping of hazardous wastes, and falsified reporting to government agencies are the main types of such conduct to actually receive occasional criminal prosecution. "White collar crimes" by business managers are not deterred, in part because they are usually not addressed as crimes at all.

When these acts *are* treated as crimes, the penalties suggest they are in a class with misdemeanors rather than felonies.⁹⁶ The following examples where charges *were* brought are illustrative.

In the trial of Ford Motor Company in 1980 on homicide charges (involving Ford Pinto car occupants' burn injuries from an exploding fuel tank), the maximum fine possible was \$30,000. Defense attorneys easily sidestepped the prosecution of any *person* in the company through the force of superior resources. The prosecutor in Winamac, Indiana, had to undertake the case within his annual budget of \$20,000, while Ford spent millions on litigation and public relations. The Ford Motor Company was acquitted, following the judge's ruling that key incriminating documents were inadmissible as evidence in the case. The documents showed a corporate decision to not remedy a design defect because the anticipated personal injury and death claims were projected to carry a lower cost than correcting the defect in thousands of cars.

The former president of a bankrupt chemical waste disposal firm was given a sentence of 1 to 7 years for bribery and dumping of wastes in a city creek. The firm had gone into bankruptcy after being confronted with large fines over the illegal dumping of wastes. The generators of the wastes (including Standard Chlorine, Texaco, Sullivan Asbestos, and SmithKline) were *not* subjected to any criminal or bankruptcy proceedings.⁹⁷

In the rare case of a major corporation officer sentenced to jail on charges of conspiracy and violations of the Clean Water Act, the time served in prison was 90 days. *Chemical and Engineering News* was kind enough to withhold the Corning Fibers executive's name.⁹⁸

Industrial Bio-Test Laboratories professionals were convicted of falsifying toxicological laboratory test results (relating to carcinogenesis of widely used pesticides) in reports to the government. They were accordingly sentenced to 6-12 months in jail in 1984. The case against the company president meanwhile ended in a mistrial.⁹⁹

In 1985, Illinois prosecutors obtained murder convictions of the owners of a small business in a highly publicized case. At

Film Recovery Systems' plant, a Polish immigrant employee had died after repeated cyanide exposures in silver reclaiming operations. Appeals courts, however, found that the convictions for both murder and involuntary manslaughter were technically inconsistent, since the underlying evidence of these intentional and unintentional crimes was the same. The case was remanded for retrial, and the Illinois Supreme Court declined to review the matter in 1990.

When W.R. Grace & Co. pleaded guilty to felony counts for lying to the Environmental Protection Agency in the Woburn, Massachusetts, case (involving childhood leukemias suspected of resulting from contamination of drinking water by waste solvent dumping), no individual was prosecuted; the corporation paid a \$10,000 fine.¹⁰⁰

Starting in the mid-1980s, some state and local prosecutors (e.g., in Michigan and California) began to bring criminal charges in cases where workers had died on the job. Special teams of criminal investigators were trained to investigate every incident of death on the job within their jurisdictions. Even so, these are very limited efforts, and for the most part even they do not extend to cases of serious injury, only deaths. Furthermore, almost all such investigations involve industrial safety lapses, not equally blatant cases of health damage to workers occurring over a longer period of time.

In most such events, of course, no criminal indictments are even brought. There have been no criminal charges filed over the conduct of anyone in the asbestos mining and manufacturing industry, though Justice Department attorneys have mused about specific actions of one firm's executives seeming rather like obstruction of justice. More extraordinary is that the commission of certain acts is not considered criminal, but an effort to conceal the facts about them in a civil suit might theoretically warrant the criminal charge, "obstruction of justice."

After all, the concealment of life-threatening hazards in the pursuit of financial gains was not an isolated phenomenon in the asbestos mining and manufacturing industry. The corporate response to the hazard was, in all too many cases, knowing and reckless concealment of vital information and disregard for the

health of the public. The review of corporate knowledge in this writing is a veritable encyclopedia of menacing business practices in the area of occupational health. In unusually strong language, New Jersey Superior Court Judge Sylvia Pressler wrote of the industry leader and a co-defendant mining company, "(the defendants) made a conscious, cold-blooded business decision in utter flagrant disregard of the rights of others, to take no protective or remedial action."¹⁰¹

In view of this record, it is interesting to consider who *did* go to jail over asbestos. In 1994, it was disclosed that there had been false reports filed to the effect that New York City's 1110 schools were free of asbestos hazards. The start of classes was delayed for nearly one million school children. The former head of the asbestos task force of the city Board of Education was accordingly sentenced to 30 months in prison.

Today's asbestos catastrophe clearly was not caused by an isolated case of a corrupt or incompetent medical director or a callous company president. It was caused primarily by the rules of a society that allows a privileged stratum to largely escape personal responsibility for acts harmful to others. The members of this privileged class decide what will be manufactured, where and how it will be made and sold. The asbestos epidemic, whose toll of preventable deaths in the U.S. alone will at least be in the hundreds of thousands, offers opportunity to see how the criminal law or lack of it relates to public health. All that is lacking is the public awareness, pressure, and political will to deal as firmly with corporate crimes as with comparably serious, generally recognized criminal offenses.

Largely inspired by revelations about the asbestos industry, Congressman George Miller proposed in 1979 to change the U.S. Criminal Code. Miller urged that until business managers were held personally accountable for their actions, civil law alone could not adequately deter financially motivated business practices from endangering the lives of unsuspecting citizens.¹⁰² This idea of establishing in federal law provisions to punish "corporate criminal liability" with imprisonment was fiercely and successfully opposed by business interests.

Congressman Miller's bill was supported by Rev. Michael Crosby, representing 23 Midwest Roman Catholic groups. The

executive director of the Interfaith Center on Corporate Responsibility testified that,¹⁰³

Pastors frequently hear parishoners confide that they feel morally compromised in corporations which frequently search for maximum profits despite the costs for society.

Journalist and author Morton Mintz argues that the threats of both the social stigma of a criminal trial and imprisonment itself would go a long way toward correcting the present situation. Mintz, who has been writing about corporate crime for over 30 years, deferred to Edward Ross as having described the problem long ago.¹⁰⁴ In the 1907 book, *Sin and Society*, Ross wrote:

The grading of sinners according to badness of character goes on the assumption that the wickedest man is the most dangerous. This would be true if men were abreast in their opportunities to do harm ... But the fact is that the patent ruffian is confined to the Social basement ... He can assault or molest, to be sure, but he cannot betray. Nobody depends on him so he cannot commit breach of trust, that arch sin of our time. He does not hold in his hand the safety or welfare of the public. He is the clinker, not the live coal; vermin, not beast of prey. Today the villain most in need of curbing is the respectable, exemplary, trusted personage who, strategically placed at the focus of a spider-web of fiduciary relations, is able from his office chair to pick a thousand pockets, poison a thousand sick, pollute a thousand minds, or imperil a thousand lives.

As Economist Richard Beilock explained, "no finite system of monetary fines, as would be levied in civil offenses, would provide the same level of deterrent" as the real threat of imprisonment. He noted in 1979 that insurance and bankruptcy courts offer no way to avoid criminal prosecution and imprisonment, in contrast to their ability to insulate against civil penalties:¹⁰⁵

For all of us time is unidirectional and death is a certainty. Chunks of our lives are priceless in that there exists no market at which we can purchase a replacement. This then

is the infinite cost that it is proper to impose upon executives for the crime of imposing infinite costs on others.

