

MetLife and its corporate allies: dust diseases and the manipulation of science

David S. Egilman¹, Tess Bird², Caroline Lee²

¹Department of Community Health, Brown University, Attleboro, MA, USA, ²Never Again Consulting, Attleboro, MA, USA

Background: The dust diseases silicosis and asbestosis were the first occupational diseases to have widespread impact on workers. Knowledge that asbestos and silica were hazardous to health became public long after the industry knew of the health concerns. This delay was largely influenced by the interests of Metropolitan Life Insurance Company (MetLife).

Objectives: To understand how MetLife influenced the science and politics of asbestos and silica exposure in the first half of the twentieth century.

Methods: We examined previously secret corporate documents produced in litigation, deposition, and trial testimony, as well as published scholarship.

Results: MetLife established itself as an authority in public and industrial health in the early part of the twentieth century, gaining the trust of the public and government. They were able to use this trust and authority to avoid financial loss, including the firing of sick workers, and avoid legal liability by organizing a network of experts to testify on their behalf in silica- and asbestos-related damage suits. They further manipulated the results of scientific findings from major research institutions, delaying important knowledge about the asbestos–cancer relationship. They also influenced law and public policy through writing and implementing worker compensation laws in numerous states and concocting an arbitrary “protective” standard to monitor asbestos exposure. This standard was known by MetLife to not protect against disease.

Conclusions: The actions of MetLife and its allies had real human and scientific consequences and an effect on the industry lasting until now.

Keywords: Asbestos, Mesothelioma, State-of-the-art, Corporate corruption, MetLife, Insurance company knowledge

...If only the slightest exposure to the dust results ultimately in death, then the scope of the necessary preventive measures is summed up in one word- prohibition- for, practically speaking, it is impossible to prevent such exposure. Merewether Memorandum on Asbestosis, Tubercle, December 1933¹

You should be concerned not only with the successful defense of your own cases but of others as well. In this situation the answer to the age old query, Am I my brother's keeper is emphatically, "Yes". Each verdict against the defendant encourages others to bring suit and provides ambulance chasing lawyers with arguments and money to see that they do. Speech of Alfred Hirth, an Owens-Illinois lawyer at the opening meeting of the Industrial Hygiene Foundation in Pittsburgh, Pennsylvania, 1935²

Introduction

There is little debate among scholars that corporations influenced disputes over the science of industrial diseases during the 20th century.^{3–9} Many contemporary critiques have emphasized strategies of scientific “uncertainty” that corporations use to avoid regulation and accountability to those injured by exposure to their products.^{10–19} However, where some scholars cite that errors, positivist exuberance, and contemporaneous lack of knowledge contributed to the disputes, others have concluded that these scientific disputes went beyond the bounds of ordinary scientific debate and contention.^{3,4,9} Rosner and Markowitz concluded that scientific disputes were based on deceit, while Ong and Glantz proposed that some disputes constitute cynical manipulations of scientific principles.^{20,21} Like this article, these investigations were based on the release of previously confidential corporate documents, which became available when courts ordered their release as a result of tort litigation.²² (In their 2008 book, McCullough and Tweedale relied on some of these documents to establish that asbestos mining and

Correspondence to: D S Egilman, Department of Family Medicine, Brown University, 8 North Main Street, Suite 404, Attleboro, MA 02703, USA
Email: degilman@egilman.com

product companies hid and/or manipulated scientific evidence that were adverse to their economic interests.⁹ In some cases, the choice of reliance materials has become a litigation strategy.²³ For example, historians who serve as defense witnesses in tobacco litigation have refused to review internal corporate documents, while they opine on contemporaneous knowledge or corporate conduct.²³) Secret corporate documents often reveal that product manufacturing companies, their insurers, and their affiliated scientists knew more about their products' toxicity than the unaffiliated medical and scientific community. Workers at these manufacturing companies were the first to be exposed and develop disease, which triggered insurance claims. Neither the companies nor their insurers had a legal obligation to publish their knowledge.

Insurance companies' secret knowledge of these health risks has been largely overlooked. Insurance companies have a fiduciary duty to assess risks and have complete access to company data. As such, they are often the first to become aware of risks through inspections of potential customers or through notices of legal death and health claims of those they insure. Unlike individual companies or even public health entities, they were and are uniquely situated to view patterns of morbidity and mortality across entire industries. For instance, both Metropolitan Life Insurance Company (henceforth MetLife) and the Prudential Life Insurance Company studied the effects of asbestos on workers and acquired knowledge about asbestos hazards a decade before any medical publications appeared on the topic. Frederick Ludwig Hoffman, a statistician for Prudential Life Insurance Company, first recognized the asbestos hazard in 1918.²⁴

This paper details one of the first examples of corporate manipulation of science in the twentieth century, focusing on the key role of MetLife. Beginning in the 1920s, MetLife and companies that purchased its group insurance policies suffered huge economic damages resulting from silicosis and asbestosis claims and lawsuits.²⁵ To alleviate their losses and "protect the interest of the industry," MetLife and their corporate allies acted in concert to distort medical literature on asbestos and silica health effects and use their political and economic power to ensure that workers were not compensated for work-related illnesses.²⁶

The companies implemented four key strategies: MetLife sought to (1) *establish itself as a public health authority*. By gaining the trust of the public and government through numerous programs in health education, treatment, and prevention, MetLife gained a reputation as a respected authority on industrial health. Based on this perception, MetLife personnel

were able to carry out work that supported its own and its clients' financial interests rather than promote public health. To do so, the corporation (2) *created a network of "experts"* who shared their priorities and promulgated their viewpoints. MetLife used its influence to (3) *manipulate science* and (4) *target law and policy* to make certain they and their clients were safe from liability in the long run. The strategies implemented by MetLife and its corporate allies are an important part of occupational health history but also have continuing relevance. They have been — and continue to be — reproduced in numerous other industries, most notably the tobacco and pharmaceutical industries, a legacy we explore in a second paper also to be published in this journal. In this paper, we look at how MetLife used the four key strategies in their engagement with the silica and asbestos industries in the first four decades of the twentieth century.

To understand these strategies, we reviewed documents produced in litigation by MetLife, personal communications between MetLife employees and other industry players, meeting minutes, and transcripts of speeches in addition to the relevant published literature, deposition transcripts, and trial testimony. Many of documents were generated by corporate executives and their medical consultants and reflect contemporaneous opinions that the authors never expected would become public.

MetLife's Power and Influence

The deleterious side effects of the inhalation of dust were well known to the ancients. Pliny (BC 23), the poet Lucretius (BC 96), Paracelsus (1534), Agricola (1556)...Agricola states that it was not uncommon to find women in the mining districts who had married seven times and there were no divorces in those days. The Colorado miners have for years referred to certain dust producing air drills as "widow makers." It was not, however, until very recently, about 1912, that worthwhile research and clinical work were undertaken. Speech of Alfred Hirth, an Owens-Illinois lawyer at the opening meeting of the Industrial Hygiene Foundation in Pittsburgh, Pennsylvania, 1935²

MetLife provided health, life, and disability insurance to thousands of miners and workers via companies (the insurer's actual customers) that deducted premiums from worker salaries and forwarded the money to MetLife.²⁷ As a mutual insurance company, MetLife's "excess revenue" was distributed to shareholders and reflected in the salaries of its employees. Its success was built on pioneering these industrial or "group insurance" policies, then uncommon in the USA but popular in Britain, and selling them to large corporations.²⁷⁻³⁰ These industrial policies made MetLife the largest life insurance company in North America by 1909 and

the largest in the world by 1914.^{31,32} In 1909, Haley Fiske, vice president of MetLife, noted that all of MetLife's profits resulted from its industrial policies. By 1929, 40% of newly issued policies were industrial.³¹ In 1935, MetLife was the largest company in the world with assets of over \$3.8 billion (\$200 million more than US federal tax receipts that year), and insured one fifth of the US and Canadian populations combined.^{29,33,34}

MetLife also exerted considerable influence over key political figures, including Governor and eventual President Franklin Roosevelt. Roosevelt considered himself a friend to the insurance industry, often speaking and acting in its favor during his time in office. He appointed Frederick H. Ecker, the President of MetLife from 1929 to 1936, to the board of the Saratoga Springs Commission (Roosevelt's pet project while governor of New York) and conferred with Ecker directly on matters such as unemployment insurance programs.³⁵ According to Richards' book on the formation of social security, Roosevelt described himself as a "hard boiled" insurance man and joked that "the little tin god I worship is called 'actuarial table.'"³⁵ Roosevelt's trusted Secretary of Labor Francis Perkins (1933–1945) was also sympathetic to the insurance industry. She used industry jargon against the British plan for state run unemployment insurance in 1931, mirroring many of MetLife's own positions.³⁵ She also played a major role in planning the industry-organized national meetings on silicosis in the 1930s.^{3,36–39} Elsewhere in the Roosevelt administration, MetLife representatives exerted their influence on policy behind the scenes, for example informally participating in the work of the Committee on Economic Security.³⁵

Much of the corporate and governmental trust in MetLife was cultivated by Dr. Anthony J. Lanza.ⁱ MetLife hired Lanza in 1924 as assistant medical director in charge of expanding and overseeing MetLife's industrial hygiene consulting, a free service that advised group policy holders on methods that could be implemented to reduce occupational injuries and dust exposures. Lanza worked in concert with his superiors, Drs. Wright and Armstrong (the third Vice-President) and the actuary department to study dust diseases at the plants and make recommendations about how the companies should approach industrial hygiene problems.ⁱⁱ As MetLife's main

ⁱ On Lanza and his role in industrial health: "He served as special adviser on industrial hygiene to the government of Australia, as special staff member of the International Health Board of the Rockefeller Foundation, and as executive director of the National Health Council. He guided MetLife's research and educational services. According to MetLife: 'His fame as an authority on certain industrial diseases such as silicosis is both national and world wide.' He was a prominent member of industrial hygiene committees of the American Medical Association, the US Chamber of Commerce, and the American Public Health Association, and served on the board of trustees of the Industrial Hygiene Foundation."⁴⁰

ⁱⁱ Lanza instructed Johns Manville's physicians to not warn workers of dust disease problems.⁴¹

contact with outside experts and government agencies, such as the US Public Health Service (USPHS),ⁱⁱⁱ Lanza played a central role in MetLife and its corporate clients' contestation of occupational disease claims.

Early knowledge of dust diseases, silicosis crisis, and MetLife's motive

Dust disease had garnered attention at the turn of the twentieth century as "miners' phthisis," the lung disease that would soon be linked to silica exposure.^{3,43} In the USA, silica dust was recognized as a cause of disease by 1900, when the *Journal of the American Medical Association* reported that many miners suffered from what was termed the fibroid form of phthisis.³ In the following years, studies of South African gold miners drew further attention to the health effects of silica dust.⁴⁴ In 1912, the word "silicosis" entered the occupational disease lexicon when a South African commission pronounced that silicosis was a separate disease, noting that "All true cases of miners' phthisis are thus primarily cases of silicosis; silicosis is the feature common to the all."⁴⁵ The commission also specified the connection between silicosis and tuberculosis:

*In the later states [of silicosis], tuberculosis becomes commonly or invariably superimposed upon this condition, and the type of the disease becomes that of a tuberculous infection in a fibroid lung.*⁴⁶

In 1917, Lanza, not yet an employee of MetLife, and his colleague Edwin Higgins conducted a USPHS and Bureau of Mines investigation on silicosis at the Joplin, Missouri mine district.⁴⁷ At that time, Joplin was the center and transportation hub of the Tri-State mining region of southeast Kansas, northeast Oklahoma and southwest Missouri. From 1850 to 1950, the Tri-State region produced 50% of US zinc and 10% of US lead.⁴⁸ Lanza and Higgins found dangerous quantities of silica dust in the mines and determined silicosis to be a legitimate and severe health hazard for the miners.⁴⁶ They were the first to propose that silicosis followed a dose–response relationship; thus, if mine owners reduced excess exposures by application of available technologies, they might reduce, but would not eliminate, clinically apparent silicosis.^{iv,47}

The US public was largely unaware of silicosis until the Depression, at which point the local and national press began reporting on a growing number of lawsuits spurred by an epidemic of silicosis in West Virginia.^{49–51}

Between 1930 and 1933, Union Carbide Corporation

ⁱⁱⁱ MetLife provided funding to the USPHS and paid the salaries of some USPHS personnel. It also provided funding for animal and human studies of the effects of dust disease.⁴²

^{iv} The modern recognition of asbestos as a hazard followed soon thereafter: a 1918 US Bureau of Labor paper (by Hoffman of Prudential) noted that "...asbestos workers...[worked] under health-injurious conditions."²⁴

(UCC) hired a contractor to drill the Hawk's Nest Tunnel at Gauley Bridge, West Virginia, through "sandstone containing in excess of 99% pure silica."^{52,53} About 3000 workers, most of whom were African Americans, performed the dustiest work of machine drilling and developed acute or "rapid" silicosis within months.^{39,53} It is estimated that as many as 1500 workers died while working or shortly after working on the tunnel; a local undertaker was hired to dispose of the bodies, burying an undetermined number in a mass grave.^{39,50,52} The death toll was certainly much higher since most silicosis cases have a long latency period (greater than 20 years), and no one determined the fate of the surviving workers in the ensuing decades.^{50,52} Five hundred and thirty-eight workers filed lawsuits against UCC's contractor.⁵² What became known as the Hawk's Nest Disaster generated a national political campaign to support worker health.⁵⁴⁻⁵⁶ In 1936, Congress held hearings on the matter, bringing national media attention to the general issue of occupational disease.^{50,57} In the mid-1930s, silicosis was regarded as the "king of occupational diseases," as well known and notorious as asbestosis would become in the 1990s.³ Hawk's Nest remains the largest single industrial disaster in United States history.

Claims for compensation resulting from the Hawk's Nest incident actually comprised only a small percentage of lawsuits and compensation claims coming from dust-exposed workers all over the country. As the primary insurer for hundreds of companies who mined, manufactured, or supplied silica and asbestos products, MetLife's financial interests were inextricably linked to the crisis.⁵⁸ If the lawsuits jeopardized their customers' size or existence, MetLife would lose business. Furthermore, at that time MetLife was obligated to pay claims to workers who became disabled while their policies were in effect.²⁵ The company also had investments in mining companies, asbestos product manufacturing companies, and companies whose workers contracted silicosis during product manufacture (Fig. 1).

By 1926, MetLife estimated that the insurance industry's total potential dust disease liabilities amounted to \$5.5 billion, the modern day equivalent of \$60 billion; of these, MetLife had the largest share.^{31,58} Bassford, MetLife's actuary, wrote that MetLife's "losses under Group Life and Health contracts have been great," and "those [losses] under Ordinary and Industrial policies [had] not [been] determined but [were] presumably great also. The prospective loss is large..."²⁵ In the Tri-State mining region of Oklahoma, Missouri, and Kansas, for example, MetLife insured 10,600 men; by 1928, 2723 — more than a quarter of them — had silicosis.⁵⁹ During the Hawk's Nest disaster, Lanza assessed the magnitude of the dust disease problem and told his

Years	Company	Total Amount
1929-1974	JOHNS-MANVILLE	69,509,028
1938-1974	NATIONAL GYPSUM	18,704,468
1943-1974	EAGLE PICHER	265,082,160
1946-1974	WESTING-HOUSE	1,161,467,225
1947-1974	GAF	502,230,722
1947-1974	OWENS-CORNING	843,876,892
1949-1974	FIBRE-BOARD	810,934,000
1952-1974	GARLOCK	129,500,000
1952-1974	PORTER, H.K.	135,272,497
1952-1974	FOSTER WHEELER	39,085,000
1963-1974	LITTON	641,454,451
1963-1974	WR GRACE	937,235,078
1967-1974	US GYPSUM	3,920,017
1967-1974	OWENS-ILLINOIS	86,619,935
1968-1974	ARMSTRONG	1,037,880
1969-1974	FLINTKOTE	17,112,736

Figure 1 The years and amounts (in US dollars) of MetLife's investments in mining companies and asbestos and silicosis product manufacturing companies from the MetLife annual reports, revealed in litigation.

superiors that the value of dust disease lawsuits had reached over \$100 million.⁶⁰

MetLife drew on its history of trust and authority in industrial health to prevent a landslide of dust disease claims. MetLife tried to stem losses and increase profits by encouraging good industrial hygiene practices and raising premiums.⁶¹ But MetLife's industrial health efforts also served several business and political purposes: promotion of lifestyle change to reduce claims, increasing sales, and gaining the longstanding trust of corporations, workers, and the US government.³³

Establishing Authority: MetLife's Public Health Programs

MetLife fashioned itself as a protector of public health by running massive public health programs. In a history published on its website, MetLife describes its role in "helping and healing people":

In 1909, MetLife Vice President Haley Fiske announced that "insurance, not merely as a business proposition, but as a social program," would be the future policy of the company. As a first step, Fiske hired the pioneering industrial social worker Lee Frankel to work at MetLife. Frankel envisioned insurance as a powerful means toward improving the lot of the underprivileged. To this end, he established MetLife's Welfare Division.

*Frankel's early work centered on the prevention of tuberculosis, the "white plague" responsible for 20 percent of all death claims. Public education was the key...*⁶²

MetLife also established a visiting nurse program in 1909 throughout New York City, providing free nursing care to sick workers.

Insurance agents, who had day-to-day contact with the insured, urged policyholders to report illnesses at the earliest possible opportunity and left cards with information identifying the closest visiting nurse. The New York City program became a

model for urban health reform, which MetLife then expanded to 13 other cities.

*The company's vigorous public health campaign, conducted through its agents, was the largest such endeavor launched by a public or private entity. For nearly a half century, approximately 20 million policyholders in more than 7,000 cities and towns in the U.S. and Canada received free nursing care. At its peak of service in 1935, 35 out of 1,000 policyholders were treated for illnesses such as diphtheria, influenza, smallpox, and tuberculosis.*⁶²

In 1921, MetLife established a model nursing program in Thetford, Quebec, the center of the Canadian asbestos mining region. MetLife designed the program as a demonstration project to reduce infant mortality. The program was successful, and as a result, the Prime Minister of Quebec appropriated \$500 thousand to establish a chain of clinics throughout Quebec.³³

By 1929, MetLife disseminated 50 million educational pamphlets annually through private and public health agencies and its own agents, addressing health issues including diet, first aid, and accident prevention, and this number only increased through the next decade.^{62,63} Additionally, MetLife “utilized movies, film strips, magazine advertisements, exhibits, posters, speakers and radio to send out its health and safety messages” as well as millions of visits to policyholders’ homes weekly. Its moving pictures alone were shown to over half the population in the USA and Canada, with 1024 showings per week in 1938.⁴⁰ The company did not charge for these services in the hope that they would enhance insurance sales as well as decrease claims.^{3,40} The popularity of MetLife’s programs was used to market its group insurance policies to its corporate customers.⁶³

By providing informational materials as a service to its corporate clients in addition to its other resources, MetLife was well placed to directly inform workers of daily hazards faced in the workplace, and did advise workers on occupational health-related subjects.⁶⁴ They published a pamphlet targeted towards corporations in 1924 titled “Industrial Hygiene” which noted that “dust is the great enemy of the workman,” but claimed that the most hazardous dusts were emery and silica (asbestos was not mentioned even though it was known to be a potential hazard since 1918).^{24,65} The US Department of Labor affirmed MetLife’s authority in the field of occupational health by re-publishing the company’s “Occupational Hazards and Diagnostic Signs” in 1922 as an official government guide meant for physician use.⁶⁶ The US Department of Labor’s reliance on MetLife’s supposedly neutral literature had lasting effects. A 1942 US government reprint of MetLife’s “Occupational Hazards” mentioned asbestosis but did not acknowledge any relationship between asbestos and cancer.⁶⁷ This exclusion conflicted with

the 20–50 case reports available in the medical literature and the major (only) textbook on occupational tumors which linked asbestos and cancer at that time.³⁴ The same pamphlet linked uranium to cancer based on far fewer case reports.⁶⁷ By 1953, MetLife had published occupational health booklets on silicosis, chromium, and welding, but not asbestos.⁴⁰

In sum, while MetLife was first and foremost a business, they came to be considered a well-trusted, neutral authority on public health, allowing them to set precedents for industrial hygiene and control access to information.

Firing of sick workers

MetLife used its reputation as a authority on industrial health initiatives to covertly gather information on workers that was of value to MetLife and its corporate clients.³¹ By 1926, MetLife was aware that X-ray abnormalities appeared months, years, or decades *before* symptoms or tuberculosis super-infection and that workers showing such abnormalities could develop silicosis disease in the future.⁶⁸ Under MetLife’s group insurance policies, an employee’s coverage was terminated when he quit or was fired, unless she or he applied for a continuation and paid a premium within 31 days of leaving the job (an unlikely occurrence in the midst of the Great Depression).²⁷ If companies fired asymptomatic workers who showed X-ray evidence of silicosis, MetLife would not have to make insurance payments for silicosis that was contracted from workplace exposures because symptoms — and thereby worker knowledge of disease — would manifest *after* their insurance had expired.