On October 1, 1984, Congressman John Conyers, Jr. introduced a bill (H.R. 6350) similar to that offered by Congressman Miller five years before. Mr. Conyers would erect criminal penalties under federal law for knowing failure of business managers to promptly inform appropriate federal agencies and affected employees about serious, non-obvious dangers associated with products and business practices. Penalties would include imprisonment for up to 10 years and a fine of up to \$250,000 for violators (such fine not payable directly or indirectly by the business entity). In introducing this bill, Conyers said:

This bill ... is an attempt to codify respect and responsibility for human life at every level of business management, and to remove the glaring legal disparities between crime in the suites and crime in the streets. It offers business the timely opportunity to explicitly reassert its highest ethical standards and, by policing itself, to preclude or limit the need for further regulatory action.¹⁰⁶

Both the idea of imprisonment and that of personally fining the responsible business executives (with the attendant publicity such proceedings would receive) go to the heart of the problem of placing personal responsibility on the decision-makers. If such legislation were enacted and enforced, there is every reason to expect that significant public health benefits would result.

Traditional Public Health Measures

Current use of and exposure to asbestos can be better controlled through a number of traditional methods. At the head of the list would be tighter workplace and environmental standards, vigorously enforced. Protection under workplace regulations can be extended to maintenance workers and brake repair workers. Contractors who do asbestos removal can be required to use proper equipment and work practices, in addition to obtaining personnel training. (This has been mandated by law throughout the United States.) In view of the dust exposures from uncon-

trolled brake and clutch repair, and continuing concern over the hazards of asbestos substitutes, brake servicing should also be licensed by health authorities. Proven, fully enclosed equipment is now available, and its use should be required.

Governments at the local, state, or federal level can take the lead by providing training and protection to state employees who do maintenance work and vehicle brake repairs. (This is done in Maryland and New Jersey.) Product bans can also eliminate widespread exposure. In Maryland, the legislature banned the sale of asbestos-containing industrial clothing in 1984. At the federal level, grants can be offered to promote the development of safe substitutes for asbestos products, sealants for deteriorating asbestos surfaces, etc. The government can also offer tax advantages to firms developing products and implementing programs that will reduce the consumption of asbestos in favor of safer materials. Workers laid off in the asbestos industry can be offered special assistance, retraining, and funds for relocation.

Public health agencies can meanwhile try to educate the public and especially those most at risk about the hazards and means to control them. Epidemiological data suggest that people with histories of occupational asbestos exposure can markedly decrease their risk of lung cancer, if they smoke, by overcoming their addiction to smoking.⁷¹ This is certainly a matter to stress, considering the proportion of asbestos-related cancers whose risk is enhanced by cigarette smoking. Much more could also be done to hopefully improve the outlook for mesothelioma victims through increased commitment of research funds.

Victims' Groups

One reaction to the severity of the asbestos problem and the inadequacy of traditional social structures has been the formation of asbestos victims' groups. These nonprofit groups respond to public inquiries, provide counseling, promote legislation for disease prevention and compensation, and bring pressure on public officials through both administrative channels and the media. These victims' groups are weakly financed charitable

organizations, which receive voluntary technical assistance by professionals in science, medicine, and law.

Association to Improve Benefits for
Retired Disabled Workers
and Their Dependents
27 N. Eleventh Avenue
Manville, New Jersey 08835 USA
(201) 722-1829

White Lung Association
P.O. Box 1483
Baltimore, Maryland 21203 USA
(410) 243-5864

Asbestos Victims of America
P.O. Box 66594
Scotts Valley, California 95067 USA
(408) 438-5864

White Lung Asbestos Information Center
80 Eighth Avenue (Rm. 303)
New York, NY 10011 USA
(212) 886-9859

Occupational and Environmental Diseases Association
(formerly Society for the Prevention of Asbestosis and Industrial
Diseases)
38 Drapers Road
Enfield, Middlesex EN2 8LU
UNITED KINGDOM
181-360-6413

Hull Asbestos Action Group
169 Cranbrook Avenue
Hull HU6 7TT
UNITED KINGDOM

Sheffield and Rotherham Asbestos Group
Mudford Buildings
37 Exchange Street
Sheffield S2 5TR
UNITED KINGDOM

Clydeside Action on Asbestos
245 High Street
Glasgow G40 QR
UNITED KINGDOM

Associazione degli Eposti all'Amianto
c/o Medicina Democratica
Via Del Carracci 2
20149 Milano
ITALY

Asbestosgroup
Steenkuhlenweg 3
28779 Bremen
GERMANY

Asbestos Diseases Society
483 Charles Street
North Perth 6006
AUSTRALIA
09-444-6665

Associação Brasileira dos Expostos ao Amianto
Rua Valdir Soares Lopes 23
Jardim Quirino 06172-220
Osasco, BRAZIL

Japan Occupational Safety and Health Resource Center
M.K. Bldg. 3F 3-1-3 Mita
Minato-ku
Tokyo 108
JAPAN

Photographer Bill Ravanese, whose father died from mesothelioma, has created an art exhibit featuring asbestos victims. Called "Breath Taken: The Landscape and Biography of Asbestos," it opened at Boston University Art Galley in March of 1990.



Dr. Irving Selikoff, center, listening to Paul Safchuck, left, President of the White Lung Association, 1990. Author (BC) at right. (*Courtesy of the White Lung Association.*)

WORLDWIDE PROLIFERATION OF ASBESTOS DISEASE

World asbestos consumption plateaued at 4 to 5 million metric tons per year in 1973-1990. During that time, lost markets in industrial nations were offset by expansion in the poorer countries. Worldwide use of asbestos then began a steep decline in the 1990s, to 2.4 million m.t. in 1994 (See Figure 3).

The degree of both regulation and liability attendant upon the use of asbestos varies enormously from country to country. Similarly, the level of public concern about the threat of asbestos ranges from total ignorance in some countries to widespread fear in others. These conditions not only invite but assure that there will be a wide range of health protection in practice around the world.