In a 1926 memo, Lanza described the plan to identify and “exclude” asymptomatic sick workers:

There would be a clinic which would make physical examinations of miners, including X-ray examinations. It is estimated that eventually between 12,000 and 15,000 men would be examined twice a year. Advice and help to the miners would be coordinated with the Metropolitan nursing service... Three definite results would be forthcoming:

- 1. Men with tuberculosis would be excluded from underground work and one of the prime sources of infection thus abated.*
- 2. Men with dust affected lungs would be excluded from underground work and the chief contributing cause to tuberculosis thus eliminated.*
- 3. Men would not be hired unless they have sound lungs, and the periodic examination would prevent them from becoming seriously affected. All of this would be supported by the continued improvement of underground working conditions.*⁶⁸

In 1926, MetLife enlisted the cooperation of the Federal Bureau of Mines, USPHS, and the Tri-State Zinc and Lead Association (a coalition of local mining companies) to open a clinic in the in the tri-state region around Joplin, Missouri, which would

“result in a substantial contribution to industrial insurance experience.”^{v,68} MetLife and the mine owners, all of which were MetLife group policyholders locally or elsewhere, provided most of the funds for the clinic which offered “free” medical services to the workers. While it was proposed that these examinations initially be done on a voluntary basis, MetLife intended them to eventually become required by law.⁶⁸ The clinic X-rayed workers for early signs of silicosis or tuberculosis.⁶⁸

While Lanza’s initial plan said workers should be excluded from certain kinds of work, a follow-up memo revealed that those who were found to be sick with dust-related diseases, including silico-tuberculosis were “eliminated,” or fired, without being informed of their results by MetLife, the Federal Bureau of Mines, and the mine owners.^{69–71} Lanza recognized MetLife could use the government association to keep the clinic’s findings secret: “We were often solicited by interested parties to permit them to have access to our records and our reply was always the same, namely, that they were Government records and not available for any purpose whatsoever, with the single exception of the United States Marshall...”^{vi,70}

A 1929 follow-up visit to the Picher clinic revealed the effectiveness of using these clinics to find and “eliminate” workers showing evidence of silicosis from employment. Lanza reported to MetLife management that:

The difference is apparent at a glance and represents the men who were eliminated either through their clinical examination or by death... Dr. Meriwether estimates that as of July, 1928 28% of all men working underground had definite evidence of lung disease; as of July 1929 12% and as of November 1, 1929 7% ... There is, however, a residuum of old employees who have advanced lung damage and who are going to proceed to a fatal termination. [emphasis added]⁵⁹

Because of how latency functions, we can assume that most of these workers were asymptomatic (and thus unaware of their disease) but had abnormal X-rays with which the physicians could predict future

^v Efforts were made to hide the participation of the mining association. Lanza wrote: “It is probable that the mining companies in the Tri-State Zinc and Lead Association will also give financial support. The Association does not wish to participate in the management of the project; they prefer to be in the position of being able to say to the employees that the Metropolitan Life Insurance Company and the officials of the US Government jointly advised them and their employees to do this...”⁶⁸

^{vi} Full quote: “No individual’s records are ever divulged by the Government. You may recollect that the Pioneer Clinic in Oklahoma was run jointly by the Public Health Service, the mine operators, and the Metropolitan. We had in our files the physical examination records of more than 50,000 individuals. We were often solicited by interested parties to permit them to have access to our records and our reply was always the same, namely, that they were Government records and not available for any purpose whatsoever, with the single exception of the United States Marshall in the performance of his duty in trying to apprehend criminals. I am sure that the federal department would not make available individual records to the State Board of Health. As a rule, the Public Health Service studies are published but I believe that this is not an invariable custom, depending upon their number and their general interest.”⁷²

disease and disablement. Thus, MetLife used their knowledge of latency of asbestos disease and the workers’ medical information to avoid paying claims.

In 1930, the fired workers in Picher belatedly recognized the true purpose of the clinic examinations and “in an open meeting... it was proposed by some of the miners that they dynamite the clinic and run the employees out.” As a result, a guard was placed at the clinic.⁷³

The firing of silicotic workers was not unique to the Picher clinic; “other properties” were affected and other companies adopted the procedure.^{49,74,75} On 15 April 1936, the *New York Times* reported that workmen in New York State who had been X-rayed and found to have silicosis would lose their jobs and later discover that “other employers were unwilling to place them on the payroll.”⁴⁹

In the early 1930s, MetLife stopped offering disability insurance.⁷⁶ In the late 1930s, MetLife changed its group policies to specifically exclude “work-related” illnesses, thereby completely circumventing its direct financial risk from dust-related industrial diseases altogether.⁶¹

Create a Network of “Experts:” Securing Defense Witnesses

None of us could have foreseen this plague of damage suits all over the county which have scared employers out of their wits and for good reason... Here we have a large mine of material, representing a lot of time, energy, and money, which were put into a nationwide study of asbestos and which we cannot print. Lanza to the Saranac Laboratories 1933⁷⁷

While ending coverage of work-related diseases helped MetLife avoid paying compensation claims, it did not decrease the liability of its corporate customers who were still being sued based on tort law. MetLife and its allies were more concerned with what Dr. Lanza called an “epidemic of damage suits” than with the epidemic of silica and asbestos-related disease among workers.^{53,78–80} MetLife used its political and economic power to develop a strategy to protect the companies from the damage suits. A key element of that strategy was creating a network of witnesses who could serve as expert defense witnesses in litigation. This network of experts included some of the same people who were responsible for confusing and manipulating the science.

Lanza remained the primary contact between MetLife and its customers on industrial hygiene, and the companies’ personnel accepted his suggestions, utilizing him to advise them on how to prosecute their defense in court cases. For example, US Gypsum Corporation relied on Lanza to evaluate potential witnesses:

Dr. Lanza of the Metropolitan Life Ins. Co. says he [Pancoast] saved a case in Milwaukee from going against the company, by his x-ray reading, which was contrary to all of the other doctor-witnesses. He [Pancoast] has recently testified in the West Virginia case brought against the subsidiary of Union Carbide Co. and is said to have caused a disagreement there in a case that would otherwise have gone clearly against the company. His price for testifying is \$1000 for the first day and \$250 for every other day. (Inflation adjusted, this price is \$10 000 and \$2500, respectively)⁸¹

In 1933, Union Carbide Company (UCC) asked MetLife for help in defending the silicosis cases at Hawk's Nest.⁷⁶ MetLife had a vested interest in helping: their group policies relied heavily on their clients and if the dust companies went bankrupt, MetLife's survival would be threatened as well.^{25,58}

By 1934, Lanza, the primary contact between the dust companies and MetLife, was directed to "place [Metropolitan's] resources ... at the disposal" of lawyers defending silicosis claims against a group policyholder.⁸² MetLife thus assisted its insureds in evaluating and obtaining witnesses to help defend silicosis lawsuits, many of whom were members of the newly formed Konicide Club (1932), (meaning "killer dust" club).^{3,83} Lanza had first proposed organizing a group of such experts in 1926.⁶⁸

Members of the Konicide Club began corresponding about the Hawk's Nest cases after Lanza contacted them in March of 1933.⁸⁴ According to two members of this club, Theodore Hatch (a hygienist at the University of Pittsburgh) and Eugene Pendergrass (a pioneer of early radiography from the University of Pennsylvania), approximately 20 experts met informally beginning in 1932 to exchange their "experiences and views" about dust-related diseases.⁸³ Other members included Philip Drinker, the head of industrial hygiene at the Harvard School of Public Health; Dr. Sayers, Chief Surgeon of the US Bureau of Mines; Dr. Henry K. Pancoast from the University of Pennsylvania, one of the most prominent radiologists in the United States at the time along with Pendergrass; Dr. Leroy Gardner, head of the Saranac Laboratory occupational dust studies program and one of the foremost researchers on dust diseases and tuberculosis; Dr. Marshall of the US Public Health Service; and Dr. Lanza.^{68,84}

In preparation for the Hawk's Nest defense, Konicide club members Sayers, Russell, Lanza, and Pancoast told UCC's defense lawyers to contact Drinker to serve as a defense witness on the (un)availability of respirators.⁸⁴ Lanza wrote to Drinker and described his contact with Mr. Davis, a UCC manager who was organizing the Hawk's Nest defense:

A number of suits have been filed on behalf persons now dead and I believe their lungs have been secured. I advised Mr. Davis to consult Dr. Gardner for this phase of the job. I shall be glad to give you any further hope if I have any.⁸⁵

Two lungs were "secured," or collected, by Dr. Russell of the USPHS and the Konicide club without the knowledge or permission of the victims, their lawyers, or their families, and sent to Gardner at the Saranac Laboratories, where numerous studies on dust-related diseases were conducted throughout the first half of the twentieth century.⁸⁶ The plaintiff's witness, Dr. Leroy Harless, provided nine cases to Dr. Gardner.^{86,87} Gardner secretly recorded the autopsy results on these 11 tunnel workers. In three cases, he listed the diagnosis as silicosis or anthracosis and did not list any tuberculosis or other complicating infection.⁸⁶ He listed rapid-silicosis (acute silicosis) in six cases, two of which were complicated by tuberculosis.⁸⁶ He questioned tuberculosis in another rapid case.⁸⁶ Three other cases received a diagnosis of silicosis; in one he questioned concomitant infection.⁸⁶

Gardner never published these results nor did he discuss them in his congressional testimony. Despite finding acute silicosis in these autopsy results, in 1933 he published a histological study of 15 workers questioning the existence of acute silicosis entitled "Pathology of So-Called Acute Silicosis." Here he claimed that the observed acuteness of infection was due to the fact that the workers were "young negroes with presumably little immunity to tuberculosis" and concluded, "although there is histological evidence of silicosis, atypical in character, it seems doubtful whether there is justification for describing the process as "acute."⁸⁸

Konicide club member and expert radiologist Dr. Pancoast was the key defense witness in the Hawk's Nest trial. In his April 1933 trial testimony, he denied the existence of acute silicosis and asserted that the plaintiff's chest X-ray failed to show "the distinct round opacities typical of silicosis and were, in fact, an expression of tuberculosis."⁵² Martin Cherniack, author of *The Hawk's Nest Incident*, argues that Pancoast's testimony was an unfortunate error: "Tragically for the tunnel workers, the orthodoxy of this distinguished physician, who had pioneered the reading of industrial chest films, prevented him from appreciating a new medical entity."⁵² However, Pancoast's testimony was no error. Similarly to Gardner, Pancoast's testimony directly conflicted with a paper that he had published four months earlier about "acute silicosis."⁸⁹ In this paper, Pancoast and Pendergrass described acute silicosis in X-ray findings that lacked "distinct round opacities," noting instead that the "appearance of

prominent... shadows and linear markings... has been designated as the *first stage* of silicosis or pneumoconiosis.” [emphasis added]^{vii,89}

The paper continued: “[I]n this particular instance under discussion, the individual may develop the appearance in a comparatively short period of from 1 to 5 years...” [emphasis added]⁸⁹ However, at trial, Pancoast testified that silicosis “might develop... eight years after exposure to silica sand dust,” contradicting his published opinion and Gardener’s autopsy results described above.^{51,89} Conveniently, this statement absolved UCC of any responsibility since it meant that the recent exposures during tunnel drilling could not have contributed to the Hawk’s Nest cases because according to his testimony, silicosis did not manifest until eight years after exposure.

Instead of a tragic error, this was one of the first well-documented examples of the concerted actions taken by a group of “expert” physicians, coordinated by MetLife, for the purpose of assisting corporations in toxic tort litigation. What drove the witnesses to testify against their own contemporaneous scientific knowledge is not as clear as MetLife’s motives. However, in addition to possible financial gain for their “expert” testimony described above, some of the witnesses were ideologically motivated. Dr. Pancoast bemoaned “how great injustice might be inflicted upon an employer by inexperienced deductions and interpretations” of workers’ medical evaluations and occupational histories.⁸⁹ However, he did not seem to consider the deprivation of compensation for injured workers to be an “injustice.” His testimony seems to have reflected his political views, not his scientific publications.

Pressure from MetLife also influenced Saranac researchers to suppress scientific findings that would harm the defense of “damage suits.” In April 1933, at the same time as the Hawk’s Nest trials, Lanza persuaded Saranac’s staff, through thinly veiled threats, to refrain from publishing papers that would reveal the extent of disease in miners in the Tri-State area of Oklahoma, Missouri, and Kansas:

I talked it over with Sayers (of the USPHS) and he feels very 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 ... it is going to be increasingly necessary for industry to have available a thoroughly scientific and impersonal establishment with which it can do business.⁹⁰

In fact, Gardner’s and Pancoast’s testimonies that worker deaths were solely due to tuberculosis were

^{vii} The term “pneumoconiosis” was used by Johns Manville to differentiate the condition of workers with any history of previous dust exposure or handling of mixed fibers from asbestosis. According to Johns Manville, only workers who had ever handled asbestos and no other “potentially toxic material” could develop asbestosis.⁴⁰

particularly disingenuous given Dr. Lanza’s views on the relationship between tuberculosis and silicosis. He even commented to Gardner on medical testimony given at the Hawk’s Nest silicosis trials: “If they [the medical witnesses] had taken the stand that those men were disabled by tuberculosis, aggravated by intense exposure to silica dust, the situation would’ve been clearer and I think the tunnel workers themselves would have been better off.”⁵³ Lanza clearly understood that silica exposure was a contributing factor to the development of tuberculosis. In private communications, he observed the fact that silicotics developed a susceptibility to tuberculosis infection: “Viewed broadly, the problem of dust in industry is the problem of tuberculosis in industry. Conversely, it may be stated that the problem of tuberculosis in this country today is an industrial one.”⁶⁰ In January 1926, Lanza sent a memo to his supervisor, Dr. Wright, indicating that tuberculosis was a complication of silicosis and that tunnel drillers were thus at risk of contracting both diseases:

This investigative work has made increasingly apparent the importance of silica laden dust as an industrial health hazard. Such dust not only produces to silicosis, that is a dust ‘fibrosis’ of the lungs which is itself disabling – but also, for reasons which are not yet entirely clear, greatly predisposes its victims to tuberculosis. The fact that deaths of miners are reported as due to tuberculosis has served to mask importance of the underlying factors of silicosis as a predisposing cause of tuberculosis....⁶⁸

In 1927, Lanza reported otherwise secret results from the MetLife studies of the Bureau of Mines clinic data from the Tri-State area to Rich Meir, vice president of the Pacific Mutual Life Insurance Company.^{viii}

The most serious feature of silicosis is that in some manner, which is not yet clearly understood, it causes a very marked predisposition to tuberculosis so that the individual whose lungs are injured by silica dust sooner or later develops tuberculosis and dies of tuberculosis. Tuberculosis runs a much more rapid course in the individual who has silicosis than in the normal individual.⁹¹

In 1938, the John B. Pierce Foundation hired L. G. Cole and his son, W. G. Cole, to prepare a text on silicosis. The Coles investigated the truthfulness of the testimonies of the Hawk’s Nest medical witnesses. The Coles reviewed the available X-rays and pathologic findings from Hawk’s Nest workers and

^{viii} At the time, companies shared amongst themselves, especially insurance companies. In the 1945 this was codified: Congress passed the McCarran-Ferguson Act, exempting insurance companies from anti trust regulations so they could share risk information.⁹⁰ But this general understanding of the law was established after 1869, according to Richards: “The size and influence of commercial insurance had grown rapidly after 1869, when the Supreme Court ruled that insurance was not interstate commerce and, therefore, was not subject to federal antitrust laws or indeed, to any other regulation by the federal government!”³⁵

reported on their meetings with Drs. Pancoast and Gardner concerning their denial of the existence of acute silicosis. The Coles did not review the Hawk's Nest X-rays seen by Gardner, as most of these were said to have been destroyed accidentally. Of these they wrote, "At least they are not available for study, a situation while fortunate for some is most unfortunate for the advancement of medical knowledge."⁹² Of their meeting with Gardner, the Coles reported that "the source material for [Gardner's] report and ours was the same, and the moment Gardner saw our microscopic sections, he said, 'Oh, I know where that case came from.' It is therefore evident that his description and ours deals with the same morbid changes."⁹² The Coles were not aware of the fact that Gardner's secret pathology reports on the workers' lungs indicated that some of these tunnel drillers had suffered from uncomplicated silicosis and not tuberculosis.⁹³

The Coles concluded that many of the Hawk's Nest workers had been denied compensation due to the views put forth by Gardner and Pancoast in their testimony and writing. Moreover, the Coles found that the workers had in fact developed acute silicosis. They argued that because the workers had so rapidly developed the disease, they did not display the conventional symptoms of the disease but emphasized that workers were entitled to compensation just the same.⁹² According to their report:

*Gauley Bridge workers died within a few years, but because they were unfortunate enough to have inhaled dust which did not cause typical roentgenological nodulation, they received no proper compensation. One boy who has since died of silicosis in tuberculosis received for his pains \$18.50. Fate fed them dust which killed but which did not cause morbid changes conforming with a neat definition of the industrial hygiene committee of America.*⁹²

The Coles suggested that the reoccurrence of "such a fiasco as the Hawk's Nest incident, or the inspired insertion of the words 'so-called' before the title of an article on acute silicosis [Gardner's 1933 article], may be avoided by an understanding of the pathology and roentgenology of this vicious form of pneumoconiosis."⁹²

MetLife's short-term strategy for fighting the silica lawsuits was remarkably successful. However, MetLife and its allies needed a long-term plan, one that would prevent similar suits in the future, particularly involving another threat to the industry: asbestos.

Manipulating Science: Funding Research

By forming and funding several important research institutions in the USA and Canada, MetLife and the companies who manufactured silica and asbestos products were able to maintain a direct hand in the

production of scientific literature. The use of industry experts and the research expertise of the Saranac Institute in the Hawk's Nest defense proved successful for MetLife and its corporate allies. It is important to note that MetLife organized funding for Saranac Laboratory where Gardner conducted his research; they and other funders had contractual control of Gardner and other Saranac research findings.⁹⁴ MetLife determined if the researchers could publish and had complete editorial control over the content of the publications.^{90,94} Through funding several other research institutions, MetLife was able to control early research on asbestos and block or delay publication of important research findings. For instance, in 1926, MetLife founded the Industrial Health Clinic at McGill University and subsequently conducted or funded studies on asbestosis in the USA and Canada between 1926 and 1934.^{9,60,95} MetLife blocked the publication of the McGill Canadian asbestos miner data collected by Dr. Frank Pedley, who found that 24 of 54 miners had asbestosis in 1930.^{60,95-97} MetLife did not prevent Pedley from misrepresenting the results in a published paper, where he wrote, "To our knowledge, however, no case of pneumoconiosis has been reported from asbestos in Canada, and the general impression among miners is that the dust is not hazardous."⁹⁸

MetLife and its allies knew they needed a long-term plan to both prevent and defend tort litigation. It was through their network that they were able to form an organization designed to "protect the interest of industry."²⁶ The formation meeting took place at another industry-founded research institution: The Mellon Institute of Industrial Research.

The formation of the Industrial Hygiene Foundation

In 1911, Pittsburgh coal magnates and bankers Andrew and Richard Mellon funded the Mellon Institute of Industrial Research as a department of the University of Pittsburgh. The institute performed contract research for industrial firms who wanted to solve a particular problem. The institute hired a scientist to conduct the research, while "all results obtained were the property of the contracting firm."⁹⁹

On 15 January 1935, representatives from over fifty industries convened a "Symposium on Dust Problems at the Mellon Institute of Industrial Research." The chairman of the organizing committee was Roger Hitchens, president of the American Refractories Institute, and the main organizer of the meeting was A. W. Sherwood, the vice president of Owens-Illinois Glass Company. Lanza was again a key organizational figure and described his meeting with Hitchens and Sherwood in a memo to MetLife Vice-President Armstrong:

It was made perfectly plain to me, both by these 2 gentlemen and others that the industries that were present are looking to the Metropolitan for advice and leadership. In this endeavor to set up accordingly the agency to deal with dust problems, Mr. Hitchins told me that he had received a letter from Mr. Gentholtz, counsel for the Republic Steel Company, stating that his company would not be interested in this Pittsburgh plan unless I were associated with it; also that he had received a letter to similar effect from Mr. E. O. Jones on behalf of the National Founders Association... There is no question in my mind that many of the largest industries in the country are looking to the Metropolitan as the one place where they can get accurate and impersonal guidance in dealing with the problem that at present is a serious menace to them from an economic standpoint.⁶⁰

The Konicide Club, likely including Lanza, held two days of meetings on dust diseases before the meeting at Mellon. Pendergrass, a Konicide Club member, noted that the “gathering was of particular significance as a preparatory session” for the Mellon Institute meeting. He wrote, “Konicide club members played leading parts in the planning and conduct of the meeting.”⁸³

The Mellon meeting was strictly confidential: “No reporters were present at this meeting and no stenographic notes were kept.”²⁶ Hitchins served as the chairman of the Temporary Organization Committee detailed the proceedings and distributed the “Suggested Program of Initial Activities” to all individuals in attendance at the Symposium. His letter revealed a concerted effort to “protect the interest of the industry.”²⁶

The Mellon meeting led to the formation of the Air Hygiene Foundation, later named the Industrial Hygiene Foundation (IHF), of which Lanza was an active and influential member.^{4,100} Vandiver Brown, Vice-President and General Attorney for Johns-Manville (the largest asbestos company in the United States and one of the more active companies that founded the IHF) noted in a 1936 letter that the IHF was “the creature of industry and... the one institution upon which employers can rely completely for a sympathetic appreciation of their viewpoint.”^{ix,57}

The primary goal of the IHF was to determine what type of “concerted action” they could take to best counteract the numerous dust-related cases and claims. Their desire was to stop “the ‘racket.’”²⁶ The strategy concocted by MetLife and its allies had two main arms.^{26,101} First, the companies sought to establish official “standards” for dust exposures.