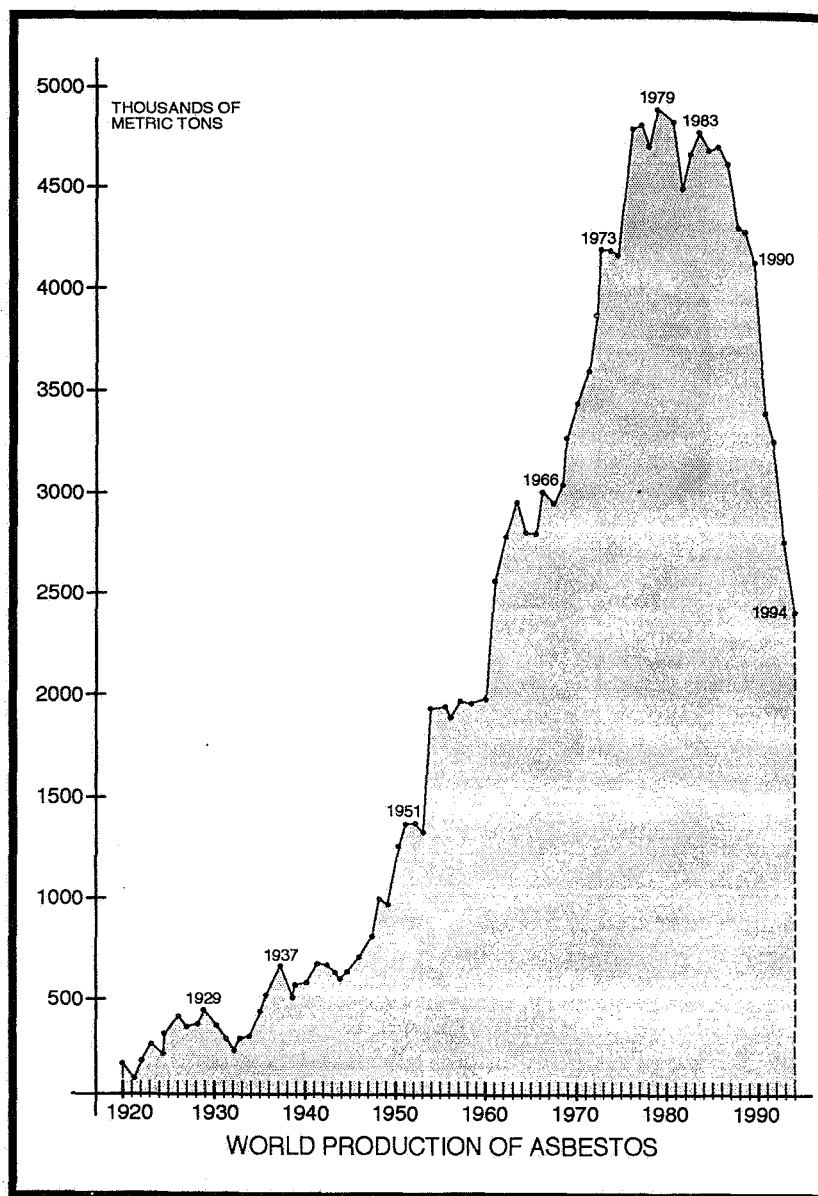


Figure 3. World Asbestos Production

From the time of the first asbestos regulations in England over 60 years ago, it was recognized that non-uniform standards internationally led to undesired economic consequences.¹⁰⁸ For, as dust controls and other health-related costs became more significant in some countries, manufacturers elsewhere could derive a competitive advantage by avoiding similar expenditures. It soon turned out that the "foreign competition" wasn't always owned by foreigners or competitors. In 1949, for example, one English firm (Cape Asbestos) found it unnecessary to take even minimal measures to protect the health of Black children it employed in its own mill in South Africa.¹⁰⁹

And so it emerged that the threat of international "double standards" within the same enterprises grew with the dominant role played by multinationals such as Johns-Manville, Turner & Newall, Cape, and the Eternit companies (headquartered in Belgium and Switzerland). At an international gathering of asbestos industry "information bodies" in London in 1971, Turner & Newall Chairman Ralph Bateman expressed the "long range view" that "future growth in the sale of Asbestos Fiber and asbestos products, particularly things such as asbestos cement building materials and pipe, may have to be concentrated in the lesser developed countries."¹¹⁰

When asked in 1975 about their policies regarding asbestos and industrial hygiene, Cape Asbestos and Turner & Newall both claimed that they followed uniformly high standards everywhere in the world.¹¹¹ T&N Medical Officer Hilton Lewinsohn meanwhile reported to upper management about atrocious practices at T&N operations in India, urging improvements and quoting Dr. Trevor A. Lloyd Davies, Senior Medical Inspector of Factories:¹¹²

A workman's capital is his health—without it he is bankrupt.

Johns-Manville made similar assertions, and in addition issued a policy statement that J-M asbestos fiber would not even be sold to customers who were unwilling to observe appropriate safeguards.¹¹³ These statements have been subjected to scrutiny on occasion, however, and the level of control in practice in developing countries was consistently poor.^{9,12,113-120}

Double standards in health protection were both created and exploited by multinational corporations engaged in asbestos mining and manufacturing. The issue of warnings is illustrative. No one would question the right of a worker handling asbestos to be informed of the lethal potential of the material. Instruction in the use and maintenance of available engineering controls and respiratory protection, as well as direction in work practices to minimize dust, should be universally provided to asbestos workers. The most basic, minimal means of notifying people that a product is dangerous is through the use of a warning label.

After Johns-Manville began to place mild warning labels on sacks of asbestos shipped from its Canadian mines in 1969, Turner & Newall's Board of Directors sought advice from outside counsel on the firm's "obligations" under the British law.¹²¹

(The lawyers advised) that the use of caution labels would have no effect on the company's liability to employees and so little on their liability to third parties that, in view of the obvious commercial disadvantages, they advised against it.

The Board agreed.¹²¹ It was not until 1974 that T&N finally agreed to let its Bell Asbestos Mines follow all the other members of the Quebec Asbestos Mining Association and affix the first generation of warning labels on sacks of asbestos. Labeling of bags for only North America was considered but rejected as less easy and economic for the mine management.¹²² Advance warning to management of when labeled bags would be sent to T&N's overseas Ferodo subsidiaries was considered "very important."¹²³ T&N still balked at placing warnings on its sacks of asbestos mined in Swaziland. Only after learning that Cape Asbestos was about to place mild health warnings on bags of African fiber did T&N decide to follow suit.¹²⁴ Three years later, T&N's Nigerian managers were still resisting the use of written warnings to customers for asbestos products, fearing an "over-reaction."¹²⁵ Corporate headquarters agreed on not warning product users until the company's competitors also applied warning labels.¹²⁶

By 1980, T&N had decided to follow other firms in Canada (Lake and Carey), and begin using warning labels using the word "cancer" on sacks of asbestos fiber. Within several days, they received a letter from Eternit's medical director sincerely congratulating them on their honesty and another one from the Belgian firm's chief executive, Etienne van der Rest, demanding an explanation of why they were risking the requirement for similarly strong warning labels in Europe.^{127, 128} T&N director Harry Hardie replied to van der Rest that the more "specific" label would be helpful in defending future claims for damages in the courts. He closed,¹²⁹

Those significantly involved with US litigation on asbestos are likely to be more sensitive on this issue than asbestos-cement manufacturers in the EEC!

Even sacks of asbestos fiber from T&N's African mines were labeled with a cancer warning in 1980, because of potential liability problems over shipments to the United States.¹³⁰ But customers in Asia, for example, could still obtain sacks with milder labels from some mining companies.

In Australia, a government advisory committee recommended in 1981 that asbestos products be required to bear labels warning that breathing asbestos dust could cause cancer. Representatives of James Hardie & Co. and the South Pacific Asbestos Association (SPAA) pressed their opposition.¹³¹ An industry spokesman explained to the *Sydney Morning Herald* that the asbestos industry had been singled out, and other more threatening carcinogens should go first.¹³¹ Unions failed to understand how Australia's failure to require cancer warnings on cigarettes had anything to do with the need for such warnings on asbestos products. SPAA chief Max Austin reported that the unions "dug in their toes and threatened national blackbans if there were to be any change in the wording of the recommendation." The committee held its ground, Austin reported to the Director-General of the Asbestos International Association, the global alliance of asbestos industry trade associations, Sir Neville ("Jimmy") Stack.¹³²

Our Australian members have been advised that although the N.H. & M.R.C. is purely an advisory body, it would be a brave businessman who ignored the possible future legal implications.

In March of 1982, Australia became the first country in the world to require sellers of asbestos products to affix cancer warning labels.¹³³

In an unusual move, Turner & Newall's Board of Directors decided in September of 1983 to use the Australian label language on asbestos products worldwide. The misleading phrase, "Take Care With Asbestos," was to be dropped.¹³⁴ This would have ended nearly a decade of using different labels on asbestos products around the world. In India, other asbestos companies were not expected to follow the lead of T&N's reluctant subsidiary.¹³⁵ The word went out, nonetheless, to T&N companies to make the change within seven months. The Board's unprecedented decision followed a month of bad press for the industry in South Africa, an experience which had "shaken the managements" of companies including T&N's subsidiary, Turnall.¹³⁶

Weeks later, the European Economic Community agreed to accept asbestos product labeling stating only that "Asbestos dust is dangerous to health."¹³⁷ T&N came under immediate pressure from the rest of the industry. In a plea to T&N Director Harry Hardie, the Chairman of the Asbestos Information Centre, Malcolm Wright (of Cape Industries, formerly Cape Asbestos, a company that had fled the U.S.), demanded that T&N reconsider its position—which he said was "tantamount to a challenge to all the industry" members who had fought for the EEC wording.¹³⁸ Hardie replied that T&N's decision on labeling had indeed been a very difficult one.¹³⁹

Unlike most UK companies in the industry, we are exposed to litigation in the United States. Like every multi-national we are likely to be attacked on dual standards. Like every company in the industry we are fighting for survival.