^{ix} The Browns, Vandiver and his brother and Manville president, Louis, were proud of their role in limiting worker knowledge: A Unarco official described a conversation with the Browns, “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.’”⁸

They recognized that they had no evidence that the standards would prevent silicosis, but they understood that if “authoritative and approved standards for the control of industrial dusts” were propagated, they would “act as a defense against personal injury suits.”^{26,101} The second arm, as reported in the “Suggested Program of Initial Activities,” was to create what one of the speakers at the first meeting of the IHF defined as “the strongest bulwark against future disaster for industry” — correctly drawn workman’s compensation laws.¹⁰² Members of the IHF saw compensation laws as a way “eliminate the jury” by adding disease to worker compensation statutes. Tort lawsuits were preempted if the disease was added to worker compensation schemes.^{x,102}

Targeting Law and Policy: Worker Compensation Laws

Worker’s compensation laws were first passed in the USA beginning in 1911, with Wisconsin being the first to adopt a statute.¹⁰³ Such laws were favored by both the workers and employers alike.⁹⁴ In exchange for giving up their right to sue their employers under tort law, workers would get fixed payments for physical injuries that occurred on the job (the initial compensation statutes were limited to work-related injuries and did not cover dust diseases).⁹⁴ Unlike work-related diseases, in these cases there was little controversy about work-relatedness.¹⁰⁴ Companies benefited because worker recoveries were fixed by statute, did not account for inflation and were generally much lower than tort settlements.¹⁰⁵ Additionally, insurance companies stood to benefit because “employers purchased substantially larger amounts of insurance under workers’ compensation because they were mandated to provide their entire labor force accident benefits that exceeded those of the negligent system.”¹⁰⁴ By 1920, all states but North Carolina, Florida, South Carolina, Arkansas, and Mississippi had passed laws. Mississippi was the last to follow suit in 1948.¹⁰⁴ Because these statutes did not cover work-related *disease*, ill workers were still able to sue to recover lost wages and medical costs under tort common law theories. The avalanche

^x “...It appeared that among the problems common to all industries were the following: 1. The menace of ambulance chasing lawyers in combination with unscrupulous doctors. The uncertainties surrounding diagnosis of any of the various forms of pneumoconiosis are so many that a question of fact is presented in every case. Expert testimony can be produced by both plaintiff and defendant and it is for the jury to decide whose experts are correct in their interpretations. In making this decision, the jury is not likely to favor the opinion of the experts produced by the employer. 2. The desirability of making various dust diseases compensable under properly drawn workmen’s compensation laws. One of the speakers stated that ‘the strongest bulwark against future disaster for industry is the enactment of properly drawn occupational disease legislation.’ Such legislation would (a) eliminate the jury and empower a Medical Board to pass upon the existence of the disease and the extent of the disability; (b) eliminate the shyster lawyer and the quack doctor since fees would be strictly limited by the law; and (c) permit the correcting of initial mistakes in the making of awards by providing for hearings to reduce or eliminate awards if proof could be adduced that the claimant was not disabled or that the extent of his disability had been overestimated.”¹⁰²

of dust-related lawsuits from the mid-1920s onward made it imperative for companies to add industrial diseases to worker compensation laws.

Beginning in 1937, with help from Lanza and IHF legal counsel, Theodore Waters, the IHF successfully added both silicosis and asbestosis to state worker's compensation laws.^{xi} However, while eliminating lawsuits, Lanza defined the criteria for qualifying for compensation so narrowly that the laws essentially blocked all compensation to workers suffering from dust disease. For example, Lanza took credit for what he called "ghostwriting" the Pennsylvania worker compensation disease statutes and influencing other states where he sometimes sat on committees dedicated to drafting similar legislation.¹⁰⁷ His Pennsylvania bill, which subsequently served as a model for most other states, minimized or eliminated any possible economic recovery by a) setting a statute of limitations of one year after leaving a job, while dust disease which usually did not manifest until decades after the worker's last exposure and b) limiting recovery to those workers who were 100% impaired or, in other words, near death.¹⁰⁷⁻¹⁰⁹

Waters was chairman of the legal subcommittee of the National Silicosis Conference (he was appointed by Secretary of Labor Frances Perkins in 1935) and used his influence to spread Lanza's model to other states. He began by revising worker's compensation laws in Maryland.^{110,111} In 1939, Waters described the model legislation and reported on the extent of the adoption of occupational disease compensation laws by the states.¹¹² Waters and Lanza wanted worker compensation systems to establish "expert panels" to adjudicate the disease cases. They exerted immense influence over national experts through the Konicide Club and industry funding of research and hoped that these panels would serve as a barricade against compensation.¹¹³

The compensation statutes severely limited the number of workers with silicosis, anthraco-silicosis, or asbestosis who could receive compensation to those who had been working for at least 4 years in Pennsylvania, "during a period of eight years next preceding the date of disability, in an occupation having a silica or asbestos hazard."^{xii,109} The 4-year exposure requirement conflicted with data from published studies and the secret MetLife studies, which revealed that disease could occur in as short as eleven months of exposure.^{86,88,89,115} Compensation was only to be paid when the disease that the claimant

^{xi} "Dr. Lanza is very strongly of the opinion that asbestosis should be made compensable under the New Jersey law. He feels that this is the only protection which the industry has, and that permitting the disease to remain outside the compensable class lends encouragement to unethical lawyers and physicians to work up claims."¹⁰⁶

^{xii} As of 2004, 4 years has been changed to 2 and 8 years to 10.¹¹⁴

had developed was unique to his occupation and had occurred within just one year of his leaving the job. A family could only receive compensation for the worker's death if that death occurred within three years after he left the job.¹⁰⁹ These criteria also conflicted with both published and secret studies, which showed that the latent period could be as long as forty or more years.^{1,115,116} Additionally, compensation would only be payable for those with total disability or death due to silicosis, anthraco-silicosis, or asbestosis. Those with only partial disability or patients with tuberculosis superimposed on silicosis were excluded from compensation.¹⁰⁹

Dr. Lanza noted with apparent satisfaction that, during a period of 2 years following the passage of these laws, the average number of claims for silicosis that resulted in compensation was about 10 or 12 in each of the states with the highest industrial activity.¹⁰⁷ The small number of claims paid, however, in no way reflects the vast number of workers stricken with silicosis at this time, such as the workers at Hawk's Nest.^{39,50,52,53,60} A 1931 USPHS study of anthracite miners in Eastern Pennsylvania found silicosis in 623 of 2711 workers.¹¹⁷ By 1959, another study found silicosis in 29% of 4,200 Pennsylvania miners.¹¹⁷ The small number of paid claims reveals the effectiveness of MetLife's efforts to minimize the number of claims that could be legally compensated. (Under the current Pennsylvania WC statute, dust disease payments are capped at \$12,750 while surviving spouses of workers who die from other work-related diseases collect a maximum of \$2028.00 annually for as long as they live.)

By manipulating latency and duration of work criteria, Lanza also successfully socialized the compensation costs. Pendergrass commented on the fact that the Commonwealth of Pennsylvania had paid family members \$23.5 million to compensate them for silicosis-caused deaths for the 1959-1961 biennium.¹¹⁷ He explained, "Since occupational pneumoconiosis is a chronic disease, and most workmen do not stay on the same job throughout their working lives, most of the claims are paid in full by the Commonwealth rather than by an insurance carrier or the industry responsible for the dust hazard."¹¹⁷

Manipulating Science and Targeting Law and Policy: The "Safe Level" (TLV)

MetLife commenced a study at five different asbestos textile plants at the end of the 1920s to evaluate the demonstrable harm caused to workers of several US companies by asbestos.¹¹⁸ Physical exams and X-rays of 126 workers, who were "selected more or less at random" and had been employed in the industry more than 3 years, diagnosed more than half with asbestosis, and 39 designated as "doubtful." Nine of

these asbestosis cases were found in employees who worked in the “spinning areas” at four plants where the dust counts were considered “relatively low” at 5 mppcf.^{xiii,100} The study report of the plants concluded, “[I]t is possible that asbestos may cause pneumoconiosis more readily than free silica.”¹¹⁸ However, this report was never published in its original form.^{100,122} When Lanza sent the report to Johns-Manville, he assured that the report was “confidential and will be given no publicity by us except with the consent of the firms concerned.”¹¹⁸

In his draft, Lanza wrote that asbestosis and silicosis were similar, and he recommended that the asbestos TLV be set at the silica standard.¹²² Hobart, an attorney for Johns Manville, expressed to Vandiver Brown (Manville’s corporate secretary and general counsel) his concern that a paper equating silicosis and asbestosis would undermine Manville’s efforts to influence New Jersey disease occupational disease legislation and defense of tort lawsuits:

*We have consistently argued that there is a substantial difference between silicosis and asbestosis—both as to the clinical nature of the disease and as to the reasonable probability of its incidence, and you will also recall that in particular, we have urged that asbestosis should not at the present time be included in the list of compensable diseases, for the reason that it is only within a comparatively recent time that asbestosis has been recognized by the medical and 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 has 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.*¹²¹

Vandiver Brown wrote Lanza requesting that he change key parts of his 1935 paper:

*...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. I feel confident we can depend upon you and Dr. McConnell to give us this ‘break’ and mine and Mr. Hobart’s suggestions are presented in this spirit.*¹²²

Lanza changed the paper to meet Manville’s needs and published the paper in 1935.¹²³ By this point, MetLife knew that workers could develop asbestosis from dust counts well below 5 mppcf.^{124,125} However, when Lanza published the summary of these studies

^{xiii} As per the recommendation of MetLife, Johns Manville had all 1140 of its workers examined at its factory (one of the plants in this study) for a separate 1932 report. Twenty-nine percent of the worker’s X-rays showed signs of “pneumoconiosis.” Over 16% of the asbestosis cases were found in the textile department, where the dust counts were found to be 2.5 mppcf or less in the original five plant study.^{119,120}

in 1935, he omitted the key dose–response data from his publication.¹²³

Two years before Lanza had expressed his skepticism about the utility of dust standards in a letter to R. H. Pass of the Onondaga Pottery Company:

*... [Dust standards] have no place whatsoever in industrial codes. Dust counts in any given location in a factory or workshop would differ from hour to hour and from day to day under environmental conditions that are apparently the same... The dust count cannot be set up as an arbitrary standard. Any attempt to do so is apt to bring upon industry a plague of industrial codes that will involve industrial establishments in a great deal of expense and confusion.*¹⁰⁸

Lanza believed that dust measurements could not be used to protect worker health. So why did Lanza propose any standard? While Lanza framed his critique of dust codes as a potential burden on industry, he based his critique on his understanding that dust counts were inherently unreliable. MetLife and the dust generating companies wanted non-governmental, unenforceable standards. They could use these published standards as a defense against lawsuits because the existence of standards meant they could argue that their existence proved there was a level of exposure below which disease did not occur. As Lanza explained, if the companies could prevent governments from adopting or enforcing these standards, they could avoid a “plague of industrial codes.”¹¹²

By 1938, Drinker and others had established an organization that published standards: the National Conference of Governmental Industrial Hygienists, later renamed the American Conference of Governmental Industrial Hygienists (ACGIH).¹²⁴ ACGIH described itself as an “independent” organization of academics and governmental experts, and indeed its very name suggested it had an official role, although it was not in fact a government organization. In fact, ACGIH served the interest of the companies. For example, the American Petroleum Institute secretly hired Drinker to oppose efforts to lower exposure standards for various substances.^{xiv,126} Beginning in 1938 and every year since, the ACGIH has recommended exposure limits for silica, asbestos, and other substances. [In 1953, the ACGIH changed the name of the standards to Threshold Limit Values (TLVs).] Every publication of the TLVs included the admonition that government agencies should not use them as standards.