Hardie agreed to bring the matter up again with "my colleagues," the other members of T&N's Board of Directors. Then,

less than two months after deciding to label T&N products as being equally capable of causing cancer everywhere, the Board reversed itself, in effect telling the *cognoscenti* that T&N's fight for survival wasn't starting at such a late date to become a fair fight. The Board decided to use the EEC label language wherever nothing else was required.¹⁴⁰

Swedish trade unionist Rolf Ählberg calls the asbestos industry the "Asbestos Mafia." Where *do* traditional business activities of preserving and expanding markets cross over into unethical, immoral, and illegal activities? A central consideration in any case would be the failure of business interests to fully inform and protect workers and consumers against insidious mortal hazards; and in some cases, deception by business interests would be another factor. Consider tobacco and asbestos.

Though the use of warning labels on sacks of asbestos had become accepted practice in Canada between 1969 and 1974, and some companies later included the word "cancer" in such labels, sales resistance was encountered elsewhere. An international sales representative of Carey Canada conveyed this in a memorandum to Michael Prus, the company president. He also described the manner in which Canadian asbestos companies discretely avoided both warnings and liability in Japan in 1977:¹⁴¹

I got very strong reactions in Japan to our requirement to translate the Tampa Text Label into Japanese and print it on all the bags.

Confidentially the Kakiuchi staff told me that they have deliberately left out the word cancer from the text because this must not even be mentioned in Japan in connection with asbestos. Altogether they are against a warning label because they do not wish to raise problems with the workers. They are already attaching a label on each bag according to Japanese law.

Kakiuchi would prefer to sign a certificate holding us blameless from harm and would in turn get a signature from all customers on a similar disclaimer to hold themselves free

of lawsuits. Asbestos Corporation and Bell have both gone this route as per attached blank forms.

Kakiuchi are of the opinion that we cannot impose American law on foreign countries in general and on Japan in particular. Listening to customers around the world I second this sentiment. I do not believe that we should raise problems with people who are more primitive than we are or less educated. We cannot, in all cases, impose American standards on other people.

The salesman asked for guidance from "the lawyers in Tampa," referring to the Florida headquarters of Carey Canada's parent firm, Jim Walter Corporation, one of the 200 largest industrial corporations in the United States. The response was conveyed two months later by a vice president of Carey Canada:¹⁴²

Charles Wilson, V. Pres. Legal Dept. Tampa, says as far as the caution label is concerned that we must be sure to cover ourselves only where the law of the land requires. I suggest we go ahead with the new caution label in English and French only. What do you think the Japanese, Finns, Swedes, and Dutch will have to say about that?

The two Canadian mining firms named in the first Carey memorandum, like Carey Canada, were either controlled or wholly owned by multinationals in the U.S. and Britain in 1977 (Asbestos Corp. by General Dynamics, Bell by Turner & Newall). Together with Johns-Manville, they accounted for virtually all asbestos exports from the world's leading asbestos-exporting country.

The international asbestos industry's collective view of its responsibility to label its products as potentially lethal was indicated in a 1978 internal memorandum of the Asbestos International Association (AIA). The "Executive Committee" consensus was to use as little by way of warning labels as the various markets would permit:¹⁴³

Most participants were in favour of an action in various stages; the switching over from one stage to a further less favourable one, depending on outside pressures.

The British asbestos industry's approach to the labeling problem was apparently regarded as a model to eventually follow. In that country so famous for understatement, the government had acquiesced to the use of a label starting with the ambiguous phrase, "Take care with asbestos."

Many of the participants were of the opinion that it was advisable to adopt the U.K label as such *if the use of a label was unavoidable*. Rediscussing the wording could bring along the risk of having to include the word cancer in it. (emphasis added)

The view that the best warning label was none at all appears to have had no opposition at this meeting:

In those countries where it was felt still too early to start voluntary labeling, in fear of a negative influence on sales, steps should be taken to prepare commercial people for the idea, making clear that in the absence of an industry's initiative we could run the risk of being imposed the 'skull and crossbones' symbol for our products. It should also be pointed out to them that the fact to agree on a kind of label did not imply the agreement of starting to use it right now.

One can easily understand the apprehensions of the AIA Executive Committee regarding the inverse relationship between warnings and sales. The U.K. label stands in mute contrast to posters used by Puerto Rican teachers protesting the hazards of working in asbestos-cement schools in 1979 (See Figures 4 and 5). Turner & Newall Director of Personnel and External Relations, Harry Hardie, confidentially observed in 1981 that the British warning label, which was introduced in Britain in 1976 and was later adopted by the Asbestos International Association, had had no adverse effect on sales in Western Europe and Australasia.¹⁴⁴

When Thailand wanted to label bags of imported asbestos with the skull and crossbones in 1984, the Canadian government persuaded the Thais to drop the idea as an "excessive" warning.¹⁴⁵ The position paper developed by the Asbestos Institute, arguing against the skull-and-crossbones warning

symbol requirement, was passed on to the worldwide asbestos industry via the Asbestos International Association.¹⁴⁶ Thailand's use of asbestos is rapidly growing.

After insulation containing asbestos was banned in some countries as unnecessary and inhumane, it was hoped that the manufacture of such products elsewhere would rapidly decline. In the United States, the Johns-Manville Corporation discontinued the manufacture of Thermobestos at the end of 1973, and the use of asbestos in thermal insulation block and pipecovering was banned in the U.S. by the Environmental Protection Agency in 1975. Yet in 1976 Johns-Manville not only made Thermobestos in Brazil but was only starting to consider applying warning labels to the product. The manufacture of Thermobestos in Brazil apparently continued into the 1980s. Product brochures described Thermobestos and other Johns-Manville insulations as reinforced with asbestos fibers, but no warnings about the health risks were given. By 1983, these insulations had been reformulated, and older stocks of asbestos-containing material had apparently all been sold.^{147,148}

Some asbestos-containing insulation was shipped out of the continental United States after it was banned by the EPA. Insulation labeled asbestos-free by Keene, on hand in 1982 at an Amerada Hess oil refinery on St. Croix, was found to contain 20-25 percent amosite (See "Keene Corporation" in Chapter 9). Related documentation was kept "under seal" in litigation. The practice of courts sometimes "sealing" evidence in civil cases where public hazards are at issue is coming under increasing restriction and criticism in Texas, Florida, New York, and other states.

Other aspects of international "double standards" in public protection from asbestos abound.^{9,12,113-120,141-143,145,147-149} Flagrant occupational and environmental health abuses have been documented at a Johns-Manville affiliate in Ahmedabad, India, manufacturing asbestos-cement, and a Turner & Newall subsidiary in Bombay making asbestos textiles and friction products.^{9,12,114,115,149} New and expanded asbestos-cement plants were meanwhile under construction or operating in Tunisia, Kuwait, the Sudan, the Philippines, Nigeria, Malaysia, Thailand, India, Sri Lanka, and many other countries.