Despite efforts to keep the TLV within the ACGIH, the Federal government and most states included the proposed asbestos and silica maximum exposure levels in industrial codes; the standards

^{xiv} In a conversation with one of the authors, (DE) Harriet Hardy recalled her first (and last) dinner conversation with the Drinkers where they complained that she was too concerned with worker health.

became and remain the foundation of the defense of asbestos and silica tort lawsuits.^{127,128}

The asbestos TLV was never designed to protect worker health. Corporations and the ACGIH claim standards are used to establish the exposure level that an employee can work under, every day for a lifetime, without becoming sick. In 1938, Dreessen *et al.* published a study of an asbestos textile plant that echoed 5 mppcf as the appropriate threshold limit as only “three doubtful cases,” all of whom had been exposed for less than 5 years, were found under this threshold.¹²⁹ The authors of the USPHS study included Dr. Waldemar Dreessen, assistant surgeon for the USPHS; William Sayers of the USPHS who had helped procure lung specimens for Gardner’s secret studies; and JW Miller, a USPHS pathologist whose salary was paid for by MetLife, highlighting potential conflicts of interest.^{42,129} In February 1938, in his seminal book *Silicosis And Asbestosis*, Lanza reaffirmed the 5 mppcf TLV even though he noted that half of the workers exposed to the 5 mppcf level had developed asbestosis.¹¹⁶ In addition to MetLife, many corporations knew the asbestos standard was not health protective: a 1947 IHF report based on a follow-up of Lanza’s 1935 study concluded that “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 the dust elimination to this extent does not positively insure that no asbestosis will develop in some workers after a long working life...”¹³⁰ The IHF never published this report.

MetLife, the IHF, and the asbestos product companies all contributed to maintaining the illusion that 5 mppcf was a “safe level of exposure” for asbestos. The standard endured even as the silica TLV (which the asbestos TLV was based on) was deemed deadly in the ACGIH “Report of Committee on Threshold Limits” of 1962: “...we have a sanatorium that has many men who have died of silica tuberculosis because of a M.A.C. that was too high...”¹³¹ Furthermore, these first 5 mppcf “dust standards” for asbestos exposure were initially designed to potentially reduce or delay asbestosis cases but not asbestos-caused cancer; yet these standards remained unchanged until 1970.^{123,124,132}

Manipulating Science and Targeting Law and Policy: Asbestos Carcinogenicity

Before 1968, ACGIH standards did not account for carcinogenicity, except in the case of nickel carbonyl.^{124,133} When industry representatives identified nickel carbonyl as a carcinogen in 1953, its TLV was immediately reduced to the limit of detection (0.001 parts per million), thus indicating that the “experts”

believed that there was no ‘safe’ exposure to a carcinogen.¹³³ In Warren Cook’s 1956 introduction to the Symposium on Threshold Limits presented to the ACGIH, he noted that the ACGIH “failed to include any acknowledgment of the known carcinogenicity of arsenic, chromates and asbestos” despite the new TLV for nickel carbonyl.¹³³ The consensus of the 1956 ACGIH symposium was that there was no safe level of exposure if a substance was a carcinogen.¹³³ In other words, if any exposure was measured, the exposure was too high. Herbert Stokinger, the chief toxicologist for the USPHS occupational health programs (from 1951 to 1977) and known as “Mr. TLV” in the world of industrial hygiene, argued that standards for carcinogens could protect workers if they were lowered by a factor of 100–500.^{xv,134–136} Based on what was known about asbestos and cancer at the time, this would have placed the 1956 asbestos limit at about the same level as the current limit of 0.1 fibers/cc. But the ACGIH did not change the TLV. If the limit was lowered to protect against cancer, the companies recognized that consumers could not use asbestos products.⁵⁴ As a result, MetLife and its corporate customers played a major role in hiding the carcinogenic properties of asbestos.

Stokinger’s views on “safe” exposures to carcinogens later changed.¹³⁷ In 1976, well after the link between cancer and asbestos was universally accepted, he responded to an inquiry from the of Manville’s medical director, indicating that he believed the TLV for asbestos should remain at 5 fibers/cc. He expressed the view that standards should not be lowered until epidemiologic studies had proven that non-cancer based standards failed to protect against cancer:

But I think this represents a new approach that has not been considered that may help fortify your position against this unnecessary reduction in industrial air standards whenever the word ‘cancer’ appears. OSHA or NIOSH has taken this position on beryllium, cadmium and chromium, without justification, as time has not elapsed in any of these substances to show that the ongoing standard is not protective.

This “new approach” would result in workers being exposed for 30–40 years in order to test the effectiveness of the standards.

The beginning of the cancer cover-up: the Saranac Studies

MetLife was made aware of the potential asbestos–cancer link in 1934 when they received an insurance

^{xv} Besides serving as the chief toxicologist for the USPHS, Stokinger also served as the editor of the AMA’s Archives of Industrial Health, and served 25 years as a member and 15 years as chairman of the American Conference of Governmental Industrial Hygienists (ACGIH).¹³⁶ ACGIH claimed it was an “independent” organization, controlled by government and corporate representatives, that published TLVs. TLV™ is a registered trademark of the ACGIH.

death claim from an employee at Raybestos-Manhattan.¹³⁸ On the attached death certificate, the attending physician listed the cause of death as bronchial carcinoma and asbestosis. Where the form asked if it the cause of death was related to work, the physician wrote: “probably asbestos dust was a contributing factor.”¹³⁸ Lynch and Smith, the employee’s physician, also published a case report entitled “Pulmonary Asbestosis III: Carcinoma of Lung in Asbestos-Silicosis” in the American Journal of Cancer in 1935.¹³⁹

In November 1936, 11 asbestos brake manufacturing companies agreed to share the cost of animal inhalation experiments to be conducted by Dr. Leroy Gardner at the Saranac Institute.¹⁴⁰ Lanza served as the liaison between the sponsoring companies and the Saranac laboratory. Dr. Gardner agreed to conduct the studies under the terms specified by Vandiver Brown, Johns Manville’s attorney: the results would be the property of the scientists and reports would be submitted for approval from the companies before publication.¹⁴⁰ One of the key purposes of the study, as outlined by Vandiver Brown, was the determination of “What concentration of dust is necessary to produce the fibrosis of the lungs which is designated as asbestosis...”¹⁴⁰

In his 1943 draft, Gardner addressed the request:

...Recommendation for a New Standard of Safe Atmospheric Concentration of Asbestos Dust:

a.) *While there is no official standard, the tentative one of 4 or 5 million particles per cubic foot of air is frequently quoted.*

b.) *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 hazard.*

c.) *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 a material.*¹⁴¹

Dr. Gardner also wrote to Brown that the confidential animal studies he had conducted revealed that “the question of cancer susceptibility now seems more significant than I had previously imagined.”¹⁴² Gardner had found that:

In 11 mice inhaling long fiber asbestos for 15 to 24 months, 8 developed malignant tumors in their lungs and 6 of them had tumors in other organs. The incidence rate of 81.8% is excessive.¹⁴¹ [Emphasis added]

Gardner also reported that there were at least 16 reported cases of cancer in asbestos workers in the published medical literature.¹⁴¹ Gardner wrote to Vandiver Brown of his findings and desire to secure funding to repeat the experiments in February of 1943.¹⁴² In March of 1943, Gardner wrote to Dr. Hektoen of the National Cancer Institute (NCI) to

seek funding and suggestions for further experiments regarding asbestos and cancer.¹⁴³ In September 1943, Gardner wrote to Hektoen again, asserting that, with the addition of three new reported cases of workers with cancer, “we cannot afford to neglect the matter much longer.”¹⁴⁴ Minutes of the NCI meeting regarding Gardner’s request expressed various reasons for not funding a repeat experiment including high cost; their belief that animal findings could not be generalized to humans (a particularly ironic view since all chemotherapeutic agents are tested in animals first); the view that “it is evident on the surface that asbestos workers should be protected from exposure to dust ...on general principles”; and that it seemed obvious that all pneumoconiosis-inducing dusts could cause cancer.¹⁴⁵

In 1946, when there had been 23 cases reported connecting asbestosis and lung cancer, Gardner wrote to J. P. Woodward of Johns Manville and requested access to the X-rays of the company’s workers so he could further study the relationship between asbestos and cancer.¹⁴⁶ Based on Gardner’s application to NCI, and his notes and records, it does not appear that he was ever given permission to look at the company’s X-rays or repeat his experiments. Before he died later that year, Gardner agreed to publish the results of his study without reference to cancer but stated that a follow-up study was necessary to explore the relationship between asbestos and cancer.¹⁴⁷

After Gardner’s death, Lanza, then a member of the Board of Trustees of the Trudeau Foundation which governed Saranac, gave Gardner’s notes to Dr. Kenneth Lynch, Dean of the Medical College of the State of South Carolina and an authority on dust diseases.¹⁴⁸ After reviewing Gardner’s unfinished manuscript, Lynch suggested that the report was worthy of publication without any significant changes: “[To] submit his manuscript for publication practically as he has it written, with an explanation, would be to properly represent him. He undoubtedly meant to add to the manuscript, but it is worthy as it stands.”¹⁴⁸

On 14 December 1948, after a 30 September 1948, meeting on the “asbestos report,” Lanza sent a letter to Arthur Vorwald, a pathologist and specialist in dust diseases at the Saranac Laboratory, expressing that “it was the feeling of this group that all references to cancer or tumors should be omitted.”¹⁴⁹ Vorwald returned the report with his extensive edits; he crossed out the entire page that addressed tumors and scribbled the word “out.”¹⁴⁹ (Fig. 2) When the paper was finally published in the American Medical Association’s *Archives of Industrial Hygiene and Occupational Medicine* in January of 1951, all references to cancer and tumors were deleted, as well as all tables and charts relating to the subject. An introductory footnote to the published paper misleadingly

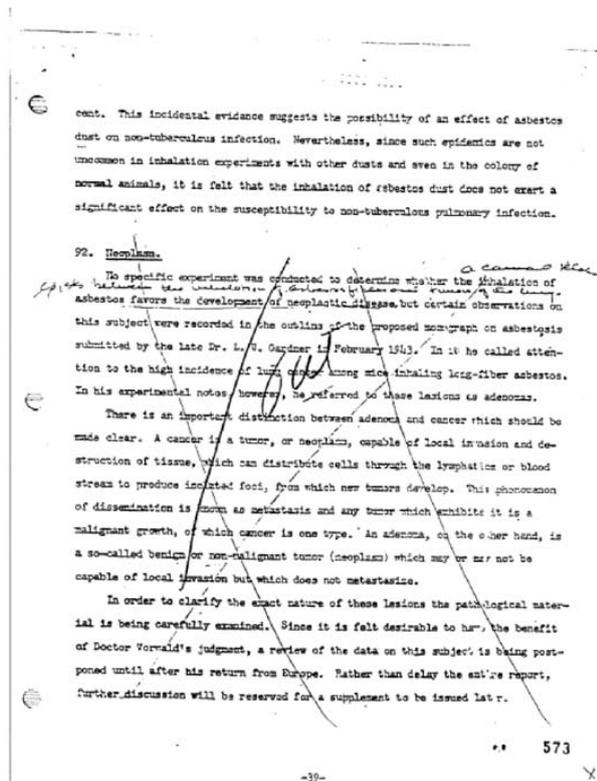


Figure 2 In 1949, Vorwald extensively edited the deceased Gardner's asbestos report and crossed out this page of the original draft, which addressed tumors, and wrote "out."

stated, "[A]lthough partial reports and informal reviews of some of the experiments had been given from time to time by Dr. Gardner, this paper presents for the first time a complete survey of the entire experimental investigation."¹⁵⁰

MetLife's direct involvement in the asbestos-cancer cover-up ends here, but the ongoing manipulation of science, law, and policy by the industry continued into the second half of the century and into the current era.

Conclusion

MetLife and its corporate allies used four key strategies to keep the silica and asbestos industries thriving and to avoid liability and compensation: establishing itself and an authority, creating a network of scientific experts, manipulating science, and influencing law and policy. These strategies had a very real human cost, from fired Picher clinic workers, to legions of silicotic and asbestotic workers who did not qualify for worker compensation but were prevented from pursuing tort remedies. They also had a lasting effect on the scientific literature, contributing for example, to a decades-long delay in the open publication of the true health hazards of asbestos. MetLife's efforts also led to confusion in US regulations and government-produced health bulletins. The TLV for asbestos, which was initially based on an arbitrary and dangerous level of exposure, was not designed to be an official government regulation

but rather look like an authoritative standard. MetLife's early efforts also encouraged the dangerous manipulation of science to persist beyond the direct influence of the company.

In a follow-up paper to be published in this journal, we will detail how the "concerted action" of the first half of the twentieth century continues into the current era, affecting both law and policy and setting a dangerous precedent for corporate malfeasance. We will discuss the continued manipulation of science by the IHF to delay publicity of the asbestos-cancer connection and the industry response to official government regulation once the asbestos-cancer connection became more public, such as the development of the *state of the art* defense used in asbestos litigation to this day. We will then discuss the continued power insurance companies and corporations have over the dissemination of science.

References

- Merewether, ERA. A Memorandum on Asbestosis. Tubercle, December 1933. p. 109-18.
- Hirth A. The Problem. Speech at Industrial Hygiene Foundation Conference; 1935.
- Rosner D, Markowitz G. Deadly dust: silicosis and the politics of occupational disease in twentieth-century America. Princeton (NJ): Princeton University Press; 1991.
- Rosner D, Markowitz G. Workers, industry, and the control of information: silicosis and the industrial hygiene foundation. J Public Health Policy 1995;16(1):29-58.
- Castleman BI, Ziem GE. Corporate influence on threshold limit values. Am J Ind Med. 1988;13(5):531-59.
- Castleman BI, Ziem GE. American Conference of Governmental Industrial Hygienists: low threshold of credibility. Am J Ind Med. 1994;26(1):133-43.
- Castleman B. How threshold limits for lead were established in the 1950s. Am J Ind Med. 1997;32(6):702-3.
- Castleman BI. Asbestos: medical and legal aspects. 5th ed. Austin (TX)/Boston (CA)/Chicago (IL)/New York: Aspen Publishers; 2005.
- McCulloch J, Tweedale G. Defending the indefensible: the global asbestos industry and its fight for survival. Oxford/New York: Oxford University Press; 2008.
- Michaels D. Doubt is their product: how industry's assault on science threatens your health. Oxford: Oxford University Press; 2008.
- Egilman D, Ardolino EL, Howe S, Bird T. Deconstructing a state-of-the-art review of the asbestos brake industry. New Solut. 2012;21(4):26.
- Egilman D, Bagley S, Connolly S. Anything but beryllium: the beryllium industry's corruption of safety information. Am J Ind Med. 2002;42(3):270-1.
- Egilman D, Fehnel C, Bohme SR. Exposing the 'myth' of ABC, 'anything but chrysotile': a critique of the Canadian asbestos mining industry and McGill University chrysotile studies. Am J Ind Med. 2003;44(5):540-57.
- Egilman D, Hardy H. Manipulation of early animal research on asbestos cancer. Am J Ind Med. 1993;24:787-791.
- Egilman D, Howe S. Against anti-health epidemiology: corporate obstruction of public health via manipulation of epidemiology. Int J Occup Environ Health. 2007;13(1):118-24.
- Egilman D, Kim J, Biklen M. Proving causation: the use and abuse of medical and scientific evidence inside the courtroom — an epidemiologist's critique of the judicial interpretation of the Daubert ruling. Food Drug Law J. 2003;58(2):223-50.
- Scout ED. Corporate corruption of science — the case of chromium(VI). Int J Occup Environ Health. 2006;12(2):169-76.
- Egilman D., et al., Manipulated data in Shell's Benzene Historical Exposure Study. Int J Occup Environ Health. 2007;13(2):222-32.

- 19 Egilman DS, Bagley S, Biklen M, Golub AS, Bohme SR. The beryllium 'double standard' standard. *Int J Health Serv.* 2003;33(4):769–812.
- 20 Markowitz GE, Rosner D. Deceit and denial: the deadly politics of industrial pollution. Berkeley (CA): University of California Press; 2002.
- 21 Ong E, Glantz S. Constructing 'sound science' and 'good epidemiology': tobacco, lawyers, and public relations firms. *Am J Public Health.* 2001;91:1749–57.
- 22 Jasanoff S. Science at the bar: law, science, and technology in America. Cambridge (MA): Harvard University Press; 2005. xvii, 285 p.
- 23 Proctor R. Golden holocaust: origins of the cigarette catastrophe and the case for abolition. Berkeley (CA): University of California Press; 2011.
- 24 Hoffman FL. Mortality from respiratory diseases in dusty trades (inorganic dusts). Washington: Bureau of Labor Statistics; 1918.
- 25 Wright W. December 30 1926 Letter to HR Bassford; 1926.
- 26 Hitchins RA. Report and recommendation of the temporary organization committee which was elected at the 'Symposium on Dust Problems' held at Pittsburgh, PA, 15 January 1935.
- 27 MetLife Group insurance: its aims and its privileges. 1926.
- 28 MetLife. MetLife Begins [Internet]. 2011 [cited 2011 May 17]. Available from: <https://www.metlife.com/about/corporate-profile/metlife-history/metlife-begins/index.html>
- 29 Dublin LI. A family of thirty million: the story of the Metropolitan Life Insurance Company. New York: Metropolitan Life Insurance Company; 1943.
- 30 MetLife. Supporting Country and Community [Internet]. 2011 [cited 2011 May 17]. Available from: <https://www.metlife.com/about/corporate-profile/metlife-history/supporting-country-and-community/index.html>
- 31 Wright W. Letter to A.J. Lanza, 29 September 1926.
- 32 MetLife. The Metropolitan Life Insurance Company: its history, its present position in the insurance world, its home office building and its work carried on therein. New York: The Metropolitan Life Insurance Company; 1914.
- 33 James M. The Metropolitan Life, a study in business growth. New York: The Viking Press; 1947.
- 34 Hueper WC. Occupational tumors and allied diseases. Springfield (IL)/Baltimore (MD): C. C. Thomas; 1942.
- 35 Richards R. Closing the door to destitution: the shaping of the social security acts of the United States and New Zealand. University Park (PA): Pennsylvania State University Press; 1994.
- 36 Perkins F. 'What you really want is an autopsy': Frances Perkins and the U.S. Government Conference in Joplin, Missouri. Tri-State Silicosis Conference, Joplin, Missouri, 1940.
- 37 Ewing H. Labor Secretary receives silicosis report. Washington (DC): Library of Congress; 1937.
- 38 Rosner D, Markowitz G. 'The street of walking death': silicosis, health, and labor in the Tri-State Region, 1900–1950. *J Am Hist.* 1990;77(2).
- 39 Harris & Ewing, Inc. Labor Secretary receives silicosis report [Internet]. 1937 [cited 2012 Jun 11]. Available from: <http://www.ancientfaces.com/research/photo/1129619/labor-secretary-receives-silicosis-report-washington>
- 40 Plooy v. MetLife, Order RE MetLife's Motion For Judgement and [Proposed] Statement of Decision (No. RG 07329961). CA Superior Court, Alameda County, 21 March 2008.
- 41 Williams S. Waukegan Memo to A.R. Fisher; 1933.
- 42 Sayers R. Payroll for Miller et al, to A.J. Lanza; 1934.
- 43 Rosen G. The history of miners' diseases, a medical and social interpretation. New York: Schuman's; 1943.
- 44 International Labor Office. Silicosis Records of the International Conference Held at Johannesburg; 1930.
- 45 Bureau of Labor Statistics. Miner's Phthisis on the Witwatersrand, Transvaal., U.S. Department of Labor; 1917.
- 46 Rice GS. Historical review of silicosis, in Siliceous dust in relation to pulmonary disease among miners in the Joplin district, Missouri, Bureau of Mines, U.S. Department of the Interior. Washington (DC): Government Printing Office; 1917.
- 47 Higgins, E. and e. al. Siliceous dust in relation to pulmonary disease among miners in the Joplin district, Missouri; 1917.
- 48 Kansas Geological Society. Lead and Zinc Mining [Internet]. 2005 May 5 [cited 2011 Dec 14]. Available from: <http://www.kgs.ku.edu/Extension/ozark/mining.html>
- 49 Reporter. Silicosis Problem in State at 'Crisis', *New York Times*, 15 April 1936.
- 50 Reporter. Silicosis Deaths Assailed in House, *New York Times*, 8 February 1936.
- 51 Reporter. Doctor Heard in Tunnel Case. *Beckley Post-Herald*, 13 April 1933; Beckley, West Virginia.
- 52 Cherniack, M. The Hawk's nest incident: America's worst industrial disaster. New Haven: Yale University Press; 1989.
- 53 Lanza AJ. Confidential Memo of August 1; 1933.
- 54 Standard for exposure to asbestos dust: hearing before A.M. Goldberg. US Department of Labor (14–17 March 1972).
- 55 Allen B. Two Thousand Dying on a Job, *The New Masses*, 8 January 1935.
- 56 Albert M. Man on a Road, *The New Masses*, 8 January 1935.
- 57 Brown V. Re: Air Hygiene Foundation of America — Membership Meeting of Nov. 24th, Letter to C.J. Stover; 1936.
- 58 Bassford HR. September 28 1929 Letter to Dunlap; 1929.
- 59 Lanza AJ. SUBJECT: Visit to the Picher Clinic, Picher, Oklahoma. Letter to Hadden; 1929.
- 60 Lanza AJ, McConnell W, and Fehnel J. The effects of the inhalation of asbestos dust on the lungs of asbestos workers. *US Public Health Service Reports*, 1935. 50(1).
- 61 Buell DC. (Metropolitan Life Actuarial Division, Group Life and Health Section), memorandum to Dr. McConnell, 22 Aug 1939.
- 62 MetLife. Helping and Healing People [Internet]. 2011 [cited 2011 May 2]. Available from: <http://www.metlife.com/about/corporate-profile/metlife-history/helping-healing-people/index.html>
- 63 MetLife. Metropolitan's Popularity Means Larger 'Employee Membership in Your Group Insurance Policy [Internet]. 1938. Available from: <http://egilman.com/Documents/Asbestos/metlife/met%20life%20popularity.pdf>
- 64 MetLife. Industrial hygiene. New York: Policy-Holders Service Bureau; 1942.
- 65 MetLife. Industrial hygiene and safety. New York: Welfare Division, Home Office; 1933.
- 66 Dublin LI. Leiboff P. Occupational hazards and diagnostic signs: a guide to impairments to be looked for in hazardous occupations, Bureau of Labor Statistics, U.S. Department of Labor. Washington (DC): Government Printing Office; 1992.
- 67 US Department of Labor. Occupation hazards and diagnostic signs. Washington (DC): United States Government Printing Office; 1942.
- 68 Lanza AJ. SUBJECT: A co-operation with the Bureau of Mines on Health Activities in the Joplin District, December 17 1926, Letter to W. Wright, 1926.
- 69 MetLife. Draft of MetLife Magazine article 'Company Works to Control 'Miners Con' in Joplin Zinc Mines', 1927.
- 70 Lanza AJ. October 30, 1936 Letter to Mitchell, 1936.
- 71 Turner S. Report of Dust Investigation of the Eagle-Picher Rock Wool Plant at Joplin Missouri March 21, 1932. To: Meriwether, F.V., 1932.
- 72 Meriwether F. SUBJECT: Informal monthly letter to R. Sayers, Washington, DC; 1930.
- 73 Meriwether FV. Letter to A.J. Lanza; 1930.
- 74 Meriwether FV. SUBJECT: Informal monthly letter. Letter to R. Sayers; 1931.
- 75 Winans W. Subject: Silicosis. Letter to A.J. Lanza; 1933.
- 76 Hayhurst ER. May 17, 1933 Letter to A.J. Lanza; 1933.
- 77 Lanza AJ. July 18, 1933 Letter to L. Gardner; 1933.
- 78 Lanza AJ. June 27, 1934 Letter to P.Folger; 1934.
- 79 Lanza A. January 26, 1933 Letter to D. Cummings, 1933.
- 80 Unknown. List of Persons Available as Witnesses on the Medical End of the Silicosis Cases [Internet]. 5 May 1933. Available from: http://egilman.com/Documents/Asbestos/metlife/usgyp_consultants_%282%29.pdf
- 81 Frey HW. RE: General Railway Signal Company. Letter to A.J. Lanza, 1934.
- 82 Hatch TF, Pendergrass EF. The Konocide Club (1932–1940). *JOM.* 1977;19(5):351–63.
- 83 Drinker P. March 9, 1933 Re: Union Carbide Tunnel in West Virginia. Letter to R. Sayers, Lanza and Pancoast; 1933.
- 84 Lanza AJ. March 10, 1933 Letter to P. Drinker; 1933.
- 85 Index of Pneumoconiosis Cases. Armed Forces Institute of Pathology: Vorwald Archives.
- 86 Dupruis J. The Dark Side of White Gold [Internet]. 2012 [cited 2011 Jun 30]. Available from: <http://www.radio-canada.ca/emissions/enquete/2011-2012/Reportage.asp?idDoc=195159>
- 87 Gardner L. Pathology of so-called acute silicosis. *Am J Public Health.* 1933;23(12):1240–9.