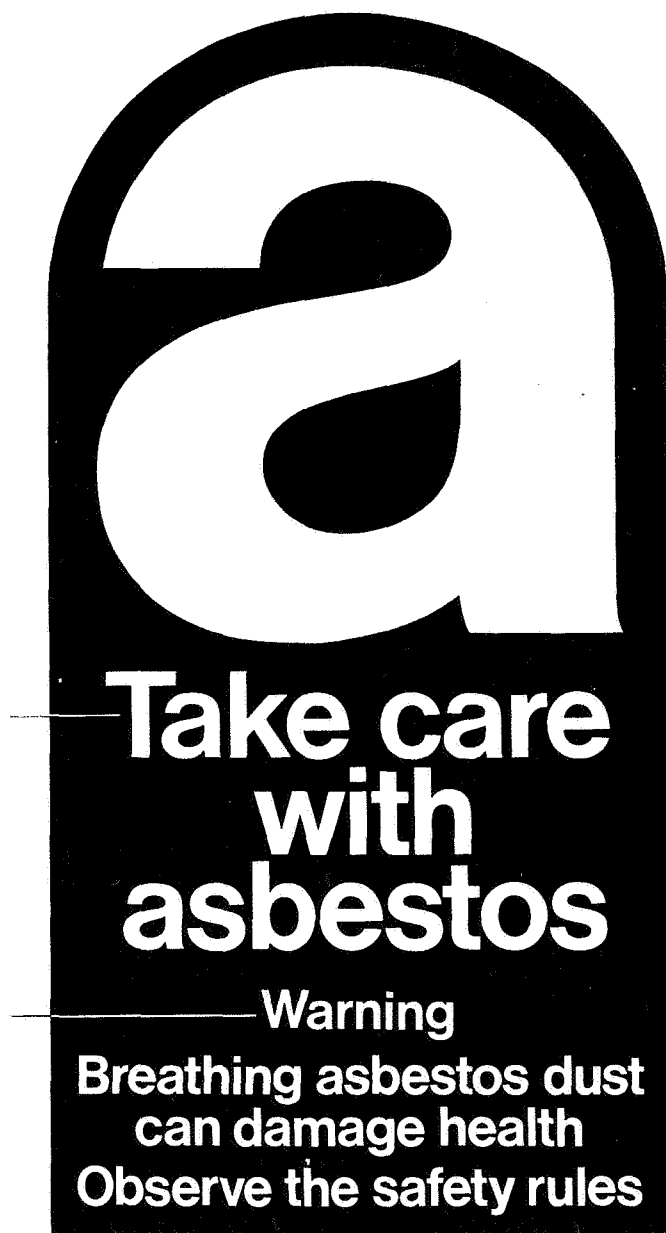


Figure 4. U.K. label for asbestos products.



Figure 5. Puerto Rican protest poster hung in asbestos-cement school buildings.

The Yorkshire Television program "Alice: A Fight for Life," went on to receive international acclaim after its 1982 broadcast in Britain. The program had caused a plunge in the value of Turner & Newall stock in addition to raising public pressure that forced the U.K. government to lower the occupational exposure limits for asbestos. In April of 1983, the program won the international Prix Futura Award in Berlin for the best television documentary.¹⁵⁰ T&N officials reporting to Chairman of the Board Francis Tombs then moved to block the airing of the program in other countries, including Swaziland, where T&N owned a 60 percent interest in the Havelock asbestos mine and mill. Havelock had been the subject of a 1982 news report in Britain because of dust counts above 50 f/cc in 1976.^{151,152} The T&N official dispatched to do damage control reported to Harry Hardie:¹⁵³

You will be pleased to know that during my visit to Swaziland last week I was able to prevail on Mr. Bill Mummary, who heads up the Swazi TV Company, not to show the Alice film.

Thus, for the second time in four years, the company prevented its Swazi pensioners with asbestosis from being informed about the lethal effects of the dust ("since it was felt that it would only cause unnecessary anxiety").¹⁵⁴

As criticism of T&N's Bombay subsidiary was published in Britain's *New Scientist* in 1981, a worldwide survey of conditions in the group's farflung subsidiaries was completed by executive Harry Hardie. Eleven operations were listed where airborne asbestos levels exceeded the 2 f/cc limit established in Britain in 1969. The Hindustan Ferodo plant in Bombay and mills at T&N's African mines were considered incapable of being brought down to 1 f/cc (without reconstructing whole plants).¹⁵⁵ In 1987, several years after the British occupational exposure limit had come down to 0.5 f/cc, T&N consultant Dr. Peter Elmes reported on conditions in Zimbabwe.¹⁵⁶

It is going to be a long time before the mine mills are acceptable workplaces judged by international standards.

A 1993 British Broadcasting Company program was critical of T&N's record of managing health hazards in the developing countries:¹⁵⁷

The documents we obtained from the Turner & Newall archive make it clear that certainly until the late eighties and notwithstanding its earlier pledges, the company's subsidiaries failed to protect workers in India and Africa in the same way the law compelled them to do in the U.K. It's clear, too, that the company knew what was going on in the foreign factories and that workers were being exposed to unacceptable levels of dust.

The Supreme Court of India had been petitioned to take action to force the government to regulate the asbestos industry and industry generally, and extend constitutional protection based on the right to live with dignity. The case was still undecided at the time of the BBC investigation, which commented on machine-gun toting guards at the plant and some of the lies included in papers that T&N's subsidiary had submitted to the Supreme Court in 1986.

Hindustan Ferodo submitted an affidavit containing a series of highly misleading claims, namely that there had never been a case of asbestosis arising from the factory in Bombay, that there had never been an asbestosis case arising from asbestos brake lining manufacture worldwide, and that there'd been no deaths relatable to asbestosis at the group's Rochdale factory, on which the Bombay technology was based, since 1950. All three statements were untrue. There had been deaths at Rochdale, there had been asbestosis cases at T&N's own brake lining plants in the UK, and there had been asbestosis at Hindustan Ferodo.

T&N refused to submit to an interview with the BBC, and then filed a complaint with the government after the radio programs aired. This was evidently done to intimidate the media, as the company showed no desire to bring the matter to resolution through February of 1996.

The Supreme Court of India decided the case in 1995, ruling that every management had the duty to take care of workers' health. The National Institute of Occupational Health was directed to examine employees in asbestos and certify the cases of disability. Within three months after certification, all companies in the asbestos trade were ordered to pay compensation to present and former employees with asbestosis. The court ordered retention of records of workers' health for 40 years after hire or 15 years after retirement. Governments were ordered to reduce permitted levels of exposure from 2 f/cc to 1f/cc for chrysotile asbestos (0.2 f/cc for crocidolite). The *Times of India* concluded its report on the judgment,¹⁵⁸

Realizing that workers have a special place in a socialist society, the judges said they are not a marketable commodity to 'be purchased by the owners of capital.' In fact, they are producers of wealth as much as capital and much more.

The worldwide network of asbestos mining, manufacturing and distribution has been dominated by enterprises that are international in scale. By 1972, Johns-Manville shipped Canadian asbestos fiber to 58 countries. J-M was also linked to operations in many of these countries through partial ownership, licensing contracts, and marketing agreements.¹⁵⁹ In September, 1983, the bankruptcy judge approved the sale of Manville's Canadian asbestos mining business to individuals including former Manville employees, for \$117 million. Turner & Newall has mined asbestos in Swaziland and Zimbabwe, and has had major holdings in asbestos manufacturing operations in India, South Africa, Zambia, Nigeria, Italy, Australia, Brazil, Spain, South Korea, and other countries. Even the construction of new asbestos plants in the developing countries was dominated by engineering firms based in Europe. *Asbestos* magazine was full of their advertisements until its demise in 1983.

Asbestos has been a major revenue-producing mineral in the economies of Quebec and Zimbabwe. Both of these areas export the bulk of their output. Russia, which leads the world in asbestos production, is second to Canada in exports of the mineral. (The Soviet Union's historic use of its asbestos deposits has not been paralleled by contributions to the scientific

literature regarding adverse health effects.) China also mines and consumes a considerable quantity (about 240,000 metric tons per year) of asbestos.¹⁶⁰ Brazil mines about 175,000 m.t. per year of chrysotile, and that country's asbestos industry is dominated by Saint-Gobain Pont a Mousson of France and Eternit of Belgium. It will take great political will for countries with growing economic dependence on this mineral to restrain its reckless exploitation.