- 88 Pancoast HK, Pendergrass EP. The roentgenological aspects of pneumoconiosis and the medico-legal importance. *J Ind Hyg.* 1933;XV(3):127.
- 89 Lanza AJ. April 11, 1933 Letter to D.E. Cummings; 1933.
- 90 Weller C. The McCarran-Ferguson Act's antitrust exemption for insurance: language, history, and policy. *Duke Law J.* 1978;22:587-643.
- 91 Lanza AJ. September 12, 1927 Letter to R. Mier; 1927.
- 92 Cole LG, Cole WG. Pneumoconiosis (silicosis): the story of dusty lungs. New York: John B. Pierce Foundation; 1940.
- 93 Vorwald Collection. Saranac Laboratory Notes, in Otis Historical Archives, National Museum of Health and Medicine, Armed Forces Institute of Pathology 1900-1980: Bethesda, MD.
- 94 Lanza AJ. December 14, 1948 letter to A. Vorwald; 1948.
- 95 Pedley FG. Report of the Physical Examinations and X-Ray Examinations of Asbestos Workers in Asbestos and Thetford Mines, Quebec. To: A.J. Lanza; 1930.
- 96 Pedley FG. October 11, 1932 letter to N.L. Burnette of Metropolitan Life Insurance Company. Department of Public Health and Preventive Medicine. Montreal: McGill University; 1932.
- 97 Lanza A, Vane R. Industrial dusts and the mortality from pulmonary disease. *Am Rev Tuberc.*, 1939;39:419.
- 98 Pedley F. G. Asbestosis. *Canad. Publ. Health J.* 22:576-577 (1930).
- 99 Unknown. Mellon Institute [Internet]. 2012 [cited 2012 Mar 15]. Available from: <http://www.chem.cmu.edu/cma/mi.html>
- 100 Lanza AJ. February 27, 1935 letter to Armstrong; 1935.
- 101 Markowitz G, Rosner D. The limits of thresholds: silica and the politics of science, 1935 to 1990. *Am J Public Health.* 1995;85(2):253-62.
- 102 Brown V. Re: Mellon Institute of Industrial Research Symposium on Dust Problems, January 22, 1935. Letter to M.F. Judd; 1935.
- 103 Guyton GP. A brief history of workers' compensation. *Iowa Orthop J.* 1999;19:106-10.
- 104 Fishback PV, Kantor SE. The adoption of workers' compensation in the United States, 1900-1930. *J Law Econ.* 1998;41(2):305-41.
- 105 Columbia Law Review Association, I., Workmen's compensation for dust disease. *Columbia Law Rev.* 1936;36(7):1142-55.
- 106 Sagar CL. Memo from Meeting at office of Johns-Manville on 15 July 1931; 1931.
- 107 Lanza AJ. The insurance carrier. In: Kuechle BE, editor. Proceedings of the Fourth Saranac Laboratory Symposium of Silicosis. Wausau (WI): Employers' Mutual Liability Insurance Co.; 1939. p. 316-319.
- 108 Lanza AJ. March 16, 1933 letter to R.H. Pass; 1933.
- 109 Pennsylvania Occupational Disease Act, Laws of Pennsylvania, Session of 1939, in No. 284, Article III. p. 570-1.
- 110 Waters TC. Occupational disease and compensation. *Arch Environ Health.* 1961;3:255-61.
- 111 Waters TC. Workmen's compensation laws. Fundamental philosophy and evolution. *Arch Environ Health.* 1962;5:510-6.
- 112 Waters TC. Administration of laws for the prevention and control of occupational diseases. *Am J Public Health Nations Health.* 1939;29(7):728-37.
- 113 Stokinger HE. Toxicologic aspects of occupational hazards. *Annu Rev Med.* 1956;7:3.
- 114 State of Pennsylvania. Pennsylvania Workers' Compensation Act, in Act of 1915, P.L. 736, No.338, as amended, Title 77 of Purdon's Statutes, Pennsylvania Department of Labor and Industry; 2004.
- 115 Wood WB. Pulmonary asbestosis, a review of one hundred cases. *Lancet.* 1934;224(5808):1383-5.
- 116 Lanza AJ. Silicosis and asbestosis. London/New York: Oxford University Press; 1938.
- 117 Pendergrass EP, Bristol LJ, Felson B, Jacobson G. Historical perspectives of coal workers' pneumoconiosis in the United States. *Ann NY Acad Sci.* 1972;29(200):835-54.
- 118 Lanza AJ. July 9, 1931 Letter to Allan Wardwell; 1931.
- 119 Lanza AJ. Letter to D.E. Cummings; 1933.
- 120 Johns-Manville. Physical Examinations at Manville Factory. Manville (NJ); 1932.
- 121 Hobart G. December 15, 1934 letter to V. Brown; 1934.
- 122 Brown V. December 21, 1934 letter to Lanza; 1934.
- 123 Lanza AJ, McConnell W, Fehnel J. The effects of the inhalation of asbestos dust on the lungs of asbestos workers. *U.S. Public Health Serv Rep.* 1935;50(1).
- 124 Egilman D, Reinert A. The origin and development of the asbestos Threshold Limit Value: scientific indifference and corporate influence. *Int J Health Serv.* 1995;25(4):667-96.
- 125 Clark WI, Drinker P. Industrial medicine. New York: National Medical Book Company; 1935.
- 126 Baird VC. Report to the API Medical Advisory Committee by the Subcommittee on Permissible Concentrations; 1947.
- 127 Hoffman S, Radcliff T. Personal Communication with D. Egilman, 30 June 2011.
- 128 Weidlein ER. February 2, 1935 Letter with Attachments dated from January 21, 1935 to R.A. Hitchins; 1935.
- 129 United States Public Health Service. A study of asbestosis in the asbestos textile industry. Washington (DC): US Government Printing Office; 1938.
- 130 Hemeon WCL. Report of preliminary dust investigation for Asbestos Textile Institute. Pittsburg (PA): Industrial Hygiene Foundation of America; 1947.
- 131 ACGIH. Transactions of the Twenty-Fourth Annual Meeting of the ACGIH. Cincinnati; 1962.
- 132 ACGIH. Proceedings of the Eighth Annual Meeting of the ACGIH. Cincinnati; 1946.
- 133 Cook WA. Introduction to 'Symposium on Threshold Limits'. American Industrial Hygiene Association, 1956;17(3).
- 134 Stokinger HE. Standards for safeguarding the health of the industrial worker. *Public Health Rep.* 1955;70:1-11.
- 135 Stokinger HE. Prepared discussion. *Am Ind Hyg Assoc Q.* 1956. 17:284-6.
- 136 Wagner WD, Herbert E. Stokinger, 'Mr. TLV'. *Toxicol Sci.* 2001;61(1):4-5.
- 137 Stokinger HE. October 13, 1976 Letter to Johns-Manville Company's Paul Kotin. ACGIH; 1976.
- 138 Smith, W.A. Proof of Death Statment of the Employer and Attending Physician, Metropolitan Life Insurance Company. Charleston, SC; 1934.
- 139 Lynch K, Smith WA. Pulmonary asbestosis III: carcinoma of lung in asbestos silicosis. *Am J. Cancer.* 1935;24:56-64.
- 140 Brown, V. November 20, 1936 Letter to L. Gardner; 1936.
- 141 Gardner L. Outline of Proposed Monograph on Asbestos. Saranac Laboratory Study under grant from Asbestos Association. Saranac, NY; 1943.
- 142 Gardner L. February 24, 1943 Letter to V. Brown; 1943.
- 143 Gardner, March 15, 1943 Letter to Ludwig Hektoen of the Committee on Cancer Research at the National Cancer Institute; 1943.
- 144 Gardner L. September 29, 1943 Letter to Ludwig Hektoen of the Committe on Cancer Research at the National Cancer Institute; 1943.
- 145 National Cancer Institute. Proceedings: twenty-fourth meeting, National Advisory Cancer Council, National Cancer Institute; 1944. p. 26-9.
- 146 Gardner L. Letter to J.P. Woodward; 1946.
- 147 Brown GT. October 28, 1946 Letter to Vandiver Brown of Johns-Manville; 1946.
- 148 Lynch K. June 30, 1947 Letter to A.J. Lanza; 1947.
- 149 Vorwald A. Asbestosis 'Revised'. Saranac Lake (NY): The Saranac Laboratory; 1949.
- 150 Vorwald A, Durkan T, Pratt P. Experimental studies of asbestosis. *Am Med Assoc Arch Ind Hyg Occup Med.* 1951;3(1):1-43.