The vulnerability of developing nations as sanctuaries for future asbestos mining and manufacturing is obvious. And even while Quebec's newly nationalized asbestos company (which has now gone broke) claimed to observe strict regulations, the title of its advertisements in *Asbestos* magazine revealed far less emphasis on regulation ("Want to Operate in a Friendly Environment?").¹⁶¹ New and expanded mining ventures of the multinationals were meanwhile coming on-stream in Mexico, Zimbabwe (Turner & Newall), and Colombia (Eternit); and a government-owned mine was opened in Greece.¹⁶² Continuing exploration in the developing nations will yield additional discoveries of ore reserves; and the result may even be the expansion of "free-fire" zones where asbestos mining, manufacturing, and product use persist virtually unrestrained from a health standpoint.

The Current Expansion of Markets for Asbestos

Canada and other asbestos-exporting countries are looking to the developing countries as the market for asbestos in the 1990s. Unfortunately, conditions of current asbestos use in Asia, Africa, Latin America, and Eastern Europe resemble those that existed in industrial nations before workers learned of the time-bomb effects of breathing asbestos dust. This exploitation of ignorance and poverty for a quick buck has the strong backing of the government of Canada, even though Canadian workers would walk off the job under the conditions of asbestos use in the poor countries. What began as a commercial lie through most of this century has thus become an official lie. Canada's Asbestos Institute proclaims, "Implementing safety in the use of asbestos is neither difficult nor expensive."

There is growing international opposition over the export of asbestos and its use in the poor countries. Wood pulp, sisal and other safer substitutes are now used in some countries to make fiber-cement panels and roofing, the most visible market for asbestos in the Third World.

In the technological development of nations, it is widely accepted that each country would do well to choose "appropriate technology" based on its resources, its people and their needs. Public health impacts of some technologies render them undesirable for Third World country development.

For example, no one would urge that developing countries should build plants to make asbestos thermal insulation. Asbestos has been replaced by wood pulp, fibrous glass, and other materials to make insulation products far less deadly than the asbestos insulations used in the past. Thermal insulation reinforced with asbestos is an example of *discredited technology* because of its severe, unavoidable hazards and the availability of safer alternatives. The most recent manufacture of this product I know of was by Johns-Manville in Brazil in 1980; however, it may still be made by producers in Thailand, China, and/or India.

The international asbestos industry has claimed for decades that asbestos can be used safely and that it should be used in Third World development. Corrugated asbestos-cement roofing is used worldwide, and together with other asbestos-cement sheet and pipe products accounts for over 80 percent of asbestos use. Increased use of asbestos in developing countries has offset tremendous market losses in the industrial nations until the last few years. Quarterly publications of the Asbestos Institute in Quebec describe aggressive sales efforts in Asia, Africa, and Latin America.

The International Labor Office has published a "Code of Practice" enumerating very basic safeguards that should be used in work with asbestos.¹⁶³ Some countries have regulations that apply to industries where asbestos hazards exist. The issuance of control instruments as published documents, however, never has and never will assure that the "mandated" controls are in fact applied. The gulf between what is advertised as "controlled use of asbestos" and the reality of manufacturing and construc-

tion work with asbestos is greatest in poor countries whose use of asbestos is on the rise.

The chief of Brazil's environmental protection agency wrote in 1986 that the labor authorities in charge of worker protection did "poor work" and were "very ineffective."¹⁶⁴ As of 1986, this official wrote that, "we don't make any (power tools with exhaust ventilation) in Brazil, and it is difficult to import them."¹⁶⁵ It is unlikely that portable saws with exhaust ventilation and dust capture are being used by any construction workers handling asbestos-cement products in countries like Brazil. When that country's authorities began to inquire about health risks in asbestos manufacturing operations in 1980, the government people depended upon the companies visited to provide and demonstrate the use of standard air monitoring equipment. As of 1986, the official workplace exposure limit for asbestos in Brazil was 4 fibers/cc, twenty times as high as the 0.2 f/cc limit in the U.S. But such comparisons hardly begin to convey the conditions of asbestos workers in the developing countries.

Uncontrolled use of asbestos continues to be the norm in the developing countries, laws and regulations notwithstanding. Dr. Rene Mendes says about 30,000 workers are employed in Brazil's asbestos industry, most of them in small plants, and conditions are so bad that asbestosis is being diagnosed 5-10 years after workers enter the industry.¹⁶⁶ Mexican researchers found severe asbestosis in workers employed spraying asbestos, who were monitored as having exposures of 54 fibers/cc.¹⁶⁷ In Egypt, workers reportedly still empty asbestos bales and mix asbestos with cement manually, with exposures measured at 3-20 f/cc.^{168,169} In Johns-Manville's former affiliate in Ahmedabad, India, where I have been told asbestos-cement pipe was sawed without local exhaust ventilation, government hygienists measured exposures of 216-418 fibers/cc.¹⁷⁰

By 1985, the Pan American Health Organization was distributing Spanish translations of the Arizona Project Module on Asbestos, to provide basic training to doctors in Latin America to diagnose asbestos disease. Dr. Robert Murray of London wrote a strong letter of protest to PAHO's Washington office,

appropriately sending a copy to Neville Stack, director of the Asbestos International Association:¹⁷¹

I hear from my contacts that this document, which we discussed last time I saw you in Washington, is still circulating. I believe it contains so many inaccurate and inflammatory comments about asbestos that it should be suppressed.

Murray wrote that a "rather more sober and scientific document" on the subject was being prepared by the World Health Organization, and that this should be used instead.

In South Korea, where asbestos consumption doubled in the 1980s, international concern was raised over the involvement of German companies and the export to countries like Germany and the United States of asbestos products, made under conditions outlawed in those countries. Cooperation between Korean and Western occupational health professionals, accompanied by publicity over the transfer of deadly industries, is believed to have led to some improvements. However, there is also concern that part of the Korean asbestos textile production was shifted to Indonesia in the early 1990s.¹⁷²

Given the historic lack of both industry product stewardship and controlled asbestos exposures, especially in the vulnerable developing countries, the operative question is: *Will* asbestos hazards be controlled? (not: *Can* asbestos hazards be controlled?) The burden is on the asbestos industry to demonstrate that it is practical to routinely use asbestos in a thoroughly controlled way in developing countries.

The record to date overwhelmingly suggests that it is unreasonable to expect that asbestos hazards will be controlled in the developing countries. Industry spokesmen acknowledge that, even now, construction contractors in the U.S. sometimes use abrasive disc saws to cut asbestos-cement pipe—despite advice against the practice by the A-C Pipe Producers Association and the existence of applicable OSHA standards since 1972. Lung disease has occurred in the U.S. from the uncontrolled sawing of asbestos-cement sheets in construction work in the 1970s.¹⁷³

How then can we expect Third World manufacturers of asbestos products and construction contractors to take on the cost of extraordinary control measures, when there typically

isn't even pressure from industry or government authorities to do so? Where is the infrastructure of prevention (information, regulation, and compensation) in Third World countries? And why should developing countries submit to the likelihood of asbestos contamination and disease, when safer alternatives exist that will not warrant the unprecedented commitment of scarce public health resources?

Developing countries may also wish to consider another form of "pollution" that has frequently come along with the growth of an indigenous asbestos industry. This is the corruption of the fledgling professions of industrial medicine and hygiene, as pressures are brought to bear on health professionals in industry, government and academia to learn the "industry line" and downplay concerns about workplace and environmental exposure to asbestos. This impact on a vital sector of a society in development may pave the way for subsequent public health abuses in other industries. Again one must wonder why a developing country would want to accept the externalized costs of a growing asbestos industry, given the alternatives now available.

In the 1980s, an increasing array of asbestos-free products has become commercially available. Asbestos-containing corrugated and flat cement sheeting, valve and pump packings, roofing felts, pipeline wrap, and vinyl flooring have not even been made in the United States since the mid-1980s. In Europe, the Swiss Eternit Group, now called Nueva A.G., agreed to eliminate asbestos in fiber-cement sheet products by 1990 in Germany and Switzerland, in favor of toxicologically tested, plastic-fiber-reinforced cement sheet. The Swiss government allowed until 1995 for asbestos use to be discontinued in making fiber-cement pressure pipes, where asbestos substitution was more difficult, although other kinds of pipe (e.g., high density polyethylene, cast iron) have long been available.

Nueva A.G. has experimented with various plant fibers and has already been able to replace asbestos in flat and corrugated cement sheet with wood fiber and sisal substitutes in Costa Rica and other Latin American countries. Nueva did not plan to expand this business or compete with cheap domestic asbestos in Brazil and Colombia or imported asbestos in Mexico,

unfortunately. Nor did the company show a willingness to share the technology with poor countries that own asbestos-cement plants, such as Vietnam and Uganda, absent the usual financial incentives (Emanuel Arni, Deputy Chief Executive Officer). Nueva's asbestos-free products carry warranties equal to those of the predecessor asbestos products and are made with locally available trees.¹⁷⁴ In Australia and Malaysia, James Hardie Industries and its affiliates are also making cement sheet products reinforced with wood pulp instead of asbestos.

This is at least technological, if not moral progress, when one considers that exposures from sawing asbestos-cement sheet without dust controls have been reported as hundreds of fibers per cc.¹⁷⁵ It is also relevant that in many countries people catch water running off their roofs for drinking and cooking. EPA researchers have reported that "asbestos fiber concentrations over 500 million fibers per liter have been found in cistern drinking waters which use asbestos-cement roofing tiles to collect water."¹⁷⁶

It would be better if people had this burden of wood, sisal, coconut, or banana plant materials instead of asbestos in their drinking water. (See also Appendix 3, on asbestos ingestion.)

The Role of the Canadian Government and Other Governments in Promoting Asbestos Use

When the U.S. Environmental Protection Agency proposed to ban asbestos, the Canadian government, representing both private and state-owned asbestos mines, applied considerable pressure to oppose the ban.¹⁷⁷ An article in the British magazine *The Economist* created a furor, for it suggested that Canada had become "a sort of merchant of death by unloading its asbestos on unsophisticated Third World clients who may not be aware of its dangers."¹⁷⁷

Canada's Energy, Mines and Resources Minister Marcel Masse in 1988 responded to the above article by writing, "(t)he risk can be managed anywhere. This includes the Third World, where governments are more aware of the risks and more capable of controlling them than your correspondent is willing to credit."¹⁷⁸ The *Toronto Star* went on to describe a \$30 million

campaign of federal and Quebec governments to "try to drag asbestos out of the doghouse."¹⁷⁸

The Asbestos Institute, partly supported by millions of dollars from Canadian taxpayers, also worried that EPA's asbestos "ban," proposed in 1986 and issued in 1989, would impede the promotion of asbestos in countries which have little or no experience, let alone resources, in controlling industrial cancer threats. The Institute is a joint venture of the asbestos mining industry and the government, "to maximize the use of existing resources in a concerted effort to defend and promote the safe use of asbestos on a global scale." It claims to be "dedicated to promoting the proper use of asbestos."¹⁷⁹

Canadian physician David Bates called in 1987 for the establishment of an independent commission ("recruited neither from industry nor from government employees") to monitor certain indicators of product stewardship in the export of Canadian asbestos and report annually to the public.¹⁸⁰ An appropriate topic for such an oversight panel would be the publication of lies like this by Asbestos Institute President Claude Forget: "In (Selikoff's) study of American insulation workers, asbestosis victims did not only inhale white asbestos as you state but *were exposed to mostly amosite asbestos*."¹⁸¹ Or this, from Asbestos Institute's "The Real Facts on Asbestos" (1990): "(Third World) construction sites, however, tend not to be a major problem as hand-operated tools, which in general generate large particulate dust and not respirable dust, are widely used." (Hand-sawing asbestos-cement panels generates optical microscopy counts from 31 to over 200 f/cc, according to an earlier industry report.¹⁷⁵)

Canada's independent asbestos oversight panel, if it is ever set up, might also want to monitor the intimidation and vilification of scientists at conferences where the hazards of asbestos are discussed. For example, there is this by the Asbestos Institute Director of the Health and Environment Division, Jacques Dunnigan, at an asbestos conference in Mexico: "It is very hard for me to abstain from expressing my feeling that what we have just heard is standard, usual, ad nauseam repeated practice of some people at Mt. Sinai."¹⁸² One doctor's repeated efforts to inject obfuscation into the proceed-

ings during the 1990 asbestos conference in New York led to him being referred to as a paid heckler.

Dr. Bates also called on the government of Canada to provide as much money for research into asbestos' health effects as is released for promotion of the industry. This balance, along with the creation of the oversight commission, "would help to reassure average Canadians that they could not be accused of simply cynical exploitation of other people's ignorance," he concluded.¹⁸⁰

Canada's union of insulation workers and other unions feel it is unworthy for the Canadian people to be represented by government officials who would rather sell ever more asbestos than plan for an asbestos-free future. Canada has spent over \$500 million on post-1978 government takeovers and subsidies to bail out its asbestos mining industry. Closing of this "poisonous" industry with its 3000 jobs (now 2100) has been compared to the government's closing of an unneeded military base by Dr. Ray Sentes, a former insulation worker with asbestosis.¹⁸³ Canadians were also urged to close the mines by Dr. Irving Selikoff of the Mt. Sinai School of Medicine in New York, whose research on asbestos workers and courage to speak out fueled public health efforts worldwide for over 30 years.

Nationally viewed television documentaries in Canada (CBC, Oct. 1988; CTV, Nov. 1989) critically examined the government's practice of pushing asbestos in the Third World. These programs included vivid filming of uncontrolled asbestos use in construction in Thailand and the Philippines. Canada's decision to sue the U.S. Environmental Protection Agency in a precedent-setting case, over EPA's ban/phase-down rule issued in 1989, was also criticized. In the CTV program, the Asbestos Institute spokesman was visibly upset to hear that the new Minister of Energy, Mines, and Resources had declined to be interviewed about asbestos. It is unlikely that this signaled a change in government policy, however, and seems to have been simply the extraordinary arrogance of a political leader.

The Canadian government's support of the asbestos industry in the lawsuit in the U.S. was indeed unfortunate. The EPA "ban" would not have affected any U.S. industry using asbestos as a raw material until 1994. At the rate the industry is declin-

ing, EPA's regulations may have been little more than closing the coffin after the banned industry was already dead. Moreover, Canada's suit against EPA added little or nothing of substance to the issues the asbestos industry could have raised by itself, based on the rulemaking record. In other words, the good name of Canada was dragged through the mud, so that the country's taxpayers could defray \$1 million or more of the legal fees that would otherwise have been borne by the international asbestos industry.

Canada has displayed an inconsistent and opportunistic regard for the U.S. legal system. Canadian asbestos mining interests have repeatedly refused to honor U.S. courts' evidence requests and verdicts awarding damages for historic longterm failure to place health warnings on sacks of asbestos. Yet even as the toll of asbestos victims mounts, publicly and privately held mining interests in Canada wanted to be forgiven their debt to past consumers of their product while being entitled to continue creating future asbestos victims in the U.S.

It is tragic that Canada lowered itself to become a litigant in U.S. courts, only to come in on the wrong side of a public health issue. Had Canada instead sued the EPA over the Reagan Administration's protracted refusal to regulate the sources of acid rain, Canada's use of U.S. courts would have been hailed in both countries by citizens, environmentalists, and public health workers.

South Africa is a major source and exporter of asbestos disease almost all of which has been officially ignored. A management official said of asbestotic mine workers: "They are like plastic syringes. You use them, and when they are damaged you throw them back to the homelands."¹⁸⁴ Miners disabled equally with pneumoconiosis in South Africa were, until 1994, eligible to receive varying degrees of compensation under 1973 law, according to their *race*. Those who developed asbestosis and cancer once they went back to the so-called homelands in South Africa or return home to neighboring countries stood little chance of being correctly diagnosed or properly treated, let alone counted by the government or compensated by their former employers.

South Africa's government reported about 100 cases of mesothelioma a year, nearly half among whites, who have comprised no more than 5 percent of the total employed historically in asbestos mining and manufacturing. Even making very conservative assumptions, one can get an idea of how the actual cancer incidence contrasts with the official count of about 50 mesotheliomas a year among non-whites.

Assuming that non-white workers sustained exposures no greater than those of their white supervisors, we would expect the ratio of mesotheliomas by race to be proportional to the numbers exposed. That comes to 950 mesotheliomas a year among non-whites, if we assume the 50 cases among whites represent complete case-finding in whites. Studies elsewhere have shown that occupationally caused lung cancer may be expected to be twice as frequent among asbestos workers as mesothelioma. So we can add roughly another 2000 officially ignored deaths from lung cancer each year among non-white former asbestos workers in South Africa.

The South African government, at least as late as 1990, took no responsibility for the way its exported asbestos was used in other African and Asian countries, either.¹⁸⁵ The amosite mine at Penge was finally closed in 1992, following Japan's belated decision in 1988 to ban amosite's use in calcium silicate insulation boards. Crocidolite production was down to 12,000 tons in 1992 from its 200,000 ton peak in 1977. The current markets for blue asbestos are North Africa and the Middle East, primarily.¹⁸⁶

The former Soviet Union evidently regarded research on asbestos' health hazards as adverse to its national interest, as the world's largest producer of the mineral. Considerable quantities of fiber were shipped to the USSR's main trading partners. At the time of the unification of Germany, the West Germans were shocked to learn that East Germany had a contractual obligation to buy 50,000 metric tons of Russian asbestos that year. The decision was made to send payment to the Russians and tell them to keep the asbestos.¹⁸⁷ The author has observed Russian asbestos in use at an asbestos-cement plant in Vietnam in 1991. The sacks of asbestos bore no health warnings, though the phrase "Use No Hooks" was printed in

English. There was no sign of product stewardship by the fiber supplier at the plant, which utterly lacked industrial hygiene safeguards.

The eventual elimination of asbestos in favor of safer (and in some cases essentially harmless) materials is of great public health importance. The continued lack of product stewardship by companies and countries mining asbestos, in the interim, constitutes a formidable health threat. It can only be hoped that this industry will see that its credibility and near-term survival depend upon worldwide implementation of unprecedented controls. Some countries may still decide that, at least for now, the continued use of asbestos-cement water conduits, for example, is still justified in health and economic terms. But even without the demonstration that asbestos *will* be used with stringent safeguards, the industry is sure to face rapid declines as social opposition mounts. Anyone who doubts the swiftness with which such events can move should recall West Africa's revulsion and response to being used as a dumping ground for hazardous wastes from the U.S. and Europe in 1988-1989.

The world's experience with the industrial use of asbestos leads to the conclusion that the only way to assure that asbestos will stop killing people needlessly is to ban it. This approach, which has been taken in Sweden and other advanced industrial nations, is even more attractive in developing countries, where stringent regulation is not really a viable alternative to a ban. Developing countries that continue to use asbestos-cement pipes for water supply should consider alternative pipe materials and alternative (preferably non-respirable if fibrous) materials in reinforcing cement pressure pipes.

Substitution and control of asbestos are the goals expressed by the Consumers Association of Penang, Malaysia, in its international campaign against "aggressive, unethical promotion of asbestos."¹⁸⁶ The International Metalworkers Federation has declared the objective of a worldwide ban on the use of asbestos.¹⁸⁷ Unions met in Brazil in 1990 to discuss the asbestos problem, and Dr. Mario Epelman of Greenpeace/Latin America also participated. Whether a country is industrialized with much asbestos already in use and in place or just starting to develop industries where asbestos can be used, a great potential for

prevention of disease exists. In the developing countries, the commitment to give health objectives great weight in technology assessment is vital if these countries are not to become the dumping grounds for discredited, deadly technologies.

Leading unions in Brazil have pressed the government to eliminate asbestos, despite the country's considerable asbestos mining and manufacturing industry. In 1994, labor, government, and the automotive parts industry agreed to phase out asbestos in friction products by 1998.¹⁸⁸ The need for a ban was impressed on some attendees of an international conference ("Asbestos: Controlled Use or Total Ban?"—March, 1994), who visited a brake plant where serious health hazards were apparent; some of the workers we met in the morning were fired the afternoon of the same day.

The São Paulo conference was opposed and subjected to pressures by the asbestos industry and the Canadian Embassy. A union secretary was beaten and his life threatened for planning to attend. Another union activist, Bento Menguine, was kidnapped and held for several days, during which he was beaten and told his family members' lives were in danger because of his opposition to asbestos. Mr. Menguine was hailed at the São Paulo conference, which denounced the mistreatment of union leaders and "double standards" of the European multinational corporations in Brazil and Peru.¹⁸⁹

Ban Asbestos, set up at the occasion of a meeting of the European Parliament in 1991, has now become an international information and mutual support network. Its purpose is to organize participation of trade unions, political parties, environmental groups, scientists, and representatives of asbestos victims to bring about a world where the commercial use of asbestos is ended. Panels of scientists and other supporters (elected representatives and other eminent figures) were being organized in 1995.¹⁹⁰

In the United States, unions have organized the Alliance Against Asbestos to publish and distribute information to counter the chrysotile "white wash" propaganda of asbestos interests. Distribution of a technical issues paper began in the last months of 1995.^{191,192}

CONCLUSION

The asbestos disease epidemic now taking place is the result of past events, but the seeds of future asbestosis and cancer continue to be sown worldwide. Favoring ever more asbestos disease well into the next century are two familiar conditions: lack of social integrity at the highest levels in industry, and lack of courage among politicians ostensibly in office to represent the public interest and resist the pressures of private interests.

In every industrial nation it has long been acknowledged that the social order and welfare, in fact all the advantages of civilization, exist because of the working man and woman. Great things have been said about the dignity of labor and society's obligations to people working in factories and trades. The continuing asbestos disaster reveals the depth of failure of societies both East and West to take reasonable steps to protect the health of workers against a long-recognized, insidious threat to life. This menace has carried over from the workplace to endanger society at large.

In the 1990s, with the mortal dangers well known and safer substitutes available for all uses of asbestos, it is patently criminal for some products to still be made with asbestos at all; it is no less monstrous for other asbestos products to be made and used without even minimal efforts to inform and protect the workers.

In every culture the specific social changes necessary to safeguard the worker in fact as well as in theory will vary. But at the level where the decisions are made, more weight must be given to the long-term health of the public and less to short-term economic pressures. Citizens and unions should have major participation in decisions affecting their health and lives.

An essential ingredient in making more health-oriented social decisions about technology is personal accountability on the part of the decision makers. This applies equally whether the decisions are made in corporate board rooms or the health ministries of centrally-managed economies.

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